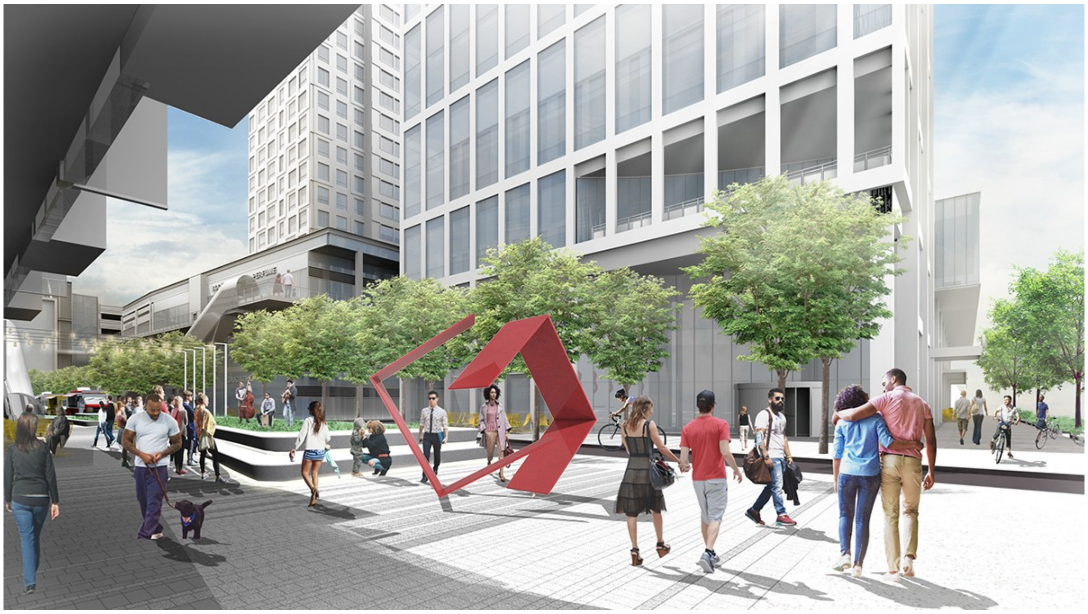
TREMONT CROSSING

WHERE COMMERCE AND CULTURE CONNECT



Second Supplement to

Draft Project Impact Report

Submitted to:
BOSTON REDEVELOPMENT AUTHORITY
One City Hall Square
Boston, MA 02201

Submitted by:
P-3 PARTNERS, LLC
222 Newbury Street, 4th Floor
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In Association with:
Cambridge Seven Associates
Bohler Engineering
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GEI Consultants, Inc.
BSC Group
DLA Piper LLC
Brown Rudnick LLP

AUGUST 8, 2016

P-3 Partners, LLC

August 8, 2016

Brian Golden, Director
Boston Redevelopment Authority
One City Hall Square
Boston, MA 02201

Re: **Tremont Crossing: Second Supplement to Draft Project Impact Report**

Dear Director Golden:

On behalf of P-3 Partners, LLC ("P-3 Partners"), we are pleased to submit for your review the Second Supplement to Draft Project Impact Report ("Second Supplement"), dated August 8, 2016, for the Tremont Crossing Project located at Parcel P-3 in Roxbury, Massachusetts (the "Project"). As set forth in the Second Supplement, the Project consists of approximately 1.2 million square feet of commercial, cultural and residential uses which will serve as the catalyst that will enhance Lower Roxbury with a more dynamic environment and greater opportunities for wealth creation.

The revised development program that is presented for your consideration is one that is responsive to: the Scoping Determination, dated August 16, 2012; the Request for Additional Information, dated January 15, 2016; comments and suggestions received from the Boston Civic Design Commission; a series of six (6) Project Review Committee Meetings held within the last six (6) months which were open to the Roxbury Community; and most recently, the Tremont Crossing Project Information Request, dated June 16, 2016. As such, since our last Article 80 submission (Supplemental DPIR, dated February 11, 2016), the Project has incorporated substantial changes to its urban planning and design, including, but not limited to:

- adding a new roadway bisecting its western commercial block, thereby enhancing the Project's cohesiveness with the neighborhood street grid and the desired neighborhood commercial scale;

- reducing the overall density of the project by approximately 250,000 square feet, including the elimination of a proposed hotel and the reduction of the office use by approximately 100,000 square feet (approximately 50%);
- reducing the maximum height of the Project's buildings by approximately 90 feet, thereby correlating to the existing vertical density in the neighborhood;
- reducing the size, height and number of parking spaces in the garage, whereby the height of the garage has been reduced by approximately 25% (by two levels) and the number of parking spaces has been reduced by 216 spaces; and
- adding townhouse style residential units along the Project's Whittier Street edge in order to more harmoniously transition from the adjacent residential neighborhood.

In addition to the aforementioned changes, which seek to further build consensus with the City and the Community, the Project remains one that is true to its core cultural mission and its commitment to creating opportunities for Roxbury. In this regard, the Proponent has continued its dialogue with the Community regarding all of the benefits the Project will provide and, as a result, our public benefits package has increased and become even more robust.

P-3 Partners thanks you and your staff for its consideration of the Tremont Crossing Project and for the collaborative nature of the Article 80 process. We continue to believe that such a collective effort will help to bring the Tremont Crossing Project to fruition and ensure that this transformative Project realizes its great potential for Roxbury and the City of Boston.

Sincerely,

Edmund Barry Gaither
Member, P-3 Partners, LLC

Barry E. Feldman

Barry E. Feldman
Manager, P-3 Partners, LLC

Cc: Mr. John Barros, Chief of Economic Development
Ms. Teresa Polhemus, BRA
Ms. Heather Campisano, BRA
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Mr. Johnathan Greeley, BRA
Mr. Dana Whiteside, BRA

TREMONT CROSSING

WHERE COMMERCE AND CULTURE CONNECT

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1.0 SUMMARY

1.1 Project Identification

Project Name:
Tremont Crossing:
Where Commerce and Culture Connect

Location:
The Project is located at the southwest corner of Tremont Street and Whittier Street in Roxbury, Massachusetts.

Proponent:
P-3 Partners, LLC ("P-3 Partners"), a joint venture of Elma Lewis Partners, LLC and Feldco Development Corp.

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Mark C. Wallace

Parking Consultants:
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1.2 Project Summary

1.2.1 *Project Site*

The Tremont Crossing development (the “Project”) will be located at Parcel P-3 (consisting of Parcel P-3 and a portion of Parcel P3-h in the Campus High School Urban Renewal Area) in Boston’s Roxbury neighborhood. The Project Site consists of approximately 7.25 acres of land area and is bounded by Tremont Street to the northwest, Whittier Street to the northeast, Downing Street to the southeast, the Whittier Street Health Center, the Madison Park Technical Vocational High School and the John D. O’Bryant School of Mathematics and Science to the southwest (the “Project Site”). The Figures 1-1 and 1-2 set forth the location of the Project Site.

Figure 1-1: Arial Locus Map

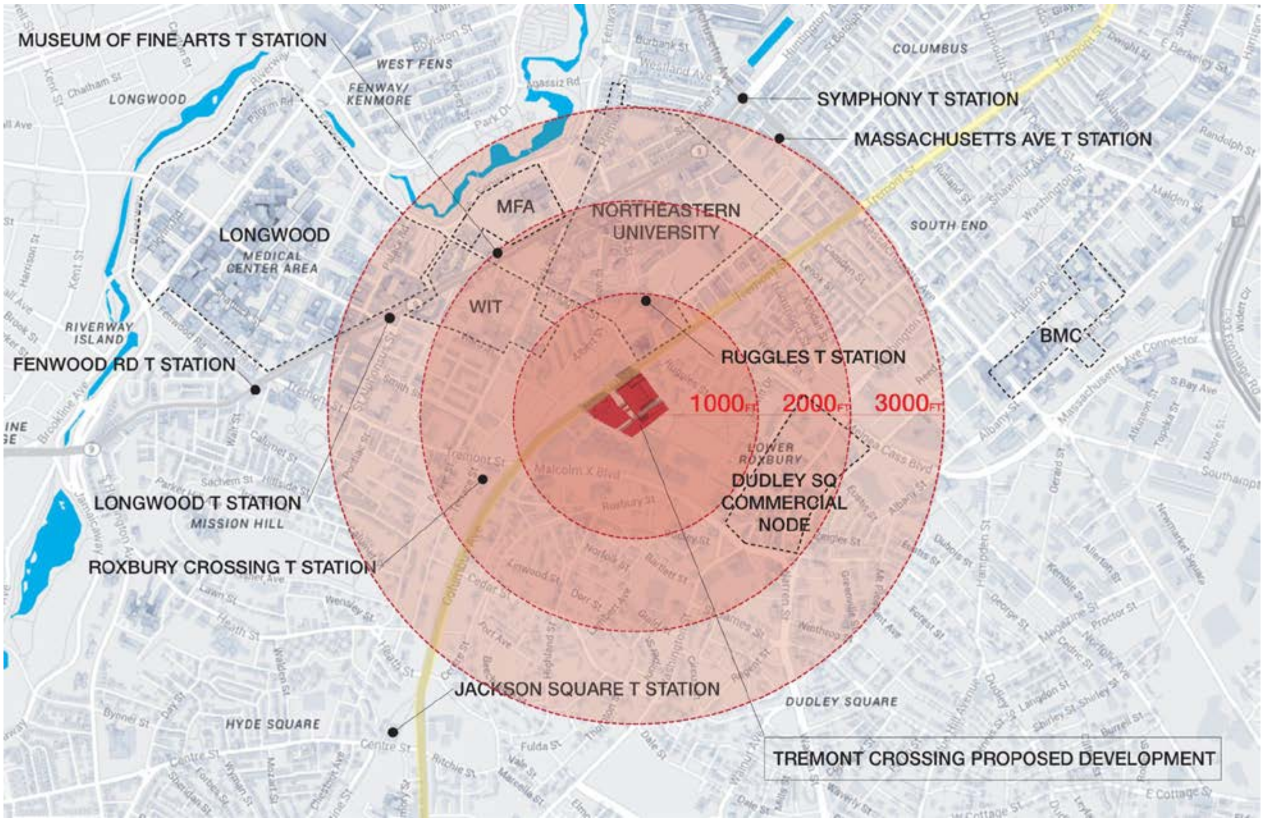


Figure 1-2: Arial Locus Map

1.2.2 *Proposed Development*

The Project's mix of uses will include: a retail component consisting of one (1) larger destination retailer of 92,000 square feet, 197,700 square feet of other destination retail, including entertainment and recreational uses, and 108,900 square feet of smaller shops and boutiques fronting along Tremont Street, Whittier Street and the Project's newly created "Market Street" and "West Drive"; 105,000 square feet of office space, two (2) multifamily residential buildings with a total of 685 units, made up of studios, one (1) bedroom, two (2) bedroom and three (3) bedroom rental apartments, 9,400 SF of townhouse style residential, consisting of approximately nine (9) units of housing along Whittier Street, and 31,000 square feet of cultural facilities that will primarily house a museum for the National Center of Afro-American Artists ("NCAAA"). The Project will also include a large, central public plaza which will be bisected by a newly created Market Street and an adjacent, multi-level parking structure to accommodate the requirements of its tenants. The proposed parking structure would consist of approximately 1,371 spaces which includes providing 106 abutter parking spaces for Whittier Street Health Center (75 spaces) and the Boston Public Schools (31 spaces), resulting in a net number of 1,265 parking spaces related to the Project's uses.

Figure 1-3 and Figure 1-4 below sets forth the Project's uses and division between four (4) distinct urban blocks:

Figure 1-3: Project Uses

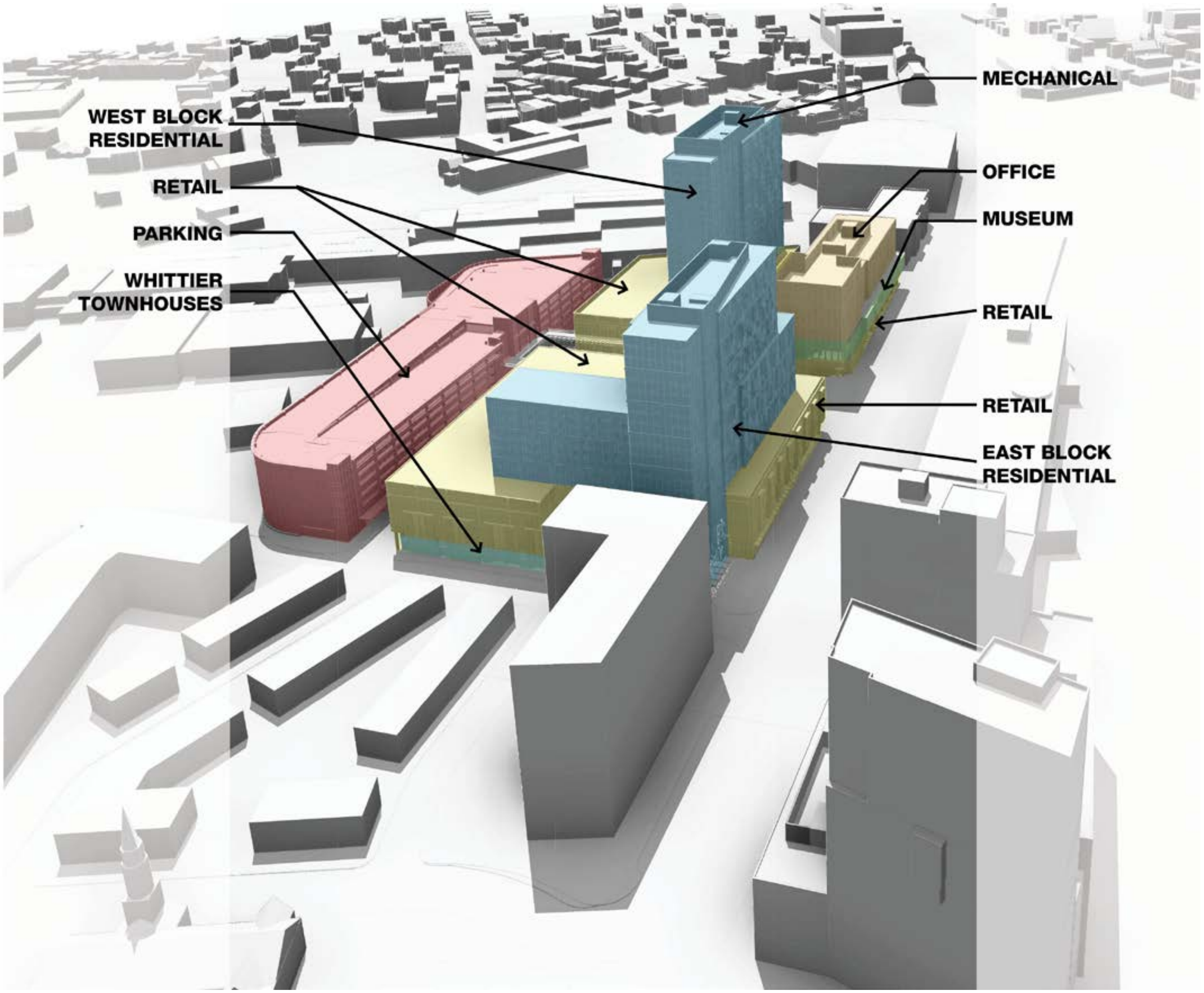
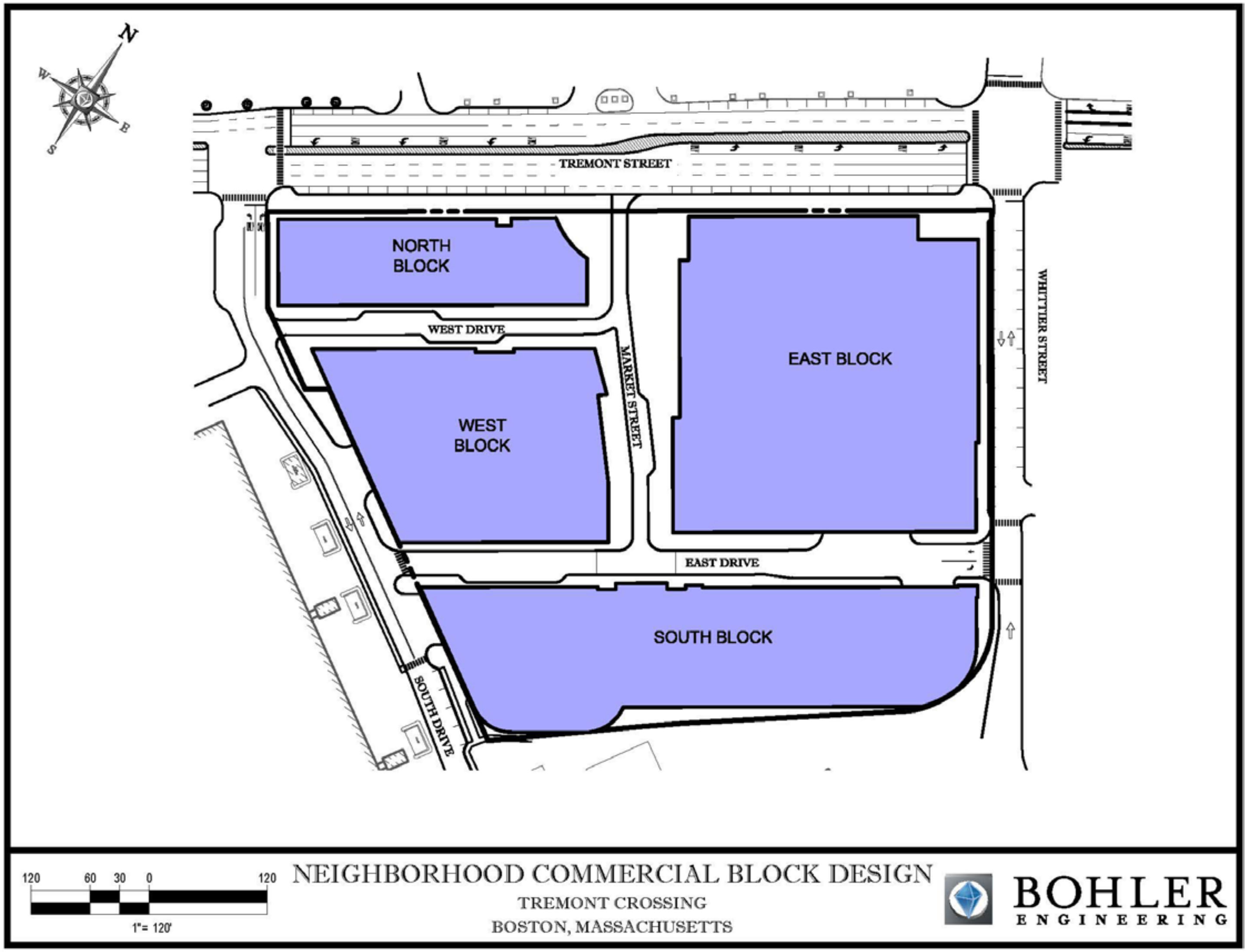


Figure 1-4: Project's Neighborhood Commercial Blocks



1.2.3 *Design Objectives*

The Project seeks to harmoniously integrate its mix of uses in a highly-functional, urban context creating a vibrant, pedestrian-friendly environment that is conducive to the success of its commercial and cultural tenants, as well as enhancing the quality of life in the neighborhood of which it will become a part. The retail portion of the Project will be a departure from the typical, suburban nature by being designed in a vertical rather than horizontal context that layers three (3) levels of retail within three (3) distinct neighborhood commercial scale blocks; the East Block, the West Block and the North Block.

The Museum and cultural space will be at the center of the development fronting a large public plaza at the Project's North Block and will be adorned with sculptures and outdoor seating space. Below the third floor Museum will be two (2) levels of retail, primarily consisting of smaller shops restaurants and boutiques. Rising above the Museum will be the Project's office use with panoramic, unobstructed views of the City.

Additionally, the Tremont Street, multifamily residential tower will sit atop the Project's retail podium at the East Block, which will house the Project's retail anchor on the second floor and entertainment uses on the third floor. On the ground level of the East Block will consist of restaurants and service stores and boutiques array along Tremont Street, in addition to townhouse style residential along the Whittier Street edge. The placement of the vertically oriented residential tower, the townhouse style residential and small retail along Tremont Street and Market Street will create a sense of pedestrian vibrancy in addition to breaking up the Project's massing. Further, a portion of the Tremont residential tower will wrap around both sides of the East Block's, three level, retail podium (in a "U" shape) and traverse along a significant portion of both the Whittier Street and Market Street edge. As a result, the Project will serve to enhance the residential character of Whittier Street and more seamlessly integrate into the urban density of which it is a part.

Further, a second residential building fronting on the Project's newly created West Drive, will emanate from above three levels of retail on the Project's West Block with small stores on the ground level, and destination driven retail and entertainment on the second and third levels, respectively. The

Proponent believes that this mixed-use design concept will create a lively, user-friendly environment not usually found in large commercial developments.

The multi-level parking garage, which will be accessible to all of the Project uses, will be situated toward the south end of the Site and thus will be hidden from view from Tremont Street. The garage's massing will be offset by visually tactile elements, including its central circulation core, which will be treated with moments of glass and transparency. Its Whittier Street edge will be treated with an architectural thoughtfulness that is indicative of its orientation towards a residential neighborhood. Further, the main pedestrian entrance to the garage's vertical circulation will be flanked by small, neighborhood scale retail. The edge of the garage that faces the Whittier Apartments at Whittier Street will also house a Community Meeting Room which will be one of the Project's public benefits.

The Proponent is designing all aspects of the Project with a sense of "transparency" that establishes connectivity with pedestrians and with the wider, surrounding public realm. Creating a sense of light and openness is a goal incorporated into the design of all of the Project's mix of uses, enhanced by the division of the Project into four (4), neighborhood commercial blocks (including the garage) and the incorporation of the large, vibrant public plaza which flows into a newly created Market Street. The neighborhood commercial scale is further accomplished by the creation of three new roads within the Project site, known as East Drive, West Drive and Market Street which separates the Project's north, east and west commercial blocks from that of the southerly block that includes parking.

The Proponent recognizes that due to the Project's density, geographic location and importance to the community that the architecture is of paramount importance. Contributing to that end, are the design elements of the façade, building orientation, urban design and streetscape.

Figure 1-5: Central Market Street Plaza- View from Tremont Street

Figure 1-6: Residential Lobby and Plaza at the Corner of Tremont Street and Whittier Street

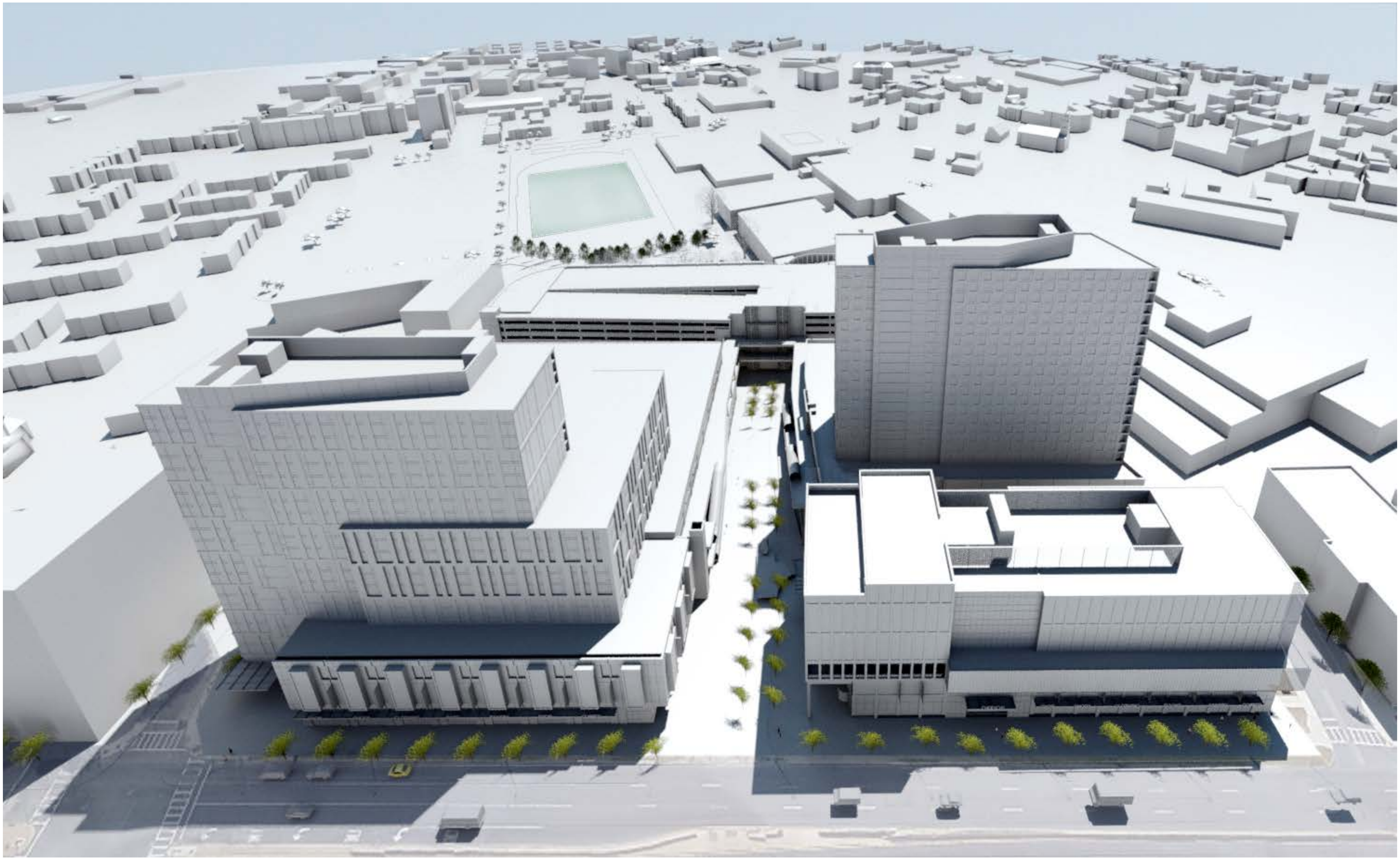
Figure 1-7: Looking East Down Tremont Street

Figure 1-8: Garage View from Playing Fields

Figure 1-9: Plaza Westerly View

Figure 1-10: Plaza Easterly View

Figure 1-11: Overhead View from Tremont Street



1.2.4 *Project Proponent*

The Project Proponent, P-3 Partners LLC (the "Proponent"), is a collaboration between Elma Lewis Partners, LLC ("ELP") and Feldco Boston, LLC, an affiliate of Feldco Development Corp ("Feldco").

ELP is an entity created by the NCAAA for the purpose of this development effort. The mission of the NCAAA, a 501 (c) (3) organization, is to preserve and foster the cultural arts heritage of African-Americans worldwide through arts teaching, and the presentation of professional works in all fine arts disciplines. For more than half a century, the NCAAA has striven towards this bold and expansive vision, and remains the largest independent black cultural arts institution in New England. In furtherance of this mission, since 1969 the NCAAA has operated the Museum for the National Center of Afro-American Artists in Roxbury, Massachusetts, which has been its principal operating activity. The Museum presents a wide range of historical and contemporary exhibitions in many media, including painting, sculpture, graphics, photography and decorative arts. It has presented hundreds of exhibitions, including many that it co-presented with the Museum of Fine Arts, an institution with which it has enjoyed a long-standing collaboration.

Feldco has been active in developing, owning and managing realty investments for over forty-seven years. Starting in July 1969, on Long Island's North Shore, the Company has extensive experience in all property types.

In that time frame, Feldco has developed or renovated through acquisition over 100 major shopping centers and malls, aggregating millions of square feet of retail space throughout New York, New Jersey, the six New England states and as far away as Ohio, Michigan, Wisconsin, Illinois, Indiana, Texas and Florida.

Over those years, the Company has also developed many office buildings from New York to Florida for such tenants as the N.Y. Telephone Co., AT&T, the Veteran's Administration, N.Y. Life Insurance Company and many other major corporations.

Within the residential sector, Feldco's projects have ranged from ground-up construction of rental residences and condominiums to the rehabilitation of historic buildings. Additionally, Feldco has purchased buildings which were then rehabilitated and repositioned as either condominiums or rental housing, as well as the conversion of suburban mid-rise rental buildings into the cooperative form of ownership.

In the last decade, Feldco has embarked on the creation of large-scale, urban, mixed-use developments, unifying its years of experience in the retail, office and residential sectors. In this regard, it is widely recognized for its ability to turn challenging locations into popular destinations.

As a family-owned and operated business, Feldco is a hands-on development firm whose principals personally participate in every project. With each one, the Company "builds to own" and forges long-term relationships with communities by including them in the development process and then, upon completion, sponsoring regular events or charitable causes in the spirit of creating a richer environment for its neighbors. Feldco works closely with local leaders to ensure that all projects foster construction and full/part time permanent jobs for local residents. These elements are designed to create sustainability and to achieve healthier, more responsible environments.

1.2.5 *Public Review*

The Project will exceed 50,000 square feet of gross floor area which is the threshold for developments being subject to Large Project Review under Article 80 of the Boston Zoning Code (the "Code"). As such, the Proponent submitted a Project Notification Form ("PNF") to the Boston Redevelopment Authority on April 17, 2012. Additionally, the Proponent submitted a Draft Project Impact Report ("DPIR") on August 31, 2013. Subsequently, on January 15, 2016 the BRA issued to the Proponent a Request for Supplemental Information. In response to the Request for Supplemental Information the Proponent submitted a Supplemental Draft Project Impact Report ("Supplemental DPIR") on February 11, 2016. Upon its review of the Supplemental DPIR, the BRA requested additional information from the Proponent set forth in the Tremont Crossing Project Information Request, dated June 16, 2016 ("Project Information Request"), a copy of which is included herein as Appendix 1. This Second Supplement to the Draft Project Impact Report ("Second Supplement") is in response to the Project Information Request and is submitted for further review.

1.2.6 *Community and Public Benefits*

Table 1.1 below summarizes the Project's public benefits. In the aggregate, the Project will provide approximately $14.6 million in one-time benefits as a result of construction, in addition to approximately $230,000 annually thereafter.

The Proponent made a significant effort to engage with the community regarding their input on the Project's community and public benefits. This grass-roots initiative has included: door-to-door canvassing in the Whittier, Madison Park and Dudley Square neighborhoods; over a hundred presentations to individual stakeholders, community groups and religious institutions; a flyer dissemination to thousands of community members; and conversations with many City of Boston departments and agencies. Table 1-1 summarizes the specific monetary commitments that the Proponent has made towards its community benefits package. An in-depth narrative of each community benefit is set forth in Section 1.2.6 of the Supplemental DPIR.

Table 1-1: Community and Public Benefits

NCAAA Museum- Cost to Build and Design	$13,550,000
Good Shepherd Church Rehabilitation	400,000
Contribution to Job Training Facility	360,000
Community Meeting Room	250,000
Total Benefits Upon Completion of Construction	$14,560,000
Ongoing Annual Benefits	
Alice Taylor Housing	$10,000
Whittier Apartments	15,000
Office of Collaboration and Partnership	125,000
Rent Contribution for Local Entrepreneurs	80,000
Total Annual Benefits	$230,000

1.3 Consistency with Zoning

According to the City of Boston Zoning Commission ("BZC") maps, effective as of October 28, 1992 as published and maintained by the BRA on its website and as updated periodically by the BRA, the Project Site is located in the Roxbury Neighborhood District (the "District") under Article 50 of the Code (the "Underlying

Zoning”). Within the District, the Project Site is located within the Greater Roxbury Economic Development Area established pursuant to Section 50-8 of the Code (the “Greater Roxbury EDA”). A portion of the Project Site located within the Greater Roxbury EDA and proximate to Tremont Street is also located within the Tremont Street Boulevard Planning District established pursuant to Section 50-37 of the Code. The Project Site is not located within the Restricted Parking (Overlay) District established pursuant to Section 3-1A(c) of the Code nor is it located within the Groundwater Protection Overlay District under Article 32 of the Code.

The Project, as presently proposed, does not comply with all the requirements of the Code and the Underlying Zoning, but Proponent intends to achieve compliance via approval of a Planned Development Area (“PDA”) pursuant to Sections 3-1A.a and 80C of the Code.

1.4 Preliminary DIP Information

The Project will be a Development Impact Project within the meaning of Section 80B-7 (Development Impact Extractions). In that regard, the approximate, preliminary measurement of the gross floor area (GFA) to be used for “DIP Uses” (as defined in the Code) is approximately 1,201,701 square feet. This calculation does not include the Project’s parking structure of approximately 442,000 square feet.

2.0 PROJECT DESCRIPTION

2.1 Existing Site

The Project will be located at Parcel P-3 (consisting of Parcel P-3 and a portion of Parcel P3-h in the Campus High School Urban Renewal Area) in Boston's Lower Roxbury neighborhood. The Project Site consists of approximately 7.25 acres of land area and is bounded by Tremont Street to the northwest, Whittier Street to the northeast, Downing Street to the southeast, the Whittier Street Health Center, the Madison Park Technical Vocational High School and the John D. O'Bryant School of Mathematics and Science to the southwest.

The Project Site is currently vacant and is being used as ancillary parking for some of the abutting educational and City agencies.

2.2 Proposed Development Program

2.2.1 *Building Program*

The Project's mix of uses will include: a retail component consisting of one (1) larger destination retailer of 92,000 square feet, 197,700 square feet of other destination retail, including entertainment and recreational uses, and 108,900 square feet of smaller shops and boutiques fronting along Tremont Street, Whittier Street and the Project's newly created "Market Street" and "West Drive"; 105,000 square feet of office space, two (2) multifamily residential buildings with a total of 685 units, made up of studios, one (1) bedroom, two (2) bedroom and three (3) bedroom rental apartments, 9,400 SF of townhouse style residential, consisting of approximately nine (9) units of housing along Whittier Street, and 31,000 square feet of cultural facilities that will primarily house a museum for the National Center of Afro-American Artists ("NCAAA"). The Project will also include a large, central public plaza which will be bisected by a newly created Market Street and an adjacent, multi-level parking structure to accommodate the requirements of its tenants. The proposed parking structure would consist of approximately 1,371 spaces which includes providing 106 abutter parking spaces for Whittier Street Health Center (75 spaces) and the Boston Public Schools (31 spaces), resulting in a net number of 1,265 parking spaces related to the Project's uses.

Figure 2-1 through 2-8, below, depict the Project's Site Plan and Floor Plans.

Figure 2-1: Site Plan

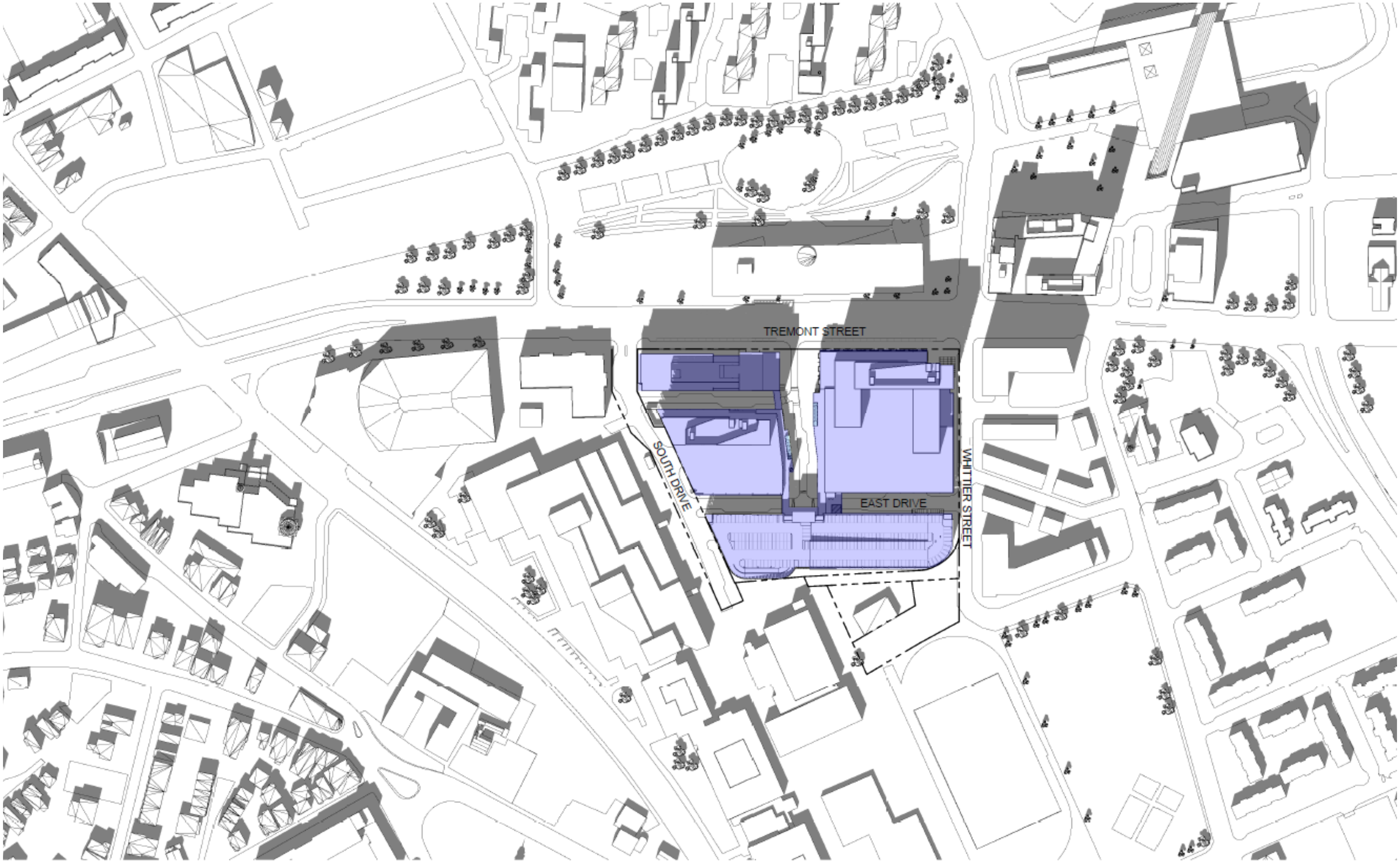


Figure 2-2: Ground Floor Plan

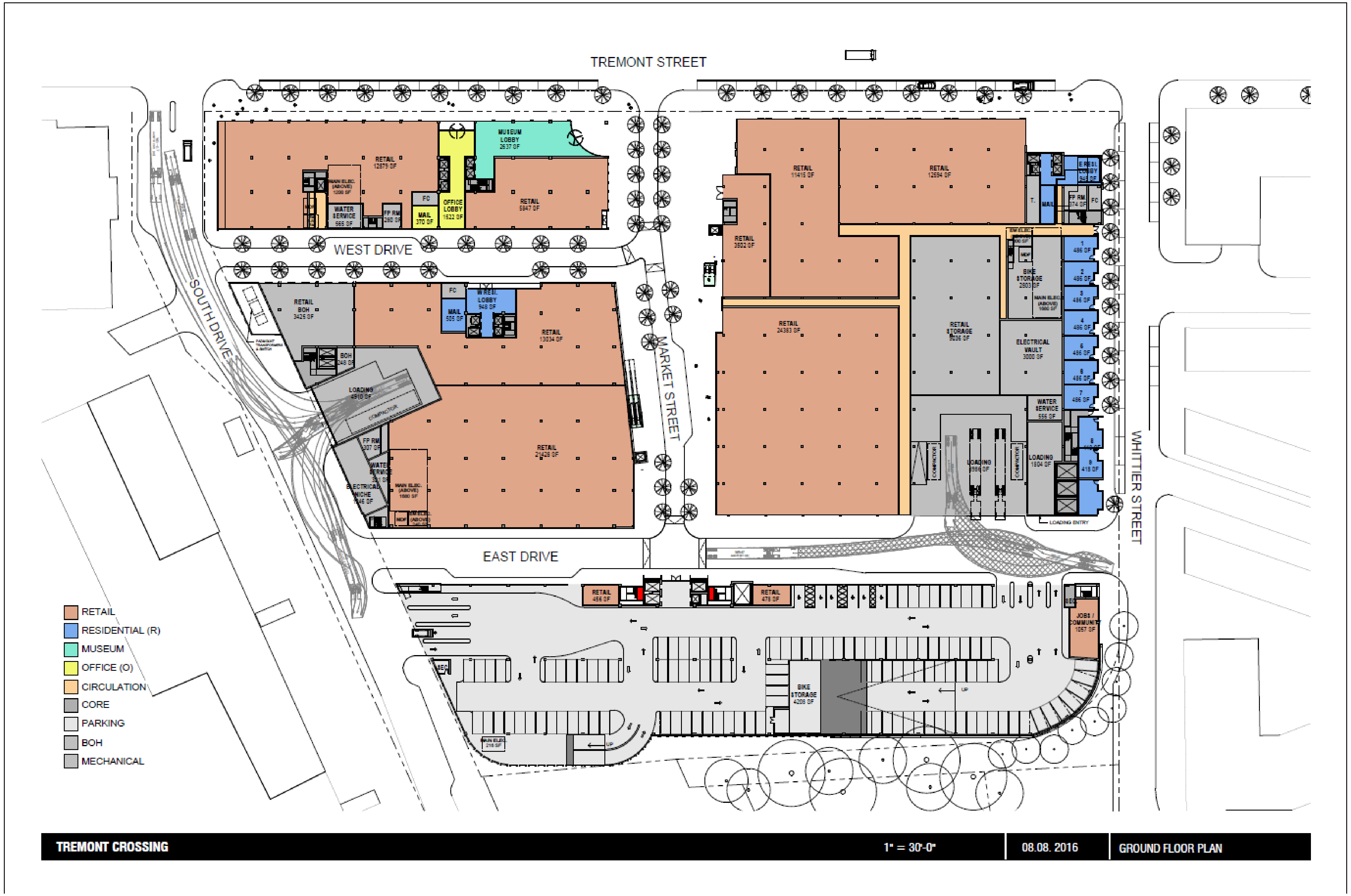


Figure 2-3: Level 2 Retail

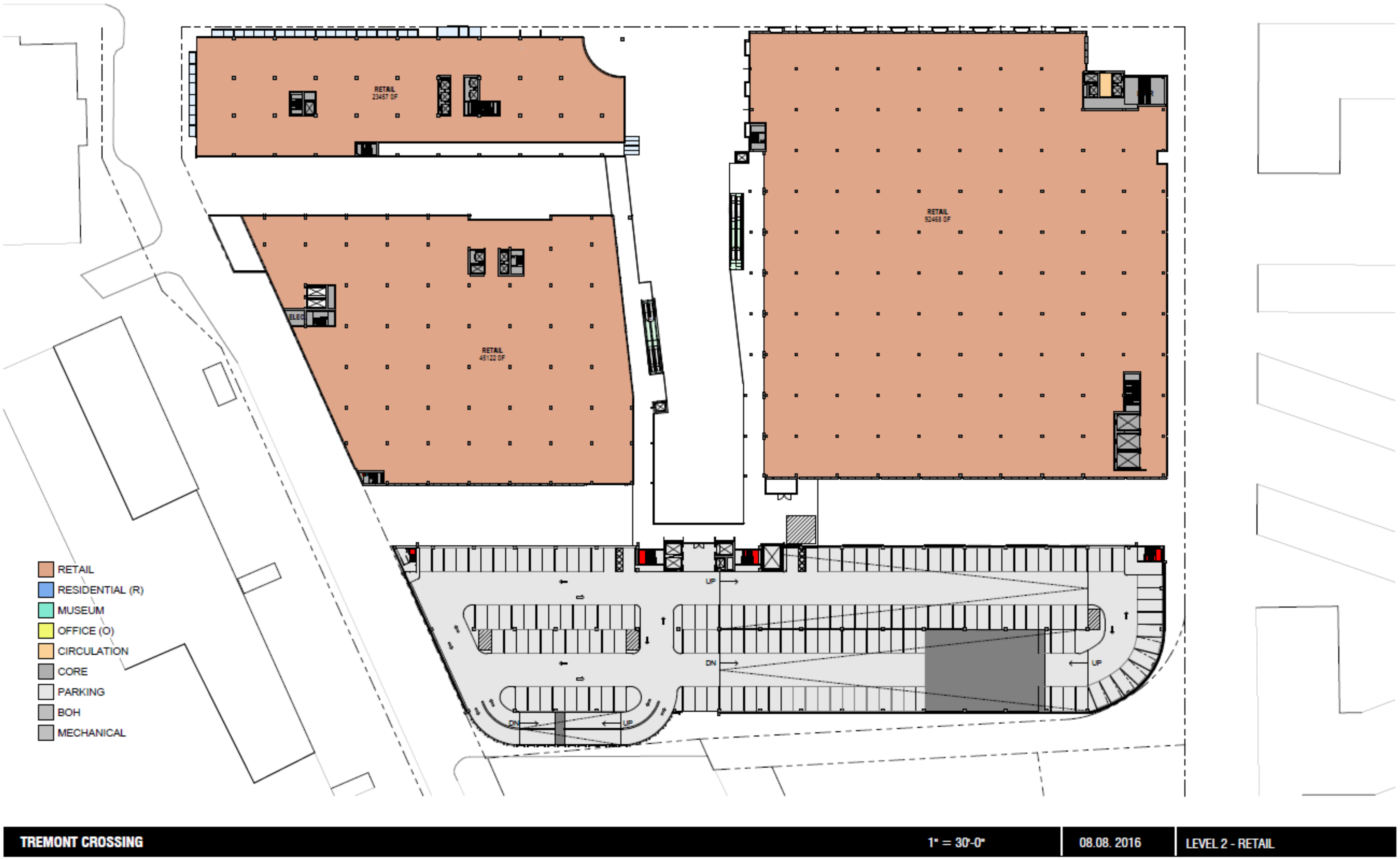


Figure 2-4: Level 3 or 3A

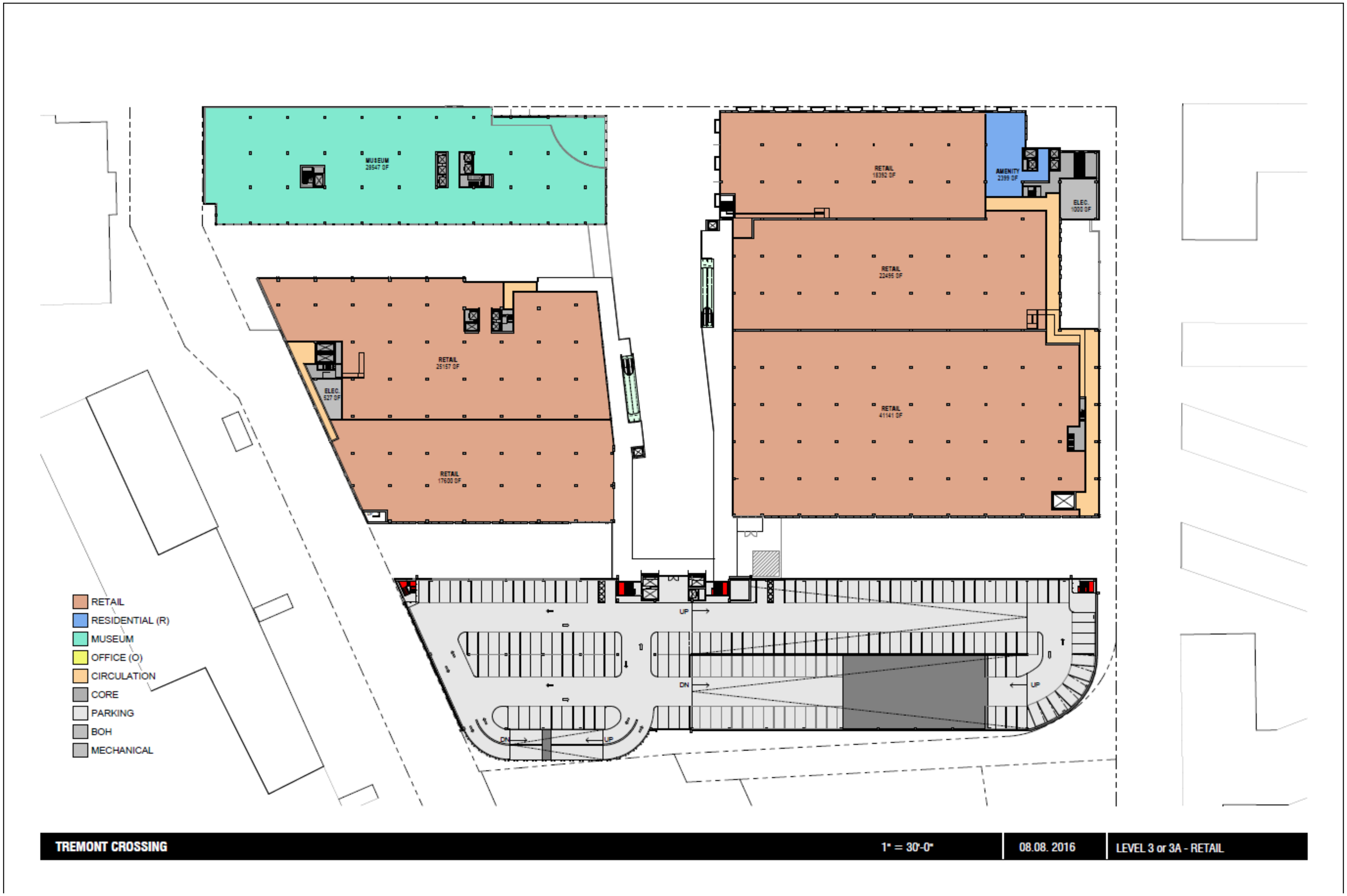


Figure 2-5: Level 4 Residential / Office

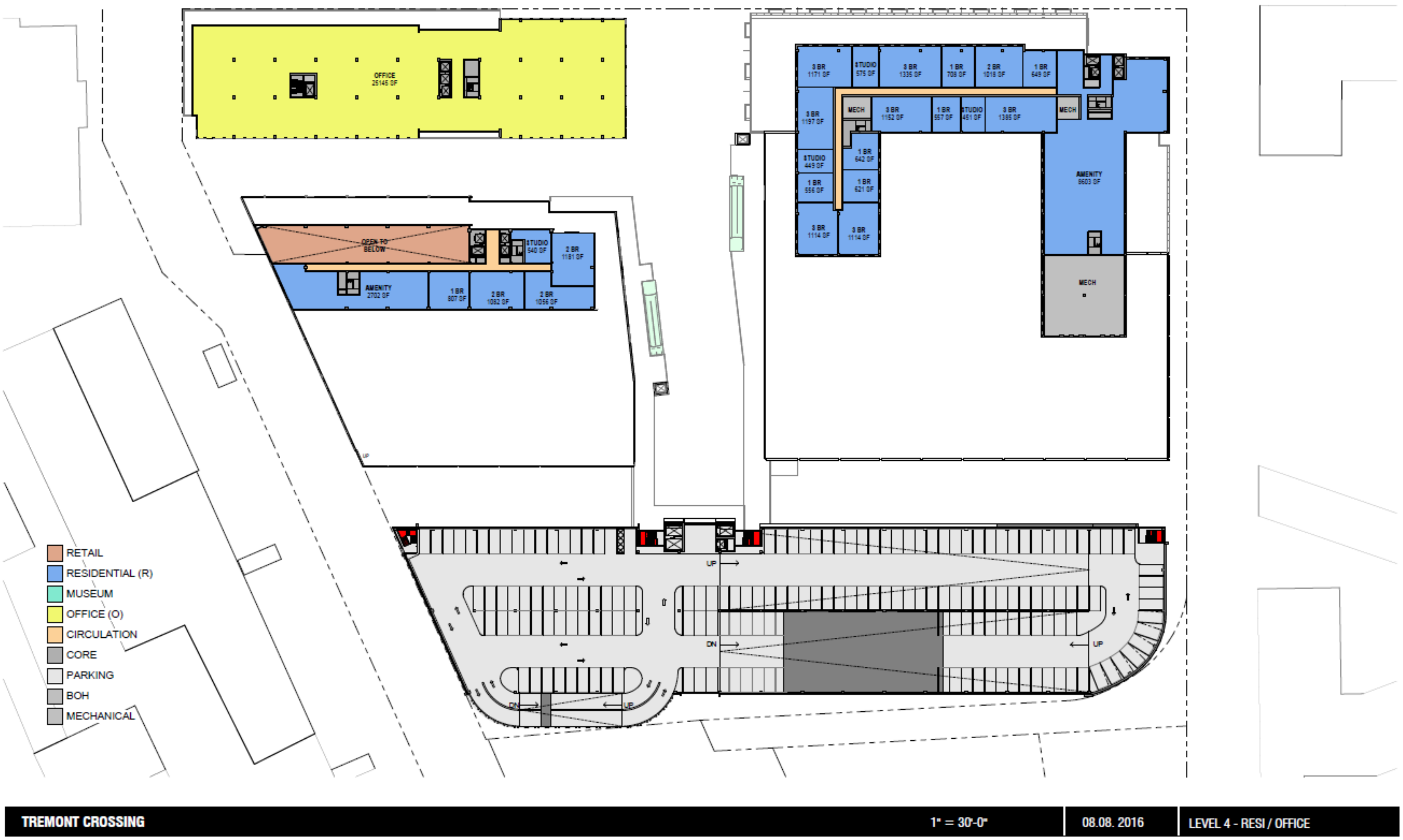


Figure 2-6: Level 8 Residential / Office PH

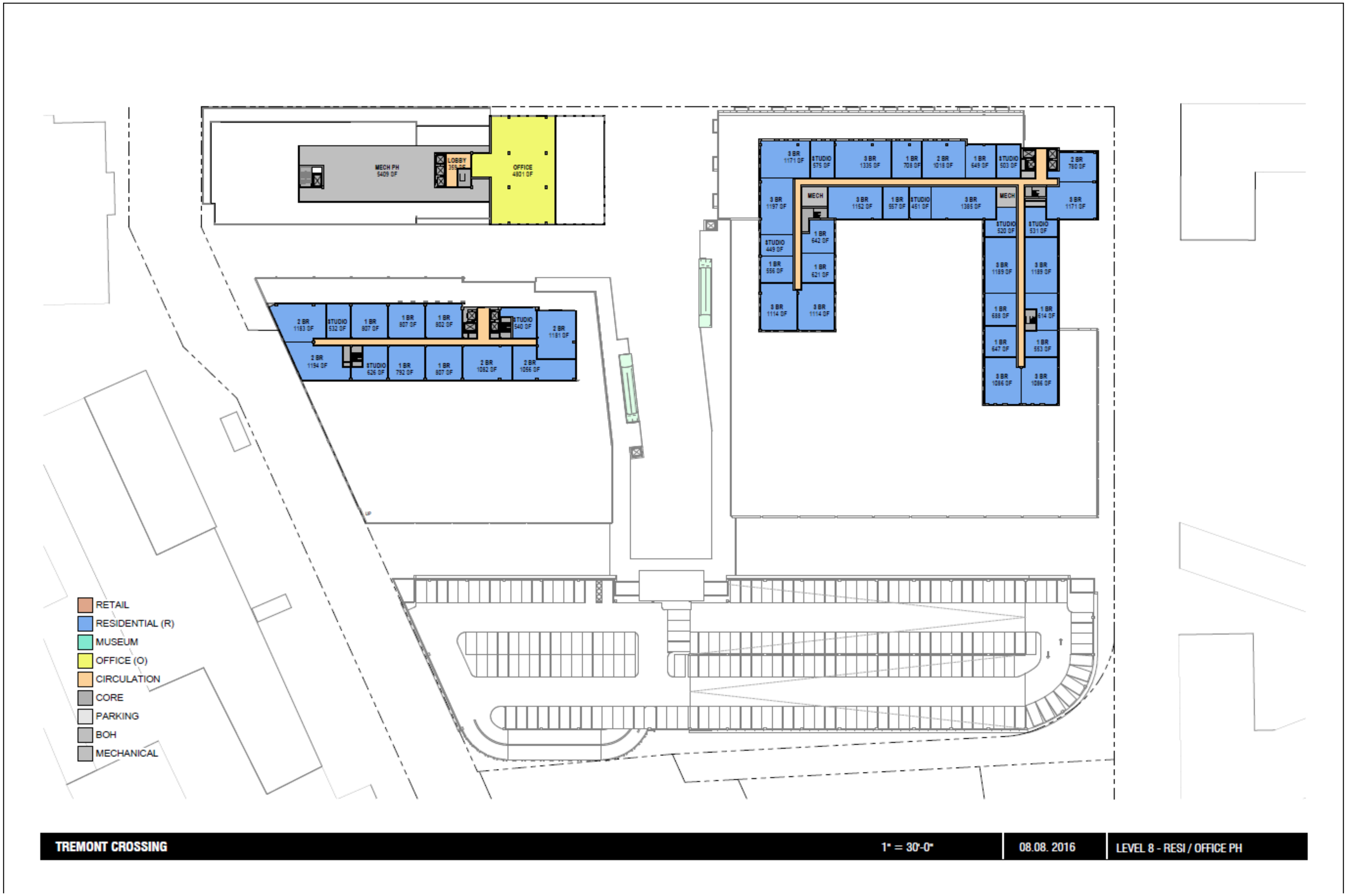
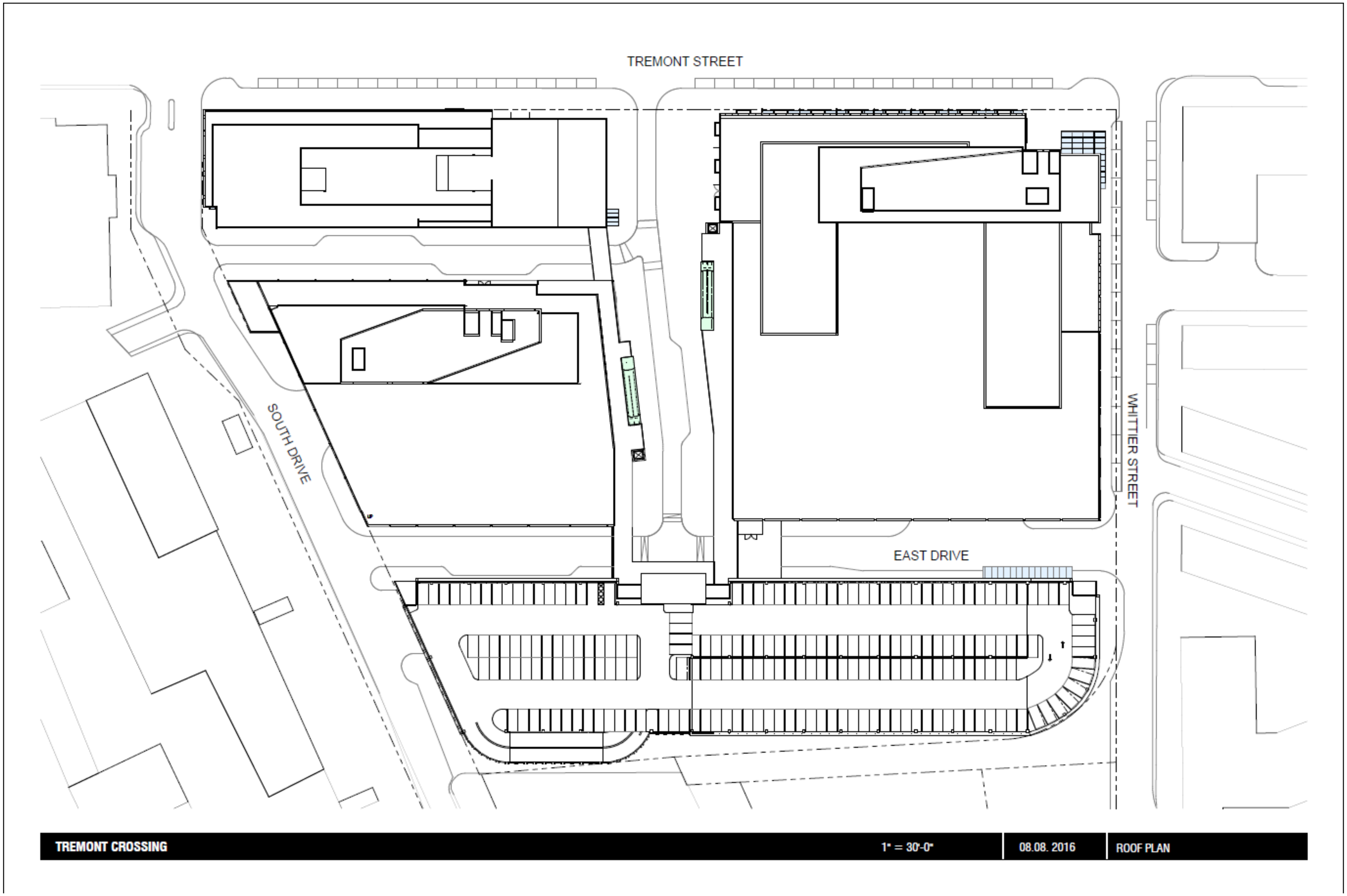


Figure 2-7: Level 17 Residential

Figure 2-8: Roof Plan



2.2.2 *Approximate Sizes*

Table 2-1 presents the approximate sizes of the Project:

Table 2-1: Approximate Sizes and Uses

Element	**Square Feet**	**Building Levels**
Destination Retail	289,798 s/f	Levels 2 - 3
Neighborhood Retail	108,923 s/f	Ground Floor
Office	100,000 s/f	4 ½ Levels (above 3 levels)
Tremont Street Residential (East Block)	386,700 s/f (385 units)	17 Levels (above 3 levels)
West Drive Residential (West Block)	279,300 s/f (300 units)	19 Levels (above 3 levels)
Whittier Street Townhouses	9,400 s/f (9 units)	2 Levels
Museum / Cultural Center	31,000 s/f	1 Level (above 2 levels)
Parking	442,000 s/f	6 ½ Levels

The layout of the Project's three (3) main building structures, two residential towers and the office building, are presently envisioned to surround the central Market Street portion of the plan and two of the primary buildings, the Tremont residential tower and the office building, will front Tremont Street. The third major component is also a residential tower and it is set back from Tremont Street along the proposed new West Drive. Smaller retail consisting of shops, restaurants and boutiques will be on the ground level of each. The destination retail / entertainment will consist of the two (2) upper levels of the East and West Block and the second level of the North Block for a total of three (3) retail floors, each of which will be on average approximately twenty-two feet (22') in height, from floor to floor for a total building retail zoning height of sixty-four and a half feet (64 ½) feet and sixty-seven feet (67') at the West and East Block respectively. The two levels of retail at the North Block will be lower and rise thirty-six (36) feet.

The residential tower facing Tremont Street on the East Block rises total of twenty stories (20) in total from the ground floor at the corner of Whittier

Street and Tremont Street (including the three levels of retail beneath). The tallest portion of the residential building will have a zoning height of two hundred and forty-three (243') feet. The residential tower also extends down Whittier Street and Market Street sides of the retail podium. This component will rise eleven (11) levels in total above the street. The height of this portion of the retail/residential tower that traverses Whittier Street and Market Street will be approximately one hundred fifty-two (152') feet of zoning height.

The Second building structure facing Tremont Street at the North Block will consist of two (2) levels of retail, the NCAAA Museum on the third level and four and a half (4 ½) stories of office above, for a total zoning height of one hundred and sixteen (124') feet.

The third significant building at the West Block is also a residential structure and is bisected from Tremont Street by West Drive. The building sits towards the western end of the site above three (3) levels of retail. This residential building, including the retail levels below, will be twenty-two (22) floors with a total zoning height of two hundred and sixty-four (264) feet.

The parking structure will be physically connected to the retail uses via pedestrian bridges. The garage is 6 1/2 stories at seventy-seven (77) feet of zoning height.

The Project Site consists of approximately 7.25 acres (315,810 square feet) of land area with a GFA (including parking) of approximately 1,643,701 feet. This equates to a proposed project FAR of 5.20.

The Section diagrams in Figures 2-9 through 2-13 below set forth the building heights of the Project.

Figure 2-9: Section Cut East - West (Residential / Office)

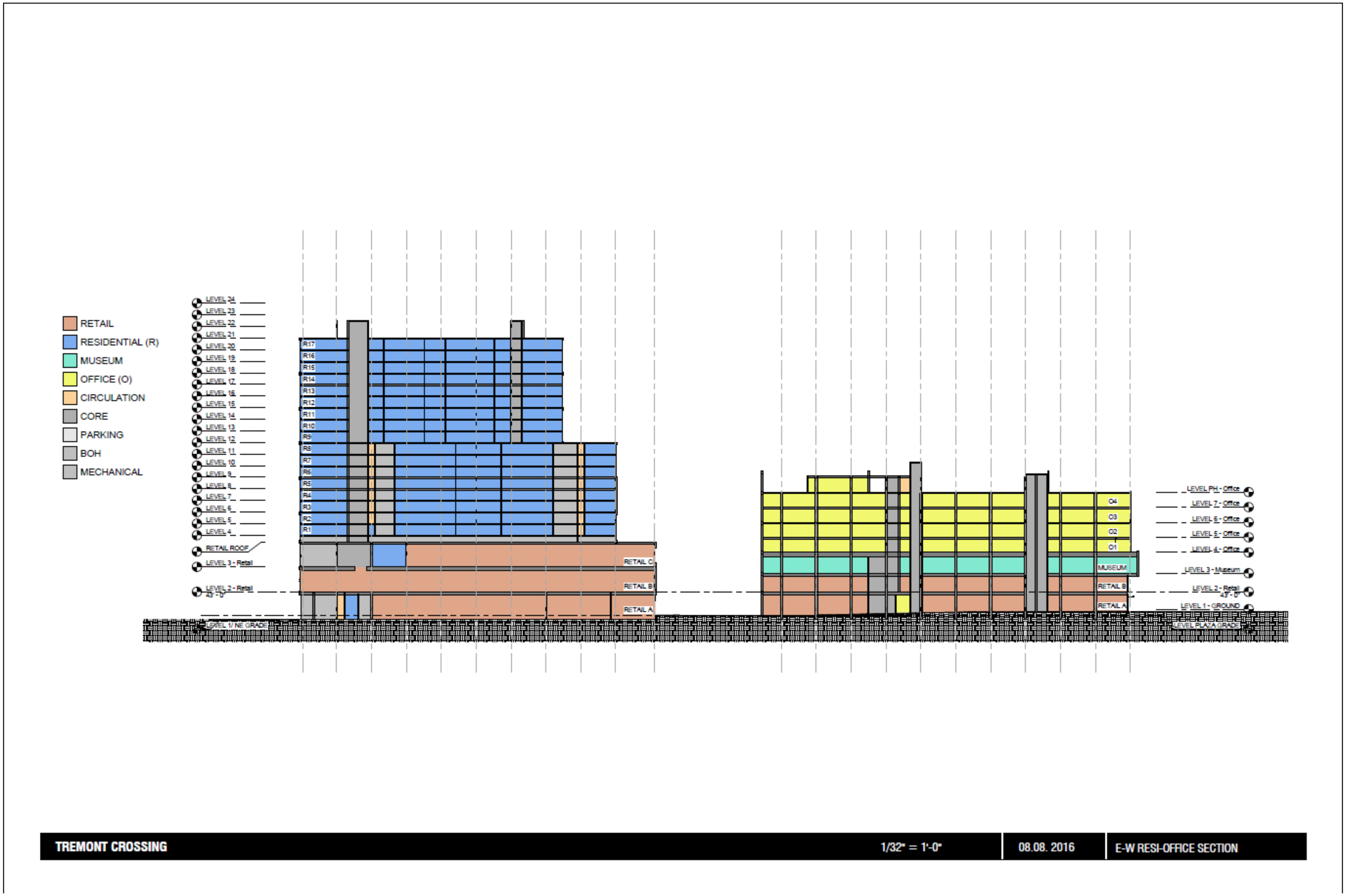


Figure 2-10: Section Cut East – West (Residential and Retail)

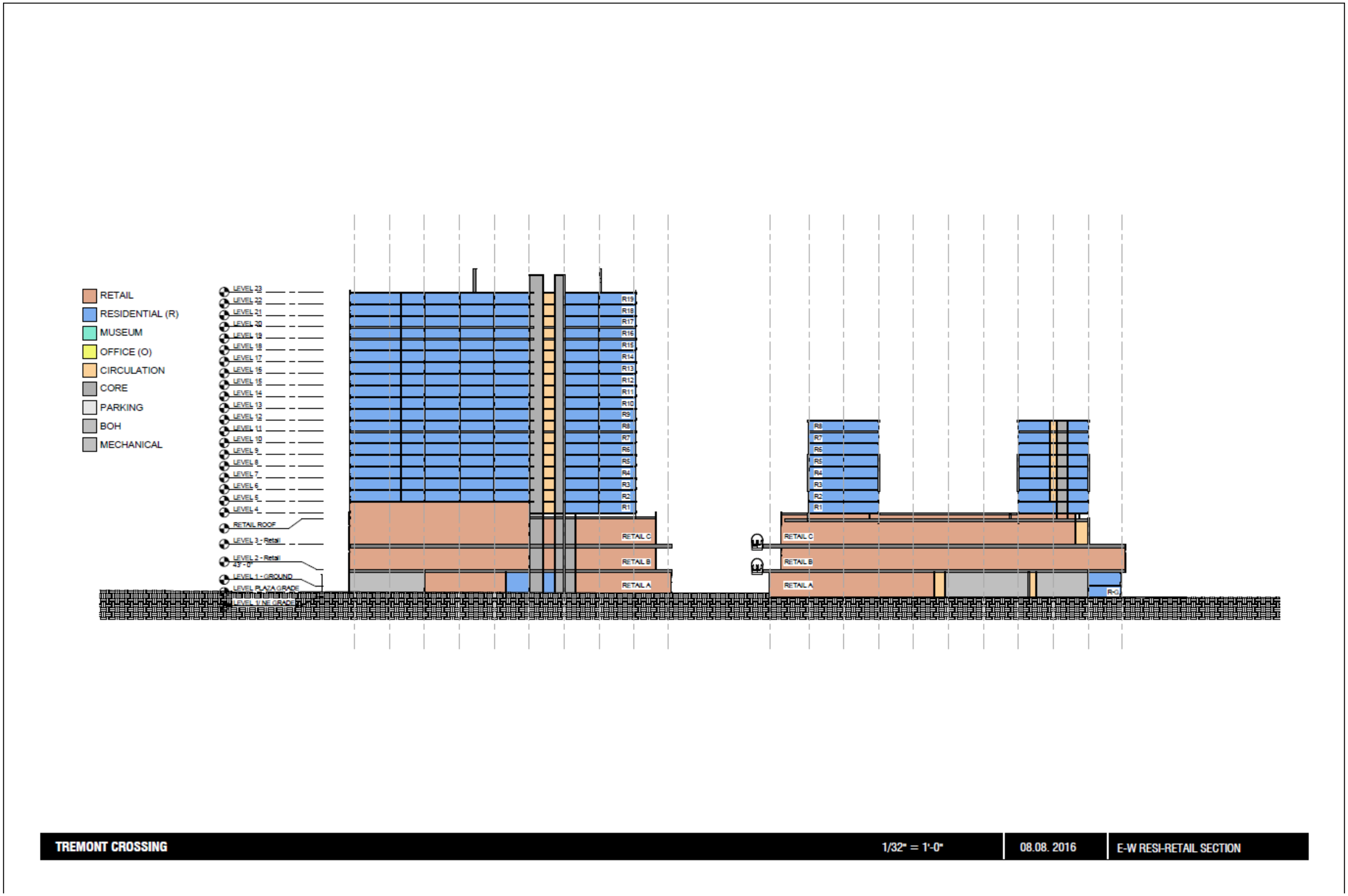


Figure 2-11: Section Cut Garage

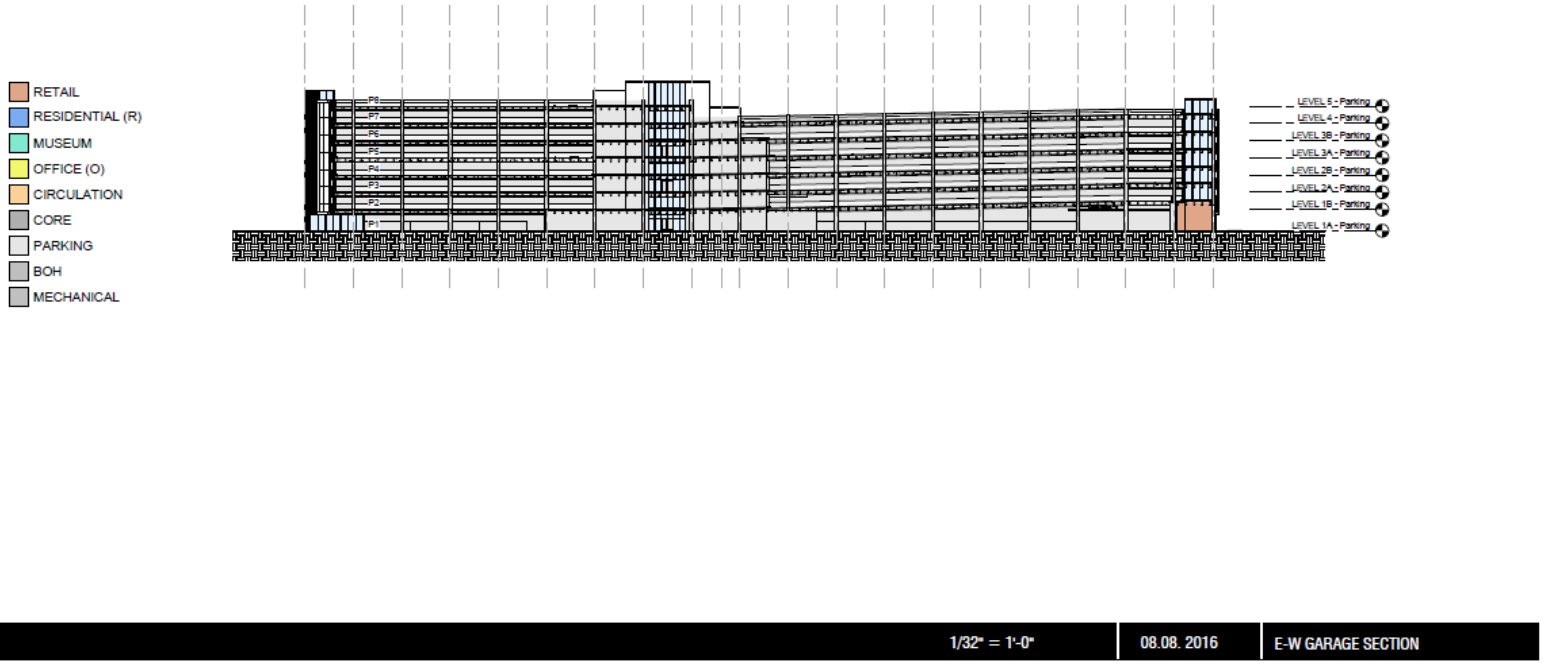


Figure 2-12: Section Cut North – South (Residential and Office)

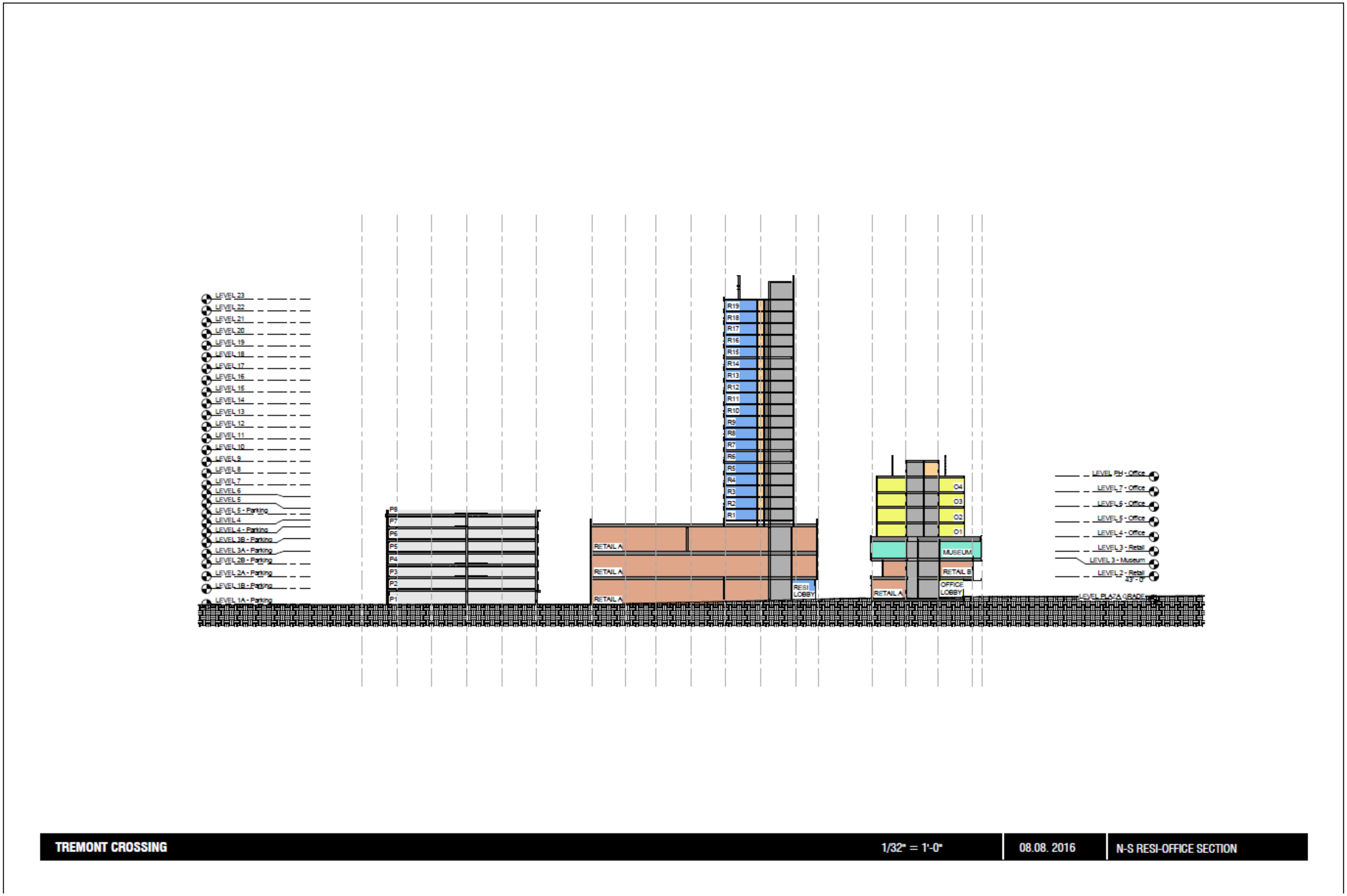
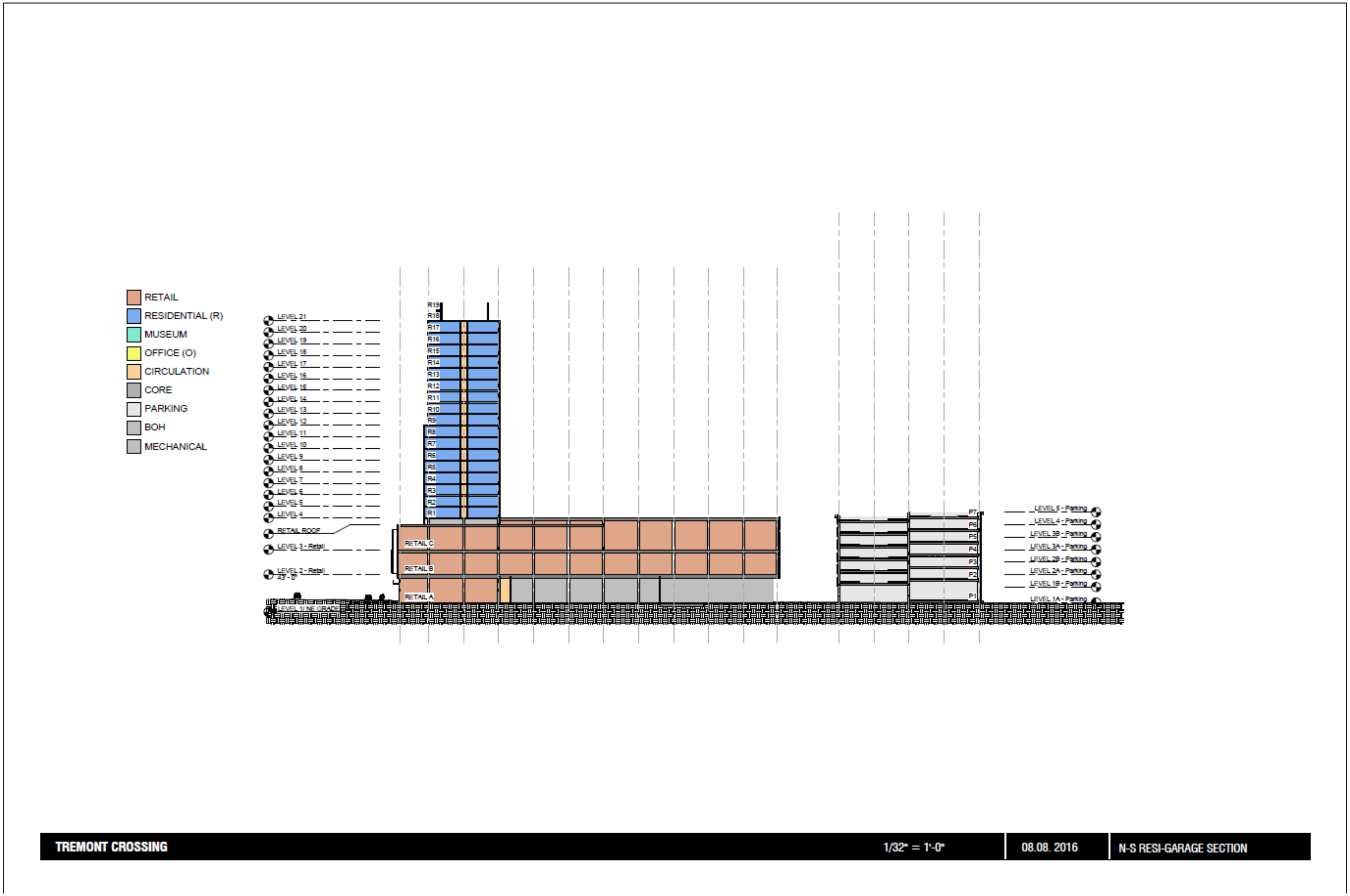


Figure 2-13: Section Cut North – South (Residential and Garage)



2.3 Schedule

The Proponent anticipates that the public comment period necessitated by the Second Supplement submission will commence upon its submission and that it will coordinate with the BRA on the timing of the process going forward.

3.0 TRANSPORTATION

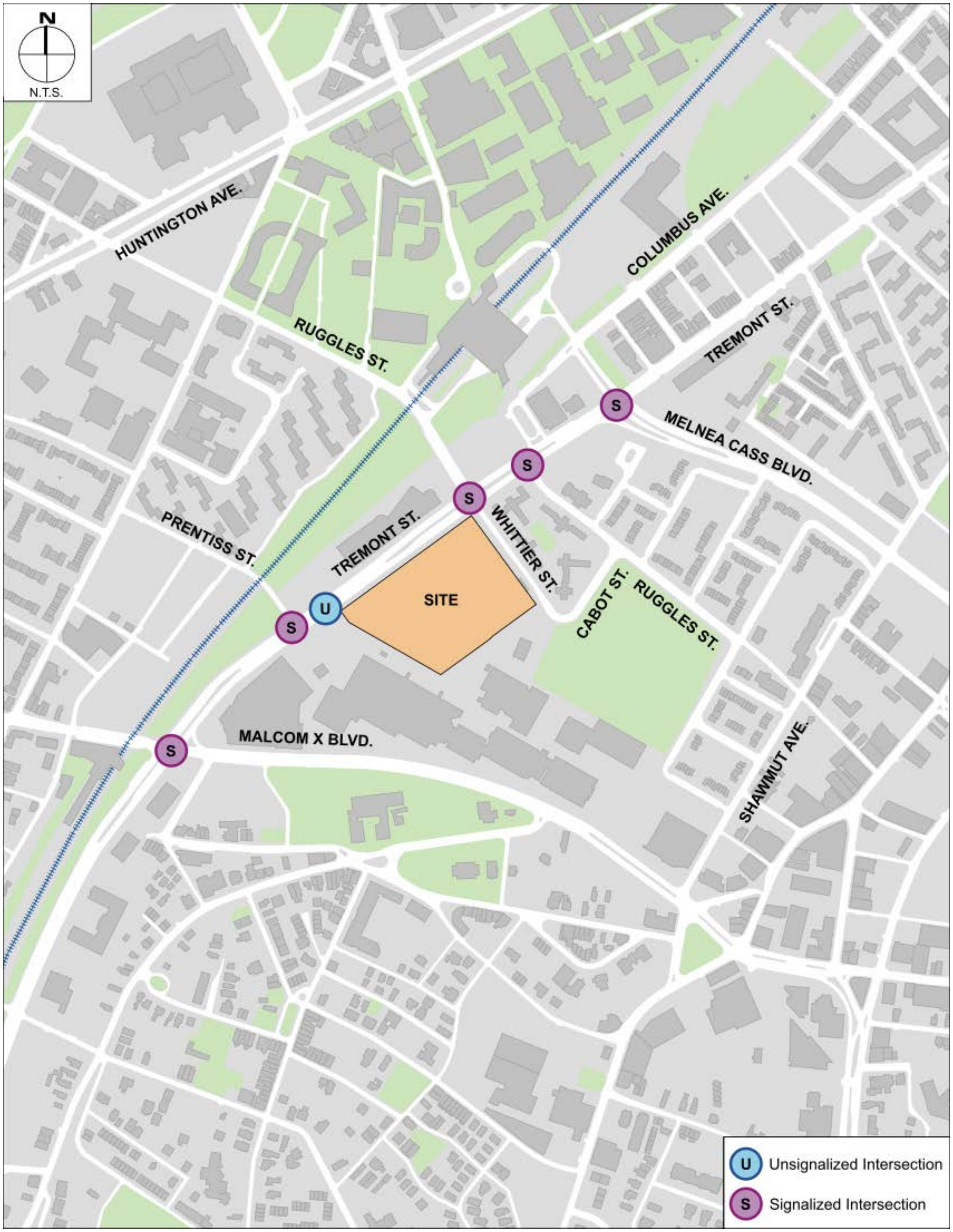
3.1 Introduction

The following sections set forth the transportation considerations that are specific to the Project. Included in these sections are a comprehensive traffic and parking analysis which will examine traffic, parking, public transportation, and pedestrian access and loading activities in the vicinity of the Project. Trip generation estimates, transportation impacts, and transportation demand management measures associated with the Project are also included in these sections. A locus of the Project and Study Area Intersections are displayed in Figure 3-1.

3.2 Project Description

The Project's mix of uses will include: a retail component consisting of one (1) larger destination retailer of 92,000 square feet; 304,000 square feet of other retail including entertainment, recreational uses, and smaller shops and boutiques fronting along Tremont Street, Whittier Street, and the Project's newly created "Market Street" and "West Drive"; 105,000 square feet of office space; two (2) multifamily residential buildings with a total of 694 units made up of studios, one (1) bedroom, two (2) bedroom, three (3) bedroom rental apartments, and townhouses; and 31,000 square feet of cultural facilities that will primarily house a museum for the NCAAA. The office space may be completed in a second phase of the project, but has been included in this section for analysis purposes. The development will also include a large, central public plaza which will be bisected by a newly created Market Street, and a multi-level parking structure to accommodate the requirements of its tenants. In addition, a museum, residential, and office drop-off area will be provided long the newly created West Drive. The proposed parking structure will consist of approximately 1,371 spaces (including parking for the office use), which includes providing 106 abutter parking spaces for Whittier Street Health Center (75 spaces) and the Boston Public Schools (31 spaces), resulting in a net number of 1,265 parking spaces related to the Project's uses.

Figure 3-1: Project Locus and Study Area Intersections



3.3 Summary of Findings

The Project's mix of uses will include a 92,000 SF wholesale club, 304,000 SF of other retail, 105,000 square feet of office space, 695 units of multifamily residential, and 31,000 square feet of cultural facilities that will primarily house a new museum for the National Center for the NCAAA and other artist studio space. The development will also include a large public pedestrian plaza and a 1,371 car multi-level parking structure (106 of which will be for the Project's abutters).

The Project proposes the following roadway and intersection modifications intended to improve the transportation network in the vicinity of the Project:

- Convert Whittier Street from one-way to two-way between Tremont Street and the proposed East Drive.
- Signalize the intersection of the site driveway at Tremont Street. The proposed traffic signal will include a pedestrian signal that will allow pedestrians to cross concurrently with the appropriate traffic signal phase, with crosswalks, accessible ramps, and pedestrian push buttons and signals. This intersection and the adjacent intersection of Prentiss Street at Tremont Street will be operated by one traffic signal controller.
- Remove the jersey barrier dividing Tremont Street at the site drive to allow left-turns into and out of the Site.
- Provide a left-turn pocket on Tremont Street southbound at Whittier Street for access into the Site.

There are four existing off-street parking facilities located within a one-quarter mile radius of the Site (Figure 3-5). On-street spaces exist in the vicinity of the Site in the form of time restricted, unregulated, police vehicle, taxi, handicapped, and resident parking spaces (Figure 3-6). The Project proposes to create additional on-street parking spaces on Tremont Street in front of the Project Site. The Project also proposes a museum, residential, and office drop-off area to be located off of West Drive with one-way vehicular travel from South Drive northeasterly to the newly created Market Street, and a retail drop-off area to be clearly demarcated and located off of Market Street within the proposed pedestrian plaza area, with one-way vehicular travel from the proposed East Drive northwesterly to Tremont Street. A portion of Whittier Street will be converted from one-way to two-way and parallel parking will be provided along both sides of the roadway. Parking on the north side of Whittier Street will require a residential parking permit with the parking on the south side, closest to the Project Site anticipated to be metered. Drop off for the Tremont Street residential building will be made available on Whittier Street near to the

Tremont Street corner. Additionally, the Proponent proposes to have a pick-up/drop-off area for retail customers along East Drive, adjacent to the Parking Garage.

In keeping with the Transit-Oriented Development nature of the Project, a large percentage of trips to the Site will be made as pedestrian, bicycle, and transit trips. The area is accessible to fourteen (14) bus routes, two MBTA Orange Line stations, and a commuter rail station serving three branches that terminate at South Station or Downtown Boston. In addition, the area is well served by sidewalks measuring 7-10 feet wide in most locations Both the Southwest Corridor Park and the South Bay Harbor Trail are within walking distance and provide pedestrian and bicycle access between the Project Site and surrounding areas, including South End, Roxbury, Back Bay, Chinatown, Jamaica Plain, South Boston, and the Fort Point Channel. The Project proposes to provide bicycle racks, a Hubway station and/or indoor bicycle storage on Site, as well.

The proposed Project is expected to generate:

- 6,207 vehicle trips during the average weekday, with 229 vehicle trips occurring during the weekday morning peak hour, 536 vehicle trips occurring during the weekday evening peak hour, and 750 vehicle trips occurring during the Saturday midday peak hour
- 6,366 transit trips during the average weekday, with 259 transit trips occurring during the weekday morning peak hour, 654 transit trips occurring during the weekday evening peak hour, and 745 transit trips occurring during the Saturday midday peak hour
- 665 pedestrian trips occurring during the weekday morning peak hour, 1,954 pedestrian trips occurring during the weekday evening peak hour, and 2,425 pedestrian trips occurring during the Saturday midday peak hour

The results of the traffic analysis indicate that, with the proposed improvements, there will not be a significant increase in delay due to the new vehicle trips generated by the Project.

3.4 Study Methodology

This report revises and updates the traffic data provided in the PNF, the DPIR (filed August 2013), and the supplemental DPIR (filed in February 2016), and reflects the current development program. This transportation study has been prepared in accordance with the Boston Transportation Department (BTD) Transportation Access Plan guidelines. This study also conforms to guidelines set forth by the Institute of Transportation Engineers (ITE) and the Massachusetts Environmental Policy Act (MEPA). All analyses are conducted using the Synchro 9 software, based on methods defined in the Highway Capacity Manual 2000 and 2010 (TRB, 2000/2010).

This study includes a review of existing transportation, roadway, and parking conditions in the vicinity of the Project, as well as an analysis of traffic operations at study area intersections. This study identifies background traffic growth for study area roadways, including traffic associated with other proposed projects in the vicinity of the Project Site. This study estimates additional traffic generated by the proposed development and evaluates impacts on the transportation network due to project-generated trips. Finally, this study proposes mitigation measures, including geometric improvements to the roadway network, signalization improvements, and Traffic Demand Management (TDM).

3.5 Study Area

Based on discussions with BTD, the following intersections are evaluated in this study in order to identify any potential project-related impacts on operating conditions at these locations:

- Tremont Street at Malcolm X Boulevard / Columbus Avenue;
- Tremont Street at Prentiss Street;
- Tremont Street at Whittier Street / Ruggles Street;
- Tremont Street at Ruggles Street;
- Tremont Street at Melnea Cass Boulevard;
- Tremont Street at Site Driveway.

This study evaluates the impacts on the aforementioned study area intersections, based on three conditions:

- 2016 Existing Conditions – to evaluate the traffic conditions that exist today. The 2016 condition was based on the year 2010 Existing Condition Synchro network provided by BTD, as well as more recent traffic volume collected for the proposed

Whittier Choice Health Center and Madison Park Infill Sites projects. Section 3.6.3 provides further discussion on how these traffic volumes were obtained;

- 2021 Future No Build Conditions – based on a 5-year planning horizon. This condition assumes that the proposed Project has not been built;
- 2021 Future Build Conditions – based on the same 5-year planning horizon, assuming the Project has been built.

3.6 Existing Transportation Conditions

This section presents the existing transportation conditions, including an overview of the roadway network, public transportation system, crash data, pedestrian and bicycle access, and parking supply.

3.6.1 *Roadways*

Tremont Street

Tremont Street is classified as an Urban Principal Arterial that generally runs in a northeast-southwest direction from Malcolm X Boulevard / Columbus Avenue in the southwest to Charles Street in the northeast. In the vicinity of the study area, Tremont Street has three travel lanes northbound and three travel lanes southbound. Sidewalks exist on both sides of the roadway, with land uses along the corridor composing of a mixture of commercial, residential, institutional, and recreational uses. Parking currently occurs along the west side of Tremont Street in front of the Boston Police Department in the vicinity of the study area, thereby reducing the number of usable travel lanes from three to two in the southbound direction.

Malcolm X Boulevard

Malcolm X Boulevard is classified as an Urban Minor Arterial and generally runs in an east-west direction from Tremont Street / Columbus Avenue in the east to Dudley Square (Dudley Street / Washington Street intersection) in the west. Malcolm X Boulevard generally consists of two travel lanes in each direction with sidewalks on both sides.

Columbus Avenue

Columbus Avenue is classified as an Urban Principal Arterial and generally runs in a north-south direction. Columbus Avenue begins in the north at its intersection with Eliot Street in Park Plaza and continues south beyond Melnea Cass Boulevard and turns east to its intersection with Tremont Street opposite Ruggles Street. There it breaks until it begins again at Tremont Street /

Malcolm X Boulevard, continuing south to its intersection with Seaver Street / Walnut Avenue. Columbus Avenue south of its intersection with Tremont Street / Malcolm X Boulevard generally provides three travel lanes in each direction with sidewalks on both sides of the roadway.

Prentiss Street

Prentiss Street is a local roadway that runs in a northwest-southeast direction from Parker Street to its intersection with Tremont Street. There are existing sidewalks along both sides of Prentiss Street. The Parker Street Lot and the Halleck Lot are located on the south side of Prentiss Street just east of Tremont Street and provide parking for area institutions. Prentiss Street provides one general travel lane in each direction.

Ruggles Street

Ruggles Street is classified as an Urban Minor Arterial that generally runs in a northwest-southeast direction. Ruggles Street begins at Huntington Avenue in the west and travels in the southeasterly direction to Tremont Street. At its intersection across from Whittier Street, Ruggles Street provides three eastbound lanes (two left-turn lanes and one right-turn lane) and two westbound travel lanes. Ruggles Street then shifts one block north on Tremont Street and continues as a one-lane, one-way street away from Tremont Street until its intersection with Washington Avenue. A sidewalk is provided on both sides of Ruggles Street along its entire length.

Whittier Street

Whittier Street is a local roadway that runs in a northwest-southeast direction from Tremont Street to Cabot Street. Whittier Street is a one-way roadway northwestbound. A sidewalk is provided on both sides of the roadway. On-street parking is allowed on both sides of Whittier Street along the entire length. These spaces are used mainly by area residents and commuters.

Melnea Cass Boulevard

Melnea Cass Boulevard is classified as an Urban Principal Arterial and generally travels in an east-west direction from Columbus Avenue in the west to Massachusetts Avenue / Mass Ave Connector in the east. Melnea Cass Boulevard is a median divided roadway that generally provides two lanes in each direction. Sidewalks are provided on both sides of the roadway. A section of the South Bay Harbor Trail runs along the north side of Melnea Cass Boulevard.

3.6.2 *Intersections*

Tremont Street at Malcolm X Boulevard / Columbus Avenue

Malcolm X Boulevard and Columbus Avenue intersect Tremont Street to form a four-way signalized intersection. Tremont Street eastbound provides one wide travel lane, which acts as two lanes, one left-through lane, and one through-right lane. Malcolm X Boulevard westbound provides one left-through lane, one through lane, and one channelized right-turn lane onto Tremont Street. Both Columbus Avenue northbound and Tremont Street southbound provide one left turn storage lane, two through lanes, and one through-right turn lane. An exclusive pedestrian phase is provided at this intersection, with crosswalks across all four legs of the intersection.

Tremont Street at Prentiss Street

Prentiss Street intersects Tremont Street to form a three-legged signalized intersection. Prentiss Street eastbound provides one general purpose travel lane. Tremont Street northbound provides one through-left lane and two through lanes, while Tremont Street southbound provides two through lanes and one through-right lane. Due to the use of the curbside lane for parking on the west side of Tremont Street, Tremont Street southbound acts as a two-lane roadway, providing one through lane and one through-right lane.

An exclusive pedestrian phase is provided at this intersection, with crosswalks across all three legs of the intersection.

Tremont Street at Whittier Street / Ruggles Street

Ruggles Street and Whittier Street intersect Tremont Street to provide a four-legged signalized intersection. Ruggles Street eastbound provides two left-turn lanes and one right-turn lane. Whittier Street, a one-way roadway westbound, provides one general use travel lane. At this intersection, each direction of Tremont Street is divided by a median. Tremont Street northbound provides one left-turn lane and three through lanes. Tremont Street southbound provides two through lanes and one right-turn-only lane. Crosswalks are provided across each leg of the intersection. The pedestrian phase is concurrent with the appropriate vehicular phase.

Tremont Street at Ruggles Street / Renaissance Park Drive

At this signalized intersection, each direction of Tremont Street is divided by a median, and Ruggles Street is a one-way roadway eastbound. Tremont Street provides three travel lanes in each direction. On the west side of Tremont Street, Renaissance Park Drive (Columbus Avenue) approaches the intersection as a one-way eastbound roadway.

Crosswalks are provided across both the Ruggles Street and Columbus Avenue legs, as well as the north leg of Tremont Street. The signalized crosswalk across Tremont Street provides a direct pedestrian access to MBTA Ruggles Station.

Tremont Street at Melnea Cass Boulevard

Melnea Cass Boulevard intersects Tremont Street to form a four-way signalized intersection. Melnea Cass Boulevard eastbound provides one left-through lane and one right-turn lane. Melnea Cass Boulevard westbound provides one left-turn lane, one left-through lane, and one through-right lane. Tremont Street northbound provides one left-through lane, one through lane, and one channelized right-turn lane. Tremont Street southbound provides one left-through lane and one through-right lane. Crosswalks are provided across each leg of the intersection.

3.6.3 *Data Collection*

The Boston Transportation Department (BTD) provided BSC with the most recent Synchro traffic model for the Roxbury area. This model includes weekday morning and evening peak hour traffic data for the Project study area, which was utilized for this study. The provided data includes traffic counts from the year 2010.

Supplemental weekday morning and evening traffic volumes were obtained from the recently proposed Whittier Choice Neighborhood EPNF and the Madison Park Infill Sites PNF. These traffic volumes were collected in 2012 and 2014, respectively.

Per BTD guidelines, Saturday midday analysis is required for projects with a retail component. Therefore, additional turning movement counts were conducted at each of the study area intersections on Saturday January 21, 2012 between 11AM – 1PM.

In order to represent baseline traffic volumes for 2016, the Synchro 2010, Whittier Choice 2012, and Madison Park 2014 volumes were grown by a rate of 0.25 percent per year for six, four, and two years, respectively. In addition, project-generated traffic volumes for any specific developments which were constructed between the source traffic volumes and January 2016 have been included in the Baseline condition traffic volumes. These projects include:

- Dudley Municipal Office Building
- Jackson Square Phase 1
- Parcel 10 (Phase 1) – Tropical Foods
- Whittier Street Health Center

Figures 3-2 to 3-4 displays the 2016 Existing Condition traffic volumes on the roadway network. Traffic count data are contained in the Appendix.

3.6.4 *Traffic Operations Analysis*

Intersection capacity analyses of study area intersections for the Baseline, No-Build, and Build Conditions have been performed. An evaluation of these analyses reveals the impact of the Project on vehicular traffic operations.

Measuring existing traffic volumes and projecting future traffic volumes quantifies traffic flow within a study area. To assess quality of flow, capacity analyses were conducted for study area intersections for the Baseline, Future No-Build, and Future Build Conditions. The capacity analyses provide a standardized indication of the ability of the intersections to accommodate traffic demands placed upon them.

Capacity analyses for the weekday morning, weekday evening, and Saturday midday peak hours were performed at each of the study area intersections. The Synchro traffic analysis software package (Version 9) was employed to evaluate operating conditions at the study area intersections.

Figure 3-2: 2016 Baseline Conditions Weekday Morning Peak Hour Traffic Volumes

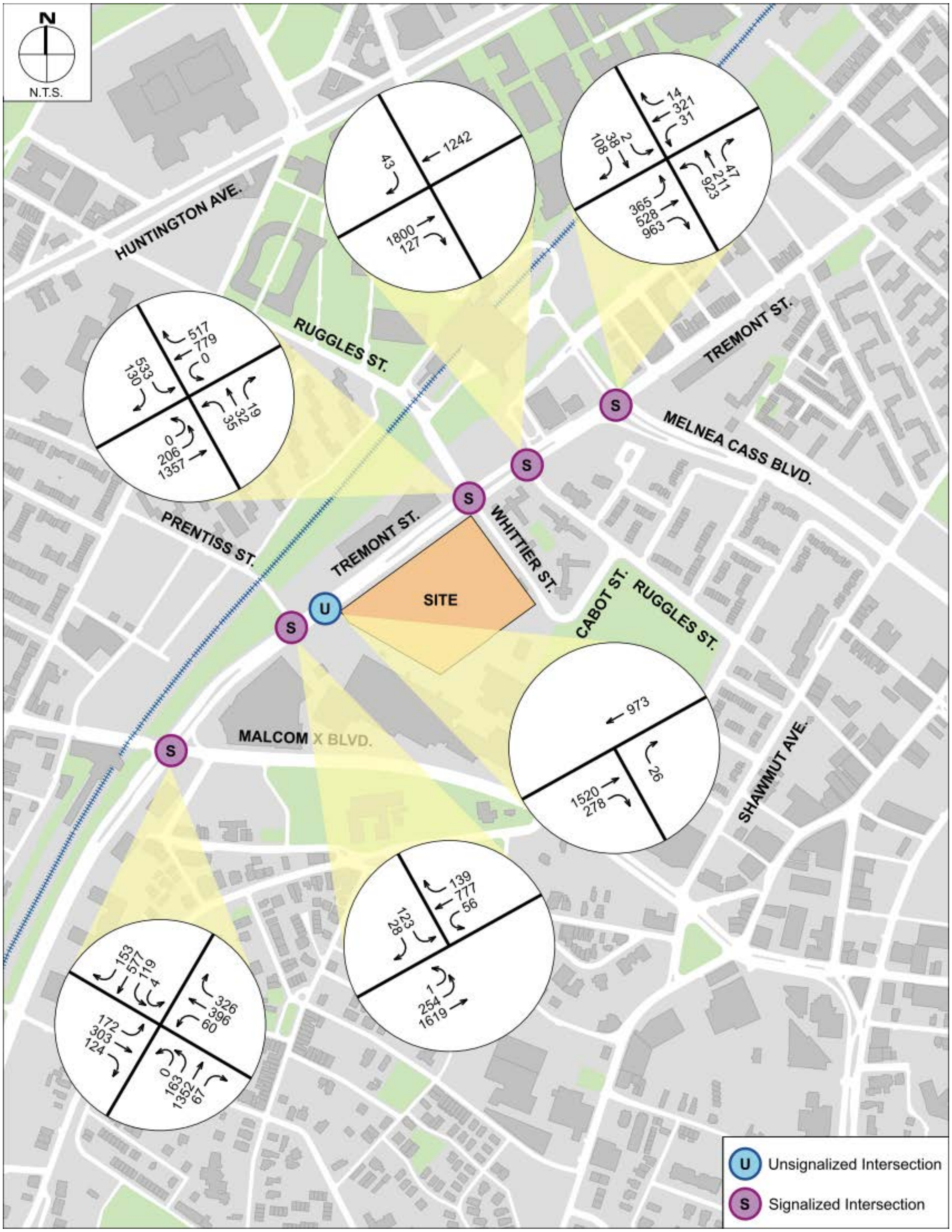


Figure 3-3: 2016 Baseline Conditions Weekday Evening **Peak Hour Traffic Volumes**

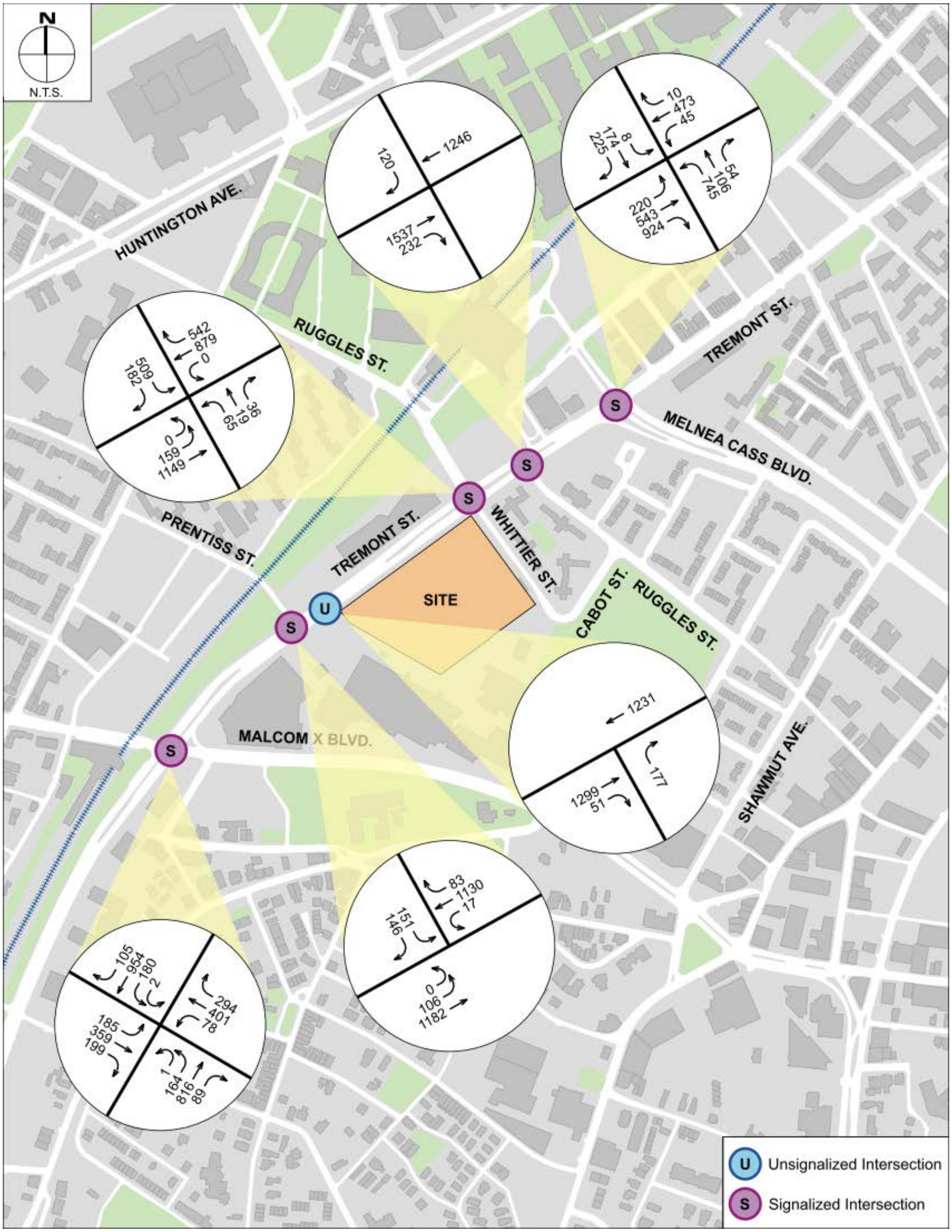
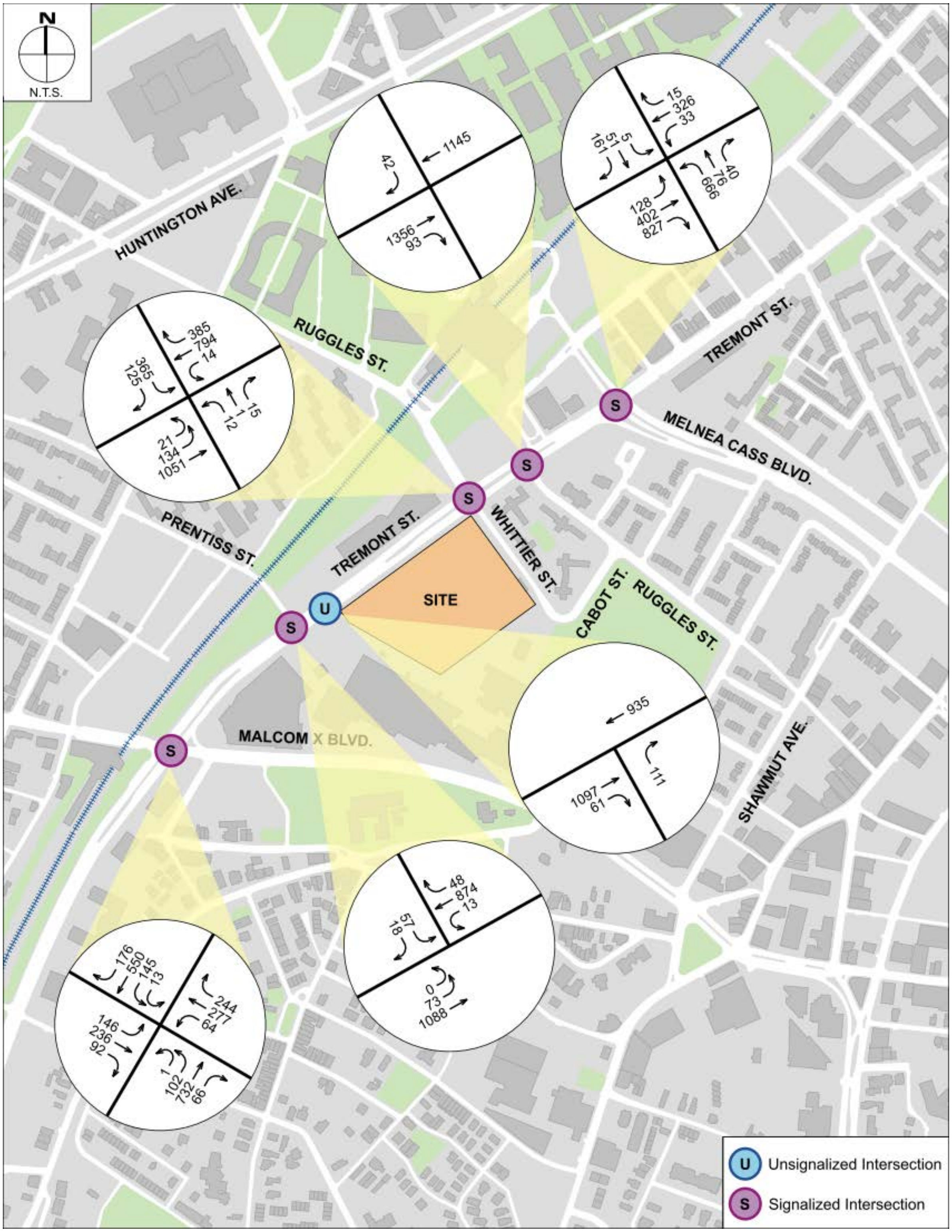


Figure 3-4: 2016 Baseline Conditions Saturday Midday Peak Hour Traffic Volumes



3.6.5 *Levels of Service Criteria*

A primary result of capacity analyses is the assignment of Levels of Service (LOS) to traffic facilities under various traffic flow conditions. Analyses were conducted using methods defined in the Highway Capacity Manual 2000/2010 (TRB, 2000/2010) for signalized and unsignalized intersections. The concept of Level of Service is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists.

A Level of Service definition generally describes these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. In so doing, Level of Service provides an index to quality of traffic flow.

Six Levels of Service are defined for each type of facility. They are given letter designations, from A to F, with LOS A representing the best operating conditions and LOS F representing the worst. Since the Level of Service of a traffic facility is a function of traffic flows placed upon it, an intersection may operate at a wide range of Levels of Service, depending on time of day, day of week, or period of year.

The average delay per vehicle approaching an intersection is used to quantify the Level of Service at a particular intersection. This is discussed briefly below, and LOS designations are defined in Table 3-1. Average delay measures the mean stopped delay experienced by vehicles entering an intersection during the design period. Average delay is measured for each individual turning movement that must yield the right of way, and for the intersection as a whole (including through vehicles that experience no delay).

Table 3-1: Level of Service Designations

	Delay (Sec/Veh)	
Category	**Unsignalized**	**Signalized**
LOS A	0.0 - 10.0	0.0 - 10.0
LOS B	10.1 - 15.0	10.1 - 20.0
LOS C	15.1 - 25.0	20.1 - 35.0
LOS D	25.1 - 35.0	35.1 - 55.0
LOS E	35.1 - 50.0	55.1 - 80.0
LOS F	50.1 +	80.1 +

Source: Transportation Research Board, Highway Capacity Manual, National Research Council, 2000.

3.6.6 *Baseline Conditions Capacity Analysis*

Baseline conditions were analyzed at each of the study area intersections for the year 2016. Analyses were conducted during weekday morning, weekday evening, and Saturday midday peak hours. Table 3-2 below presents a summary of the baseline condition capacity analyses. Complete analysis calculations and summaries, including queue length, queue figures, and detailed results for each movement, are contained in Appendix 2.

Table 3-2: Baseline Conditions Capacity Analysis Summary

		2016 Baseline		
Intersection	**Time Period**	**Delay (sec)**	**LOS**	**v/c Ratio**
Tremont St / Melnea Cass Blvd	Weekday AM	49.9	D	0.98
	Weekday PM	47.5	D	0.97
	Saturday MID	23.2	C	0.76
Tremont St /Ruggles St / Renaissance Park	Weekday AM	4.7	A	0.52
	Weekday PM	5.4	A	0.51
	Saturday MID	4.9	A	0.42
Tremont St / Ruggles St / Whittier St	Weekday AM	35.6	D	0.83
	Weekday PM	51.0	D	0.80
	Saturday MID	>80.0	F	1.14
Tremont St / Prentiss St	Weekday AM	>80.0	F	1.05
	Weekday PM	65.8	E	0.92
	Saturday MID	15.6	B	0.64
Tremont St / Malcolm X Blvd / Columbus Ave	Weekday AM	>80.0	F	1.03
	Weekday PM	>80.0	F	0.94
	Saturday MID	58.9	E	0.72

3.6.7 *Existing Parking*

Off-Street Parking

Per BTD guidelines, existing off-street parking facilities located within one-quarter mile of the Project Site have been identified. Within this area, four facilities have been identified, as shown in Figure 3-5.

The Project Site is currently utilized as ancillary parking for both the Boston Police Department and the Boston Public Schools, both of which have adjacent facilities. According to information provided by the Boston Redevelopment

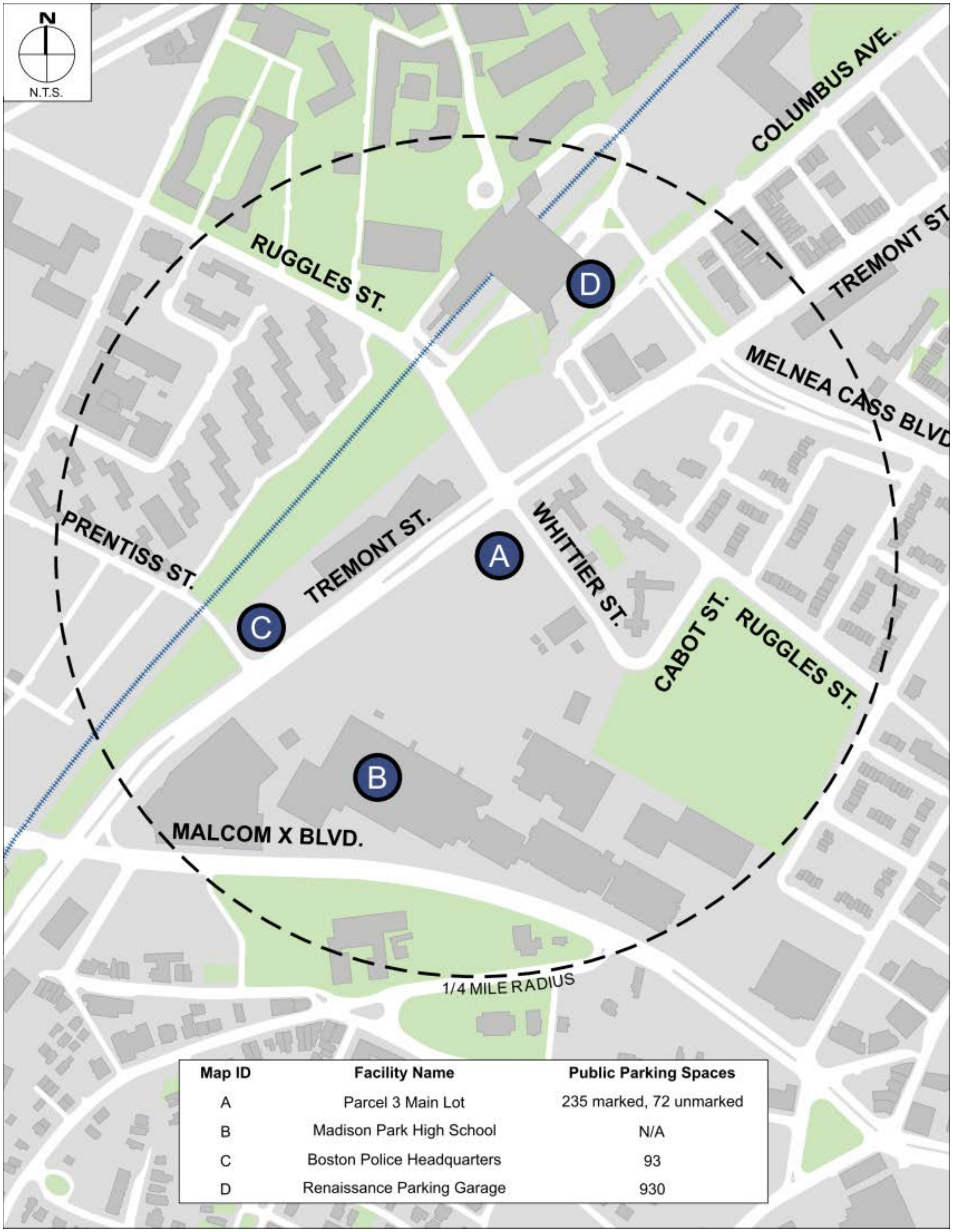
Authority, the main parking lot of Parcel P-3 currently provides 235 marked parking spaces, with an additional 72 informal unmarked parking spaces. The nearby Boston Police Headquarters lot provides 93 parking spaces for the employees of the Boston Police Department. The Renaissance Parking Garage, which is owned by Northeastern University, provides approximately 930 parking spaces.

The Project Site is utilized by the Whittier Street Health Center (WSHC) for parking at its new facility. As per an existing agreement between the Whittier Street Health Center and the Proponent, during construction of the Tremont Crossing project, seventy-five (75) parking spaces will be made available by the Proponent for use by the WSHC facility. Once construction of the Project has been completed, the Proponent will lease seventy-five (75) permanent parking spaces to the WSHC in the parking structure to be a part of the Project.

On-Street Parking

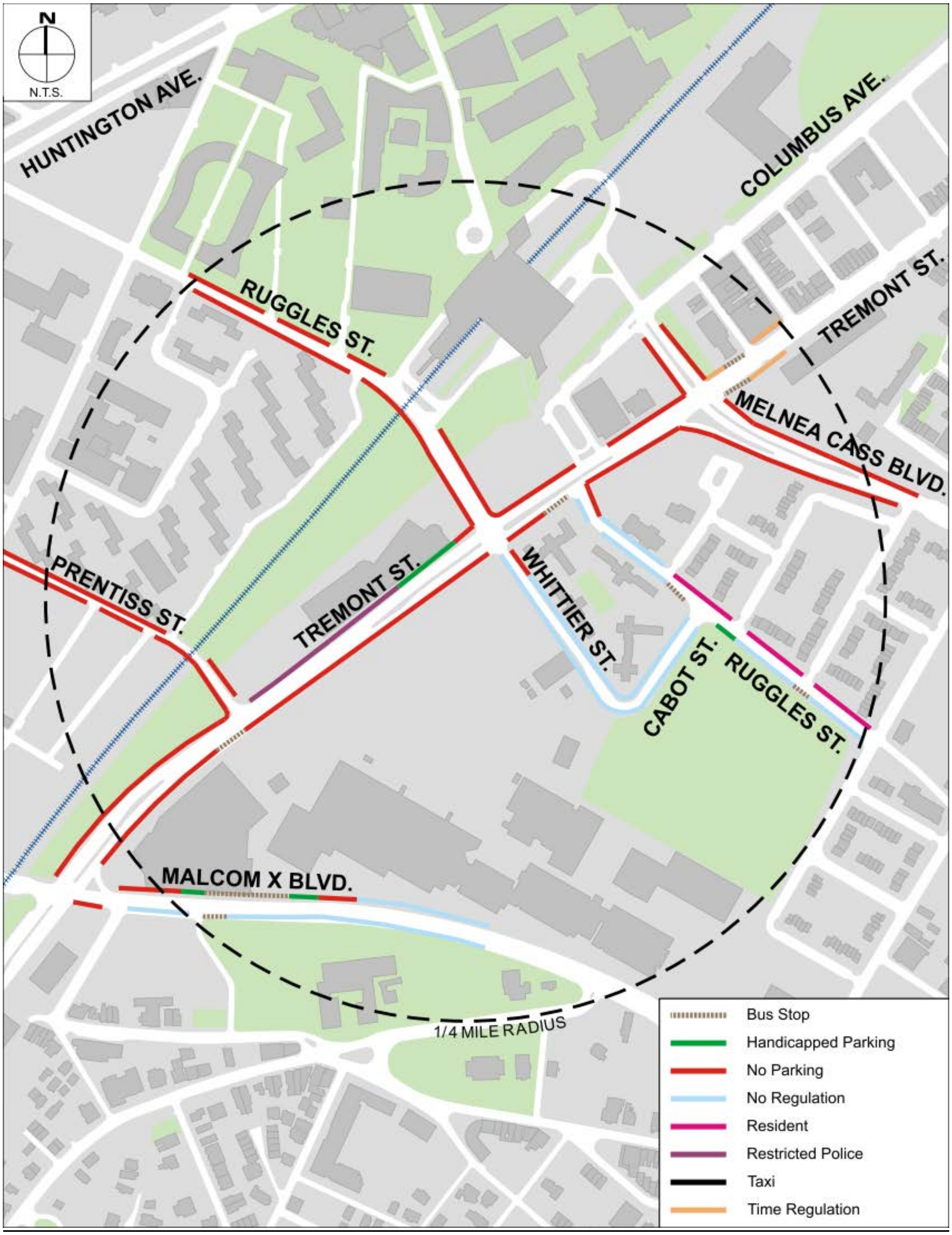
Existing on-street parking availability was inventoried in January 2012 to determine the locations and types of on-street parking regulation available on Tremont Street and side streets within the one-quarter mile radius of the Site. The results of the inventory are shown below in Figure 3-6. As can be seen in this figure, parking is restricted along large portions of Tremont Street. The remaining areas are in front of the Boston Police Department headquarters and are used for police vehicles, emergency vehicles, taxi stands, and handicapped spaces. Additional uses within the area include various time regulated areas, resident permit locations, and several areas where parking is not regulated, including most of Whittier Street. In addition, there are seven (7) bus stops within the quarter-mile radius, including four (4) on Tremont Street, two (2) on Malcolm X Boulevard, and one (1) on the eastern leg of Ruggles Street.

Figure 3-5: Map of Public Parking within Quarter-Mile of the Site



Map ID	Facility Name	Public Parking Spaces
A	Parcel 3 Main Lot	235 marked, 72 unmarked
B	Madison Park High School	N/A
C	Boston Police Headquarters	93
D	Renaissance Parking Garage	930

Figure 3-6: Map of On-Street Parking Within Quarter-Mile of the Site



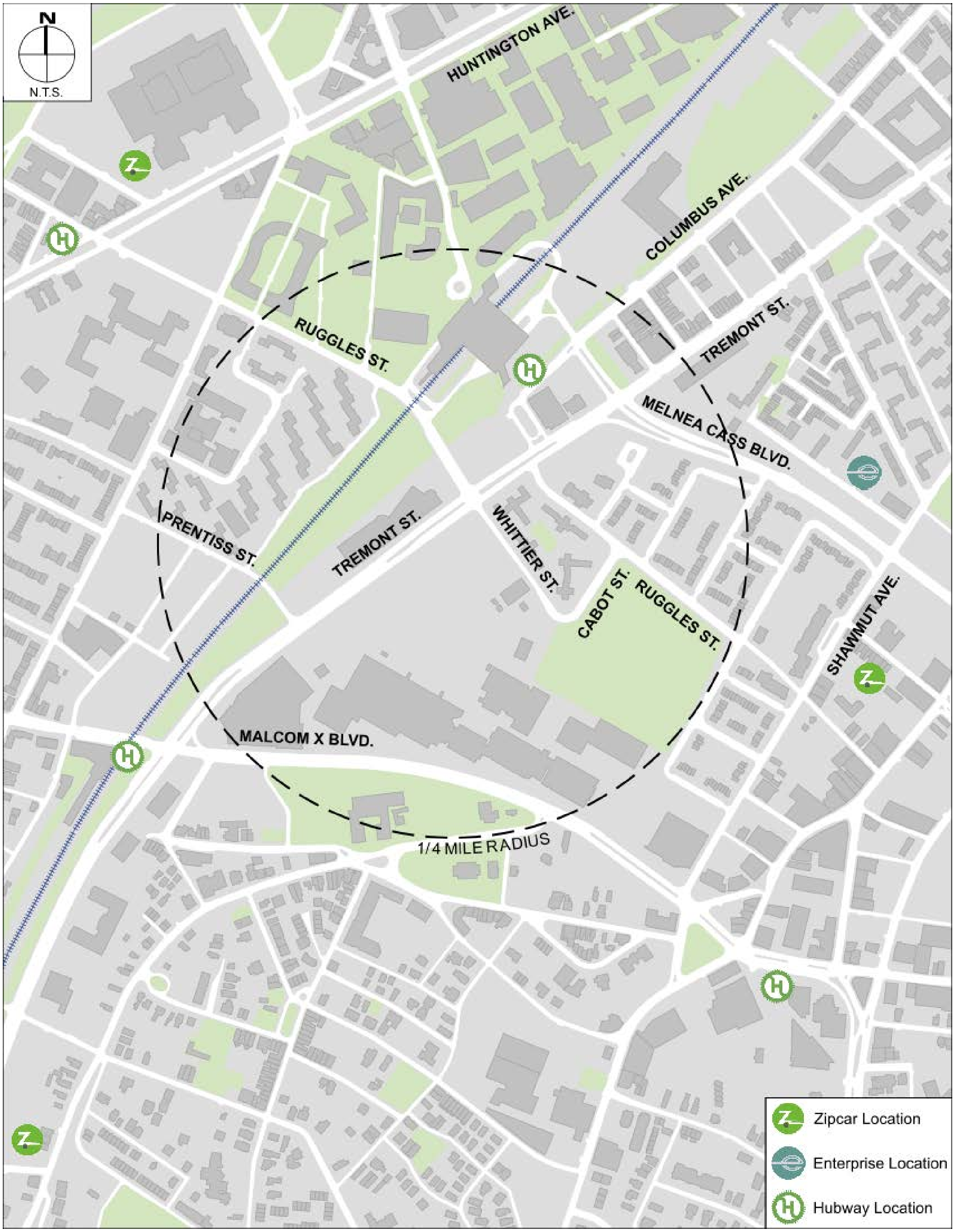
On Tuesday May 21, Thursday May 23, and Saturday June 1, 2013, BSC performed a parking utilization study on a section of Tremont Street in front of the Boston Police Department (BPD).

Parking utilization data were obtained for the area in front of the police station at the request of BTD. The limit of the area was along the western side of Tremont Street from Ruggles Street to Prentiss Street. The parking study, conducted over a 12-hour period from 6 AM to 6 PM, found that a high proportion of the spaces were occupied by vehicles parking long-term, despite the fact that the areas are designated for 30-minute police parking. Also, the overall utilization of the parking spaces was high, with approximately 80% of the parking spaces occupied for most of the weekday study period.

3.6.8 *Existing Rideshare Facilities*

Within the vicinity of the Project site, there exist various rideshare services and amenities. Vehicular ridesharing services are offered by third party providers Zipcar and Enterprise, while the City of Boston offers the bicycle sharing service, Hubway. Figure 3-7 shows the location of the existing rideshare services within one-quarter mile of the Project site. As can be seen, one Hubway location is within this direct circle, while three other Hubway, two Zipcar, and one Enterprise locations are just outside of this radius.

Figure 3-7: Map of Existing Rideshare Facilities within One-Quarter-Mile of the Site



3.6.9 *Existing Public Transportation*

Public transportation in the form of rapid transit, commuter rail, and bus services is provided by the Massachusetts Bay Transportation Authority (MBTA) in the vicinity of the study area. Ruggles Station and Roxbury Crossing Station, both serving MBTA busses and the MBTA Orange Line, are located within approximately one-third of a mile from the Site. Ruggles Station also serves three (3) Commuter Rail routes: the Needham, Franklin, and Providence / Stoughton Lines. A major bus terminal is located at Dudley Square, approximately one-half mile southeast of the Project Site and provides connections to over 15 bus routes and 2 Silver Line routes.

Fourteen bus routes, listed below, are within walking distance from the Project Site. A bus stop located on the east side of Tremont Street, across from Prentiss Street, provides access to eight (8) of these fourteen (14) routes. Table 3-3 and Figure 3-8 show the available public transit routes and latest ridership data available in more detail.

Table 3-3: Bus Routes near the Project Site

Route Number	Travel Route	Headways[a]	Ridership[b]
CT2	Sullivan Station – Ruggles Station	15	2,815
CT3	Beth Israel Deaconess Medical Center – Andrew Station	15	1,393
8	Harbor Point / UMass – Kenmore Station	14	3,992
15	Kane Square or Fields Corner Station – Ruggles Station	6	6,309
19	Fields Corner – Kenmore or Ruggles Station	14	3,600
22	Ashmont Station – Ruggles Station	8	8,656
23	Ashmont Station – Ruggles Station	5	12,527
28	Mattapan Station – Ruggles Station	7	14,057
42	Forest Hills Station – Dudley or Ruggles Station	12	3,047
43	Ruggles Station – Park & Tremont Streets	12	1,853
44	Jackson Square Station – Ruggles Station	12	3,515
45	Franklin Park Zoo – Ruggles Station	10	3,453
47	Central Square, Cambridge – Broadway Station	8	5,036
66	Harvard Square – Dudley Station	7	13,933

[a] *Minutes between busses during the weekday morning and evening peak hours*

[b] *Typical weekday boarding, based on data provided by the Massachusetts Bay Transportation Authority (MBTA) Ridership and Service Statistics Fourteenth Edition (2012 data)*

Figure 3-8: Public Transportation Map

3.6.10 *Existing Pedestrian Access and Bicycle Accommodation*

In the vicinity of the Project, sidewalks are provided along both sides of Tremont Street, Columbus Avenue, Malcolm X Boulevard, Ruggles Street, Whittier Street, and Melnea Cass Boulevard. Crosswalks are located across both legs of Tremont Street at the intersections of Malcolm X Boulevard, Prentiss Street, Ruggles Street / Whittier Street, and Melnea Cass Boulevard. A crosswalk is also located across the north leg of Tremont Street at Whittier Street to the pedestrian plaza on Columbus Avenue that leads to the Ruggles MBTA Station. Pedestrian push buttons, pedestrian signals, and accessible ramps are provided with each of the crosswalks across Tremont Street. Along Tremont Street, all sidewalks measure 7-10 feet wide, and are generally in good condition. The existing roadway network provides pedestrian and bicycle connections to Ruggles, Roxbury Crossing, and Dudley Stations, all located within one-half mile.

The existing crosswalks across the intersection of Tremont Street at Malcolm X Boulevard and Columbus Avenue are up to 100 feet long. This length not only requires pedestrians to cross a long distance, but also requires a long exclusive pedestrian phase, which contributes to existing delays and long traffic queues at the approaches to this intersection.

On the west side of Tremont Street, a multi-use path provides pedestrian and bicycle access within Southwest Corridor Park. This 52-acre Park, owned by the Massachusetts Department of Conservation and Recreation (DCR), connects the neighborhoods of South End, Back Bay, Roxbury, and Jamaica Plain. This path provides both pedestrian and bicycle access to the area.

A section of the South Bay Harbor Trail currently exists on the north side of Melnea Cass Boulevard. This 3.5-mile trail is intended to connect several Boston neighborhoods with Boston Harbor and the Emerald Necklace. Upon completion, the trail will connect five Boston neighborhoods: South End, Roxbury, Chinatown, South Boston, and the Fort Point Channel. This trail will provide access for pedestrians and bicyclists alike.

3.6.11 *Crash Data*

Crash data for the study area intersections were obtained from MassDOT – Highway Division for the most recent three years on record (2011 – 2013). Crash rates were calculated for each study area intersection. These rates represent the number of reported crashes per million vehicles entering the intersection and are used as a means to measure the "relative safety at a particular location". To calculate the crash rates, BSC applied the K-factor based on 2009 MassDOT count stations. The baseline 2016 traffic volumes were used to calculate the crash rates.

The most recent average crash rates provided by MassDOT are 0.77 for signalized intersections and 0.58 for unsignalized intersections Statewide. The average crash rates in District 6 (which includes the Roxbury neighborhood in the City of Boston) are 0.70 for signalized intersections and 0.53 for unsignalized intersections.

As indicated in Table 3-4, all of the five study area intersections exhibited crash rates lower than the MassDOT averages. Summaries of the crash data are provided in Table 3-5. Crash rate worksheets are contained in the Appendix.

Table 3-4: Crash Rate Summary

	Number of Crashes				
Intersection	**2011**	**2012**	**2013**	**Average**	**Calculated Crash Rate***
Tremont St at Malcolm X Blvd / Columbus Ave	1	1	0	0.67	0.04
Tremont St at Prentiss St	2	0	0	0.67	0.04
Tremont St at Whittier St	0	0	0	0.00	0.00
Tremont St at Ruggles St	3	2	1	2.00	0.12
Tremont St at Melnea Cass Blvd	2	0	2	1.33	0.07

**per million entering vehicles, as defined by the Massachusetts Department of Transportation (MassDOT)*

Table 3-5: Summary of Crash Data

	Tremont Street at Malcolm X Boulevard / Columbus Avenue			**Tremont Street at Prentiss Street**			**Tremont Street at Whittier Street**		
	2011	2012	2013	2011	2012	2013	2011	2012	2013
Crash Severity									
Property Damage				1					
Injury	1	1							
Hit and Run									
Fatality									
Other				1					
Manner of Collision									
Rear End		1							
Angle	1								
Head On									
Sideswipe									
Other				2					
Time of Day									
6am-10am				1					
10am-4pm				1					
4pm-7pm	1								
7pm-6am		1							
Roadway Condition									
Dry	1			1					
Wet		1							
Snow/Ice									
Other				1					
Season									
Dec-Feb									
Mar-May				1					
Jun-Aug		1							
Sep-Nov	1			1					
Light Condition									
Daylight	1	1		1					
Dawn/Dusk									
Dark (Unlit)									
Dark (Lit)									
Unknown				1					
Total	**1**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**
Average No. of Crashes	**0.67**			**0.67**			**0.00**		
Calculated Crash Rate [a]	**0.04**			**0.04**			**0.00**		
MassDOT Avg. Statewide / District 6 Crash Rate[b]	**0.77 / 0.70**			**0.77 / 0.70**			**0.77 / 0.70**		

[a] *per million entering vehicles, as defined by the Massachusetts Department of Transportation – Highway Division*

[b] *crash information queried on January 23, 2013 from www.massdot.state.ma.us*

Table 3-6: Summary of Crash Data (cont'd)

	Tremont Street at Ruggles Street			**Tremont Street at Melnea Cass Boulevard**		
	2011	2012	2013	2011	2012	2013
Crash Severity						
Property Damage	2					
Injury		2	1	1		1
Hit and Run						
Fatality						
Other	1			1		1
Manner of Collision						
Rear End	2	2				
Angle						1
Head On						
Sideswipe	1		1			
Other				2		1
Time of Day						
6am-10am	1	1	1			
10am-4pm	2	1		2		1
4pm-7pm						
7pm-6am						1
Roadway Condition						
Dry	1	2		1		
Wet	2					1
Snow/Ice			1			
Other				1		1
Season						
Dec-Feb	2	1				
Mar-May			1	1		2
Jun-Aug	1	1		1		
Sep-Nov						
Light Condition						
Daylight	3	2	1	1		
Dawn/Dusk						
Dark (Unlit)						
Dark (Lit)				1		1
Unknown						1
Total	**3**	**2**	**1**	**2**	**0**	**2**
Average No. of Crashes	**2.00**			**1.33**		
Calculated Crash Rate [a]	**0.12**			**0.07**		
MassDOT Avg. Statewide / District 6 Crash Rate[b]	**0.77 / 0.70**			**0.77 / 0.70**		

[a] *per million entering vehicles, as defined by the Massachusetts Department of Transportation – Highway Division*

[b] *crash information queried on January 23, 2013 from* www.massdot.state.ma.us

3.7 Long-Term Transportation Impacts

Future traffic conditions within the study area were projected to gain an understanding of the impact on the adjacent transportation network due to the Project. Traffic growth within the study area is a function of the expected land development, economic activity, changes in demographics, and changes in travel patterns.

Two future scenarios were evaluated in order to determine future traffic conditions under a five-year planning time horizon. This timeline is consistent with BTD guidelines for evaluating a project's long-term transportation impacts. The first scenario, the future No Build condition, examines vehicular traffic conditions five years into the future (2021) assuming that the proposed Project is not constructed. The second scenario, the future Build condition, examines the impact that the proposed development will have on all transportation modes within the study area.

3.8 Future No Build Traffic Conditions

In order to evaluate traffic impacts associated with the proposed Project, the future No Build condition is analyzed to provide a baseline condition for comparison. Future No Build condition vehicular traffic volumes are those that are expected to use the roadway network in the future, assuming the proposed Project is not constructed. BTD guidelines recommend the evaluation of traffic conditions five years into the future, resulting in an analysis for the year 2021. The future year for the traffic analysis was also confirmed at meetings with the BTD. Future No Build condition traffic volumes consist of background growth and traffic generated from specific proposed development projects in the study area added to the Baseline volumes.

3.8.1 *Growth Rate*

Typically, background growth is a function of future land development, increased economic activity, and changes in travel patterns. Based on discussions with BTD, a 0.25 percent annual growth rate was used to determine background growth. This growth rate was applied to the 2016 Baseline Conditions traffic volumes.

3.8.2 *Specific Projects*

Based on discussions with BTD and BRA, trips from the following specific developments were included in the No Build volumes.

1480 - 1486 Tremont Street – located in the Mission Hill neighborhood, this project involves the construction of a 75,000 SF residential building for 66 housing units (21 studios, 28 one-bedroom, and 17 two-bedroom units) and 6,200 SF of ground-floor commercial space.

2451 Washington Street – this project consists of 37 residential units.

Bartlett Place – located at 2565 Washington Street, the overall Project development will consist of 323 residential units, 31,322 SF of retail, and 22,153 SF of commercial / light industrial space.

Parcel 9 – located at the intersection of Melnea Cass Boulevard and Washington Street, this Project proposes the Melnea Hotel and Residences, consisting of a 145-room hotel, 50 residential units, and approximately 8,000 SF of retail space.

Whittier Choice Neighborhood – located at 1158 Tremont Street on a nearly 4-acre parcel immediately north of the Project site, this project proposes to demolish the existing buildings and construct three new buildings with approximately 387 residential units and 7,680 SF of retail space.

Northeastern University Interdisciplinary Science and Engineering Building – this project involves the development of a new building of approximately 197,000 SF of research and office space, specialized teaching labs, classrooms, and student space. The site will be located on a portion of Northeastern's existing surface parking lot located at 795 Columbus Avenue between the Renaissance Parking Garage and the Columbus Parking Garage.

Trips from the proposed programs were taken from available reports or generated using ITE trip generation rates. The resulting trips were distributed onto the study area roadway network where the reports were not available. No Build vehicular traffic volumes are displayed in Figures 1-9 to 1-11. Background traffic data is contained in the Appendix.

3.8.3 *Background Transportation Studies*

BTD is working with the Roxbury community to redesign Melnea Cass Boulevard. The proposed project involves provisions for bicycles, pedestrians, vehicles, and bus rapid transit services. The project is currently at the 25% design stage and therefore is not included in this Project.

The Massachusetts Bay Transportation Authority (MBTA) is expanding the Ruggles Commuter Rail Station to construct a new platform which will serve Track 2. The construction of this platform will benefit the station by improving commuter rail service and access for all users, as well as improving operational flexibility. The improvements will also include a new pedestrian tunnel, additional seating, improved accessibility for all users including elevators and ramps, as well as additional security, signage, and lighting.

3.8.4 *No Build Conditions Capacity Analysis*

Table 3-7 below presents a summary of the No Build condition capacity analyses for each of the study area intersections during the three peak hours analyzed. Complete analysis calculations and summaries, including queue length, queue figures, and detailed results for each movement, are contained in the Appendix.

Table 3-7: No Build Conditions Capacity Analysis Summary

		2021 No Build		
Intersection	**Time Period**	**Delay (sec)**	**LOS**	**v/c Ratio**
Tremont St / Melnea Cass Blvd	Weekday AM	54.3	D	1.01
	Weekday PM	63.0	E	1.05
	Saturday MID	23.2	C	0.76
Tremont St /Ruggles St / Renaissance Park	Weekday AM	4.6	A	0.54
	Weekday PM	5.3	A	0.54
	Saturday MID	5.0	A	0.42
Tremont St / Ruggles St / Whittier St	Weekday AM	37.9	D	0.87
	Weekday PM	53.3	D	0.84
	Saturday MID	>80.0	F	1.16
Tremont St / Prentiss St	Weekday AM	>80.0	F	1.05
	Weekday PM	65.8	E	0.92
	Saturday MID	15.9	B	0.65
Tremont St / Malcolm X Blvd / Columbus Ave	Weekday AM	>80.0	F	1.07
	Weekday PM	>80.0	F	0.97
	Saturday MID	60.0	E	0.73

Figure 3-9: 2021 No Build Condition Weekday Morning Peak Hour Traffic Volumes

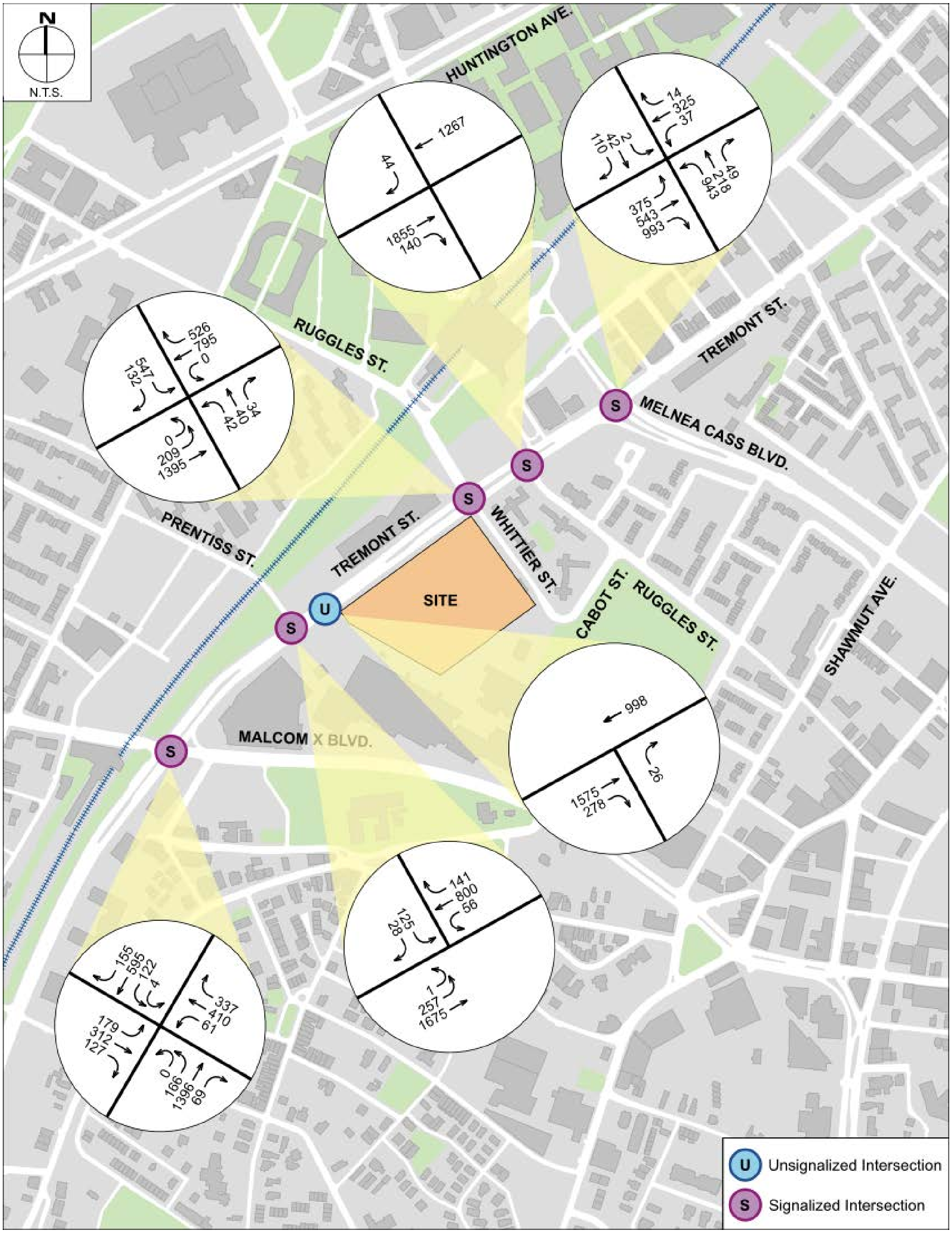


Figure 3-10: 2021 No Build Condition Weekday Evening Peak Hour Traffic Volumes

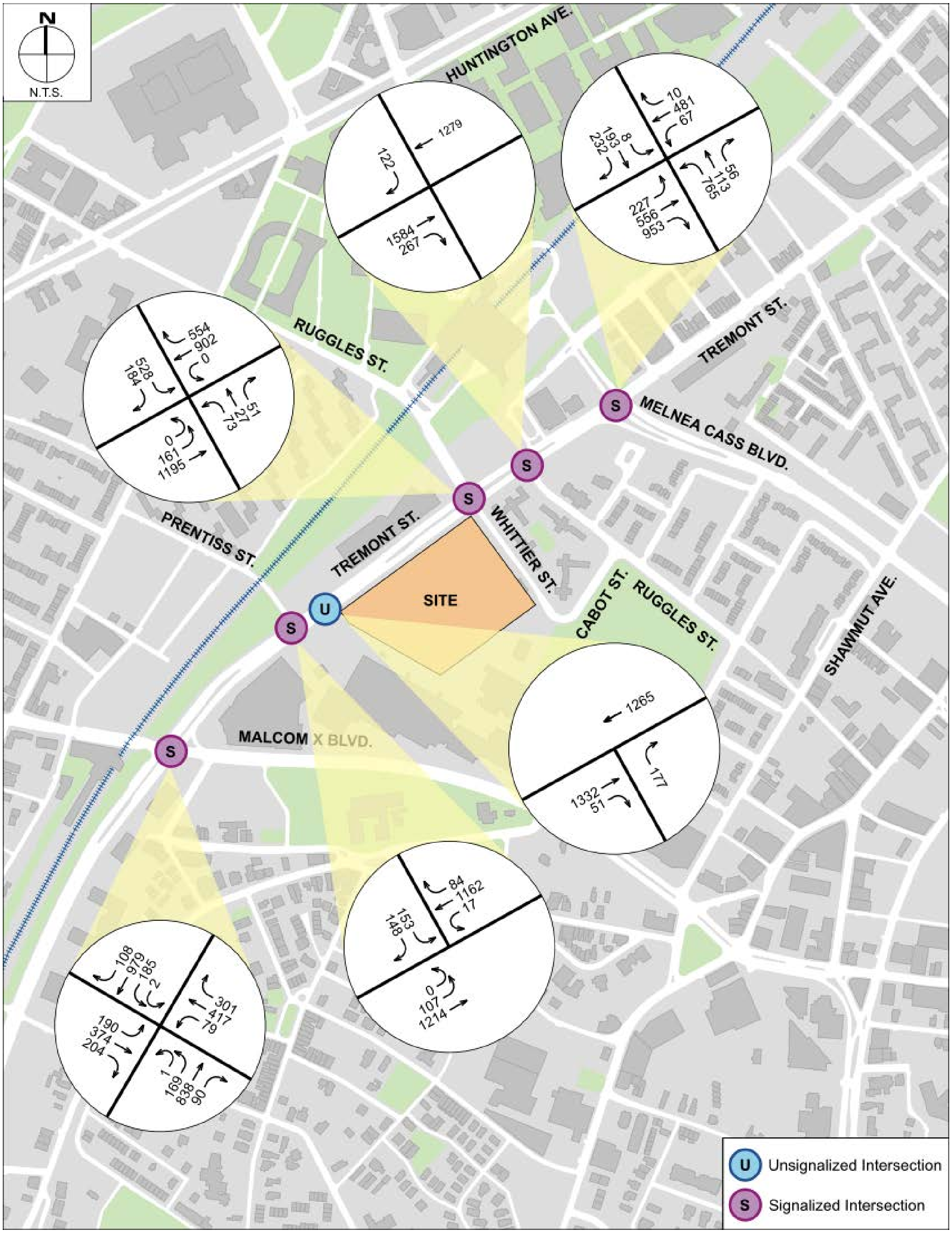
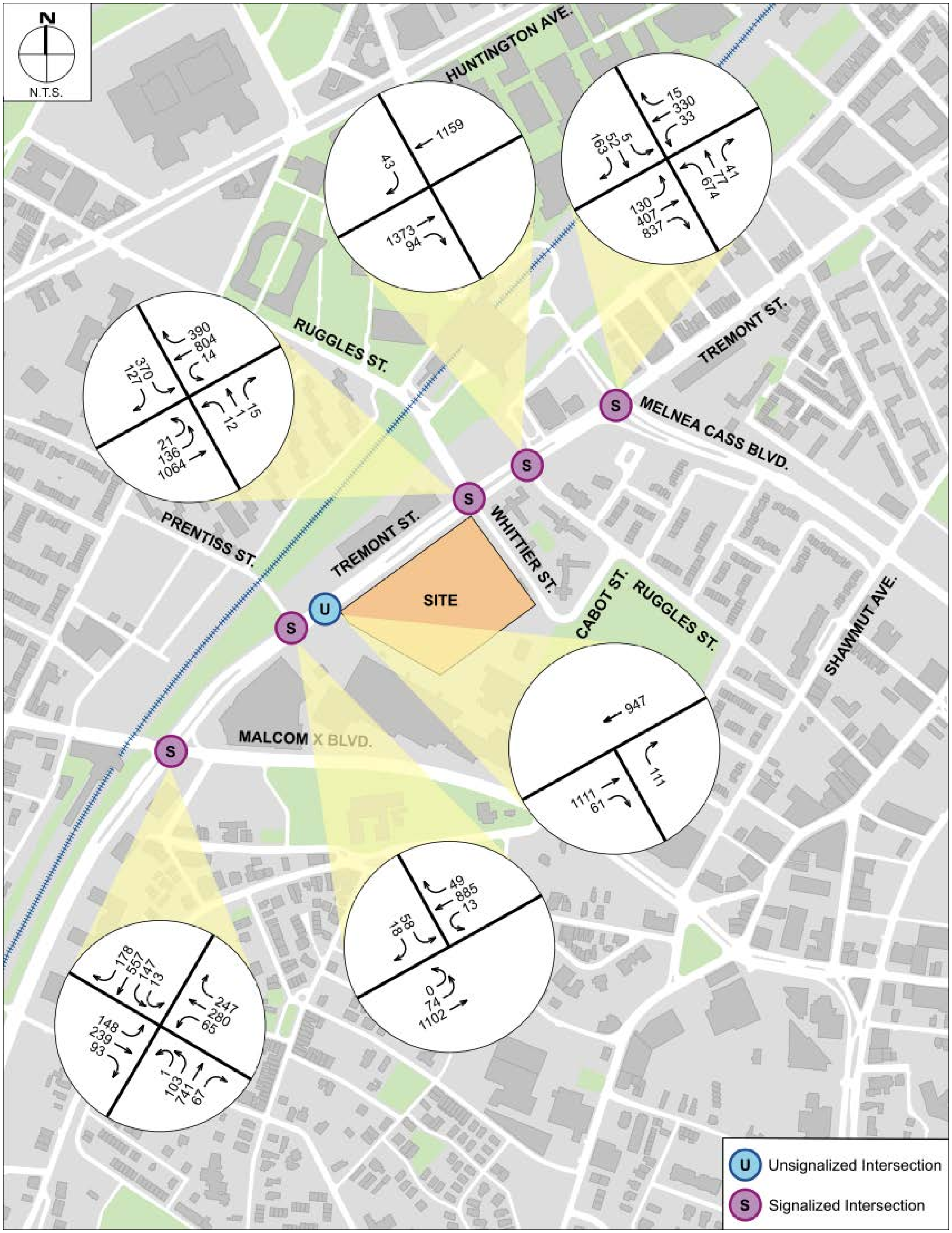


Figure 3-11: 2021 No Build Condition Saturday Midday Peak Hour Traffic Volumes



3.9 Future Build Traffic Conditions

In order to evaluate the effect of the Project on traffic conditions in the study area, Site-generated trips were projected, distributed, and assigned to the adjacent transportation network. In the case of vehicular traffic, these vehicle-trips are added to future No Build conditions traffic volumes to form the Build condition traffic volume networks for the weekday morning, weekday evening, and Saturday midday peak hours.

3.9.1 *Trip Generation Analysis*

The proposed building program for the Tremont Crossing development involves the construction of a total of 396,000 SF of retail (including 92,000 SF of a discount club, as well as a health club, cinema, and other retail entities), 105,000 square feet of office space, a total of 695 units of multifamily residential (approximately 659,000 square feet), and 31,000 square feet of museum.

In order to estimate the number of trips associated with the proposed development, the Institute of Transportation Engineers (ITE) Trip Generation Manual (9th Edition, 2012) was employed. This manual provides vehicle-trip generation projections for a number of land uses.

Trips generated by the retail component, with the exception of the discount club, were generated using ITE Land Use Code 820 – Shopping Center. According to the Trip Generation Manual, this land use can also include “non-merchandising facilities, such as office buildings, movie theaters, restaurants, post offices, banks, health clubs, and recreational facilities” and is appropriate for the specific uses of this Project.

Table 3-8 below outlines the breakdown of the trips associated with the proposed uses on the Site.

Table 3-8: Trip Generation

	Total Weekday Daily	Weekday Morning Peak Hour (trips)			Weekday Evening Peak Hour (trips)			Saturday Midday Peak Hour (trips)		
	Trips	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
92,000 SF Discount Club [a]	3,846	32	13	45	193	192	385	288	298	586
304,000 SF Retail [b]	13,990	182	110	292	606	656	1,262	937	864	1,801
105,000 SF Office [c]	1,362	176	23	199	34	162	196	25	20	45
31,000 SF Museum [d]	30	8	1	9	1	5	6	15	5	20
695 Apartment Units [e]	4,335	69	275	344	260	140	400	181	180	361
Total ITE Trips	23,563	467	422	889	1,094	1,155	2,249	1,446	1,367	2,813

[a] *based on ITE Land Use Code 857 – Discount Club*

[b] *based on ITE Land Use Code 820 – Shopping Center*

[c] based on ITE Land Use Code 710 – General Office Building

[d] *based on ITE Land Use Code 580 – Museum*

[e] based on ITE Land Use Code 220 – Apartments

3.9.2 *Modal Split / Vehicle Occupancy Ratio*

The City of Boston benefits from widely accessible public transportation, bicycle, and pedestrian facilities. Mode split data obtained from the Boston Transportation Department (BTD) has been applied to the total trips to account for the different modes of travel available in the City. The mode share data was developed as part of the Access Boston Citywide Transportation Study using the Central Transportation Planning Staff's (CTPS) regional traffic model and Journey-to-Work data.

The area in which the Project is located is along the border between Zone 15 and Zone 4. Given the Project Site's proximity to Zone 4 and with over 14 bus routes, two Orange line rapid transit stations, and three commuter rail lines in the immediate vicinity of the Site, BTD agreed that the modal split characteristics of the Site were more represented by Zone 4 than by Zone 15. Comments by BTD on the PNF submission for this project suggested a reassessment of the zone used for the analysis. After further discussions with BTD, it was confirmed that the characteristics of Zone 4 were more appropriate for this Project location than those of Zone 15.

Due to the distinct nature of the Discount Shopping Club, BSC has assumed that this store will be a regional attraction and will generate a higher number of vehicle trips than are provided in the Zone 4 modal split data. Therefore, the modal splits for this use were based upon Zone 15 data. Table 3-9 displays the modal split percentages which were used for each land use.

Table 3-9: Modal Split

			Weekday				Saturday	
		Daily	Morning Peak		Evening Peak		Midday Peak	
			Entering[a]	Exiting[b]	Entering	Exiting	Entering	Exiting
Discount Club	Auto	53%	51%	42%	42%	51%	54%	54%
	Transit	12%	13%	21%	21%	13%	12%	11%
	Walk	35%	36%	37%	37%	36%	34%	35%
Retail	Auto	29%	24%	26%	26%	24%	29%	29%
	Transit	16%	19%	13%	13%	19%	16%	16%
	Walk	55%	57%	61%	61%	57%	55%	55%
Office	Auto	44%	37%	43%	43%	37%	44%	44%
	Transit	32%	38%	28%	28%	38%	32%	32%
	Walk	24%	25%	29%	29%	25%	24%	24%
Museum	Auto	29%	24%	26%	26%	24%	29%	29%
	Transit	16%	19%	13%	13%	19%	16%	16%
	Walk	55%	57%	61%	61%	57%	55%	55%
Resi-dential	Auto	24%	19%	21%	21%	19%	24%	24%
	Transit	19%	22%	15%	15%	22%	19%	19%
	Walk	57%	59%	64%	64%	59%	57%	57%

Source: Boston Transportation Department, Policy and Planning Division

[a] *Entering = trips ending in Zone 4/15/site*

[b] *Exiting = trips beginning in Zone 4/15/site*

Average vehicle occupancy rates (VOR) were sourced from ITE, from the Boston Redevelopment Authority (BRA) report entitled "Fenway Neighborhood Transportation Plan" (November 2001), and from the Northeastern University Institutional Master Plan. These rates, which have also been used in recent traffic reports in the area, are as follows: a VOR of 1.2 persons per vehicle was used for trips associated with office and residential use, and a VOR of 1.8 persons per vehicle was used for the retail (including discount club) and museum trips. It must be noted that it is expected that most of the museum will consist of school busses carrying school children. Therefore the VOR for that use may be higher; a rate of 1.8 may be a conservative estimate. Table 3-10 displays the person-trips by mode based on the percentages shown above.

Table 3-10: Total Person-Trips by Mode

			Weekday				Saturday	
		Daily	Morning Peak		Evening Peak		Midday Peak	
			Entering[a]	Exiting[b]	Entering	Exiting	Entering	Exiting
Discount Club	Auto	3,669	30	10	146	176	280	290
	Transit	831	8	5	73	45	62	59
	Walk	2,423	21	9	129	125	176	188
Retail	Auto	7,303	79	51	284	283	489	451
	Transit	4,029	62	26	142	224	270	249
	Walk	13,850	187	121	666	673	928	856
Office	Auto	719	78	12	18	72	13	11
	Transit	523	81	8	11	74	10	8
	Walk	392	53	8	12	49	7	6
Museum	Auto	16	4	1	1	2	8	3
	Transit	9	3	0	0	2	4	1
	Walk	30	9	1	1	5	15	5
Resi-dential	Auto	1,248	16	69	66	32	52	52
	Transit	988	18	50	47	37	41	41
	Walk	2,965	49	211	200	99	124	123

Source: Boston Transportation Department, Policy and Planning Division

[a] *Entering = trips ending in Zone 4/15/site*

[b] *Exiting = trips beginning in Zone 4/15/site*

Table 3-11 displays the combined person-trips generated by automobile, and then converted into vehicle-trips based on the previously mentioned VORs of 1.2 for office and residential, and 1.8 for retail, discount club, and museum.

Table 3-11: Total Project Vehicle Trips

		Weekday					
		Morning Peak		Evening Peak		Saturday Peak	
	Daily	Entering	Exiting	Entering	Exiting	Entering	Exiting
Discount Club (Person-Trips)	3,669	30	10	146	176	280	290
Retail (Person-Trips)	7,303	79	51	284	283	489	451
Office (Person-Trips)	719	78	12	18	72	13	11
Museum (Person-Trips)	16	4	1	1	2	8	3
Residential (Person-Trips)	1,248	16	69	66	32	52	52
Total Person-Trips by Auto	12,956	206	143	513	566	843	806
Total Vehicle-Trips	7,747	143	105	311	347	488	468

3.9.3 *Pass-By Trips*

It is expected that a portion of the trips generated by the retail facilities will come from the existing vehicle traffic streams along Tremont Street. These trips are referred to as “Pass-By” trips and do not contribute to the new vehicle trips generated by the development. Per MassDOT guidelines in effect when the report was originally prepared, a 25% pass-by rate was applied to the retail portion of the vehicle trips. Currently, MassDOT allows a higher percentage in comparison with the on-street traffic. Table 3-12 shows the incremental vehicle trips, minus the pass-by trips, to result in the total net new trips generated by the proposed Project.

Table 3-12: Net New Vehicle Trips

	Daily	Weekday				Saturday Peak	
		Morning Peak		Evening Peak			
		Entering	Exiting	Entering	Exiting	Entering	Exiting
Office, Museum, and Residential Vehicle-Trips	1,650	82	70	71	90	60	55
Retail Vehicle Trips	6,097	61	35	240	257	428	413
LESS Retail Pass-By Vehicle Trips (25%)	1,525	9	9	61	61	102	102
Net New Vehicle-Trips	6,222	134	96	250	286	386	366

As can be seen in Table 3-12, the proposed Tremont Crossing Development is expected to generate 230 net new vehicle-trips during the weekday morning peak hour (134 entering, 96 exiting), 536 net new vehicle-trips during the weekday evening peak hour (250 entering, 286 exiting), and 752 net new vehicle-trips during the Saturday midday peak hour (386 entering, 366 exiting).

On a weekday daily basis, the Project is expected to generate a total of 6,222 net new vehicle trips.

3.9.4 *Vehicle Trip Distribution and Assignment*

Trip generation results quantify additional trips associated with a proposed development. In order to assess the impacts related to these additional traffic volumes, trips must be distributed onto the local transportation network. For this analysis, only the vehicle-trips were distributed and assigned to the roadway network.

Vehicle-trips generated to and from the proposed Tremont Crossing project were distributed regionally, based on origin-destination data provided by the BTD. The data consist of an established distribution of vehicle-trip origins and destinations for vehicle-trips ending and beginning (respectively) in the trip zone in which the project is located (Zone 4, as discussed above). Table 3-13 shows the projected vehicle-trip distribution to and from the Project for the weekday morning, weekday evening, and Saturday midday peak periods.

Table 3-13: Vehicle-Trip Distribution Summary

		Percent of Site Trips			
Route	**Direction (To/From)**	**AM Enter**	**AM Exit**	**PM/SAT Enter**	**PM/SAT Exit**
Tremont Street	West	19%	14%	17%	20%
Columbus Ave	South	21%	16%	17%	20%
Malcolm X Boulevard	East	6%	5%	5%	5%
Ruggles Street	West	16%	18%	19%	17%
Tremont Street	North	23%	31%	28%	24%
Melnea Cass Boulevard	East	15%	16%	14%	14%
Total		100%	100%	100%	100%

3.9.5 *Future Build Condition – Roadway Network*

Site Access and Circulation

Access to the project drive will be provided via two locations. The primary access will be off of Tremont Street at the northwest corner of the Project Site and will be shared with the Whittier Street Health Center (WSHC). Currently, the WSHC Drive consists of one ingress lane and one right-turn only egress lane. Under future conditions, this drive will be widened to accommodate two egress lanes (one left-turn and one right-turn) and one wide ingress lane (to allow for truck turns). The intersection of the Site Drive with Tremont Street will be signalized, and operate as part of the signal at Prentiss Street. The jersey barrier median on Tremont Street at the Site Drive will be removed, allowing left turns into and out of the site. Pedestrian access ramps and pedestrian signals will be provided at the Site Drive intersection to enhance pedestrian access to the site.

The Project Site driveway (South Drive), in addition to being shared with WSHC, will provide access to the parking garage which is currently owned and used by the Boston Public School (BPS).

A secondary means of access/egress to the Project Site will be provided via Whittier Street, to allow for full circulation around the Project Site. This will be accomplished by widening a section of Whittier Street from one lane to two lanes for approximately 400 feet from Tremont Street to the proposed East Drive and making it a two-way street. Parallel parking will be provided on both sides of Whittier Street by widening the road into the Tremont Crossing property. A left-turn lane with approximately 200 feet of storage will be provided on Tremont Street southbound for vehicles turning onto Whittier Street eastbound.

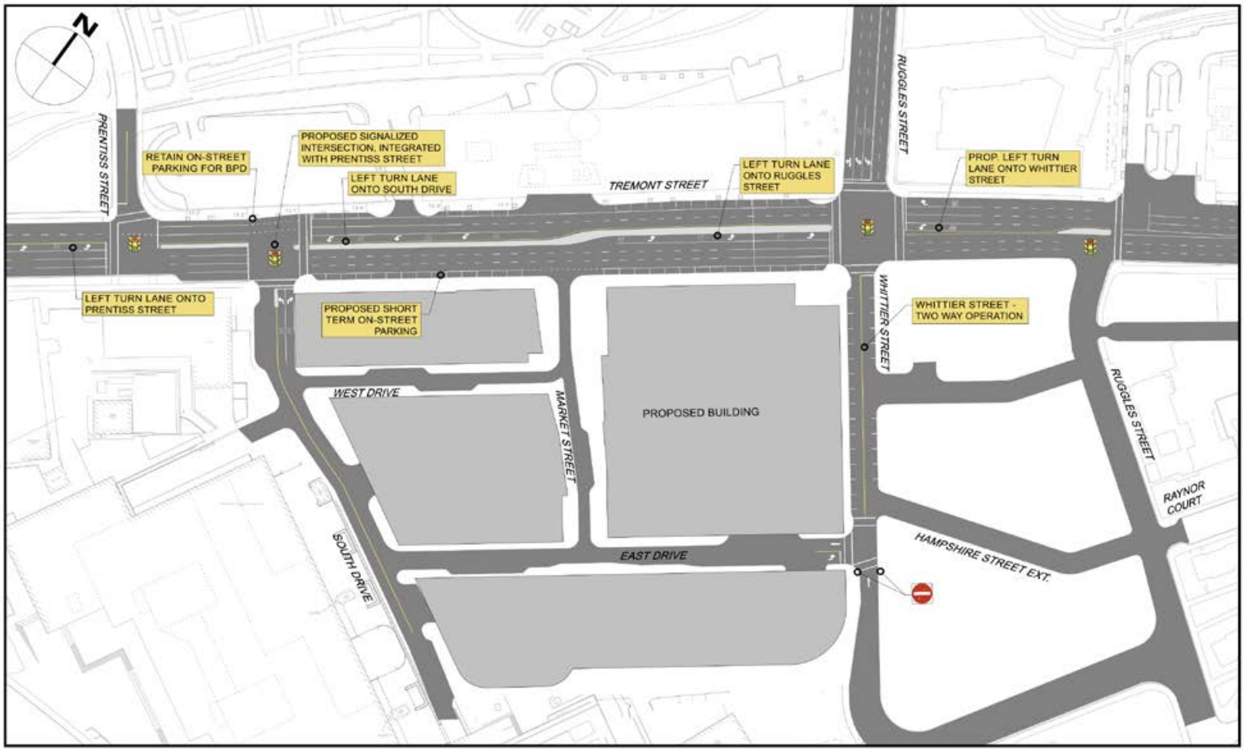
All delivery vehicles, in particular all trucks, will be prohibited from using Whittier Street and will be directed to enter and depart the Site only through South Drive. Two parking garage entrances/exits will be provided: one off of South Drive and one off of East Drive. Figure 3-12 shows the plan view for the proposed site circulation.

A public plaza which will be bisected by a new Market Street will be located through the center of the site, separating the three mixed-use buildings and providing pedestrian access between Tremont Street and East Drive. A vehicular drop-off area for retail use will be located adjacent to the pedestrian plaza on the site proper. This drop-off will allow vehicles to turn from East Drive and travel westbound through the pedestrian plaza. The vehicular travel way will be clearly demarcated to minimize conflicts with pedestrians. Vehicles will travel one-way westbound and exit this drop-off area via an exit-only single curb cut on Tremont Street, where they will be restricted to right-turns only. There will also be a pick-up/drop-off area for the retail component of the Project along East Drive at the forefront of the western portion of the garage. These areas will provide for safe and secure waiting areas for either shoppers with large bundles who are waiting to be picked up or those who do not own a vehicle and want to take a taxi or shared ride service to the Project.

The Project also proposes a museum, residential, and office drop-off area to be located off of West Drive, a newly created one-way northbound street connecting South Drive to Market Street.

Drop off for the northern residential tower will occur at the corner of Tremont and Whittier Street by the lobby of that use. In this way, all of the uses—retail, commercial and residential—each have their own distinct pick-up/drop-off zone, near to the relative use and dispersed throughout the Project Site.

Figure 3-12: Site Circulation Plan



Using the projected trip distribution, the Project vehicle-trips were assigned to the local roadway network based on expected travel patterns. Vehicle trip distribution patterns are illustrated on Figures 3-13 to 3-14. Vehicular traffic volumes expected to be generated by the Project have been distributed and assigned according to the traffic patterns developed in this report and are presented on Figure 3-15 through 3-17.

The traffic patterns reflect the removal of the jersey barrier on Tremont Street at the Site Drive to permit full access at this intersection, thereby eliminating southbound U-turns at Prentiss Street and reducing northbound U-turns at Ruggles Street. The traffic patterns also reflect the conversion of Whittier Street from one-way to two-way between Tremont Street and Downing Street.

The future Build network volumes account for the above changes. Year 2021 Build Condition vehicular traffic volumes, which consist of the addition of project-generated vehicle-trips to previously identified No-Build Condition traffic volumes, are displayed in Figures 3-18 through 3-20. Trip Generation Calculations are contained in the Appendix.

Figure 3-13: Project Trip Distribution – Weekday Morning Peak Hour

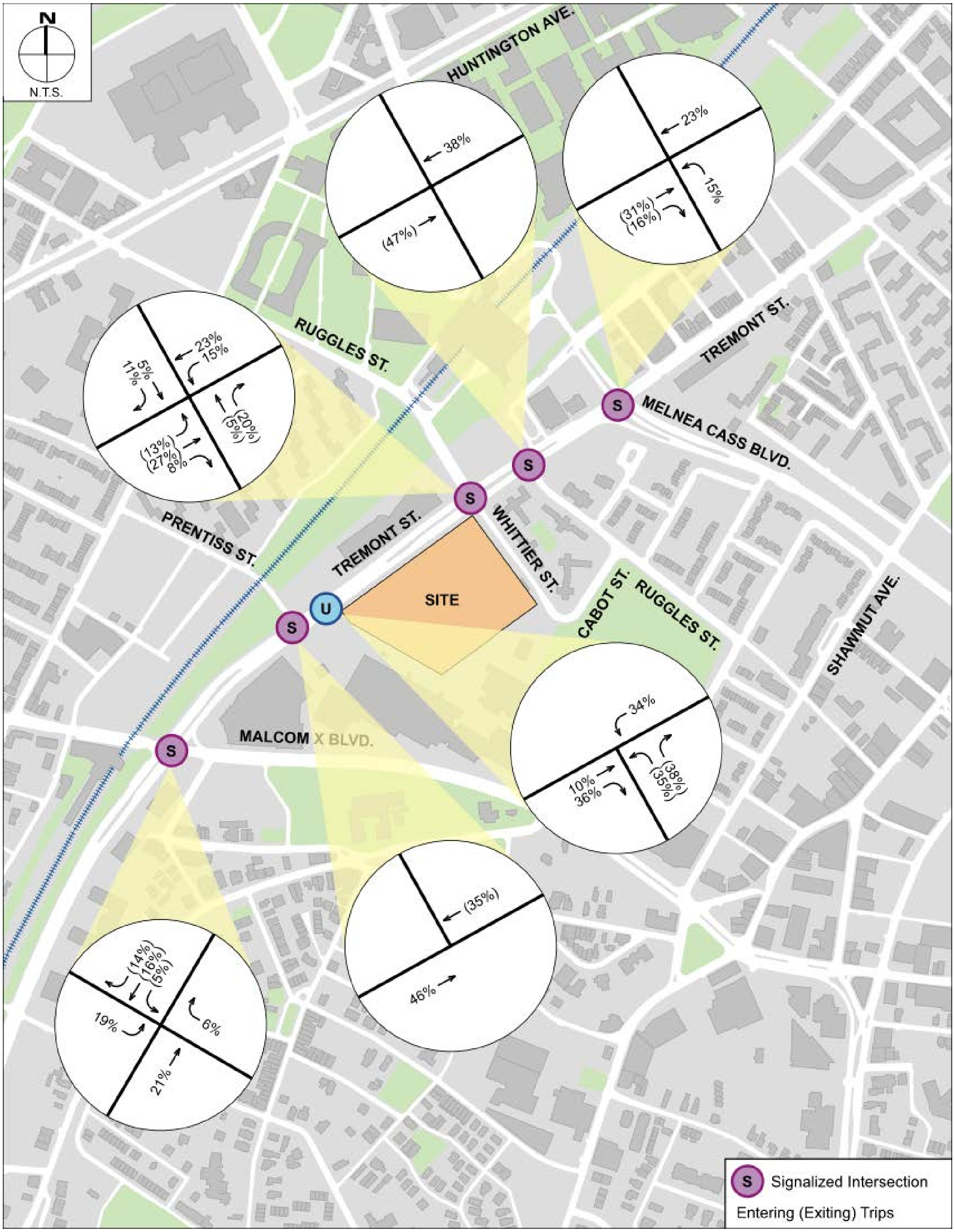


Figure 3-14: Project Trip Distribution – Weekday Evening & Saturday Midday Peak Hours

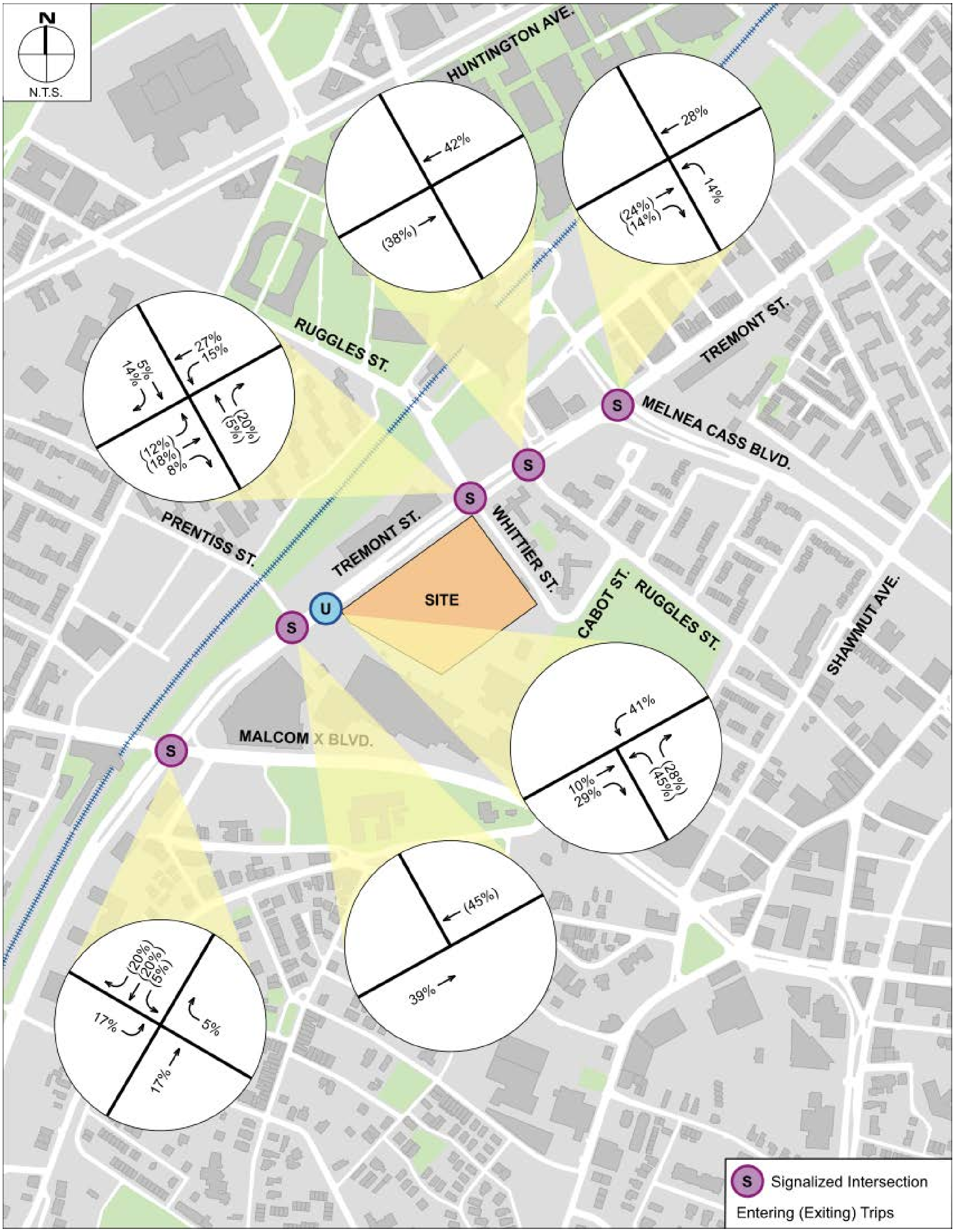


Figure 3-15: Weekday Morning Peak Hour Site-Generated Project and Pass-By Trips

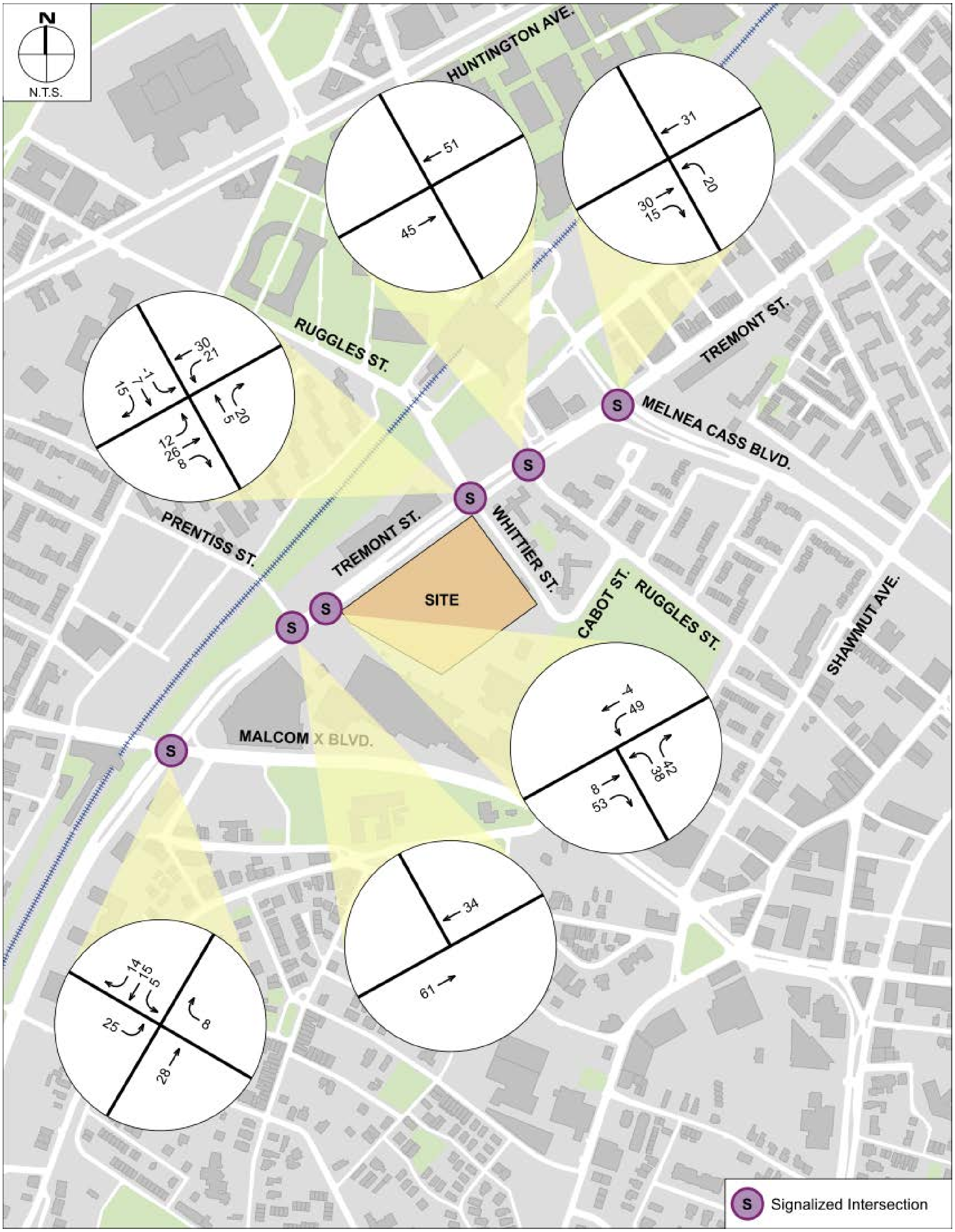


Figure 3-16: Weekday Evening Peak Hour Site-Generated Project and Pass-By Trips

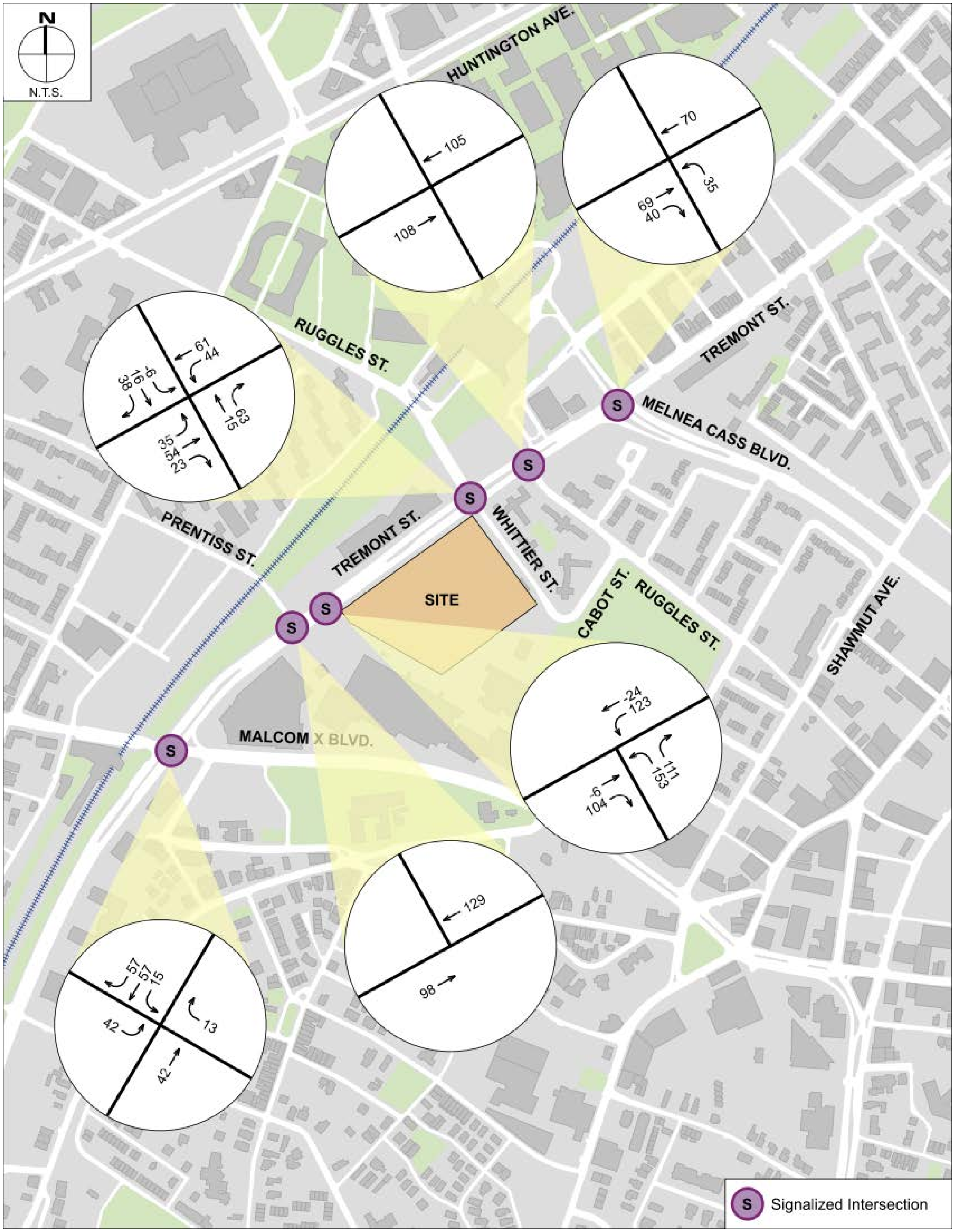


Figure 3-17: Saturday Midday Peak Hour Site-Generated Project and Pass-By Trips

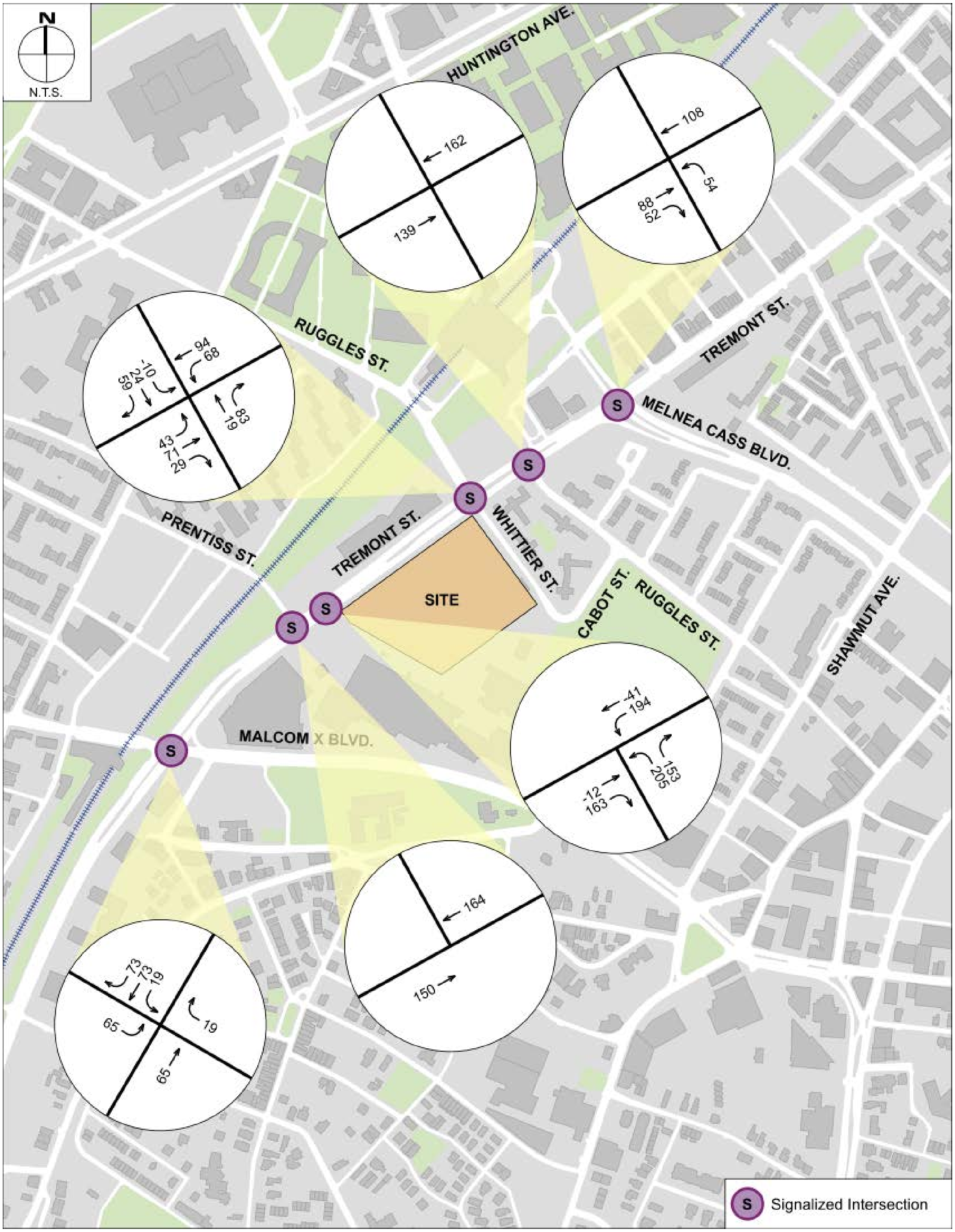


Figure 3-18: 2021 Future Build Conditions Weekday Morning Peak Hour Traffic Volumes

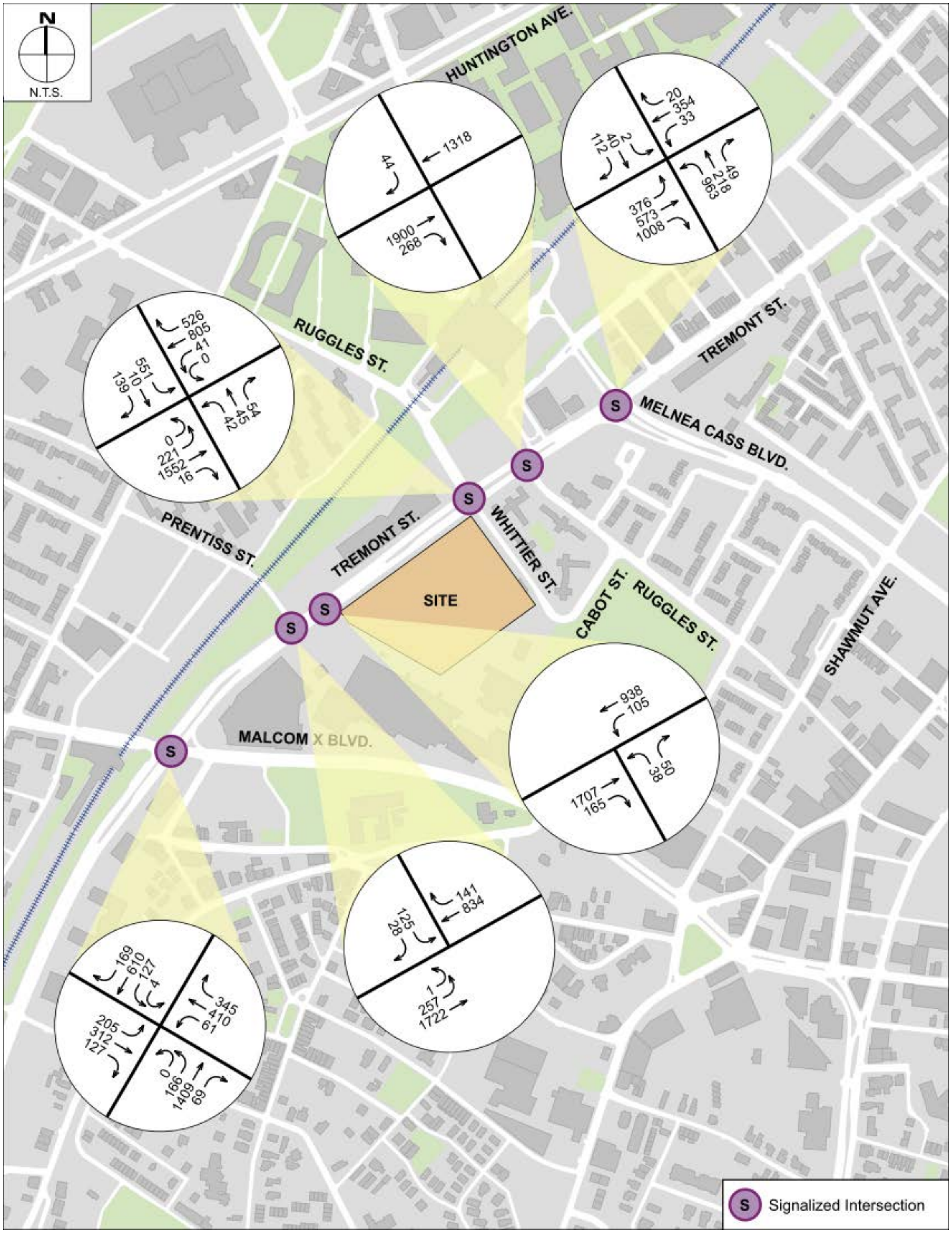
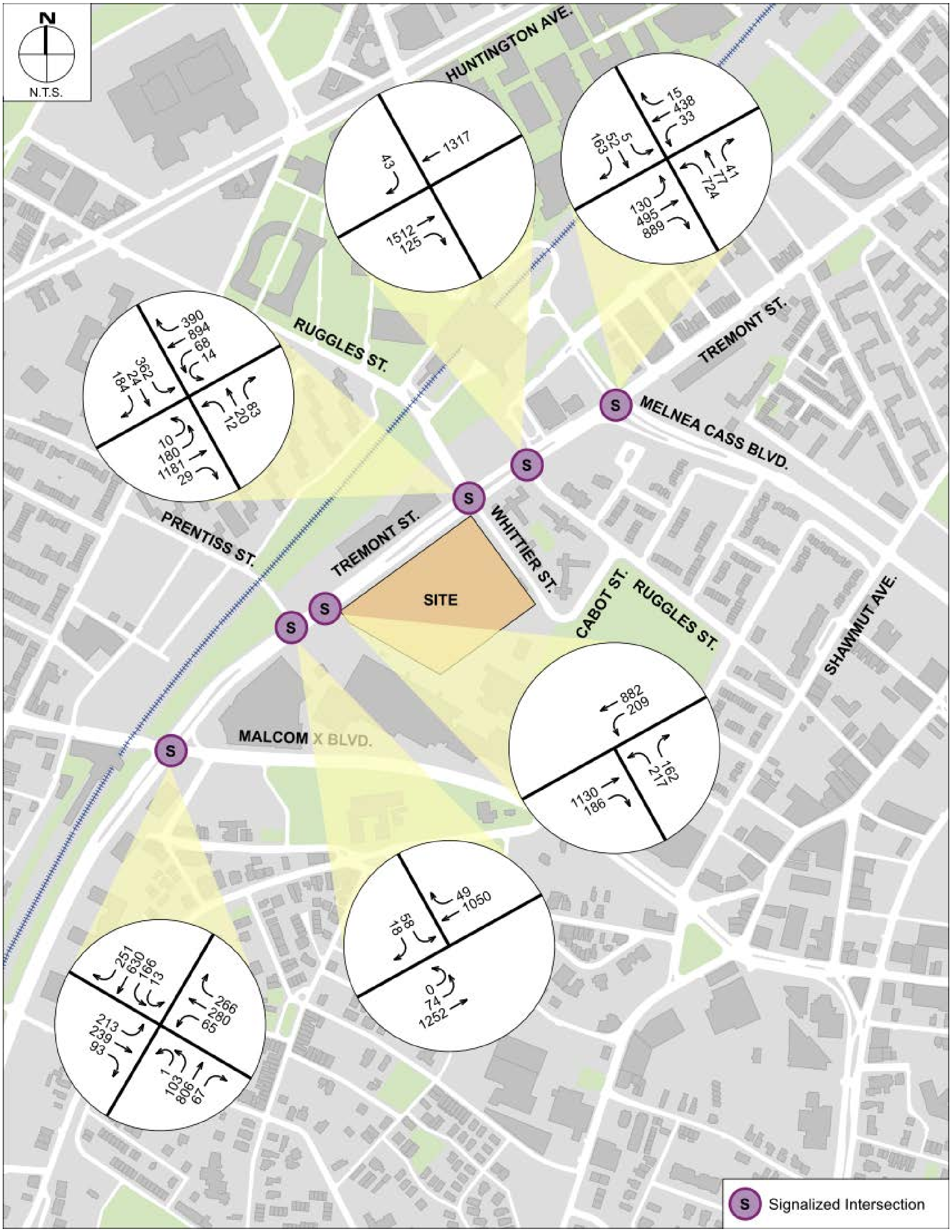


Figure 3-19: 2021 Future Build Conditions Weekday Evening Peak Hour Traffic Volumes

Figure 3-20: 2021 Future Build Conditions Saturday Midday Peak Hour Traffic Volumes



3.9.6 *Build Condition Operating Conditions*

The results of the capacity analysis for the intersections under evaluation are summarized below in Table 3-14. 2016 Baseline, 2021 Future No-Build, and 2021 Future Build volume scenarios are evaluated. Complete analysis calculations and summaries, including queue length, queue figures, and detailed results for each movement, are contained in the Appendix.

Table 3-14: Capacity Analysis Summary- Signalized Intersections

		2016 Baseline			2021 No Build			2021 Build		
Intersection	**Time Period**	**Delay (sec)**	**LOS**	**v/c Ratio**	**Delay (sec)**	**LOS**	**v/c Ratio**	**Delay (sec)**	**LOS**	**v/c Ratio**
Tremont St / Melnea Cass Blvd	Weekday AM	49.9	D	0.98	54.3	D	1.01	62.0	E	1.05
	Weekday PM	47.5	D	0.97	63.0	E	1.05	80.0	F	1.10
	Saturday MID	23.2	C	0.76	23.2	C	0.76	25.5	C	0.83
Tremont St /Ruggles St / Renaissance Park	Weekday AM	4.7	A	0.52	4.6	A	0.54	10.1	B	0.59
	Weekday PM	5.4	A	0.51	5.3	A	0.54	5.0	A	0.59
	Saturday MID	4.9	A	0.42	5.0	A	0.42	4.9	A	0.47
Tremont St / Ruggles St / Whittier St	Weekday AM	35.6	D	0.83	37.9	D	0.87	59.8	E	0.96
	Weekday PM	51.0	D	0.80	53.3	D	0.84	64.8	E	0.98
	Saturday MID	>80.0	F	1.14	>80.0	F	1.16	47.6	D	0.89
Tremont St / Prentiss St	Weekday AM	>80.0	F	1.05	>80.0	F	1.05	34.8	C	0.88
	Weekday PM	65.8	E	0.92	65.8	E	0.92	59.2	E	0.96
	Saturday MID	15.6	B	0.64	15.9	B	0.65	41.4	D	0.72
Tremont St / Malcolm X Blvd / Columbus Ave	Weekday AM	>80.0	F	1.03	>80.0	F	1.07	>80.0	F	1.10
	Weekday PM	>80.0	F	0.94	>80.0	F	0.97	>80.0	F	1.05
	Saturday MID	58.9	E	0.72	60.0	E	0.73	77.3	E	0.81
Tremont St / Site Drive	Weekday AM		Unsignalized			Unsignalized		18.0	B	0.67
	Weekday PM							40.2	D	0.84
	Saturday MID							37.1	D	0.73

Under existing conditions, the intersection at Tremont Street / Melnea Cass Boulevard currently operates at LOS D during the weekday morning and evening peak hours, and at LOS C during the Saturday midday peak hours. Under the future No Build condition, the intersection is expected to operate at LOS D and E, respectively, during the weekday morning and evening peak hours. Under the future Build condition, the intersection will operate at LOS E during the weekday morning peak hour and LOS F during the weekday evening peak hour. During the Saturday midday peak hour, the intersection will operate at LOS C under both the No Build and Build conditions.

The intersection at Tremont Street / Ruggles Street / Renaissance Park currently operates at LOS A during all three peak hours. Under future No Build conditions, this intersection will operate at LOS A during all three peak hours. Under future Build conditions, this intersection will operate at LOS B during the weekday morning peak hour and LOS A during the weekday evening and Saturday midday peak hours.

Currently, the intersection at Tremont Street / Ruggles Street / Whittier Street operates at LOS D during the weekday morning and evening peak hours and at LOS F during the Saturday midday peak hour. Under future No Build conditions, this intersection will operate at LOS D during the weekday morning and evening peak hours and at LOS F during the Saturday midday peak hour. Under future Build conditions, the intersection will operate at LOS E during the weekday morning and weekday evening peak hours and at LOS D during the Saturday midday peak hour.

The intersection of Tremont Street / Prentiss Street currently operates at LOS F and E during the weekday morning and evening peak hours, respectively, and at LOS B during the Saturday midday peak hour. Under No Build conditions, the intersection will continue to operate at these during all peak hours. During future Build conditions, the intersection is expected to operate at LOS C during the weekday morning peak hour, LOS E during the weekday evening peak hour, and LOS D during the Saturday midday peak hour.

Currently, the intersection at Tremont Street / Malcolm X Boulevard / Columbus Avenue operates at LOS F during the weekday peak hours and LOS E during the Saturday midday peak hour. Under both the future No Build and Build conditions, this intersection is expected to continue to operate at LOS F during the weekday peak hours and LOS E during the Saturday midday peak hour. These levels of service may be attributed to the time required for the pedestrians to traverse the crosswalks. The use of a concurrent pedestrian phase with Lead Pedestrian Intervals (LPI) was analyzed, and it was determined that this phasing would improve levels of service at this intersection to LOS E, E, and D during the weekday morning, weekday evening, and Saturday midday peak hours, respectively (see Appendix for detailed capacity analysis).

The intersection at Tremont Street / Site Drive is currently unsignalized. Under future Build conditions, the intersection is expected to become signalized, with the entire intersection operating at LOS B during the weekday morning peak hour and LOS D during the weekday evening and Saturday midday peak hours.

3.10 Future Build Condition – Other Impacts

3.10.1 *Tremont Crossing Parking Demand*

Tremont Crossing will include a multi-level above-grade parking structure that will accommodate the needs of all of its mix of uses. The parking facility will consist of approximately 1,371 parking spaces (1,246 for Phase 1 and 125 for Phase 2). The users of the facility will include residents, retail customers, office tenants, and museum visitors. A portion of the spaces will provide replacement parking for the Boston Public Schools (31 parking spaces) and Whittier Street Health Center (75 parking spaces).

The Proponent intends to employ parking management strategies that would discourage long-term commuter parking. For example, the Proponent is working with the retail tenants to allow up to 2 hours of parking to be free, but to increase the fees after the initial 2 hours have elapsed.

BTD has provided guidelines for parking ratios within different sections of the City and within proximity to MBTA transit stations. The proposed parking ratios are as follows:

<u>Residential</u> – There are 348 parking spaces provided for 695 residential units, resulting in a parking ratio of 0.50 spaces per unit, which is less than the BTD suggested ratio of 0.75 to 1.25 spaces per unit.

<u>Museum</u> – 21 parking spaces are provided for 31,000 SF of museum space. This results in a parking ratio of 0.68 spaces per thousand square feet, which is less than the BTD suggested ratio of 0.75 to 1.25 spaces per thousand square feet.

Retail – A total of 771 parking spaces are provided for 396,000 SF of retail space, resulting in a parking ratio of 1.95 spaces per thousand square feet. This is slightly more than BTD-suggested guideline of 0.75 to 1.25 spaces per thousand square feet. However, it is anticipated that the discount club retail, with its regional attraction, will require a significantly higher parking ratio, approximating 5.00 spaces per 1,000 square feet of gross leasable area for both the weekdays and the weekend.

Office (Phase 2) – There are 125 parking spaces provided for 105,000 SF of office space, resulting in a parking ratio of 1.19 spaces per thousand square feet. This ratio is within the BTD suggested ratio of 0.75 to 1.25 spaces per thousand square feet.

Table 3-15 below summarizes the number of spaces allocated to each use, the resulting parking ratio, and the BTD recommended parking ratio.

Table 3-15: Parking Ratio Analysis

Weekday	Allocation of Spaces	Size	Corresponding Parking Ratio	BTD Guidelines Parking Ratio
Phase 1				
Residential	348	695 units (659,000 SF)	0.50 spaces per unit	0.75 – 1.25
Museum	21	31,000 SF	0.68 spaces per TSF	0.75 – 1.25
Retail	771	396,000 SF	1.95 spaces per TSF	0.75 – 1.25
Subtotal	1,140	1,086,000	1.05 spaces per TSF	N/A
Phase 2				
Office	125	105,000 SF	1.19 spaces per TSF	0.75 – 1.25
Phase 1 + Phase 2 Subtotal	1,265	1,191,000	1.06 spaces per TSF	N/A
Whittier Street Health Center	75	N/A	N/A	N/A
Boston Public Schools	31	N/A	N/A	N/A
Total	1,371	N/A	N/A	N/A

** based on BTD parking guidelines for residential*

3.10.2 *Shared Parking Analysis*

In response to comments by the BRA, a shared parking analysis was conducted for the Project based on methodologies developed by the Urban Land Institute. Based on these analyses, the estimated shared parking demand for the development is 1,492 parking spaces during the weekday, which is comparable to the 1,371 spaces (including 106 spaces for Whittier Health and Boston Public

Schools) being proposed. A summary of the shared parking analysis is included in the Appendix.

3.10.3 *On-Street Parking*

Besides the parking structure, the Project anticipates the inclusion of short-term, on-street, parallel parking spaces along Tremont Street and Whittier Street. These spaces will be primarily used by patrons of the small format retail that will be part of the Project's mix of uses. It should be noted that these street level spaces will be constructed on the Project Site, and will not impact the existing traffic lanes traveling northbound into downtown Boston.

Currently, Whittier Street is a one-way street providing unregulated parking on both sides of the roadway. The Proponent proposes to convert Whittier Street to a two-way roadway between Tremont Street and the proposed East Drive. The Project will provide short-term parallel parking spaces on both sides of Whittier Street, by widening into the Project site. Currently, most of the parking spaces on Whittier Street are being utilized by commuters. The Proponent recommends regulating the parking on the north side of Whittier Street as "Residential Permit Only". In the comments of the PNF, BTD indicated support for the Residential Parking regulations. The Proponent, through the TAPA process, will work with the BTD to institute these Residential Parking regulations and other on-street parking regulations.

In order to allow for the proposed left/through lane and two exclusive through lanes on Tremont Street southbound at its intersection with the Site Drive, it is proposed that parking be prohibited on the west side of Tremont Street between Prentiss Street and Ruggles Street.

3.10.4 *Traffic Signal Warrant Analysis*

A traffic signal warrant analysis was conducted as part of the 2013 DPIR submission in order to justify the installation of a traffic signal at the intersection of Tremont Street and the Site Drive. Traffic volumes were utilized from the future Build condition from the 2013 DPIR submission, assuming the construction of the proposed Tremont Crossing. It is assumed that the traffic signal warrant analysis done previously would be sufficient for this subsequent submission.

Hourly non-retail traffic volumes were determined by taking the weekday morning and evening project trip volumes and extrapolating them based on hourly traffic volume data obtained from a nearby MassDOT count location on Tremont Street. Hourly retail-based traffic volumes were determined by extrapolating weekday morning and evening project trip volumes based on "hourly variation in shopping center traffic" data contained in the ITE Trip Generation Manual (9th Edition, 2012).

The current Manual on Uniform Traffic Control Devices (MUTCD) contains nine traffic signal warrants, at least one of which must be satisfied in order to justify the installation of traffic signals at a particular location. Satisfying one or more warrants, however, does not necessarily justify the installation or continuous operation of a traffic signal. The traffic signal warrants are listed below.

- Warrant 1: Eight-Hour Vehicular Volume
- Warrant 2: Four-Hour Vehicular Volume
- Warrant 3: Peak Hour
- Warrant 4: Pedestrian Volume
- Warrant 5: School Crossing
- Warrant 6: Coordinated Signal System
- Warrant 7: Crash Experience
- Warrant 8: Roadway Network
- Warrant 9: Intersection Near a Grade Crossing

Using the procedure contained in the MUTCD, four of the nine warrants that were evaluated were satisfied: Warrants 1, 2, 3, and 6. Therefore, a new traffic signal at the intersection of Tremont Street and the Site Drive would be justified. Signal warrant analysis worksheets are contained in the Appendix.

3.10.5 *Transit Impacts*

Table 3-16 below summarizes the person-trips that are expected to be generated by the Project that will use transit services.

Table 3-16: Total Person-Trips for Transit Use

		Weekday					
		Morning Peak		Evening Peak		Saturday Peak	
	Daily	**Entering**	**Exiting**	**Entering**	**Exiting**	**Entering**	**Exiting**
Discount Club	831	8	5	73	45	62	59
Retail	4,029	62	26	142	224	270	249
Office	523	81	8	11	74	10	8
Museum	9	3	0	0	2	4	1
Residential	988	18	50	47	37	41	41
Total Transit Person-Trips	6,380	172	88	273	382	388	358

As can be seen in the table above, the number of person-trips expected to use public transit is 260 during the weekday morning peak hour (172 entering, 88 exiting), 656 during the weekday evening peak hour (273 entering, 382 exiting), and 746 during the Saturday midday peak hour (388 entering, 358 exiting). On a daily basis, the Project is expected to generate 6,380 person-trips using transit services.

As outlined in the section entitled “Public Transit”, there are a large number of MBTA transit facilities and services in the vicinity of the site, including 14 bus routes, two subway stations, and three Commuter Rail lines. Based on information provided in the 2012 MBTA Ridership and Service Statistics, the breakdown of public transit services, it is assumed that approximately 30 percent of the public transit trips will occur via MBTA busses, 59 percent will occur via MBTA rapid transit (subway), and 11 percent will occur via MBTA commuter rail. Table 3-17 below displays the breakdown of trips per each type of transit use, based on these percentages, followed by further discussions for each option.

Table 3-17: Breakdown of Person-Trips for Transit Use

		Weekday					
		Morning Peak		Evening Peak		Saturday Peak	
	Daily	**Entering**	**Exiting**	**Entering**	**Exiting**	**Entering**	**Exiting**
Total Transit Trips	6,380	172	88	273	382	388	358
Bus (30%)	1,914	51	27	82	115	116	107
Rapid Transit (59%)	3,764	101	52	161	225	229	211
Commuter Rail (11%)	702	20	9	30	42	43	40

MBTA Bus

The Project is expected to generate approximately 1,914 trips on the MBTA bus system on a daily basis, with 77 bus trips during the weekday morning peak hour (51 entering, 27 exiting), 197 bus trips during the weekday evening peak hour (82 entering, 115 exiting), and 223 bus trips during the Saturday midday peak hour (116 entering, 107 exiting). These trips are distributed over the fourteen (14) bus routes that service the study area, eight (8) of which have routes that travel on Tremont Street. A bus stop is located on the east side of Tremont Street across from Prentiss Street, within a short walk to the Project site.

Rapid Transit (Subway)

Based on the data outlined above in Table 3-17, it is expected that the Project will generate 3,764 person-trips on a daily basis that will use the MBTA rapid transit system (subway). The Project will generate 153 rapid transit trips (101 entering, 52 exiting) during the weekday morning peak hour, 386 rapid transit trips (161 entering, 225 exiting) during the weekday evening peak hour, and 440 rapid transit trips (229 entering, 211 exiting) during the Saturday midday peak hour.

During the weekday morning and evening peak hours, the headways between trains are 4 to 5 minutes, resulting in approximately 12 trains per hour. This results in an additional project-related ridership of up to 12 persons per train during the weekday morning peak hour, and 24 persons per train during the weekday evening peak hour. During the Saturday midday peak hour, the headway on the Orange line is approximately 8 minutes, resulting in approximately 8 trains per hour. This results in an additional project-related ridership of up to 31 persons per train on a Saturday midday peak hour.

Commuter Rail

On a daily basis, the Project will generate 702 person-trips that are expected to use the commuter rail lines available near the Project site. The Project will generate 29 commuter rail trips (20 entering, 9 exiting) during the weekday morning peak hour, 72 commuter rail trips (30 entering, 42 exiting) during the weekday evening peak hour, and 83 commuter rail trips (43 entering, 40 exiting) during the Saturday midday peak hour.

It is anticipated that the additional transit trips could be accommodated by the existing public transportation network. It should be noted that, as stated above, the MBTA will be expanding the Ruggles Station Commuter Rail by constructing a new platform to serve Track 2. This expansion will improve service and access to Ruggles Station, as well as improve operational ability.

3.10.6 *Pedestrian Impacts*

As shown in Table 3-10, it is expected that the Project will generate 669 pedestrian trips during the weekday morning peak hour, 1,958 pedestrian trips during the weekday evening peak hour, and 2,428 pedestrian trips during the Saturday midday peak hour.

The expected new pedestrian trips will be well served by the existing 7-10 foot sidewalks along Tremont Street, as well as by the two multi-use paths in the area (Southwest Corridor Park and South Bay Harbor Trail). The sidewalks along the project frontage will be rebuilt and widened to support street-level retail.

In addition, several crosswalks exist across Tremont Street in the vicinity of the Project, all of which provide pedestrian signals, push buttons, and accessible ramps. Particularly of note is the pedestrian crossing located on Tremont Street between Ruggles Street and Renaissance Park. This mid-block pedestrian crossing provides access to Ruggles Station with the newly constructed promenade, expected to encourage pedestrian activity in the area and provide a safer route across Tremont Street. In addition, the proposed traffic signal at the project site drive (South Drive) will provide crosswalks, pedestrian signals, and push buttons, with a concurrent pedestrian signal phase.

3.10.7 *Bicycle Accommodations*

The Project proposes to install bicycle racks on the site, both on-street and within the parking garage, for use of trips made by bicyclists. The Proponent will work with BTD to determine the number and location of bicycle racks to be located on the site. As stated previously, bicycle lanes currently exist in both directions on the north leg of Ruggles Street. In addition, the two multi use paths in the area – Southwest Corridor Park and South Bay Harbor Trail – provide bicycle access to the Project site from the surrounding areas, including South End, Roxbury, Back Bay, Chinatown, Jamaica Plain, South Boston, and the Fort Point Channel. To improve access, this Project will install shared lane markings (sharrows) on Prentiss Street, which will connect to the new crosswalks across Tremont Street, providing connections to both the Ruggles and Roxbury Crossing MBTA stations. Bicyclists also have access to local roadways, such as Whittier Street, in the vicinity of the site.

3.10.8 *Services and Loading*

All delivery vehicles will both enter and exit the site via the Site Drive (South Drive) on Tremont Street. There will be no loading or delivery circulation on Whittier Street. Two loading bays will be provided for the Project's retail tenants. One will be located off of South Drive and the other will be located in the rear of the Project off of East Drive. Both will be enclosed in the retail buildings and shielded from view without noise to the local environment. The loading bay off of East Drive is located diagonally across from one of the parking garage entrances. Truck loading for large trucks will need to be coordinated so that the times conflict minimally with the use of the parking garage, thereby reducing vehicular conflicts.

As mentioned previously, a retail drop-off area will be located within the plaza along Market Street, and will be clearly demarcated in order to minimize conflicts between pedestrians and vehicles. A museum, residential, and office drop-off area will be located on West Drive. Additional short-term parking spaces will be available along Tremont Street on the project frontage and along both sides of Whittier Street. Figure 3-21 shows the enclosed loading bays.

Figure 3-21: Enclosed Loading

3.11 Recommended Improvements

As part of this study, several improvements are being proposed along the Tremont Street corridor. These improvements are intended to improve traffic operations and help improve pedestrian safety at the study area intersections and throughout the corridor. The improvements are outlined below.

Tremont Street Improvements

Based on discussions with BTD, the roadway cross section on the northern Tremont Street leg of its intersection with South Drive consists of, from west to east: a sidewalk with a minimum 10-foot width, a 7-foot parking lane, two 11-foot through lanes, one 10-foot left turn lane, an 8-foot median to provide pedestrian refuge, three 11-foot travel lanes, one 8-foot parking lane, and a sidewalk with a minimum 5-foot width. Figure 1-22 shows the proposed Tremont Street layout at this location.

The proposed roadway cross section on the southern Tremont Street leg of its intersection with Whittier Street consists of, from west to east: a sidewalk with a minimum 10-foot width, a parking lane varying in width from 9 feet to 11 feet, two 11-foot through lanes, an 8-foot median, one 11-foot left-turn lane, three 11-foot travel lanes, one 8-foot parking lane, and a sidewalk with a minimum 5-foot width. Figure 1-23 shows the proposed Tremont Street layout at this location.

On-Street Parking

During the PNF submission, the Proponent had requested the removal of parking along the frontage of BPD in order to restore the full three through lanes on Tremont Street southbound. However, based on comments from BTD and parking turnover studies, the cross-section of Tremont Street has been changed in order to retain the police parking. Tremont Street has been widened in front of the police station to provide one parking lane, two southbound through lanes, and one left-turn lane.

The Proponent recommends regulating the parking on the north side of Whittier Street as “Residential Permit Only”. The Proponent also recommends that the existing on-street parking regulations on Tremont Street southbound, including the “No Stopping 4:30 – 6:00 PM”, be retained and enforced.

Figure 3-22: Tremont Street at South Drive

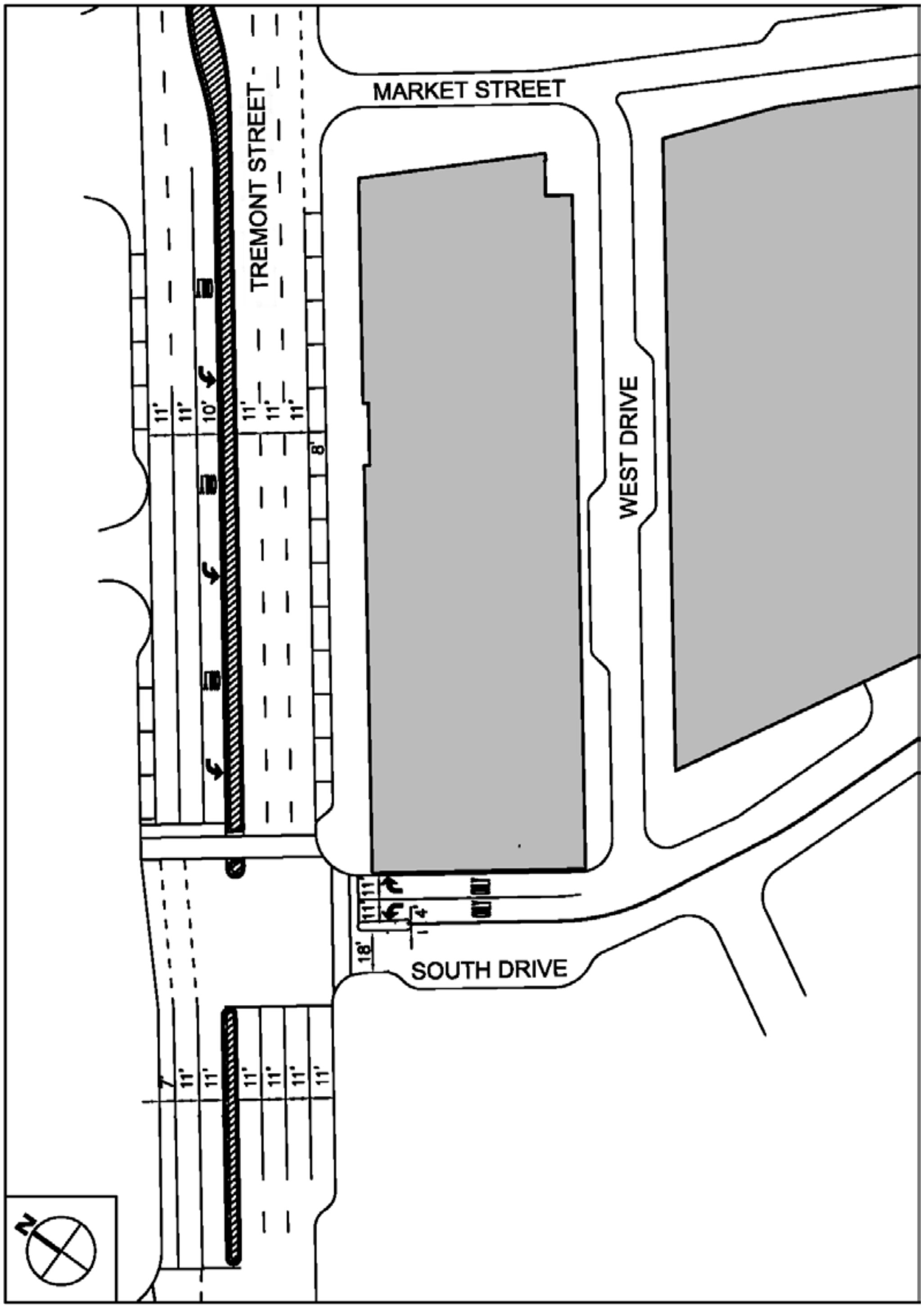
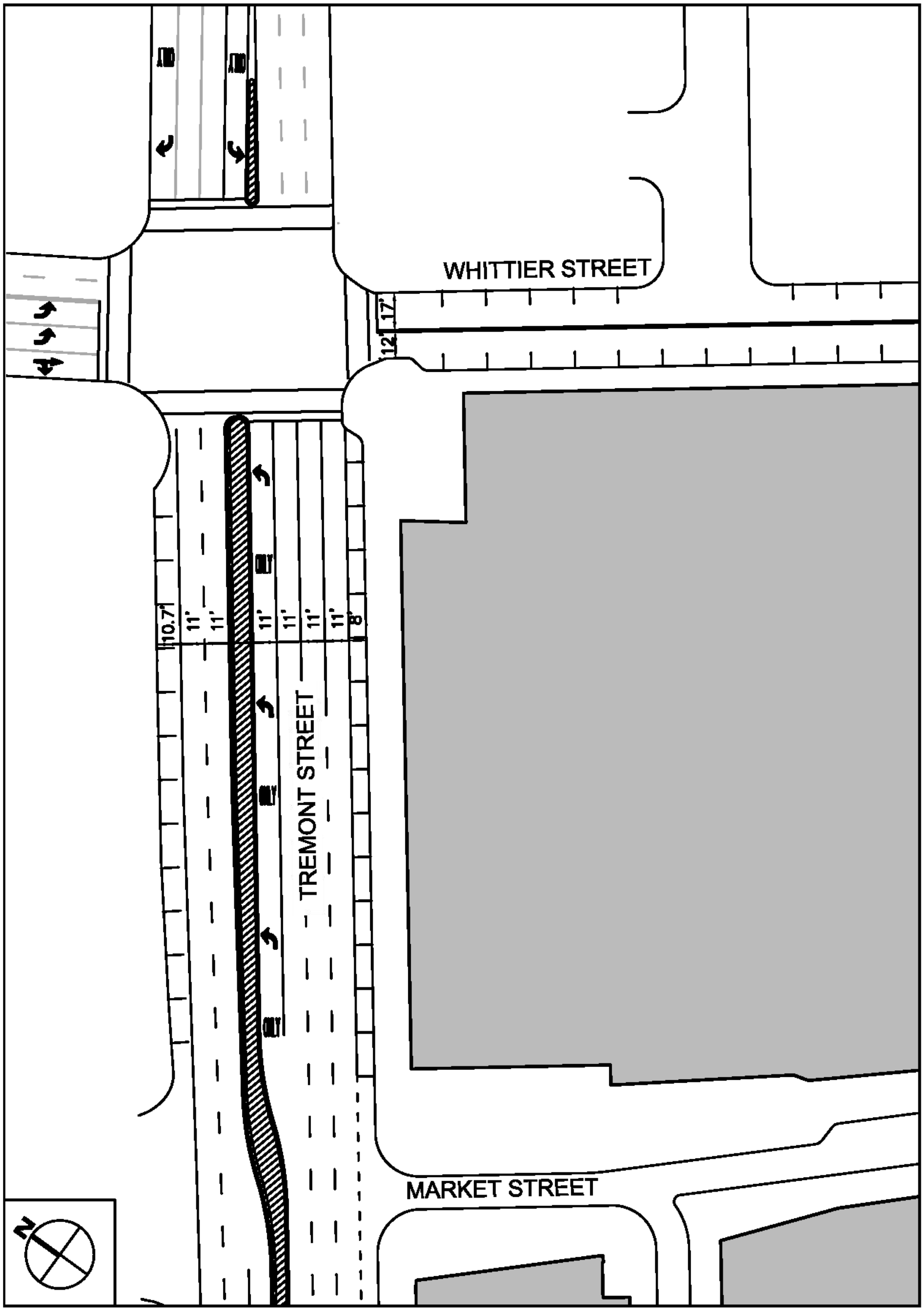


Figure 3-23: Tremont Street at Whittier Street



Whittier Street Two-Way Operation

Currently, Whittier Street is one-way westbound, providing one general use lane and parking on both sides of the roadway. Under future conditions, Whittier Street will be widened between Tremont Street and the proposed East Drive to provide one travel lane in each direction. Parallel parking will be provided on both sides of Whittier Street, with an approximately 8-foot sidewalk on the south side (on the project site). The existing 7.5 foot sidewalk on the north side will remain. The eastern section of Whittier Street from the proposed East Drive to Ruggles Street will remain one-way southwestbound to prevent cut-through traffic on Whittier Street.

Based on comments from BTD, capacity analyses were performed in order to justify the conversion of Whittier Street from one-way to two-way. Table 3-18 compares the results of the 2021 Build condition capacity analyses at the intersection of Tremont Street at the Site Driveway (South Drive) between one-way and two-way operations on Whittier Street.

Table 3-18: 2021 Build Condition Capacity Analysis Summary – Whittier Street Operations

	Whittier Street Two-Way Operations				**Whittier Street One-Way Operations**			
	Ave. Delay (sec)	**LOS**	**V/C Ratio**	**Queue Length (ft)**	**Ave. Delay (sec)**	**LOS**	**V/C Ratio**	**Queue Length (ft)**
				WEEKDAY MORNING PEAK HOUR				
Tremont St / Site Drive								
Site Drive WB L	68.3	E	0.33	82	68.3	E	0.33	82
Site Drive WB R	62.1	E	0.04	44	62.9	E	0.04	44
Tremont St NB T	0.4	A	0.56	13	0.4	A	0.55	13
Tremont St NB R	0.0	A	0.14	0	3.6	A	0.21	18
Tremont St SB L	85.1	F	0.76	112	74.8	E	0.80	143
Tremont St SB T	41.2	D	0.75	450	41.2	D	0.75	538
Overall	*18.0*	*B*	*0.67*		*18.4*	*B*	*0.70*	
				WEEKDAY AFTERNOON PEAK HOUR				
Tremont St / Site Drive								
Site Drive WB L	57.6	E	0.55	233	57.6	E	0.55	233
Site Drive WB R	60.7	E	0.13	76	58.9	E	0.13	76
Tremont St NB T	1.8	A	0.55	20	1.8	A	0.54	20
Tremont St NB R	0.0	A	0.10	0	0.0	A	0.16	0
Tremont St SB L	>80.0	F	0.84	257	>80.0	F	1.08	417
Tremont St SB T	75.9	E	1.02	960	76.1	E	1.02	961
Overall	*40.2*	*D*	*0.84*		*44.8*	*D*	*0.88*	
				SATURDAY MIDDAY PEAK HOUR				
Tremont St / Site Drive								
Site Drive WB L	52.8	D	0.57	324	52.8	D	0.57	324
Site Drive WB R	58.8	E	0.12	74	58.8	E	0.12	74
Tremont St NB T	1.1	A	0.46	4	0.5	A	0.44	4
Tremont St NB R	0.0	A	0.14	0	0.0	A	0.17	0
Tremont St SB L	>80.0	F	1.02	414	>80.0	F	1.47	646
Tremont St SB T	60.7	E	0.88	572	60.9	E	0.88	573
Overall	*37.1*	*D*	*0.73*		*57.4*	*E*	*0.80*	

Abbreviations: EB = Eastbound, WB = Westbound, NB = Northbound, SB = Southbound, L = Left, T = Through, R = Right

The results of the analyses indicate that, by keeping Whittier Street one-way, left-turns from Tremont Street onto South Drive would experience longer delays and queues than when the corridor is analyzed with Whittier Street two-way. The reported 95th percentile queues would exceed the available storage on Tremont Street southbound at South Drive during the weekday evening and Saturday midday peak hours. This would result in vehicles backing up beyond the left-turn storage lane, thereby blocking one through lane on Tremont Street southbound, and effectively reducing capacity for the Tremont Street southbound through traffic. In addition, the conversion of Whittier Street into a two-way road would allow for an alternate means of access to the Project site. If Whittier Street were to remain one-way, any potential incident that caused South Drive to be blocked would effectively render Tremont Crossing temporarily inaccessible.

Left-Turn Lane on Tremont Street Southbound at Whittier Street / Ruggles Street

An exclusive left-turn lane will be provided on Tremont Street southbound at the intersection of Tremont Street and Whittier Street / Ruggles Street. This lane will provide approximately 200 feet of storage for vehicles turning left onto Whittier Street eastbound.

Pedestrian Accommodations

Minimum 10-foot wide sidewalks will be provided along Tremont Street, with crosswalks at the intersection of Tremont Street and the Site Drive: one across the Tremont Street north leg, another across the Site Drive east leg. Pedestrian signals, push buttons, and accessible ramps will be provided at the newly-signalized intersection.

As discussed above, the Project will include a pedestrian / vehicular plaza through the center of the site, between the three mixed-use buildings, which will provide a walking route between buildings on the site, connections between the parking garage and East Drive to Tremont Street, as well as provide an area for restaurant outdoor seating or additional outdoor space for the small retail shops. Sidewalks will also be provided along the proposed East Drive.

Other Mitigation Measures

Based on discussions with BTD, the controllers in the corridor will need to be upgraded. Therefore, the Proponent will provide four new controllers at the intersections of Tremont Street with the Site Drive / Prentiss Street, Ruggles Street, Malcolm X Boulevard, and Melnea Cass Boulevard. The Proponent will also improve detection with the installation of video cameras at these intersections. The Proponent will work with BTD through the TAPA process for any applicable mitigation measures.

A concurrent pedestrian phase with a Lead Pedestrian Interval (LPI) will be provided at the intersection of Tremont Street and the Site Drive / Prentiss Street.

Comments from the BRA on the PNF requested the Proponent to “closely analyze the Tremont/Malcolm X intersection and incorporate geometric and signal operations improvements to mitigate the project’s impacts”. Based on this comment, the use of a concurrent pedestrian phase with LPI was analyzed at this location as well. As discussed in Section 3.9.6, a concurrent pedestrian phase would improve overall LOS at this location during all three peak periods.

The Appendix contains cross section and plan figures showing the proposed improvements outlined above.

3.12 Transportation Demand Management (TDM)

In line with the City’s commitment to reduce auto-dependent trips, especially single occupancy vehicles (SOV), the Proponent will implement the Transportation Demand Management (TDM) measures listed below. These measures will be codified between the City and the Proponent through the TAPA process.

- Public Transportation Information – The Proponent will provide information on public transportation options including bus, rapid transit (subway), and commuter rail schedules and pricing. This information will be posted in an easily accessible area for all residents, tenants, employees, and visitors.
- Car Sharing & Ridesharing – The Proponent will work with carpooling, vanpooling, and car sharing programs, such as Zipcar™ and MassRides to allocate a designated number of preferred parking spaces for this use.
- Transportation Coordinator – The Proponent will designate an on-site Transportation Coordinator to manage all TDM matters and serve as a liaison with the City.
- Transit Pass – The Proponent will encourage employees (and tenants) to offer subsidized transit-pass programs, potentially with pre-tax incentives
- Transit Scheduling Information – The Proponent will provide real-time transit scheduling information online, via mobile device, and/or on large screens in lobbies or other common areas.
- Parking Fees – The Proponent will charge the market rate for parking garage fees.
- Electric Vehicles – The Proponent will provide dedicated parking spaces and charging stations for electric vehicles.

- Bicycle Storage – The Proponent will provide secure bicycle storage, to be located in the form of outdoor bicycle racks or indoor storage facilities. The Proponent will work with BTD to determine the quantity and locations of these bicycle racks.

3.13 Conclusions

The proposed Tremont Crossing project is expected to provide a lively and diverse mix of uses along Tremont Street in the Roxbury neighborhood of Boston. The Project will construct a mixed-use facility including retail, office, residential, and museum space that will attract a number of users to the area.

The proposed project is expected to generate:

- 6,222 vehicle trips during the average weekday, with 230 vehicle trips occurring during the weekday morning peak hour, 536 vehicle trips occurring during the weekday evening peak hour, and 752 vehicle trips occurring during the Saturday midday peak hour
- 6,380 transit trips during the average weekday, with 260 transit trips occurring during the weekday morning peak hour, 656 transit trips occurring during the weekday evening peak hour, and 746 transit trips occurring during the Saturday midday peak hour
- 669 pedestrian trips occurring during the weekday morning peak hour, 1,958 pedestrian trips occurring during the weekday evening peak hour, and 2,428 pedestrian trips occurring during the Saturday midday peak hour

The additional traffic generated by the proposed project is not expected to have a significant impact on the nearby transportation infrastructure, assuming the proposed improvements are implemented. In addition, this project is expected to generate a larger portion of bicycle, pedestrian, and transit trips, in comparison to vehicle trips.

The results of the analysis indicate that, for the majority of the intersections, the average delay and overall LOS will not significantly degrade under the future Build condition. Traffic operations will improve at the intersections of Tremont Street with the Project Site Drive and Prentiss Street due to the proposed implementation of three full lanes on Tremont Street southbound, the proposed redistribution of trips, geometric and intersection modifications, and signal timing changes.

In summary, the project will seek to complete the following actions:

- Implement Traffic Demand Management (TDM) measures.

- Convert Whittier Street from one-way to two-way between Tremont Street and the proposed East Drive.
- Implement “Residential Permit Only” parking on Whittier Street between Tremont Street and East Drive and metered parking on the Project side of the street.
- Modify current traffic signal timings at the study area intersections to improve traffic flow and safety.
- Provide two through lanes and one left-turn lane on Tremont Street southbound
- Provide a right-turn pocket on Tremont Street northbound at the Site Drive into the Project site.
- Provide a left-turn pocket on Tremont Street southbound at Whittier Street into the Project Site.

- Signalize the intersection of Tremont Street with the Site Drive, and allow left-turns into and out of the site. Provide crosswalks, pedestrian push buttons, accessible ramps, and a concurrent pedestrian phase at this intersection.

4.0 URBAN DESIGN

4.1 Building Design

The Project's mix of uses will include: a retail component consisting of one (1) larger destination retailer of 92,000 square feet, 197,700 square feet of other destination retail, including entertainment and recreational uses, and 108,900 square feet of smaller shops and boutiques fronting along Tremont Street, Whittier Street and the Project's newly created "Market Street" and "West Drive"; 105,000 square feet of office space, two (2) multifamily residential buildings with a total of 685 units, made up of studios, one (1) bedroom, two (2) bedroom and three (3) bedroom rental apartments, 9,400 SF of townhouse style residential, consisting of approximately nine (9) units of housing along Whittier Street, and 31,000 square feet of cultural facilities that will primarily house a museum for the National Center of Afro-American Artists ("NCAAA"). The Project will also include a large, central public plaza which will be bisected by a newly created Market Street and an adjacent, multi-level parking structure to accommodate the requirements of its tenants. The proposed parking structure would consist of approximately 1,371 spaces which includes providing 106 abutter parking spaces for Whittier Street Health Center (75 spaces) and the Boston Public Schools (31 spaces), resulting in a net number of 1,265 parking spaces related to the Project's uses.

4.1.1 *Urban Design Concept*

The Tremont Crossing project presents the City of Boston with a transformative opportunity that will continue the dramatic urban changes both anticipated and on-going from Dudley Square north towards the Longwood Medical Area to the Fenway Development and west to Jackson Square. As such, this location becomes an important crossroads along the development of the Tremont Street corridor of Boston, one that has the opportunity to become a destination for both the neighborhood and the entire City.

The site is located along Tremont Street bordered to the east by Whittier Street and the west by the Whittier Health Center and the Reggie Lewis Track Facility. To the southwest of the site sits the Madison Park Technical Vocational High School and O'Bryant School and south of the site sits the school's combined play fields and track. To the north is the Boston Police Headquarters building, Wentworth Institute and Northeastern University. Site vehicular access is primarily from Tremont Street with limited access from

Whittier Street. The site is served by the Orange Line Ruggles Street MBTA stop and several bus lines.

The Parcel 3 site is unique within the city street fabric of Boston. While fronted to the north on Tremont Street and to the east on Whittier, the bulk of site is not directly accessible by vehicle from any other location. With the Public High Schools bordering the site on the west and the Good Shepard Church of God and Christ and the High School's playing fields to the south, there is also no easy pedestrian connections to the south and west as these institutions noted above effectively block any pathways in those directions. In essence the parcel is landlocked peninsula, however, it is the proponent's desire to connect the site wherever possible via new roadways thru the property and adjacent to the western edge of the property thru a new road, South Drive, that converts the High School's service drive into an activated way open utilized by the public. Where possible pedestrian pathways will be established to connect to the adjacent districts and the proposed internal roadways will connect to the adjacent neighborhood.

From an urban design perspective, the site at 7.25 acres in the aggregate, is large and should be utilized to provide economically vitality thru a variety of uses and activities. With a combination of destination retail, neighborhhod retail, entertainment, office, residential, the NCAAA Museum and parking, this location will provide the re-invigoration that this currently dormant parcel may bestow on the Roxbury neighborhood. The proposed mix of uses promises to deliver a new vibrant urban center.

The current selection of programmatic elements as depicted in this DPIR which include: ground floor, neighborhood retail, multilevel retail, including entertainment uses, office, residential, parking, and the NCAAA Museum are the very elements which have the potential draw, and cache to attract residents and visitors alike to this new urban center of commerce and culture.

Because the site is bounded by large volume and large foot-printed buildings, it is ideally suited to accommodate the square foot requirements necessary to support destination retail that serves to connect the community to the Greater Boston economy. These volumes can be situated on the site in such a way that they are shielded and screened from the neighboring residential areas while still providing the benefit of this form of retail in the city. Program elements such as housing, street front retail the NCAAA Museum and other uses can be strategically located to create harmonious edges with abutting neighborhoods that are consistent with the scale of the adjacent residential neighbors. Conversely, where the site abuts large institutions with little or no associated pedestrian activity, such as the adjoining high school, uses within Tremont Crossing such as the garage and building services seem appropriate.

This site is ideally suited for density and height and as a true transit oriented development. The site is a short walk from the Ruggles Street MBTA stop. Shadow paths are reasonably contained on the site due its orientation. There is an ability to utilize height in this location based upon recent precedents to gain density and take advantage of views. In general, the parcel offers a rare opportunity to build a true mixed use development catering to a local and a citywide audience, while establishing new physical forms that create exciting street edges and add architectural character and vitality to this part of Boston.

Neighborhood Commercial Block Context

Fundamental to the Project's urban design, is that its scale has been modeled to conform to a neighborhood commercial block district. As such, the Project has been divided into four (4), distinct, "organic" blocks: the east block, west block, north block and south block. The building footprint of the east, west, north and south blocks are approximately 96,000 square feet, 50,000 square feet and 27,000 square feet and 68,000 square feet respectively, and are in keeping with the scale of other, urban districts such as the Fenway and Boylston Street. The four (4) blocks of the Project are defined by either newly created or enhanced roadways which have been aligned with the neighborhood street grid, facilitating both pedestrian and automobile movement to and from the surrounding communities, particularly from the future Whitter Choice Neighborhoods Project. Figure 4-1 below depicts the Project's current neighborhood commercial district scale.

Urban Planning Model

The Proponent has used other dense commercial districts as an urban planning model for the scale of the Project. In this regard, Figure 4-2 below sets forth both recent and BRA Board approved development projects in the Fenway district.

The Van Ness Project, fronting Boylston Street, is similar to Tremont Crossing in that it is a mixed use development that is anchored by Target, a substantially sized retail tenant with 160,000 square feet of store area, built over three (3) levels. Both residential and office uses rise above the Target footprint in a similar orientation to the east block of Tremont Crossing. The Van Ness has a building footprint of approximately 71,000 square feet and is approximately (18% larger) the same size as the average block size of Tremont Crossing. Further, the Project is similar to the Van Ness building in that, as requested by the BRA Urban Design department, the Proponent has located its only large destination retailer, BJ's Wholesale Club, on the second level of the east block. This will allow for the inclusion of smaller shops, restaurants and boutiques on the ground level of the Project and facilitate a vibrant, urban retail experience that is emblematic of neighborhood commercial districts. The second level placement at the Project will be the first in the BJ's Chain and represents the understanding BJ's has of the environment in which it will be located.

The Landmark Center redevelopment in the Fenway District is another example of a substantially sized, mixed-use project containing retail, a movie theater and a substantial amount of office space rising above the retail. Although the building footprint of the Landmark redevelopment will be reduced from its current size, it will still be in excess of any of Tremont Crossing's four (4) blocks with an approximate size of 111,000 square feet.

Sitting in the middle of the Van Ness and the Landmark project, between Boylston Street and Brookline Avenue is the Fenway Triangle Trilogy residential project (the "Fenway Triangle"). The total building footprint of that project is 57,000 square feet and is approximately the same size as the average of the Project's four (4) city blocks. However, due to the horseshoe configuration of the buildings, they appear to have a massing that is in excess of the actual footprint. Therefore, from an urban design perspective, the Fenway Triangle should be considered to have a perceived building footprint that encompasses the entire block bounded by Kilmarnock Street, Boylston Street and Brookline Avenue, which is approximately 75,000 square feet and is even larger than the same size of Tremont Crossing's four (4) neighborhood commercial blocks.

It should be noted that the Van Ness, the Landmark redevelopment and the Fenway Triangle are majority-owned by one (1) entity and to a large extent function as one (1), large, mixed-use project that is divided into similarly-sized, neighborhood commercial blocks as Tremont Crossing. In this regard, the roadway network of the Van Ness project incorporated a new street, Richard B. Ross Way, which served to not only create smaller commercial blocks, but also a pedestrian/automobile penetration, connecting the Van Ness building to the Landmark project and the Fenway Triangle. Tremont Crossing's incorporation of the East Drive, West Drive and the Market Street roadway bisecting the Project's central pedestrian area will function in a similar capacity to the Richard B. Ross Way, as they will facilitate connectivity to the Whittier and Madison Park neighborhoods and producing a road network that helps define the Project's scale.

Figure 4-1: Current Neighborhood Commercial Design Concept

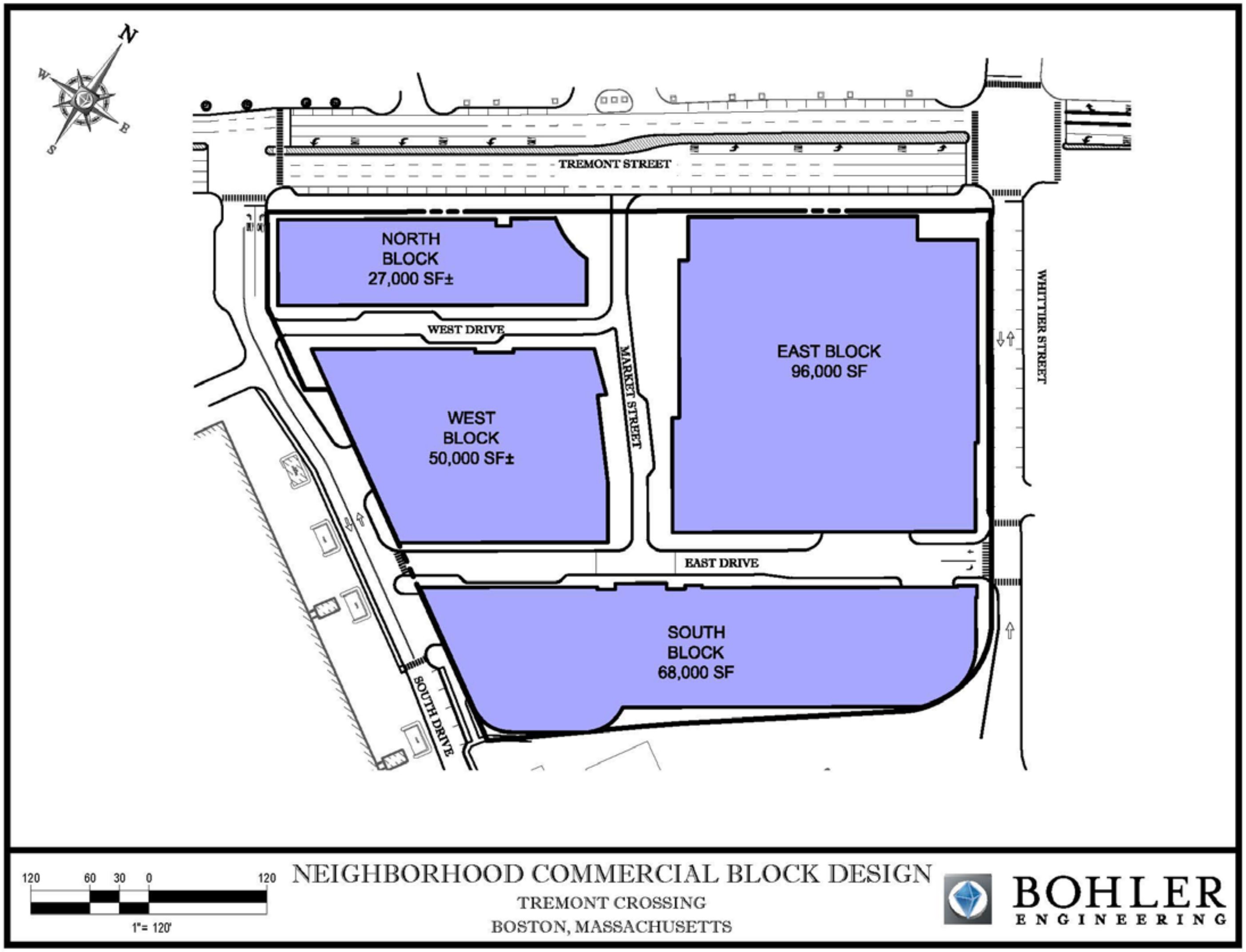
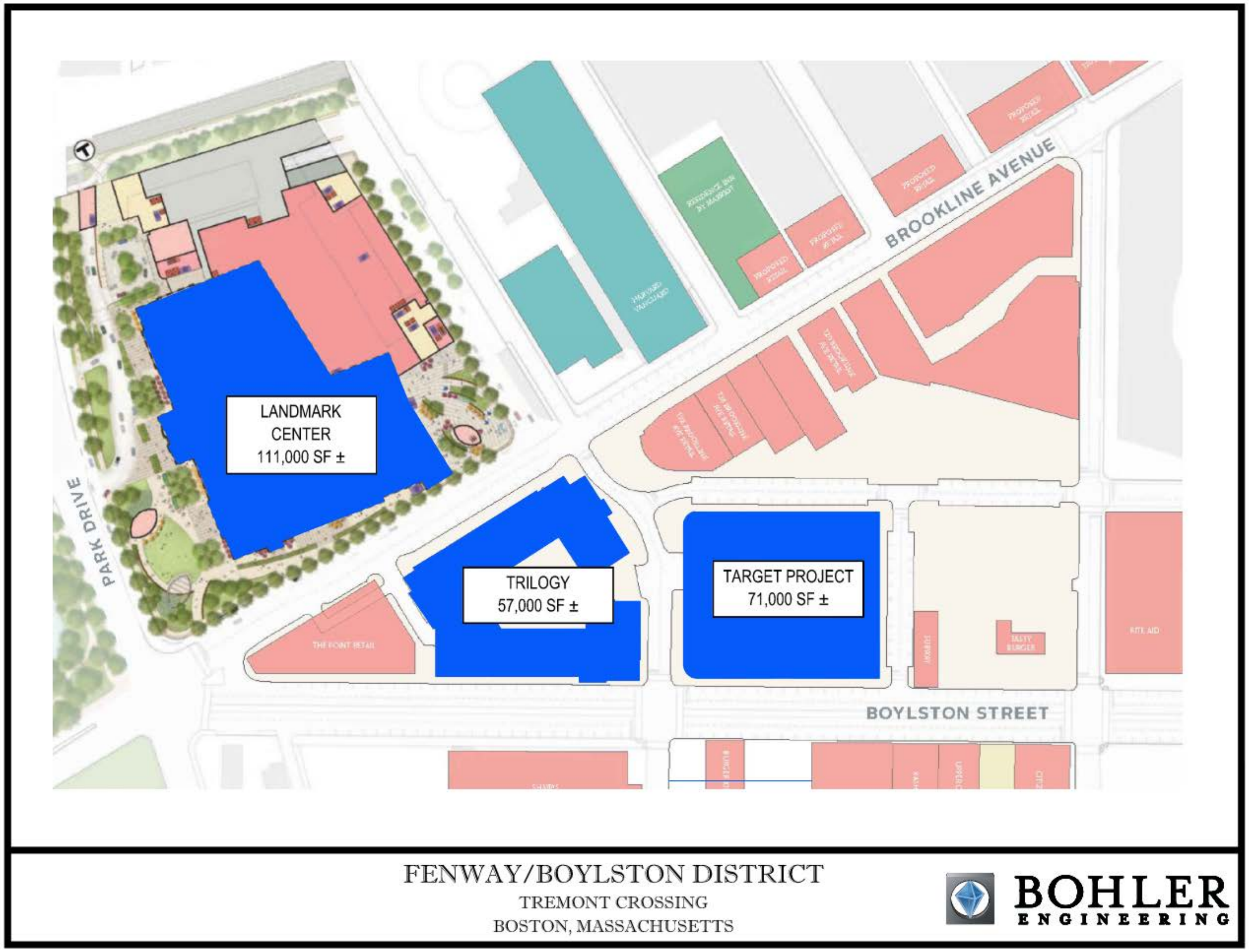


Figure 4-2: Fenway / Boylston District



4.1.2 *Architectural Design Concept*

The architectural expression for the Project, first and foremost, must be reflective of the various uses contained within this mixed use facility. Secondly, those expressions themselves must be accurately scaled to reflect the intensity of those uses contained within and the desired porosity of each element within that use. Finally, the overall design expression of the facility must be engaging to the public while being reflective of the surrounding urban environmental context.

To these ends, the architectural design has evolved to create a unique urban destination. Each of the building components supports the whole while its architectural expression is distinctive unto itself thus creating a new urban precinct. Architecturally, the buildings are each unique and contribute to an overall urban composition without ascribing to historical models or sameness. The various components are best described individually.

An overarching concept that is at work throughout each of the individual building designs is a carefully orchestrated attempt at manipulating the building forms to create a series of interlocking and overlapping volumes and exterior envelope layers. This approach is used as a device to fragment the overall massing into smaller components while remaining true to the uses within.

4.1.2.1 Overall Planning Concept

The site is viewed as a destination for four (4) distinct user groups. The first is retail, second residential, third office and fourth, the NCAAA Museum. These uses are integrated into a cohesively planned development that takes the site and subdivides it into four distinct parcels separated by internal road ways. This immediately breaks down the scale of the development into "blocks" which are consistent with the street grid character of so much of urban Boston. The central road, running north and south from Tremont Street is the heart and center of the project. This space between the blocks has been designed as a shared pedestrian open space combined with a vehicular roadway. The vitality of this mix is evident in many European cities where the car and the pedestrian co-exist in public open spaces and markets. This space is planned as a destination and gathering place, it is truly a “marketplace within the City” that serves to anchor the street front retailers and destination retailers alike.

This central open space is both an orienting device for the project and is the central circulation spine for all pedestrian users to gain access to the three levels of open air retail venues contained within this space. The three (3) public floors of retail are correlated to the adjoining parking garage floors in such a way that vehicular users can park their car and then use bridges and vertical transportation elements to arrive at their intended destinations, all the while viewing those same destinations while in the central space from a variety of heights and viewpoints. This will create a vitality within the project in a vertical context, besides just engaging the horizontal plain.

The central spine of the project is also the entry address for one of the residential towers and the NCAAA museum. Ground level shops, from clothing stores to health and beauty aids, restaurants and “grab and go” coffee shops will enliven the ground plain experience.

The center roadway and pedestrian gathering place is an exciting, active and visually stimulating space with vertical transportation elements consisting of elevators and glazed escalators expressing the vertical circulation and providing animation thru pedestrian movement.

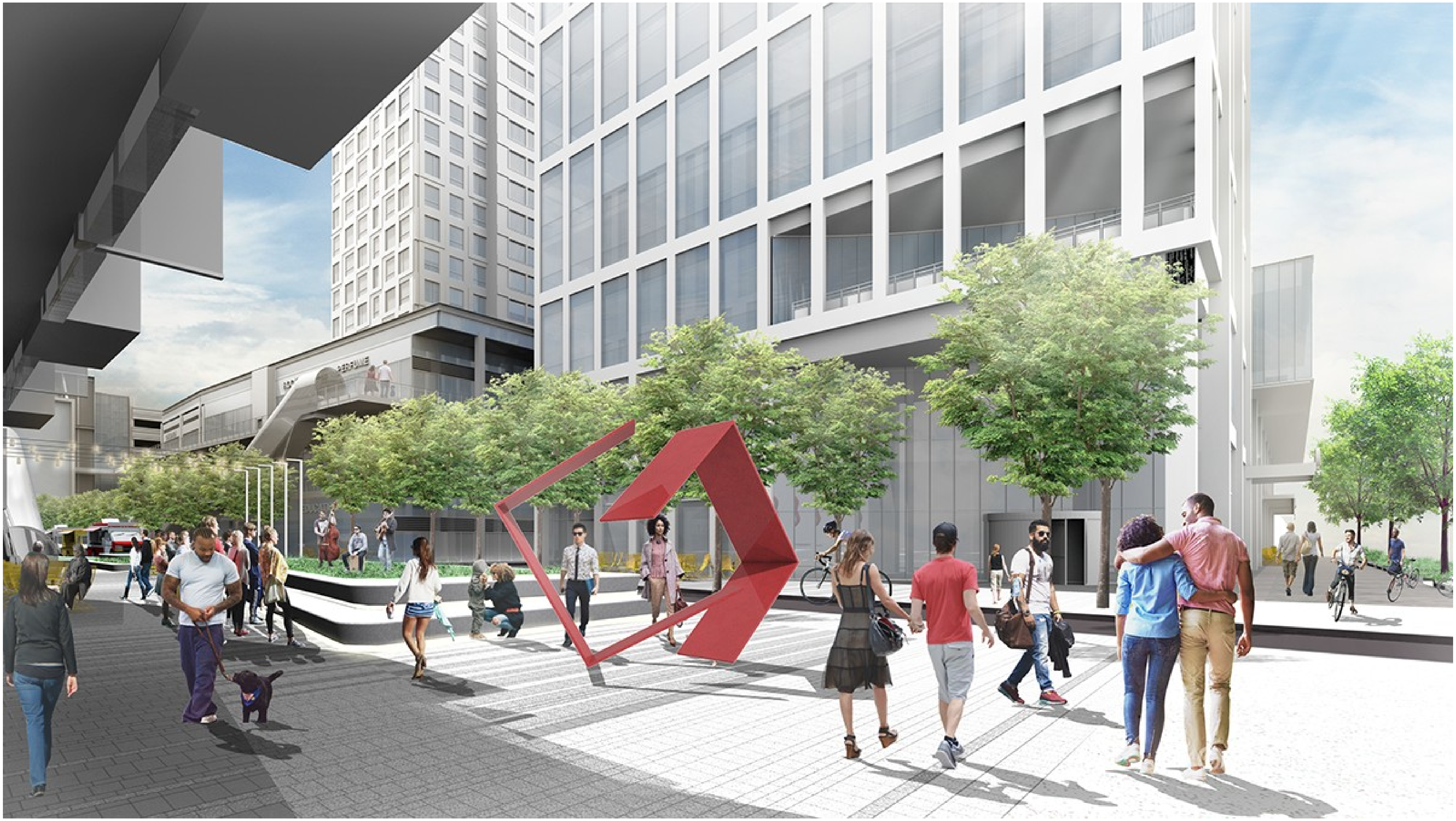
The retail venues and entries are of course all glazed and highly illuminated to make the retailers wares beautiful and enticing from all points in the central space. The retail “walkways” that front each retailer are not stacked one on top of the other, but are instead stepped back from one to the other above the courtyard thus expanding the visual interest and increasing the width of the open space as it rises skyward. The street and pedestrian spaces are open to the air allowing daylight into the space. At night, there will be lighting integrated with the vertical transportation elements of the retail facades, the bridges above and of the course the vertical transportation elements to enliven the whole space and support the day and night presence envisioned for the Project.

The retail components of the project are further enhanced by retail signage itself, organized above stores and as unique vertical displays.

Wayfinding devices including graphic elements, artwork, ground plan landscaping and integrated lighting combined with the movements of shoppers, will make this place an exciting and beautiful open air market environment unique to the City. Figures 4-3 and Figure 4-4 set forth the "Market" plaza and the central Market Street's personality.

Figure 4-3: Market Place Plaza Perspective

Figure 4-4: Market Street Looking South



4.1.2.2 Retail Expression

The primary retail components of the project occupy the first three (3) levels within the central market street and then again along Tremont Street and West Drive. While the newly created Market Street may be the exciting arrivals destination for the facility, it is the Tremont Street retail edge that anchors the project as a retail destination. Three (3) floors of glass integrated "show cases", essentially bay windows, composed of metal panels and vision glass integrated with retail signage in such a way that the entire façade becomes an organized rhythm of transparency, colored glass, metal panel and graphics. A similar expression continues on the west side of Market Street under the office building along Tremont Street. The Market Street second and third floor retail is larger scaled destination venues for shopping, recreation and entertainment, while the ground level along Tremont Street and within the Market Street area is comprised of smaller shops, restaurants, café and service retail venues. The architecture reflects these smaller scaled retail elements by using similar devices to define an appropriate scale with signage and wayfinding elements that are appropriate and stimulating. The overall intent is to create visual excitement of multilevel retail and urban vitality.

The retail continues and extends to the south of the site along Whittier Street. Again the expression of retail bay window shop fronts, glass, metal panels, signage, will be used to create visual interest for retail that is more neighborhood focused, yet with a quieter, less illuminated feel that is more appropriate and subdued for abutting this community environment.

4.1.2.3 Residential

Tremont Residential

Perhaps the most visually impactful component of the Project is the mixed use, high rise on the corner of Whittier and Tremont Streets that contains 385 residential units of the development. This building element rises seventeen (17) floors above the retail and 243' above street level along the Tremont Street edge and turns the corner and runs along both Whittier Street where the building presents itself at ten (11) stories. Further, the ground floor and second floors along Whittier Street also contain residential town house style units facing directly onto the street. The objective is to maintain the feel of the residential environment contiguous with the Choice Neighborhoods Project so that both sides of Whittier Street are residential in nature. The building's form is used to alter the scale while increasing from the lower rise of the proposed Whittier Street Housing to a denser and taller new residential component.

The architecture concept of the façade of the residential building is based on verticality and movement. Composed of glass, metal panel, and cast concrete panels accentuated with color, the building's envelope achieves a sense of playfulness by using seemingly random patterns of two and three (3) story vertical fenestration elements. These elements become transparent as they approach the Whittier Street corner signifying the importance of this corner in the development while also establishing this corner as the entry point of the residential lobby.

This playful movement in turn is continued, albeit at a reduced scale, along Whittier Street. The difference however is that on this lowest register of housing the vertical fenestration takes on the added complexity of becoming vertical bay windows. The Proponent believes that this small change transforms this portion of the building such that it is reminiscent of the way in which Roxbury and the South End complement existing and historic residential architecture of row housing with projecting bay windows. Further, the Whittier Street side of the development receives an additional change in scale by setting a portion of the building back from the street edge above the seventh level. This change in form, which is both horizontal and vertical, also is accentuated by a color change of the primary façade material, as one additional scaling device.

West Block Residential Building

The Project's second residential building, located above the retail on the west block will contain 300 apartments. The building is 264' tall from grade with 19 floors of apartments above the retail. This location provides for a retail lobby as a part of the Market Street experience while also minimizing shadows on the public plaza. This location also addresses a need for much desired residential activation at the central open space and internal streets within the development thereby creating active and vibrant 24/7 life at the very heart of the Project.

The design of the West Block residential building is intentionally broken into slight, cascading offsets. The offsets are further reduced in scale by utilizing a panelized precast concrete and window-wall systems. The cladding of the building is used as a scaling means. By using multiple compatible exterior cladding systems the building is broken into smaller apparent masses with a focus on proportion and visual interest.

Whittier Street Townhouses

The Whittier Street edge of the Project's East Block will be lined with two level, townhouse style residences. Each residence will have its own entrance off of Whittier Street and will be consistent in tone to the residential neighborhood which the Project abuts. The scale of the townhouses will be lower in density than the other residential uses of the Project and will thereby serve to more harmoniously transition from the Whittier and Madison Park neighborhoods to the Project's mixed-use, neighborhood commercial scale. Additionally, the Whittier townhouses will be a defining element in the character of Whittier Street, which will have lower density residential uses on both sides of the street. The Proponent has coordinated the urban design aspects of the Whittier Street townhouses with the Boston Housing Authority in order to facilitate the long-term objectives for the neighborhood, including the planning for the Whittier Choice Neighborhoods Initiative.

4.1.2.4 Office

The office component, located on the North Block along Tremont Street, rises above the retail and museum. Unlike the residential this component is designed as less playful and more organized. Using a similar palette of materials, but not similar in color, the office presents itself in a straightforward expression of its function. The one unique feature of the office, like the residential, is that the exterior envelope of the office becomes more transparent within the lower register of the building as it approaches the central courtyard. The change in fenestration is related to the entry of the museum and the office itself which share in and celebrate this prime corner along Tremont Street.

4.1.2.5 Museum

The NCAAA Museum is located on the third level of the North Block of the project, also facing Tremont Street. Located above the retail and below the office, the museum is the focal feature of the project. The museum is entered from a two (2) story entry pavilion located at the corner of the central Market Street and Tremont Street plaza area. This entry becomes a beacon for the museum, showcasing the vertical transportation elements contained within and providing a showcase for a large-scale graphic representation of the museum's content for all to see. The location of the museum, with its lobby and circulation as a feature, highlights its importance within the Project and becomes a "draw" for museum patrons, pedestrians and motorists alike. Moreover, the expression of the museum is slightly different in character from the retail below or the office above. It maintains a cohesive yet independent look that is all its own, using a glazed geometry at the exterior accompanied by a roof terrace that is undercut below the office.

4.1.2.6 Parking

The parking structure is located behind the primary elements of the project along East and South Drives. The parking is shielded from primary view from Tremont Street and across from the workshops of the Madison Park Technical Vocational High School. The Proponent has designed the garage to have as little vertical density as possible, thereby limiting its visual impact from the school's playing fields.

The garage which contains 6 ½ stories is 77' in height. The portion of the garage which will be adjacent to Whittier Street and facing the Whittier Apartments and the future Choice Neighborhood Project will be clad in a precast concrete "screen wall" that is not the average horizontal garage precast system. The garage is further enhanced along this portion with a "green screen" using natural vegetation to soften the impact on the play field and neighboring residential uses.

The west end of the garage is clad in precast concrete panels with varying textures, punctuated with horizontal and vertical elements to distract from the scale of the garage and to add visual interest from the southern playfields.

Additionally, the garage’s ground floor elevator access will be flanked by small, neighborhood retail establishments which will activate the structure with pedestrian vitality. Additionally, the easterly edge of the garage facing the Whittier Apartments will be lined with a community meeting room which will further enhance its cohesion with the residential neighborhood it abuts.

Figure 4-5: East Elevation- (West Block Residential)

Figure 4-6: East Elevation (East Block Residential)

Figure 4-7: North Elevation (Garage)

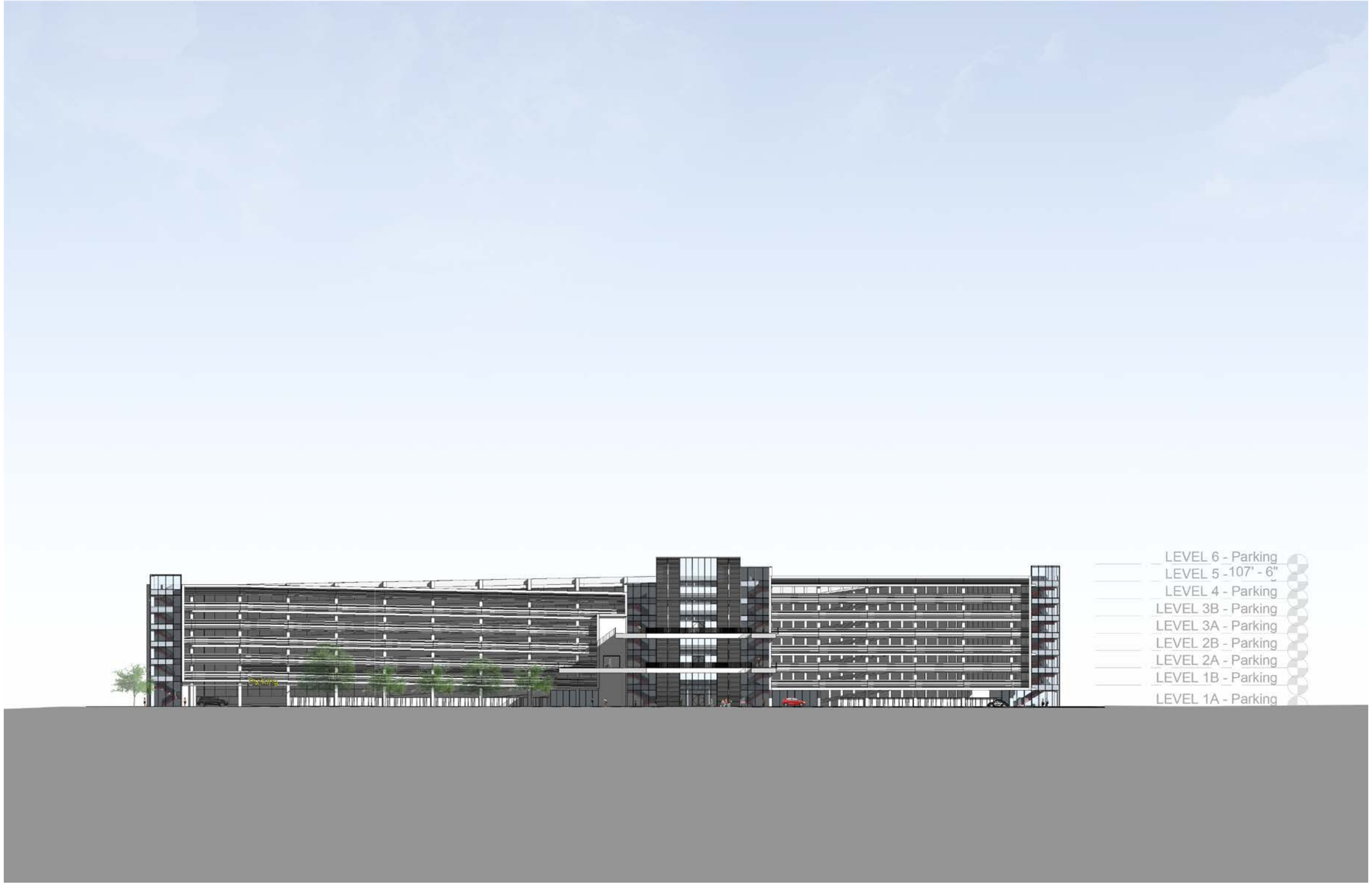


Figure 4-8: North Elevation (West Block Residential)

Figure 4-9: North Elevation

Figure 4-10: South Elevation

Figure 4-11: South Elevation (Garage)

Figure 4-12: South Elevation (North Block Office)

Figure 4-13: West Elevation- East Block Residential

Figure 4-14: West Elevation (North Block / West Block / Garage)

4.1.3 *Height and Massing*

Table 4-1: Approximate Sizes and Uses

Element	**Square Feet**	**Building Levels**
Destination Retail	289,798 s/f	Levels 2 - 3
Neighborhood Retail	108,923 s/f	Ground Floor
Office	105,000 s/f	4 ½ Levels (above 3 levels)
Tremont Street Residential (East Block)	386,700 s/f (385 units)	17 Levels (above 3 levels)
West Drive Residential (West Block)	279,300 s/f (300 units)	19 Levels (above 3 levels)
Whittier Street Townhouses	9,400 s/f (9 units)	2 Levels
Museum / Cultural Center	31,000 s/f	1 Level (above 2 levels)
Parking	442,000 s/f	6 ½ Levels

The layout of the Project's three (3) main building structures, two residential towers and the office building, are presently envisioned to surround the central Market Street portion of the plan and two of the primary buildings, the Tremont residential tower and the office building, will front Tremont Street. The third major component is also a residential tower and it is set back from Tremont Street along the proposed new West Drive. Smaller retail consisting of shops, restaurants and boutiques will be on the ground level of each. The destination retail will consist of the two (2) upper levels of the East and West Block and the second level of the North Block for a total of three (3) retail floors, each of which will be on average approximately twenty-two feet (22') in height, from floor to floor for a total building retail zoning height of sixty-four and a half feet (64 ½) feet and sixty-seven feet (67') at the West and East Block respectively. The two levels of retail at the North Block will rise thirty-six (36) feet.

The residential tower facing Tremont Street on the East Block rises total of twenty stories (20) in total from the ground floor at the corner of Whittier Street and Tremont Street (including the three levels of retail beneath). The tallest portion of the residential building will have a zoning height of two hundred and forty-three (243') feet. The residential tower also extends down

Whittier Street and Market Street sides of the retail podium. This component will rise eleven (11) levels in total above the street. The height of this portion of the retail/residential tower that traverses Whittier Street and Market Street will be approximately one hundred fifty-two (152') feet of zoning height.

The Second building structure facing Tremont Street at the North Block will consist of two (2) levels of retail, the NCAAA Museum on the third level and four and a half (4 ½) stories of office above, for a total zoning height of one hundred and sixteen (124') feet.

The third significant building at the West Block is also a residential structure and is bisected from Tremont Street by West Drive. The building sits towards the western end of the site above three (3) levels of retail. This residential building, including the retail levels below, will be twenty-two (22) floors with a total zoning height of two hundred and sixty-four (264) feet.

The parking structure will be physically connected to the retail levels of the Project via pedestrian bridges. And a network of escalators. The garage is 6 ½ stories, with a maximum height of seventy -seven (77) feet of zoning height.

4.1.4 *Façade Design, Fenestration and Building Materials*

Tremont Crossing is envisioned as a collection of individual buildings that share the common value of clean contemporary forms and detailing, but they are not mirror images of one another. They are as individual as their internal uses. The shared vocabulary of the buildings, in addition to their architectural character, will be dependent upon elegant proportions and the materials used. The materials anticipated to be used include; glass window-wall systems, including shadow box window units; punched windows in panelized wall systems; formed metal panels with metallic and colored finishes; precast textured concrete panels used both horizontally and vertically; modular masonry units; and exposed and fireproofed painted steel. Signage will include traditional fixed signs and LED Reader Board signage systems

4.1.5 *Landscape Plan*

Tremont Crossing strives to create an alluring pedestrian juncture within the new civic uses, shops and businesses carefully tailored to serve the commercial needs of the surrounding community. With a new interconnected street network and generous multimodal pedestrian accommodations, the Project will enhance the community's identity while serving as a vibrant activity center for surrounding neighborhoods.

The ground plane of the Project is tremendously important, as it sets the "stage" for how the buildings are organized and pedestrian movement is orchestrated on and around the Project Site. Bisecting the site is a newly created vibrant and activated pedestrian and vehicular spine, referred to as Market Street that forms a pivotal corridor connecting the site's interior uses, including retail and cultural amenities, with the urban fabric. Surrounding the site are a series of multimodal complete streets that frame the new development and connect the site to circulation networks beyond the site.

At the heart of the site, the pedestrian corridor supports an activated open space with community amenities. The material and dimensional qualities of the open space are responsive to the program and adjacencies to the site, providing spatial experiences that include broad, expansive flexible spaces as well as smaller scaled gathering spaces as an extension of the public uses of the site. These will relate to the retail and cultural amenities that will serve as pivotal attractions to the new development.

A series of raised planters will offer a variety of seating opportunities and define primary gathering spaces. Given the scale of the larger, flexible paved surfaces, a strong paving pattern will add interest and help define spaces, circulation and activity zones. The Market Street corridor will also support intermittent vehicular access to service the functional needs of the development and provide emergency access. A key component of the Complete Street initiative is to ensure that streets are shared by all users and not dominated by cars. In this instance, we have a unique opportunity to design a plaza space that is not only shared by all users, but puts the pedestrian first. The pedestrian should be free and encouraged to meander freely across the plaza taking advantage of the dining and retail amenities. By extending the plazas textured paving patterns through vehicular zones, not only is the driveway's impact diminished, but drivers are instantly made aware that they have entered a pedestrian realm.

Green design elements promote an environmentally sensitive, sustainable use of the public space. Trees planted in permeable paving will be utilized as part of a broader site strategy for stormwater management, while offering places of respite in their dappled shade. Program elements including outdoor dining, food truck services, art installations and public events will establish the bustling activity of the open space. Lighting integrated with the open space will maintain vibrancy and a sense of safety in the evenings.

The streets framing the site fully embrace the cities Complete Streets initiative striving to improve the quality of life in Boston by creating streets that are both great public spaces and sustainable transportation networks. Safe, comfortable and accessible to all users, the generous sidewalks will link the residential community with the retail frontage and provide an activated pedestrian and vehicular corridor that improves upon the existing streetscape to bring a new and dynamic character to the neighborhood. The Whittier Street sidewalk is of particular importance as it connects the Ruggles and Tremont Street areas easily to Dudley Square. The wider sidewalks along Tremont use the street trees and their associated rain garden planters to provide protection from the street and to also provide a measure of safety for motorists parked along the street to exit cars without interfering with pedestrian movements. Sidewalk restaurant dining is anticipated within this pedestrian zone. All sidewalks will have well-defined accessible routes paved with a smooth concrete surface. Sustainable streetscape attributes such as rain gardens and pervious paving systems will form a comprehensive solution to improving stormwater infiltration and mitigating runoff while demonstrating Tremont Crossing's dedication to the well-being of its community.

Figure 4-15: Project Landscape Plan

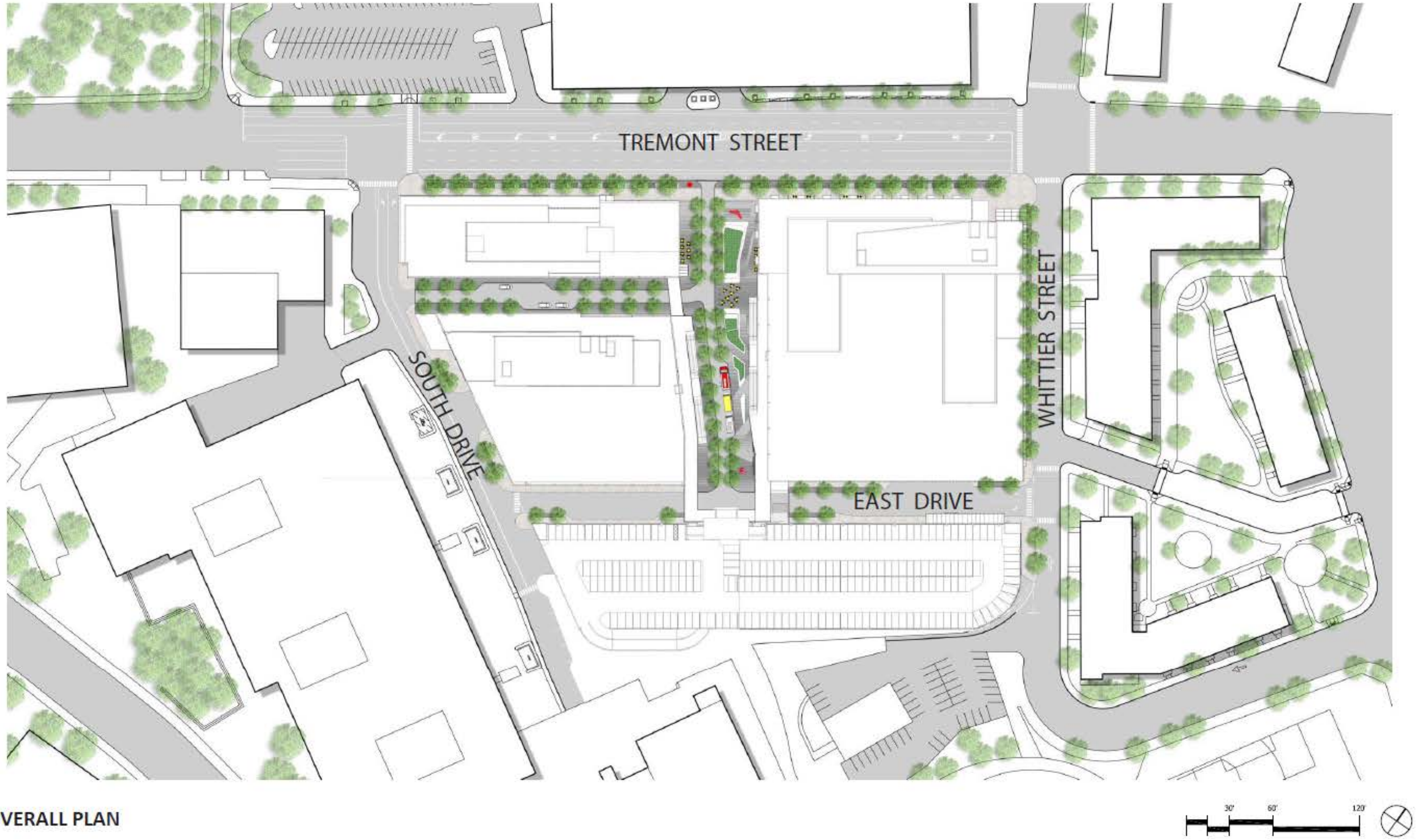


Figure 4-16: Central Market Street and Plaza

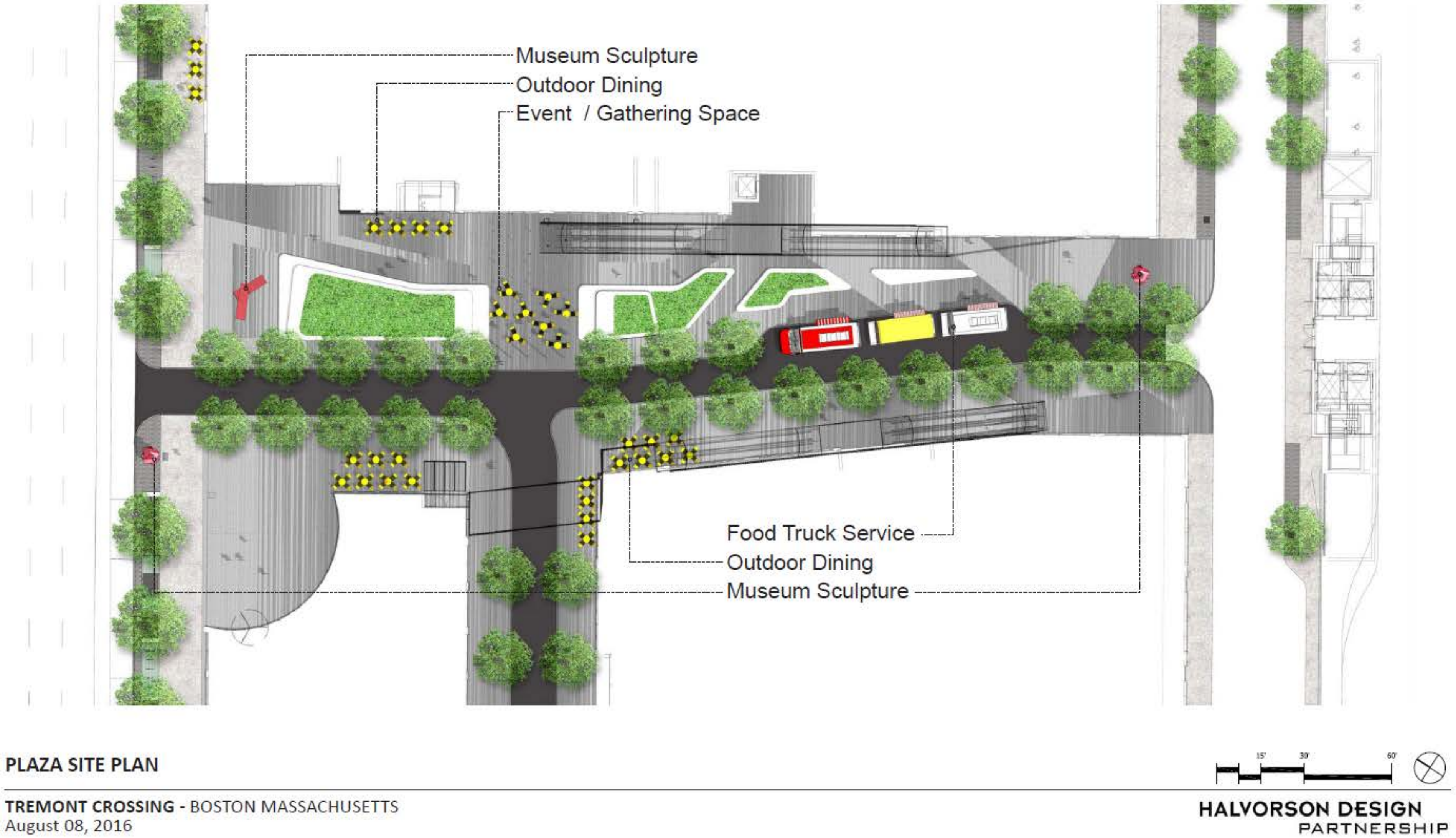


Figure 4-17: Market Street and Plaza Perspective from Tremont Street

4.2 Neighborhood Context

Tremont Crossing will be a substantial addition to the Lower Roxbury neighborhood of the City of Boston. The Project's mix of uses will be a catalyst for further economic growth and its architectural expression will invigorate a long decadent parcel of land. However, of equal importance, the Project is cognizant of the realm in which it will be built. As such, Tremont Crossing's uses and urban planning objectives have been engineered in a manner that not only realize and fill need, but also seek to weave the Project into the urban fabric of which it will become a part.

As can be seen in Figure 4-18: Neighborhood Building Uses, the Project Site is adjacent to multifamily, residential (Whittier Apartments) to the northeast and institutional uses on its other periphery edges. However, missing from this urban dynamic is both a pedestrian vitality and broader connection to other neighborhoods in the City. The Proponent believes that by adding a significant amount of retail and office space to the existing balance, a new vitality will emerge. Both wealth creation for Roxbury residents and access to the goods and services that make for a true urban experience will be the result of a combination of regional and local retail tenants in the Project and a new basis for commercial activity. The Project will bring smaller, shops, restaurants and boutiques to the edge of Tremont Street, running from its southwesterly edge at the Whittier Health Center and continue its entire length to a pedestrian focused plaza at the corner of Whittier Street. These establishments will serve the residents of the Whittier Street Apartments, the Madison Park communities and the many intuitions in the vicinity. Additionally, the destination retail not only will fill an existing void in value/price oriented shopping, they will also serve to rebalance the expenditure of capital to this area of Boston.

Although the Project will create the aforementioned retail and commercial vitality, it will also do so in a way that transitions this focus in a thoughtful and integrated manner. The East Block retail building will have atop its base multifamily residential that will also wrap around a significant portion of its Whittier Street and Market Street edge. This continuation of residential uses will project to the northeast of the Project Site and maintain the character of a long established community. Further, the addition of townhouse style residences along the Whittier Street edge of the East Block will activate and enliven the street and also transition the residential neighborhood which the Project abuts more harmoniously to its neighborhood commercial scaled block.

The institutional uses that abut the Project Site include the Madison Park and O'Bryant High Schools, The Reggie Lewis Track, The Whittier Street Health Center, the Boston Police Department Headquarters and Northeastern University's International Village, residence hall. As mentioned above, the Proponent believes that its retail and commercial uses will serve and invigorate these existing and established institutions. However, great care was taken in orientating the Project's massing in a manner that is consistent with the footprint and massing of the adjacent institutional buildings. For example, the footprint of the Project's parking structure is very similar to that of the Madison Park High School, which it abuts. Thus, as is illustrated in Figure 4-20: Site Context Section ("Section C"), the Project follows the low, broad massing of the educational cluster that runs the length of Malcolm X / New Dudley Street.

In contrast to the cascading rear elements to the Project's southeast, the Proponent has oriented its vertical expression to correlate with the surrounding neighborhood context. As such, at the corner of Tremont Street and Whittier Street is the aforementioned multifamily residential tower which tracks closely with the height of the Northeastern University dormitory directly across Tremont Street. Additionally, the North Block's retail/museum/office building will align with the vertical density of the adjacent Whittier Street Health Center

The Project's West Block residential tower will rise atop three levels of retail with a height of approximately 264 feet. As is set forth in Figure: 4.20 (Section "B"), the Northeastern International Village building, which is diagonally across Tremont Street is approximately 214 feet tall. Although slightly taller, the West Block building is set back significantly from Tremont Street therefore "mitigating" its vertical impact. Thus, the focal, vertical "energy" of the Project's massing is both spatially and functionally aware of its surroundings and seeks to harmoniously integrate into its environs. Both the neighborhood building use context and relative building heights are set forth in Figures 4-18 through 4-21 below. Additionally, Figure 4-22, sets forth an aerial views of the Project and its relationship to its surroundings.

Figure 4-18: Neighborhood Plan

Figure 4-19: Site Context Sections

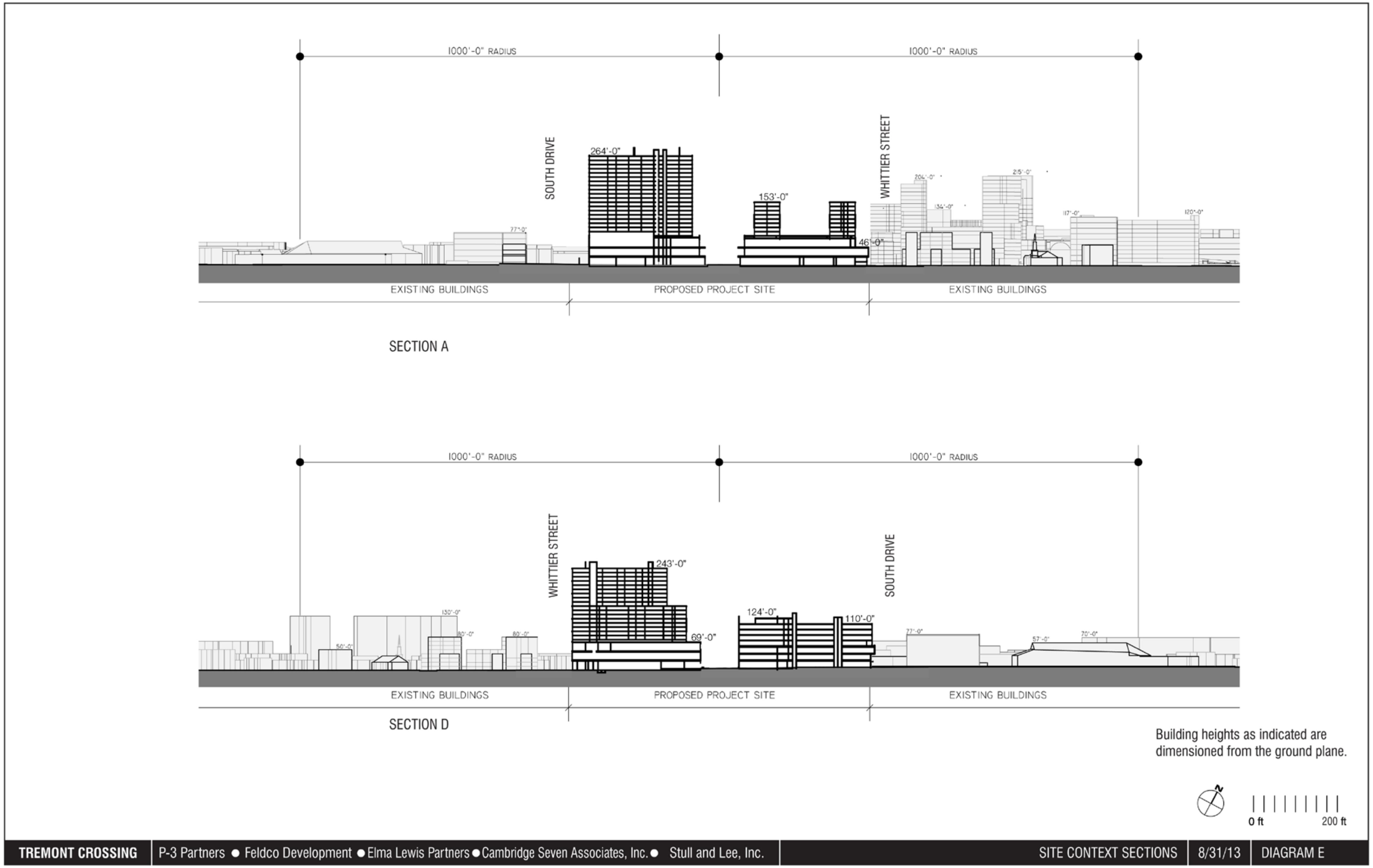


Figure 4-20: Site Context Sections

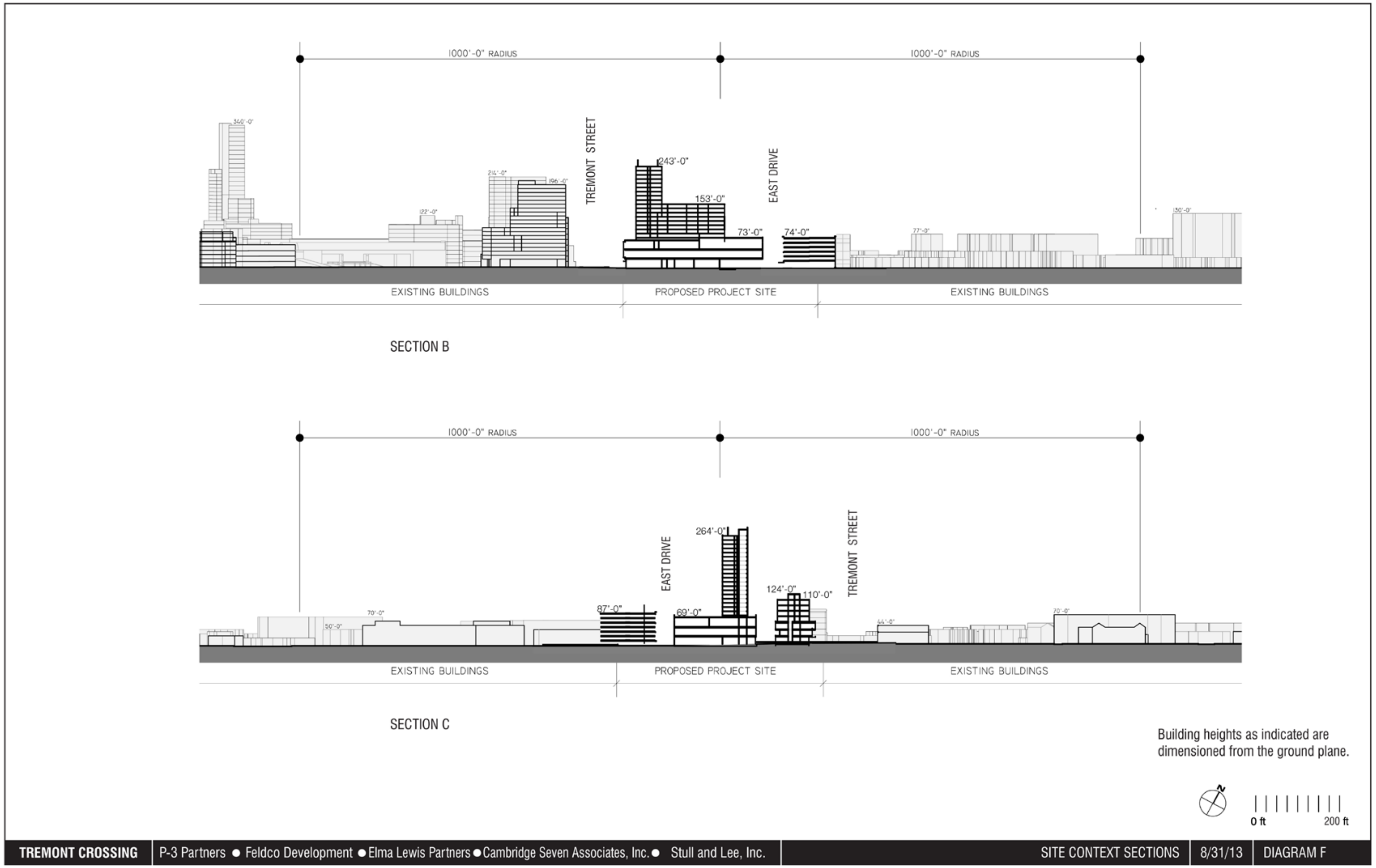
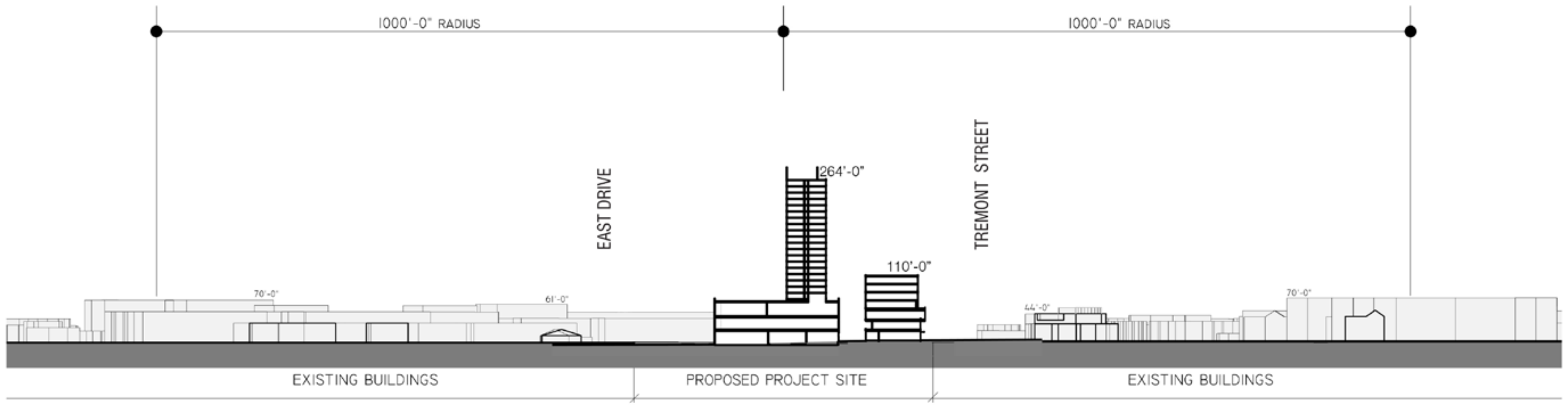


Figure 4-21: Site Context Sections

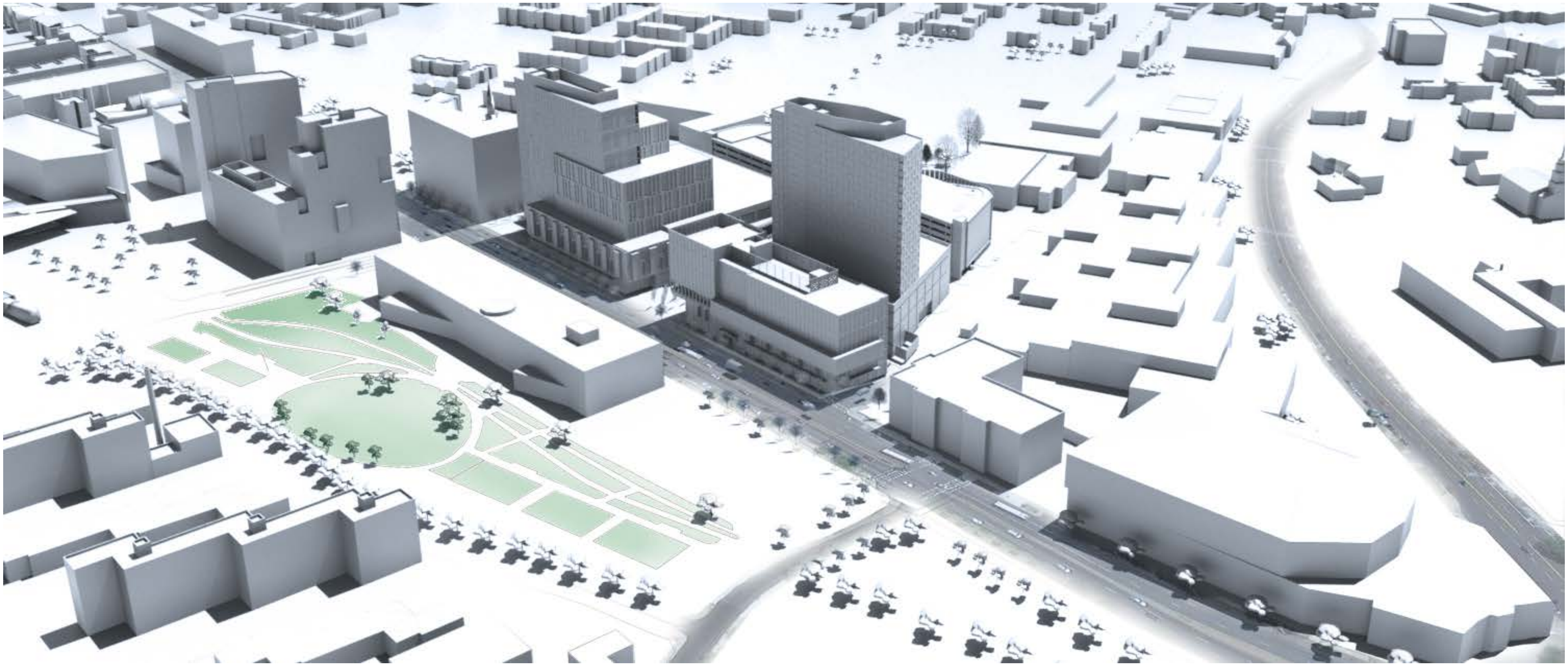


SECTION E

Building heights as indicated are dimensioned from the ground plane.

TREMONT CROSSING | P-3 Partners ● Feldco Development ● Elma Lewis Partners ● Cambridge Seven Associates, Inc. ● Stull and Lee, Inc. | SITE CONTEXT SECTIONS | 8/31/13 | DIAGRAM G

Figure 4-22: Neighborhood Context Looking South-East



4.3 Signage

The Proponent believes that the Project's balance of uses will be the catalyst for a dynamic and vibrant energy that permeates throughout the Roxbury community. As such, a necessary metric in the ongoing success of the Project is that its tenants have the means to establish a presence and create a necessary "sense of place" that could further extend to a larger revitalization along Tremont Street. In order to do so, a well thought out signage program that balances the aforementioned considerations with sensible urban design parameters is essential.

With regard to the office building and Museum, the Proponent envisions signage prototypical of these uses that allow for distinct but appropriate recognition of these institutions on the façade of their respective facilities. The office building would recognize anchor and/or key tenants (including Feldco Development Corp) with lighted signage above the entryway at an appropriate height on the building, which could be seen be passing vehicles to provide an emanating and clear presence onto Tremont Street.

In order to further enhance the presence and vitality of the cultural facilities, the Proponent would like to include an LCD screen in the interior areas of the central, public plaza. Such a screen could display slideshows of art, as well as tastefully promote the goods and services being offered by the various retail stores. Additionally, the Proponent would like the ability to have such a screen or series of smaller screens displayed in a setback manner from the interior of the Museum's ground floor or the ground floor or upper floors of the interior atrium space visible to passersby. This has proven to be an effective means of creating energy and vitality in other locations in the Greater Boston area, such as the Museum at the Broad Institute which faces Main Street in Kendall Square, Cambridge. Such a display would create interest and excitement relative to the important cultural uses of the Project and do so in a manner unobtrusive to the Project's neighbors.

Relative to the retail component, the Proponent hopes to offer potential tenants a comprehensive signage package that includes tenant name recognition in various places along the retail façade and within the Market Street public space. These colorful and playful signage bands would be integrated and mixed with the materials of the building themselves, and thus function as architectural elements. Having such signage be visible for both inbound and outbound traffic would be critical, so that motorists and pedestrians alike can become aware all of their shopping options while approaching the Project.

The Proponent also believes that having much of this signage as back-lit is vital, so that it may be seen at night. Not only will this signage provide further vibrancy and a sense-of-place to the Project, but many of these retail tenants will stay open after dark and it would be crucial for them to maintain visibility during these hours. The Proponent will design and orient the "lit" signage in a manner that is cognizant of the urban sensibilities in which it will be located and anticipates coordinating with the BRA in this regard.

In addition, as is typical and necessary for visitor navigation to the Site, the Proponent foresees including signage at the primary vehicular access point, listing all the major tenants of the Project, as well as providing for parking structure signage to help organize traffic along Tremont Street. Additionally, tasteful monument signage located at the corner of Whittier Street and Tremont Street and at a "pedestrian scale" would be an effective means of way finding for passersby's of the residential use. Further, the lobby of the residential components of the Project would be demarcated by elegant awnings either made of fabric or metal.

Figure 4-23: Signage along Tremont Street (Looking Northeast)

Figure 4-24: Signage Along Tremont Street (Looking Southwest)

4.4 Project Phasing

At this time, the Proponent does not anticipate that it will need to construct the Project in multiple phases and currently intends to build all of the constituent uses in a single, linear construction process. Notwithstanding, if the Proponent determines that it is the best interest of the Project moving forward in a timely fashion, the office use could be built as a second phase of construction, in the location indicated herein, in a manner that would not disrupt the operations of the Project's other uses.

The Proponent will be sequencing the construction of the Project such that certain critical path elements of construction are performed as a first step before others may begin. The first sequence of construction will include: site preparation; site work, including clearing, grubbing and grading; utility relocation, including the Stony Brook sewer line; and the demolition of the old Whittier Health Building on Whittier Street. The first sequence of construction is anticipated to last approximately six (6) months and once it has been completed, the remaining elements of the Project will be constructed in a simultaneous process.

Throughout construction, there will be continued, uninterrupted access to the Madison Park School's drive lane and loading. Additionally, the Whittier Health Center and the Madison Park Schools will be provided 75 parking spaces and 31 parking spaces, respectively at all times.

5.0 ENVIRONMENTAL PROTECTION

5.1 Shadow

A shadow impact analysis was conducted to identify net shadow impacts from the proposed Project as well as identifying the existing shadows at the Project Site. The analysis considers four time periods (9:00 am, 12:00 noon, 3:00 pm, and 6:00 pm) for the vernal equinox, summer solstice and autumnal equinox and three time periods for the winter solstice (9:00 am, 12:00 noon, and 3:00 pm). For purposes of this analysis the vernal equinox and autumnal equinox have been combined, as they yield identical results. The shadow analysis is depicted in Figures 5-1 through 5-11 below.

The analysis is focused on the impact to public open spaces, major pedestrian areas and sidewalks. Additionally, the analysis notes the shadow impact on the surrounding building's rooftops, including the educational, residential, houses of worship and institutional uses in the vicinity. It should be noted, that the analysis was completed using a general massing of the Project and as the design of the buildings has evolved, it is anticipated that the additional architectural features that have been incorporated, such as setbacks and tactile facades, will result in a decrease in the net new shadows as they are presented in the analysis.

Shadows have been determined using the applicable Altitude and Azimuth data for the City of Boston.

Currently, the Project Site consists primarily of open space, comprised of parking lots and over-grown fields. Therefore, the Project will result in net new shadow in excess of the existing conditions. However, in most cases, the Project's shadow impact to the surrounding public realm is marginal. Of note, is that in all cases of the analysis, there is virtually no net shadow impact on the Whittier Street Health Center and the Madison Park High School educational facilities. The Whittier Street Apartments are only impacted at sun set (6PM) as is the case for a small portion of the Madison Park High School playing fields. Overall, the majority of the shadow impact falls on the Project Site and on Tremont Street in front of the Project, including portions of the front façade of the Boston Police Headquarters. The Project has been designed so that its public and pedestrian open space provides both sun and shade, with noon time being a period of sun in most cases. In conclusion, impacts to surrounding areas outside the Project site and to existing public space are minor. Existing public space primarily consists of the Madison Park High School playing fields (the "Playing Fields"), which are to the southeast of the Project and the park located behind the Boston Police Headquarters.

5.1.1 *Vernal Equinox and Autumnal Equinox (March 21 and September 21)*

New shadow created on March 21 and September 21 is illustrated in Figures 5.1 through 5.4.

At 9:00 am on both March 21 and September 21, the only net new shadow impact being created off the Project Site will be to the north and northwest of the Project. New shadow will be cast onto the sidewalk in front of the Project and onto Tremont Street. Additionally, shadow will be cast onto most of the sidewalk in front of the Boston Police Department and onto the parking lot to its west. The eastern portion of the rooftop of the Police Department will have shadow cast onto it. A small portion of the park behind the Police Department will have net new shadow (although by noon it will be completely in the sun). Most of the Project's central plaza will be impacted by shadow. The public plaza on the corner of Tremont Street and Whittier Street will be completely free of shadow impact. There will not be any net new shadow impact to any of the Project's other abutters. There will be no shadows cast onto the Whittier Street Apartments, the Whittier Street Health Center, The Madison Park High School nor the Good Sheppard Church. The Playing Fields to the southeast of the project will not be impacted by any net new shadow at this time.

At 12:00 noon, new shadow will be cast to the north and northeast of the Project. New shadow will be cast onto the east and west portions of the sidewalk on Tremont Street in front of the project Site. The portion of the sidewalk in front of the central plaza will consist primarily of sun. A small portion of the sidewalk in front of the Boston Police Headquarters, mostly to the west, will also have new shadow. A portion of the intersection of Tremont Street and Whittier Street will have new shadows cast, as will the western street side sidewalks. The rooftops of the building structures of the Whittier Street Apartments will remain free of new shadow and will consist of sun. The Project's other abutters will also remain free of any new shadow as will the Playing Fields. Only a small portion of the Project's central plaza will be cast in shade and the portions of the plaza that are programmed for pedestrian activity will be completely in the sun at noon. East Drive and West Drive will be cast in shadow at this time.

At 3:00 pm, new shadow will be cast primarily to the east of the Project. Net new shadow will be cast onto Whittier Street and onto both sides of the sidewalk. New shadow will extend onto a portion of the open space of the Whittier Street Apartments, but not onto the rooftops of the complex. The public plaza at the corner of Tremont Street and Whittier Street will be cast in shade as will most of the central plaza. The vast majority of Tremont Street will be in the sun, but the southern sidewalk in front of the Project will cast in shade. The Playing Fields, the Madison Park High School, the Church and the Whittier Street Health Center will not have any new shadow cast by the Project at this time.

At 6:00 pm the sun will be approaching setting on both the Vernal Equinox and the Autumnal Equinox. The central plaza will be cast in shadow as will both sides of Whittier Street and its sidewalks. However, the mouth of the plaza will still be mostly in the sun. A portion of the rooftops of the Whittier Apartments will be cast in shadow. The Playing Fields, the Madison Park High School, the Church and the Whittier Street Health Center will not have any new shadow cast by the Project at this time.

Figure 5-1: Shadow Study for March 21 and September 21 at 9:00 am

Figure 5-2: Shadow Study for March 21 and September 21 at 12:00 noon

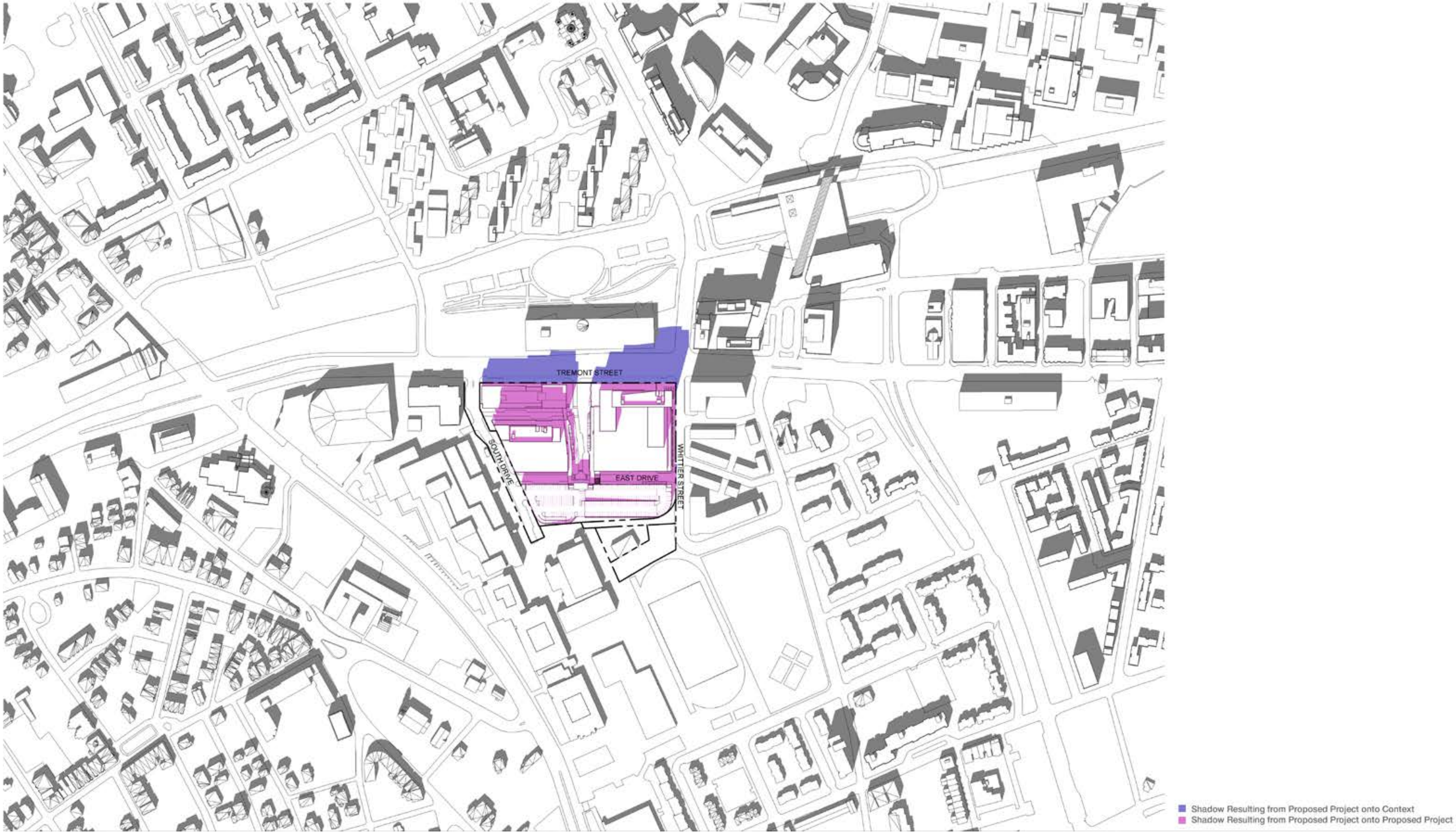


Figure 5-3: Shadow Study for March 21 and September 21 at 3:00 pm

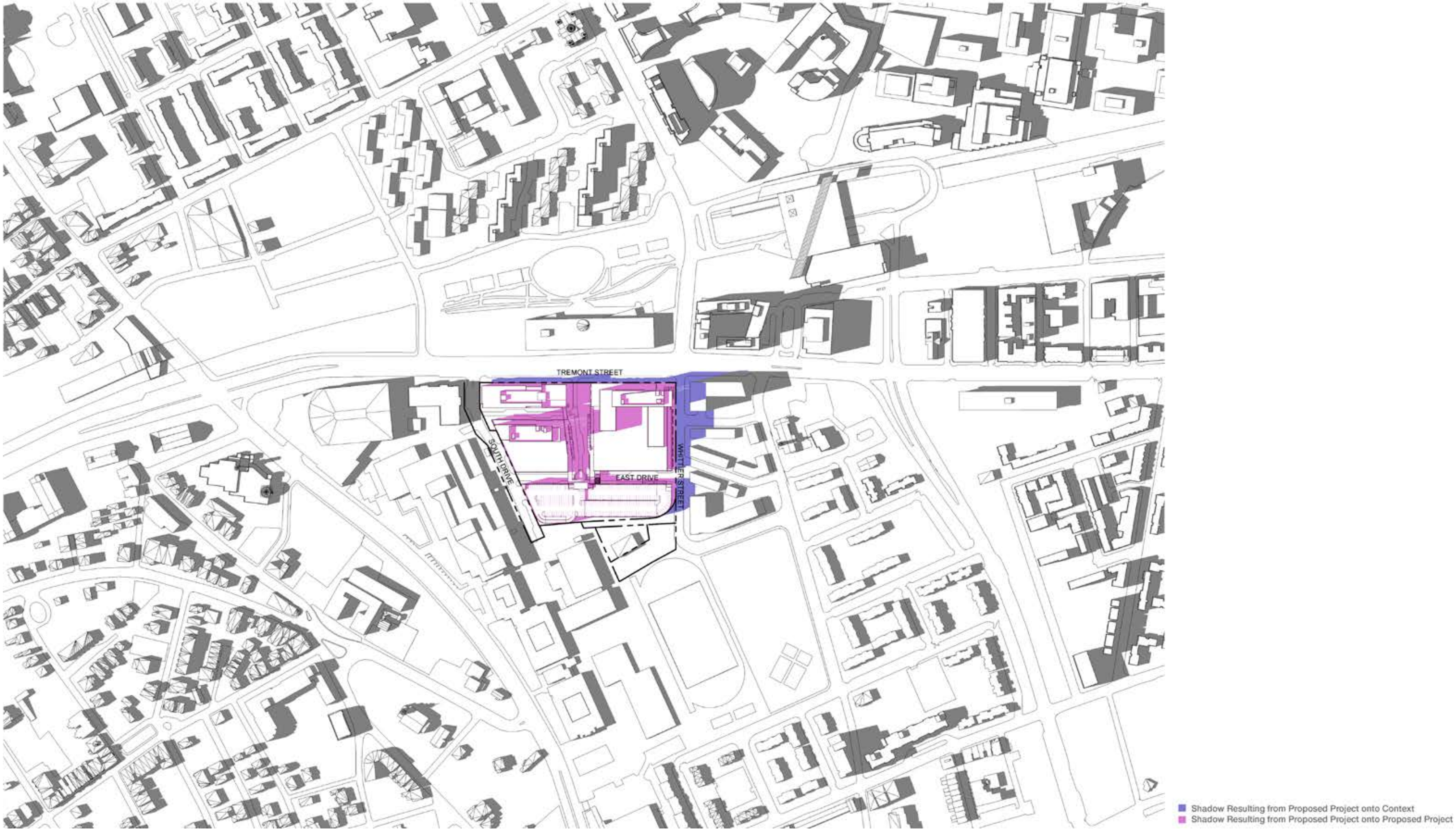
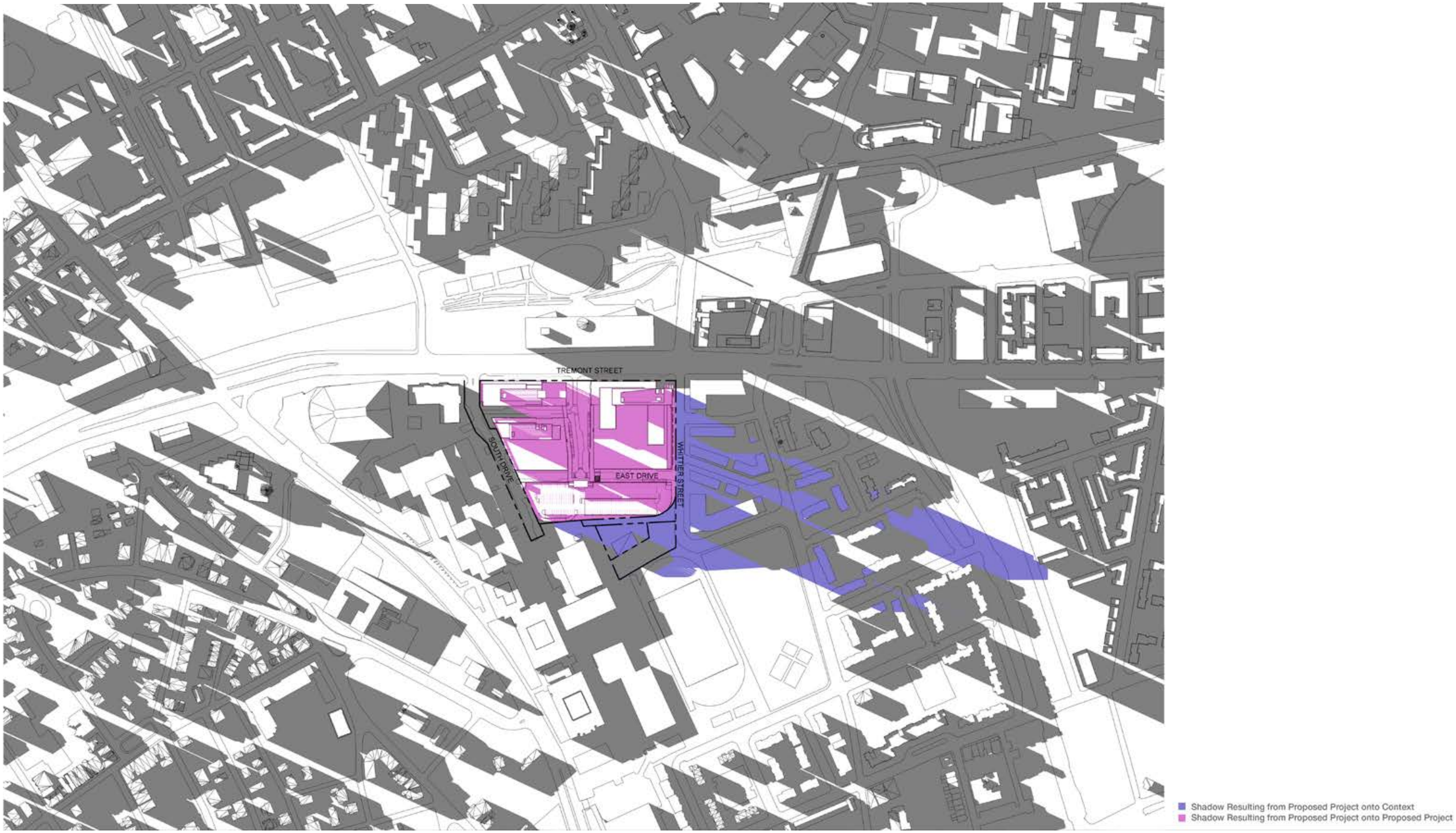


Figure 5-4: Shadow Study for March 21 and September 21 at 6:00 pm



5.1.2 *Summer Solstice (June 21)*

New shadow created on June 21 is illustrated in Figures 5.5 through 5.8.

At 9:00 am on June 21, the vast majority of the net new shadow impact will be to the north and northwest of the Project. New shadow will be cast onto the sidewalk in front of the Project and onto Tremont Street. The cntral plaza will be impacted by shade except for its western edge. Shadow will be cast onto a portion of the sidewalk in front of the center portion of the Boston Police Department. The public plaza on the corner of Tremont Street and Whittier Street will be free of any shadow impact by virtue of the Project. All of the East Drive and West Drive will be cast in shadow. There will be no shadow impact to the sidewalk to the east of the Project running along the Whittier Street. The sidewalk on South Drive will be cast in shade. There will not be any net new shadow impact to any of the Project's other abutters except for a very small portion of the northern corner of the Whittier Health Center. There will be no shadows cast onto the Whittier Street Apartments, The Madison Park High School nor the Good Sheppard Church. The Playing Fields to the southeast of the project will not be impacted by any net new shadow at this time.

At 12:00 noon, new shadow will be cast to the north and northeast of the Project. New shadow will be cast onto the sidewalk in front of the Project Site and Tremont Street. However, the he central plaza is cast in sun. All of East Drive and West Drive will be in shadow. None of the rooftops of the building structures of the Whittier Street Apartments will be impacted by new shadow and will consist of sun. The Projects other abutters will also remain free of any new shadow as will the Playing Fields.

At 3:00 pm, new shadow will be cast primarily to the east of the Project. Net new shadow will be cast onto Whittier Street and onto both sides of the sidewalk. New shadow will extend onto a small portion of the open space of the Whittier Street Apartments and onto a margin portion of the rooftops of the complex. The public plaza at the corner of Tremont Street and Whittier Street will be primarily cast in sun. The mouth of the central plaza and small strip along its western border impacted by new shade. All of Tremont Street and the sidewalks in front of the Project will remain free of shadow and consist of sun. A small portion of the centermost portion of East Drive will be cast in shade. The Playing Fields, the Madison Park High School, the Church and the Whittier Street Health Center will not have any new shadow cast by the Project at this time.

At 6:00 pm the net new shadow impact will be to the south and east of the Project. The easterly portion of the grounds in front of the Whittier Street Apartments will be shaded as will a portion of the rooftop of the buildings of that complex. Tremont Street and both of its sidewalks will be free of shade. However, portions of the central plaza will be cast in shade. The Good Sheppard Church grounds will be partially shaded at this time. None of the Project's other abutters are impacted at this time, including the Madison park High School's building facilities nor the Whittier Street Health Center.

Figure 5-5: Shadow Study for June 21 at 9:00 am

Figure 5-6: Shadow Study for June 21 at 12:00 noon

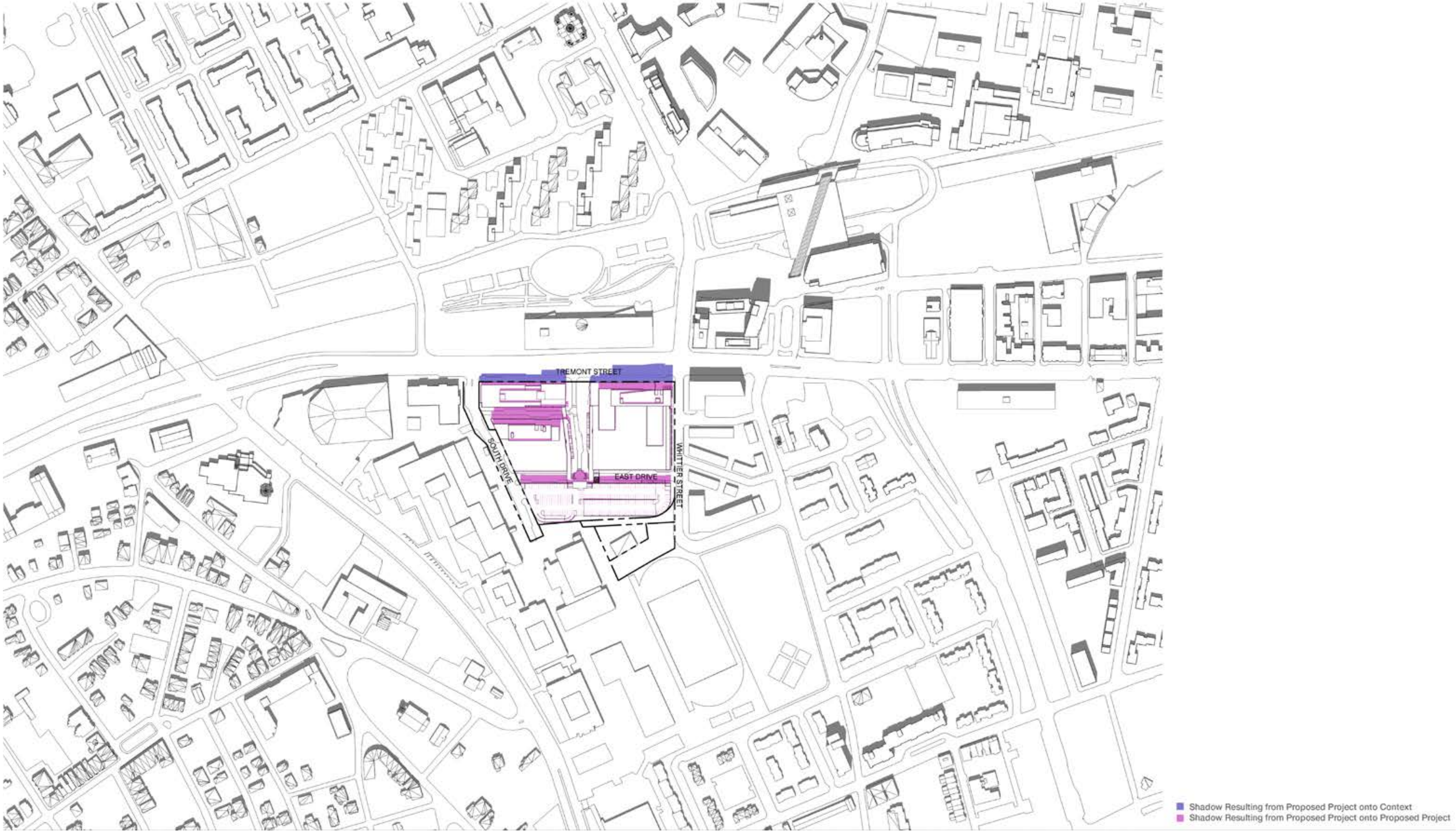
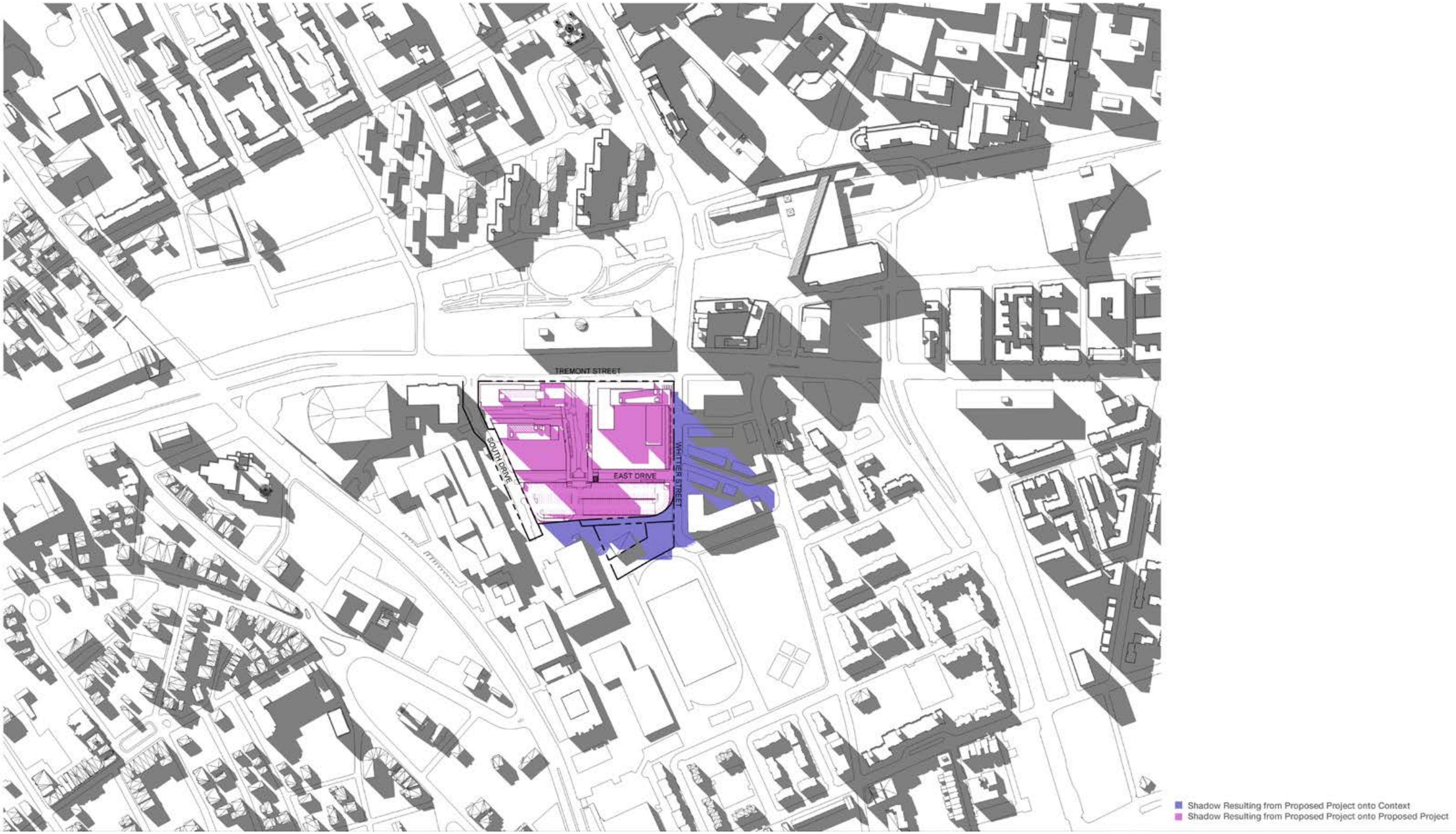


Figure 5-7: Shadow Study for June 21 at 3:00 pm

Figure 5-8: Shadow Study for June 21 at 6:00 pm



5.1.3 *Winter Solstice (December 21)*

New shadow created on December 21 is illustrated in Figures 5.9 through 5.11.

At 9:00 am on December 21, the vast majority of the net new shadow impact will be to the north of the Project. New shadow will be cast onto the sidewalk in front of the Project and onto Tremont Street. Additionally, shadow will be cast onto the sidewalk and rooftop of the Boston Police Department. Additionally, the public, open space behind the Police Department will be shaded, but not entirely by the Project as it is impacted by the Police Headquarters building. The central plaza will be fully impacted by shadow and will not consist of sun at this time nor will the public plaza on the corner of Tremont Street and Whittier Street. All of East Drive and West Drive will be cast in shade, but South Drive will remain in the sun. There will not be any net new shadow impact to any of the Project's other abutters. There will be no shadows cast onto the Whittier Street Apartments, the Whittier Street Health Center, The Madison Park High School nor the Good Sheppard Church. The Playing Fields to the southeast of the project will not be impacted by any net new shadow at this time.

At 12:00 noon, new shadow will be cast to the north and northeast of the Project. New shadow will be cast onto the sidewalk in front of the Project Site and onto Tremont Street. The shadow impact will extend to impact the sidewalk and rooftop of the westerly half of the Boston Police Headquarters. Additionally, the intersection of Tremont Street and Whittier Street will be cast in shadow at this time, with the shadow impact extending to the sidewalk in front of the Northeastern University's International Village dormitory. The sidewalks along Whittier Street will have new shadows cast, as will Whittier Street. The Project's abutters, including the Whittier Street Health Center, the Whittier Apartments, the Madison Park High School building facilities and the Good Sheppard Church, will remain free of any new shadow as will the Playing Fields.

At 3:00 pm, new shadow will be cast primarily to the north and east of the Project. Net new shadow will be cast down Tremont Street to the east. There will be shadow cast onto Whitter Street and onto a small portion of the rooftops of the Whittier Street Apartments. Further, the public plaza at the corner of Tremont Street and Whittier Street will be cast in shade. All of the central plaza will be cast in shade at this time as will all of East Drive, the majority of South Drive and a portion of West Drive. The Playing Fields, the

Madison Park High School, the Good Sheppard Church, the Boston Police Headquarters and the Whittier Street Health Center will not have any new shadow cast by the Project at this time.

Figure 5-9: Shadow Study for December 21 at 9:00 am

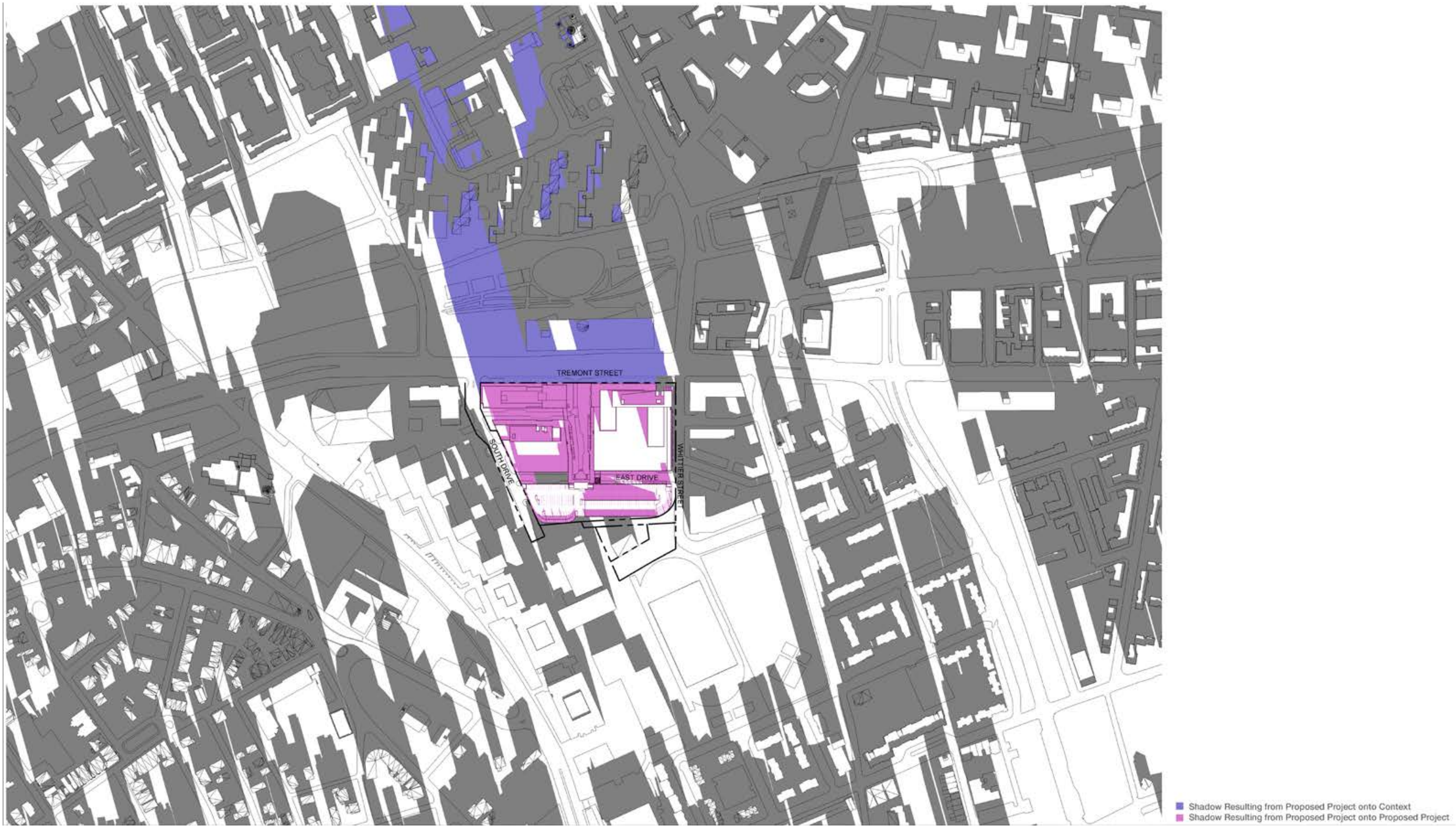


Figure 5-10: Shadow Study for December 21 at 12:00 noon

Figure 5-11: Shadow Study for December 21 at 3:00 pm

5.1.4 *Conclusions*

In conclusion, the majority of the net new shadow will fall on the Project Site and to portions of Tremont and Whittier Streets. The only significant, public open space is the Playing Fields and the park behind the Boston Police Headquarters and they are only partially impacted during two (2) study date and time. Further, the Project does not have an undo shadow impact on its abutters with the majority of the shadows being cast on the Boston Police Headquarters. However, even in this case, in only two (2) of the study periods, was its rooftop cast in shadow. Further, at no time was there a material impact to the open space or rooftops of the Madison Park High School or the Whittier Street Health Center. In sum, the Project does not appear to have a negative impact on its surroundings by way of an excess in net new shadows.

5.2 Air Quality

5.2.1 *Introduction*

Tech Environmental, Inc. (“Tech Environmental”) performed air quality analyses for the Project in 2013. These analyses consisted of: 1) an evaluation of existing air quality and noise baseline conditions; 2) an evaluation of potential carbon monoxide (CO) impacts from the operation of the Project’s fuel combustion and parking garage, and 3) a microscale CO analysis for intersections in the Project area that meet the BRA criteria for requiring such an analysis. The results of the air quality impact analyses demonstrated that the Project would safely comply with the CO National Ambient Air Quality Standards (NAAQS).

The changes with the amended Project compared to the original Project are not significantly different that they would alter the results of the 2013 air quality analyses. Tech Environmental anticipates that since there is no significant difference in the square foot area or Project Site footprint that there will be no appreciable change in the predicted CO concentrations for the amended Project; therefore, it will safely comply with the NAAQS for CO. Tech Environmental’s air quality analysis can be found in Section 5.2 and Appendix 3 of the Supplemental DPIR.

5.3 Noise

Tech Environmental, Inc. performed a noise impact analyses for the Project in 2013 in order to predict the impact of rooftop equipment sound levels on nearby noise-sensitive areas. The results of the noise impact analyses demonstrated that the Project would safely comply the City of Boston Noise Regulations and the Massachusetts Department of Environmental Protection ("DEP") Noise Policy.

The changes with the amended Project compared to the original Project are not significantly different that they would alter the results of the 2013 noise analyses. Since there will be no significant difference in the square footage or area of rooftop equipment, there will be no appreciable change in the predicted sound levels for the amended Project. Therefore, it will safely comply with the City of Boston Noise Regulations and DEP Noise Policy. Tech Environmental's noise impact analysis can be found in Section 5.3 and Appendix 4 of the Supplemental DPIR.

5.4 Solar Glare

Buildings with the Project Site will utilize high-performance materials and facades that are cognizant of the necessary balance of visual aesthetics, thermal performance, cost, heat gain and construction efficiency. The Project will comply with Article 37 of the Boston Zoning Code and will be "LEED Certifiable" per LEED-NC v 2.2 and LEED 2009 definitions. As such, all of the Project's building structures will incorporate significant efficiencies related to energy conservation into their design.

Further, the Proponent does not believe that there will be any solar glare issues resulting from material and façade choices. Glazing performance will balance the metrics of visible light transmittance, thermal insulation value and solar heat gain. Highly mirrored finishes or glazing with a high degree of reflectivity will not be used within the Project Site.

5.5 Wind

Rowan Williams Davies & Irwin Inc. (RWDI) was retained by the Proponent to conduct a pedestrian wind study for the Project. The objective of the study was to assess the effect of the proposed development on local conditions in pedestrian areas around the study site and provide recommendations for minimizing adverse effects.

The study involved wind simulations on a 1:300 scale model of the proposed building and surroundings. These simulations were then conducted in RWDI's boundary-layer wind tunnel at Guelph, Ontario, for the purpose of quantifying local wind speed conditions and comparing to appropriate criteria for gauging wind comfort in pedestrian areas. The criteria recommended by the Boston Redevelopment Authority were used in this study. The report describes the methods and presents the results of the wind tunnel simulations. The Wind Study, including a list of the drawings used for the construction of the model can be found in Appendix 3 herein.

5.6 Geotechnical Impacts / Groundwater

5.6.1 *Exploration Program*

New England Boring Contractors of Derry, New Hampshire drilled ten borings (B201 through B210 depicted on Figure 5-12) between June 28, 2016 and July 19, 2016. Borings were drilled using a track-mounted Mobile B-53 ATV drill rig or truck-mounted Mobile B-53 drill rig depending on the accessibility of each borehole. The borings were advanced using wash-rotary techniques with driven casing and drilling mud. A GEI Consultant's field engineer observed the drilling and logged the samples.

Standard Penetration Tests (SPTs) were performed and split spoon samples were generally collected at five foot intervals. All SPTs were performed using a safety hammer with a rope and cathead. Recovered split-spoon soil samples were placed in jars and sent to our laboratory for verification of field classification.

Rock core samples were collected using an NX-size, double-tube core barrel with a diamond bit yielding 2-inch-diameter rock core samples. Core runs were a maximum of 5 feet long.

5.6.2 *Pressuremeter Testing*

In addition to the SPTs and soil sampling, GEI performed a program of specialized field testing. A series of pressuremeter tests were performed to provide supplemental information to evaluate the allowable soil bearing pressures for foundation design and to estimate foundation settlements.

The pressuremeter test consists of lowering an inflatable probe into the borehole to the desired test depth. The probe is expanded against the soils forming the walls of the borehole, and the pressure required to expand the probe and the corresponding volume changes are recorded incrementally. In effect, an in-situ stress-strain load test is performed in the soil. The results of the pressuremeter test can be related empirically to both allowable bearing capacity and settlement estimates.

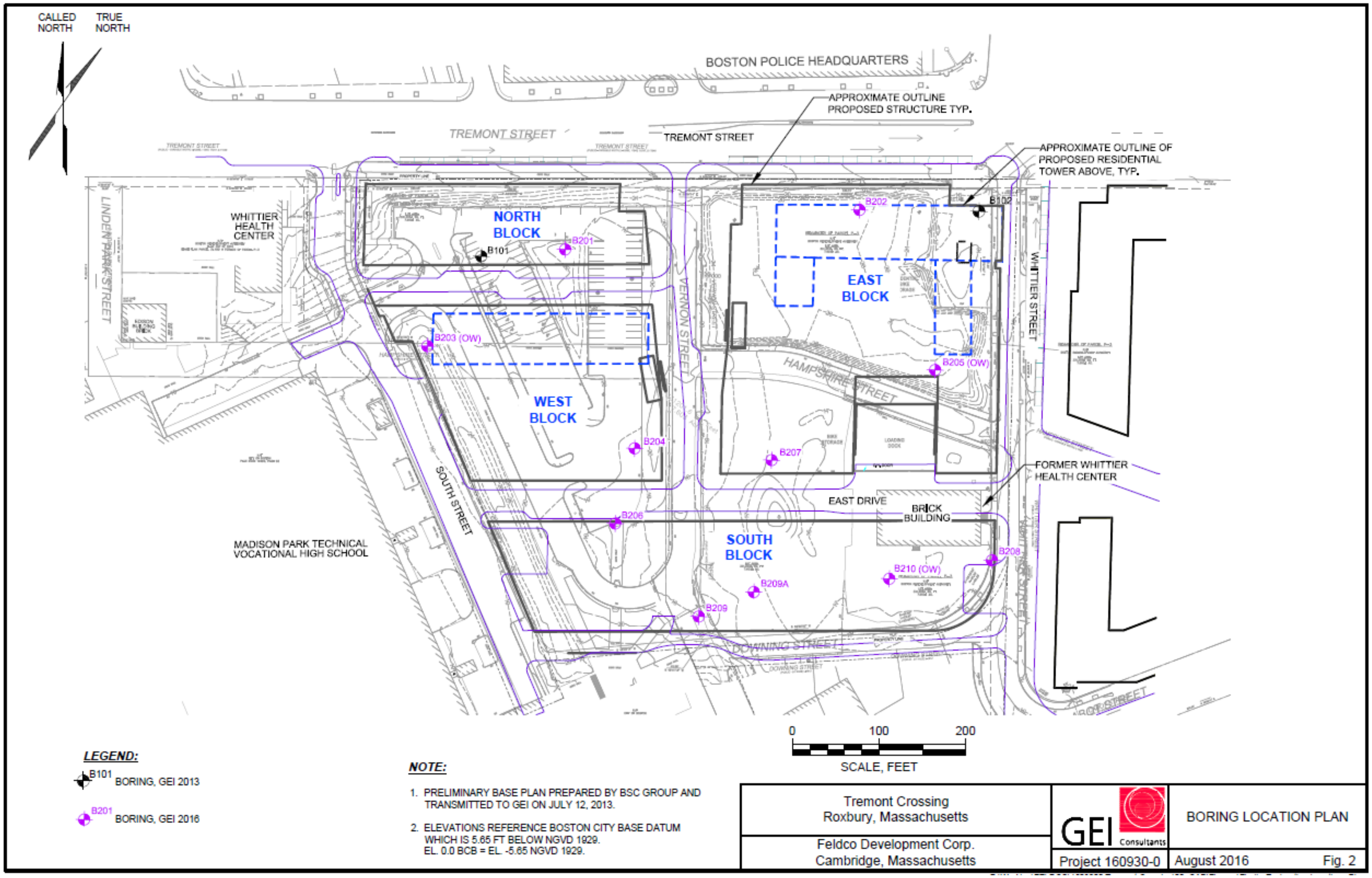
5.6.3 *Laboratory Testing*

GEI Consultants performed nine grain size analyses on granular soil samples and five moisture content analyses on fine-grained soil samples collected from the borings to verify field descriptions.

5.6.4 *Subsurface Conditions*

GEI Consultants' Preliminary Foundation Recommendations and Geotechnical analysis are set forth in Appendix 4.

Figure 5-12: Boring Location Plan



LEGEND:

- B101 BORING, GEI 2013
- B201 BORING, GEI 2016

NOTE:

1. PRELIMINARY BASE PLAN PREPARED BY BSC GROUP AND TRANSMITTED TO GEI ON JULY 12, 2013.
2. ELEVATIONS REFERENCE BOSTON CITY BASE DATUM WHICH IS 5.65 FT BELOW NGVD 1929. EL. 0.0 BCB = EL. -5.65 NGVD 1929.

Tremont Crossing
Roxbury, Massachusetts

Feldco Development Corp.
Cambridge, Massachusetts

BORING LOCATION PLAN

Project 160930-0 | August 2016 | Fig. 2

5.7 Solid and Hazardous Waste

The site is approximately 7.25 acres, of which only 2.5 acres (the MCP Portion) have been identified as contaminated and included as part of the Massachusetts Contingency Plan (MCP). The MCP Portion is bounded by Tremont Street to the northwest, Whittier Street to the northeast, Downing Street to the southeast and Vernon Street to the west. Additionally, asbestos, lead-based paint and miscellaneous hazardous waste (such as fluorescent light and light ballasts. motor oil, lube oil and antifreeze) was identified in the former Whittier Street Health Center building.

GEI Consultants, Inc. has completed an ASTM Phase I Environmental Site Assessment (ESA), on behalf of the Proponent. It is set forth as Appendix 5 herein.

5.7.1 *Recognized Environmental Conditions*

Based on GEI's evaluation of current Project Site conditions and the review of available records for the Project Site, they identified the following RECs, defined as evidence of past, current or future potential releases of OHM, at the Project Site:

- Starting in the 1890's to 1998 the Project Site has been occupied by different industrial, commercial, and manufacturing companies that stored and used OHM. Tremont Foundry Machine Company (Co.), Eastern Electric Cable Co., The Roxbury Carpet Co., A.J. Tower Oil Clothing Manufactory, the former Whittier Street Health Center (WSHC), and Connolly's Tavern formerly stored and utilized various forms of OHM at the Project Site. Although subsurface investigations have been conducted on the eastern portion of the Project Site, the western section of the Project Site (Area 3) has not been investigated for releases of OHM. In particularly, the former Roxbury Carpet Company parcel has not been investigated.

- Area 1 and Area 2 of the Project Site comprise a disposal site identified by the MassDEP on-line database. MassDEP assigned release tracking number (RTN) 3-15009 for the release of TPH, certain PAHs, and lead in soil on April 14, 1997. The disposal site remains open with a Tier II Classification. Although an AUL has been recommended for the disposal site, it has yet to be implemented at the Project Site to allow for its closure.

5.7.2 *Historic Recognized Environmental Conditions*

GEI identified five historic RECs (HRECs), defined as a past release of OHM that has achieved regulatory closure without the use of required controls or conditions (e.g. AULs, engineering controls, etc.) at the Property:

- During subsurface investigations in February 2010 at a former gasoline filling station located at 1290 Tremont Street, concentrations of VPH C9-C10 aromatic fractions and 2-methylnathalene were detected in the soil at concentrations above applicable reportable concentrations. MassDEP assigned RTN 3-29371 to the release. The disposal site abuts the Project Site to the west. Following additional subsurface investigations, a Method 3 Risk Characterization concluded that the site posed a condition of NSR and was closed with a Class B-1 RAO.

- The property located at 1177-1229 Tremont Street is a disposal site (RTN 3-3429). The site is located north of the Property across Tremont Street and was formerly occupied by gasoline filling stations. A release of TPH and VOCs to soil was reported to MassDEP on January 15, 1991. It was concluded that the site posed a condition of NSR and was closed with a Class A-2 RAO.

- During the removal of a 550-gallon No. 2 fuel oil UST at the MBTA Ruggles Street “T” Station located on Forsyth Street in January 1999, soil samples collected in the UST grave exceeded reportable concentrations for PAHs (RTN 3-18303). The site is located approximately 950 feet north of the Property. Following subsurface investigations, a Method 1 Risk Characterization concluded that the site posed a condition of NSR and was closed with a Class A-2 RAO.

- The property located at 1170 Tremont Street is a disposal site (RTN 3-11181). The site abuts the Property to the northeast. A release of No. 2 fuel oil occurred on March 18, 1997 and was reported to MassDEP. The storage tank and approximately 100 yd3 of contaminated soil were removed and transported offsite. The site was cleaned up to background and was closed with a Class A-2 RAO.

5.7.3 *Controlled Recognized Environmental Conditions*

GEI identified the following controlled RECs (CRECs), defined as a past release of OHM that has achieved regulatory closure with the use of required controls or conditions (e.g. AULs, engineering controls, etc.) at the Project Site:

The MBTA Parcel 18 located adjacent to the Ruggles “T” Station is a disposal site (RTN 3-00739). The site is approximately 150 feet north of the Property. Various PAHs, metals, and TPH were detected in soil above reportable concentrations at the property. Based on a Method 3 Risk Characterization and an AUL, the site posed a condition of NSR and was closed with a Class A-3 RAO.

5.7.4 *Additional Environmental Investigation*

Weston & Sampson, Engineers, Inc., of Peabody, Massachusetts (Weston & Sampson) on behalf of the BRA conducted compliance actions pursuant to Chapter 21 E of the Massachusetts General Laws (M.G.L) and the Massachusetts Contingency Plan (MCP). The Proponent will assume responsibility for project site conditions and MCP compliance in accordance with the site ground lease.

Weston & Sampson investigated contaminant conditions at the Project Site between 1996 and 2002. Based on the review of historic records, no industrial or commercial uses were identified that would be the source of site contamination. However, a significant portion of the soil at the site would be characterized as "urban fill;' containing debris such as pieces of brick, coal and coal ash, glass, asphalt and concrete. Several urban fill contaminants, including petroleum hydrocarbons (EPH), polyaromatic hydrocarbons (PAH), and lead were encountered at Project Site. The BRA reported the contamination to the Department of Environmental Protection (DEP) and initiated compliance with the MCP including more extensive site investigation, a risk characterization, and developing an approach to site cleanup. The cleanup strategy recommended by Weston & Sampson for the MCP Portion focused on excavating "hot spots" and placing an Activity and Use Limitation (AUL) on the property.

5.7.5 *Site Compliance*

The MCP Portion is currently out of compliance with the MCP, and the developer will return the "disposal site" to compliance. A Phase II Comprehensive Site Assessment and Phase III Remedial Action Plan were submitted to the DEP in April 2002; cleanup of the site was to be completed by April 2003.

In order to return the MCP Portion of the site back to compliance, we will prepare a Class C Response Action Outcome (RAO) Statement, as a temporary solution. The Class C RAO will state that the MCP Portion of the site poses no substantial hazard to the community. Site cleanup activities will be completed during construction. Once construction is completed, a Class A RAO, a permanent solution, likely with an AUL will be prepared.

The site cleanup strategy will be incorporated directly into design and construction of the mixed use development. A portion of the urban fill, some of which is contaminated, and "hot spots" will be excavated and reused below building areas on site or disposed off-site. The urban fill that remains on site will be capped beneath buildings or pavement. The key elements of our cleanup plan involve the following strategies:

1) Prepare a Class C RAO (Temporary Solution) for the disposal site, to return it to compliance;
2) Conduct additional subsurface investigation during the design phase to confirm foundation design plans and characterize soil identified for off-site disposal. This will better define the contaminant conditions on the "disposal site" along with the non-MCP portion of the site;
3) If MCP reportable conditions are encountered outside of the current MCP disposal site, the existing disposal site would be expanded to include those conditions;
4) Prepare a Release Abatement Measure (RAM) Plan prior to construction that revises the recommended remedy to incorporate construction of the Project;
5) Excavate "hot spots" and urban fill during the construction phase as required for development;
6) Revise the risk assessment upon completion of remediation, to reflect the characteristics of the urban fill that remain beneath the buildings and pavement;
7) Submit a Class A RAO (Permanent Solution), and an AUL, to MassDEP.

5.7.5.1 Remediation General Permit

According to the Boston Water and Sewer Commission in their comment letter of May 31, 2013, the US Environmental Protection Agency issued a draft Remediation General Permit (RGP) for Groundwater Remediation, Contaminated Construction Dewatering, and Miscellaneous Surface Water Discharges. The Proponent did not apply for the RGP. At the appropriate time, prior to construction, the Proponent will file a Notice of Intent with the EPA for an RGP for this project with current groundwater quality data.

5.8 Sustainable Design

The Project will be Leadership in Energy and Environmental Design (LEED) certifiable in accordance with the BRA's Article 37 Green Building Program (Green Building Program). Energy conservation and efficiency will be integral parts of the Project's design. Buildings will employ energy efficient features in the mechanical, electrical, architectural, and structural elements where possible. Mechanical and HVAC systems will be designed and installed to industry standards as well as applicable sections of the Massachusetts Building Code. The Project is situated in a dense, urban Site that is well serviced by public transportation.

5.8.1 *General*

Sustainable building practices can substantially reduce or eliminate negative environmental impacts through high-performance, market-leading design, construction, and operations practices. As an added benefit, sustainable operations and management reduce operating costs, enhance building marketability, increase workers' productivity, and reduce potential liability resulting from indoor air quality problems.

LEED is a voluntary, consensus based, market-driven program that provides third-party verification of green buildings. From individual buildings and homes, to entire neighborhoods and communities, LEED has transformed the way built environments are designed, constructed, and operated. The LEED rating system addresses the entire lifecycle of a building.

5.8.2 *City of Boston*

In 2007, Boston was the first city in the nation to require a green building standard through municipal zoning requirements. By amending Article 37 of the municipal zoning code, the City requires that all large-scale projects meet the U.S. Green Building Council's LEED certification standards.

5.8.3 *Green Rating System*

The LEED Green Building Rating System for New Construction is a set of performance standards for certifying the design and construction of buildings of all sizes, both public and private. The intent is to promote healthful, durable, affordable, and environmentally sound practices in building design and construction. As a requirement of the City of Boston, the Tremont Crossing project will be designed to achieve minimum LEED certification standards. The overarching goals for LEED Certified buildings are to:

- Lower operating costs and increase asset value;
- Reduce waste sent to landfills;
- Conserve energy and water;
- Be healthier and safer for occupants;
- Reduce harmful greenhouse gas emissions.

LEED for New Construction certifications are awarded according to the following scale:

- Certified 40—49 points;
- Silver 50—59 points;
- Gold 60—79 points;
- Platinum 80 points and above.

Prerequisites and credits in the LEED Green Building Rating Systems address seven topics:

- Sustainable Sites;
- Water Efficiency;
- Energy and Atmosphere;
- Materials and Resources;
- Indoor Environmental Quality;
- Innovation in Design;
- Regional Priorities.

5.8.4 *Tremont Crossing LEED Considerations*

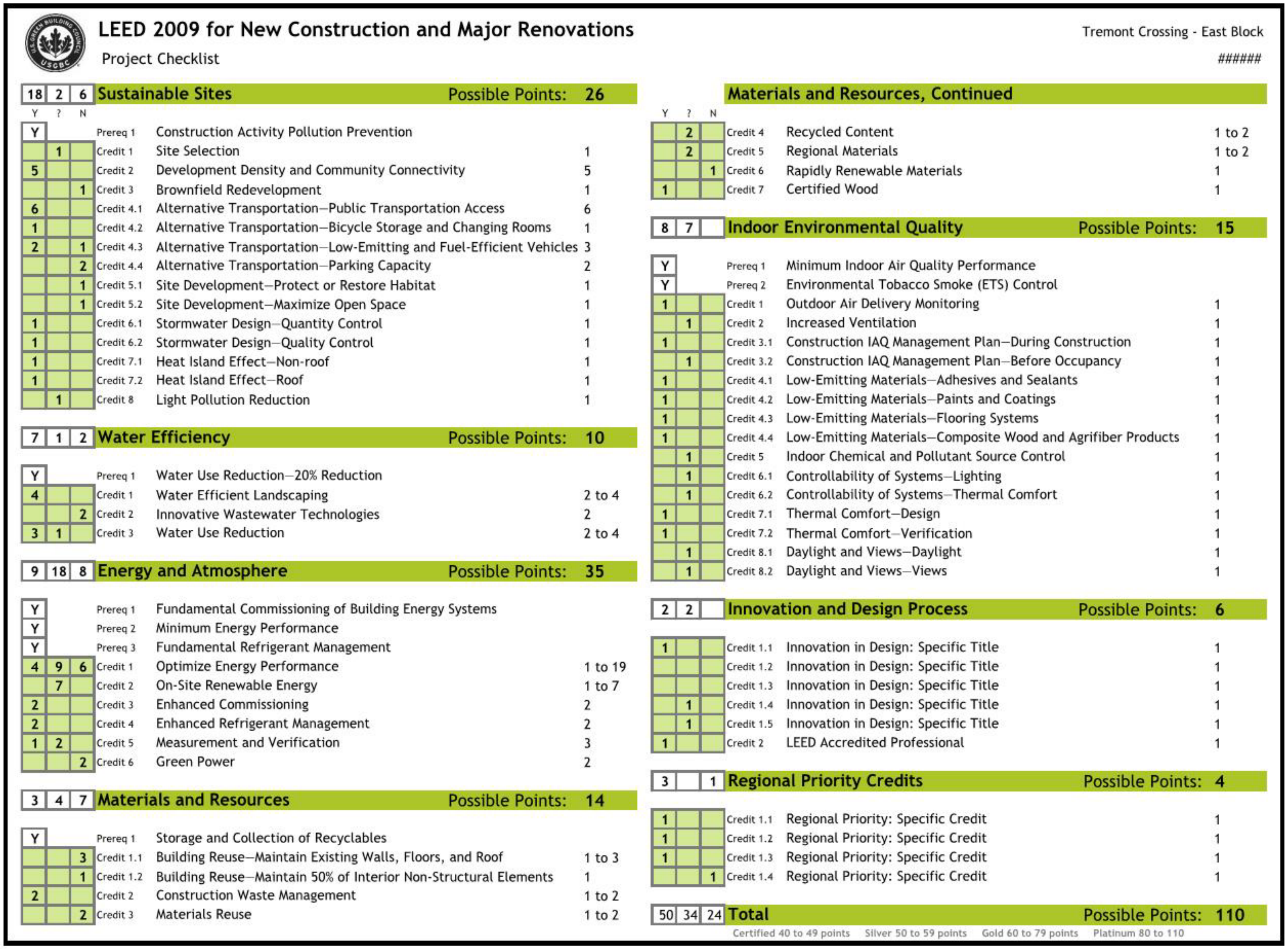
The following highlights are elements to be integrated into the Project. The Proponent anticipates a collective 50 points allowing Tremont Crossing to be certified LEED Silver:

- Construction activity pollution prevention plan including preventing sedimentation of storm sewers and air pollution with dust and particulate matter;
- Encouraging developmental density through the use of existing infrastructure and promoting community connectivity through its walkable location to cultural, institutional, shopping, and mass transit within ½ mile from site;
- Promoting bicycle commuting through bicycle storage and accessibility;

- Encouraging low-emitting and fuel-efficient vehicles through innovative parking locations and/or charging stations. A car sharing service will be available onsite;
- Enacting a stormwater management plan to ensure that the post-development stormwater discharge does not exceed the existing rates and that the the stormwater from the roadways is captured and treated prior to dsicharge;
- Using lighter-color roofing and hardscape materials to reduce the heat island effect—when dark, nonreflective surfaces absorb the sun's warmth and radiates heat. This is an identified LEED regional priority for Boston;
- Reducing potable water use by at least 30% better then EPA baseline through selection of efficient urinals, toilets, and faucets;
- Improved landscaping practices including selection of water-efficient plant species, and irrigation efficiency;
- Enhanced commissioning of building energy systems to ensure correct and efficient use for equipment and maintenance staff;
- Improved energy performance for mechanical, electrical, and plumbing systems through efficient operations and equipment selection;
- Selection of mechanical refrigerants with zero or low ozone depleting potential (ODP) and minimal direct global warming potential (GWP);
- Storage and collection of recyclables;
- Construction waste management plan to divert construction debris from disposal in landfills;
- Maximizing the use of wood-based materials certified in accordance with the Forest Stewardship Council to support responsible forest practices and wildlife habitat;
- Measuring CO_2 concentrations to determine and maintain adequate outdoor air ventilation rates;
- Construction Indoor Air Quality Management Plan to the potentially negative effects of construction on indoor air contaminants;
- Selection of materials, adhesives, sealants, paints and coatings that have a positive impact on indoor air quality through reduction of emitting volatile organic compounds (VOCs);
- Increased ventilation and isolation of areas in spaces with increased airborne chemicals and particles, such as copying or printing rooms;
- Controllability of lighting and thermal systems to provide controls for occupant's comfort.

Preliminary LEED checklists for the Project's East Block, West Block, North Block and South Block (parking structure) are provided at the end of this section (Figure 5-13 through Figure 5-16) to identify sustainable design goals for the Project. Additionally, Appendix 6 and Appendix 7 sets forth an analysis relative to the Project's Article 37 compliance and Energy Modeling respectively.

Figure 5-13: East Block LEED Checklist



LEED 2009 for New Construction and Major Renovations

Project Checklist

Tremont Crossing - East Block

######

18	2	6	**Sustainable Sites**		Possible Points: 26
Y	?	N			
Y			Prereq 1	Construction Activity Pollution Prevention	
	1		Credit 1	Site Selection	1
5			Credit 2	Development Density and Community Connectivity	5
		1	Credit 3	Brownfield Redevelopment	1
6			Credit 4.1	Alternative Transportation—Public Transportation Access	6
1			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
2		1	Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
		2	Credit 4.4	Alternative Transportation—Parking Capacity	2
		1	Credit 5.1	Site Development—Protect or Restore Habitat	1
		1	Credit 5.2	Site Development—Maximize Open Space	1
1			Credit 6.1	Stormwater Design—Quantity Control	1
1			Credit 6.2	Stormwater Design—Quality Control	1
1			Credit 7.1	Heat Island Effect—Non-roof	1
1			Credit 7.2	Heat Island Effect—Roof	1
	1		Credit 8	Light Pollution Reduction	1

7	1	2	**Water Efficiency**		Possible Points: 10
Y			Prereq 1	Water Use Reduction—20% Reduction	
4			Credit 1	Water Efficient Landscaping	2 to 4
		2	Credit 2	Innovative Wastewater Technologies	2
3	1		Credit 3	Water Use Reduction	2 to 4

9	18	8	**Energy and Atmosphere**		Possible Points: 35
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
4	9	6	Credit 1	Optimize Energy Performance	1 to 19
	7		Credit 2	On-Site Renewable Energy	1 to 7
2			Credit 3	Enhanced Commissioning	2
2			Credit 4	Enhanced Refrigerant Management	2
1	2		Credit 5	Measurement and Verification	3
		2	Credit 6	Green Power	2

3	4	7	**Materials and Resources**		Possible Points: 14
Y			Prereq 1	Storage and Collection of Recyclables	
		3	Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
		1	Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
2			Credit 2	Construction Waste Management	1 to 2
		2	Credit 3	Materials Reuse	1 to 2

			Materials and Resources, Continued		
Y	?	N			
	2		Credit 4	Recycled Content	1 to 2
	2		Credit 5	Regional Materials	1 to 2
		1	Credit 6	Rapidly Renewable Materials	1
1			Credit 7	Certified Wood	1

8	7		**Indoor Environmental Quality**		Possible Points: 15
Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1			Credit 1	Outdoor Air Delivery Monitoring	1
	1		Credit 2	Increased Ventilation	1
1			Credit 3.1	Construction IAQ Management Plan—During Construction	1
	1		Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
1			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
1			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
1			Credit 4.3	Low-Emitting Materials—Flooring Systems	1
1			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
	1		Credit 5	Indoor Chemical and Pollutant Source Control	1
	1		Credit 6.1	Controllability of Systems—Lighting	1
	1		Credit 6.2	Controllability of Systems—Thermal Comfort	1
1			Credit 7.1	Thermal Comfort—Design	1
1			Credit 7.2	Thermal Comfort—Verification	1
	1		Credit 8.1	Daylight and Views—Daylight	1
	1		Credit 8.2	Daylight and Views—Views	1

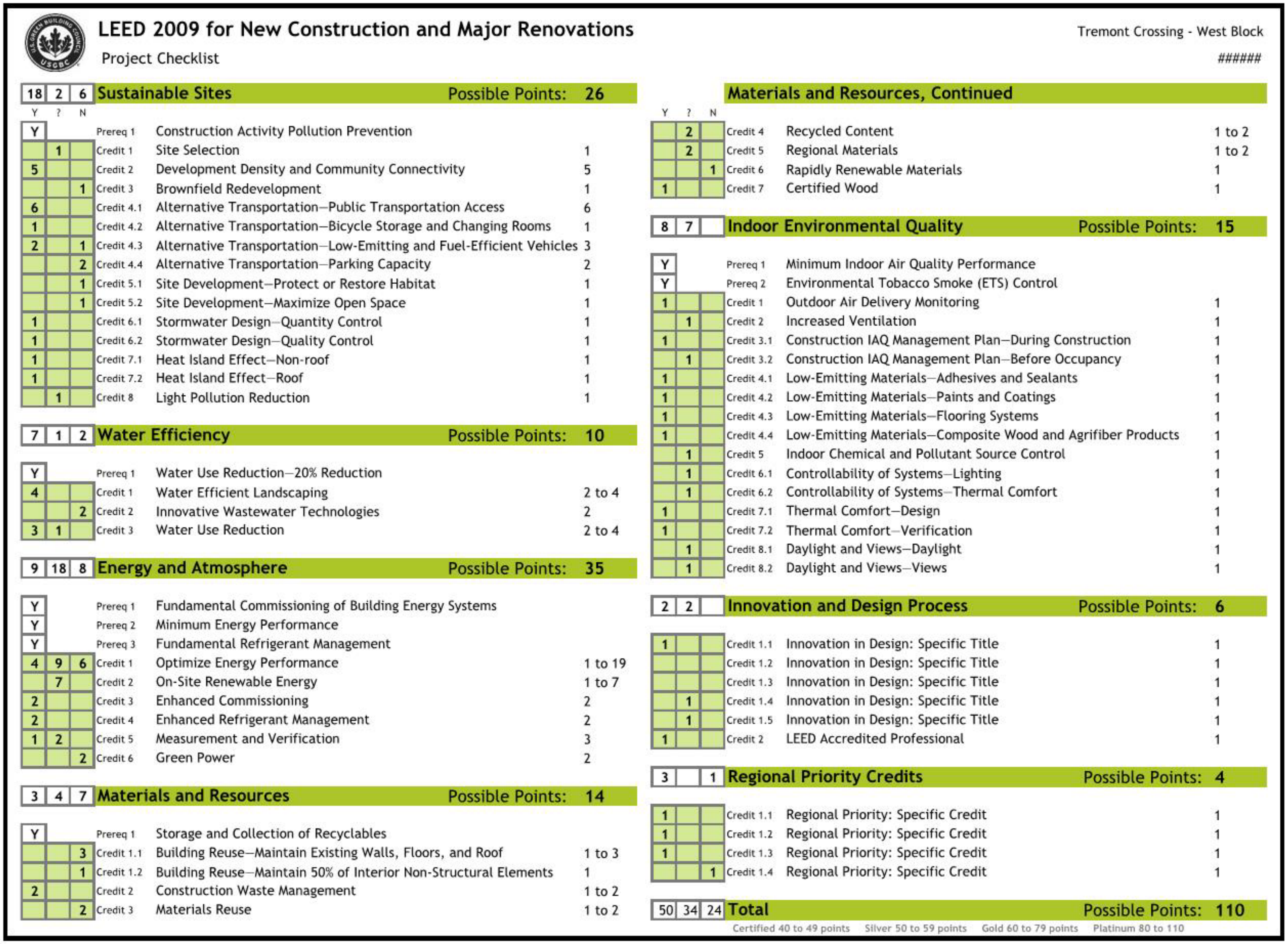
2	2		**Innovation and Design Process**		Possible Points: 6
1			Credit 1.1	Innovation in Design: Specific Title	1
			Credit 1.2	Innovation in Design: Specific Title	1
			Credit 1.3	Innovation in Design: Specific Title	1
	1		Credit 1.4	Innovation in Design: Specific Title	1
	1		Credit 1.5	Innovation in Design: Specific Title	1
1			Credit 2	LEED Accredited Professional	1

3		1	**Regional Priority Credits**		Possible Points: 4
1			Credit 1.1	Regional Priority: Specific Credit	1
1			Credit 1.2	Regional Priority: Specific Credit	1
1			Credit 1.3	Regional Priority: Specific Credit	1
		1	Credit 1.4	Regional Priority: Specific Credit	1

50	34	24	**Total**		Possible Points: 110

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

Figure 5-14: West Block LEED Checklist



LEED 2009 for New Construction and Major Renovations

Project Checklist

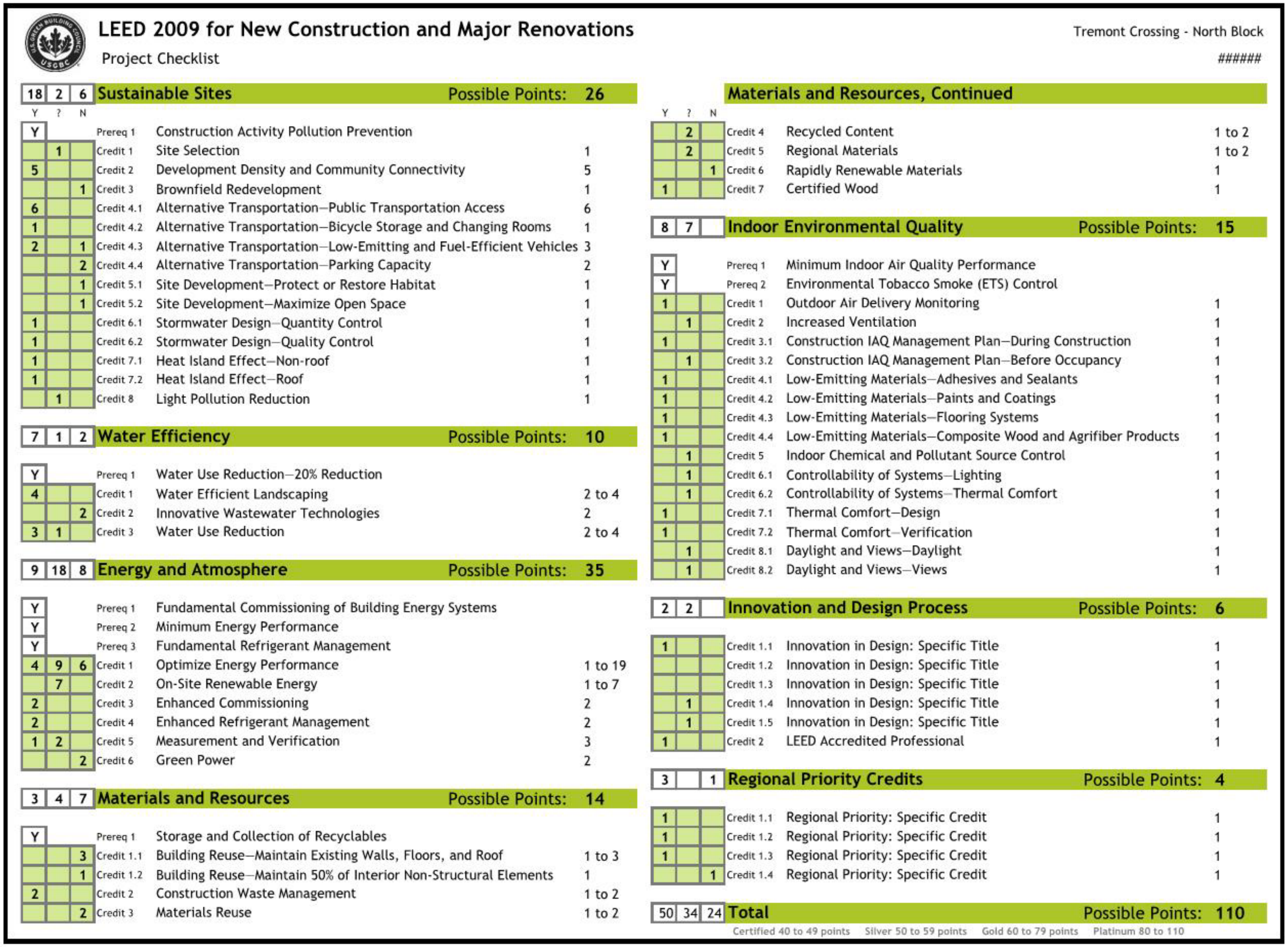
Tremont Crossing - West Block

######

Y	?	N			
18	2	6	**Sustainable Sites**	Possible Points:	**26**
Y			Prereq 1	Construction Activity Pollution Prevention	
	1		Credit 1	Site Selection	1
5			Credit 2	Development Density and Community Connectivity	5
		1	Credit 3	Brownfield Redevelopment	1
6			Credit 4.1	Alternative Transportation—Public Transportation Access	6
1			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
2		1	Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
		2	Credit 4.4	Alternative Transportation—Parking Capacity	2
		1	Credit 5.1	Site Development—Protect or Restore Habitat	1
		1	Credit 5.2	Site Development—Maximize Open Space	1
1			Credit 6.1	Stormwater Design—Quantity Control	1
1			Credit 6.2	Stormwater Design—Quality Control	1
1			Credit 7.1	Heat Island Effect—Non-roof	1
1			Credit 7.2	Heat Island Effect—Roof	1
	1		Credit 8	Light Pollution Reduction	1
7	1	2	**Water Efficiency**	Possible Points:	**10**
Y			Prereq 1	Water Use Reduction—20% Reduction	
4			Credit 1	Water Efficient Landscaping	2 to 4
		2	Credit 2	Innovative Wastewater Technologies	2
3	1		Credit 3	Water Use Reduction	2 to 4
9	18	8	**Energy and Atmosphere**	Possible Points:	**35**
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
4	9	6	Credit 1	Optimize Energy Performance	1 to 19
	7		Credit 2	On-Site Renewable Energy	1 to 7
2			Credit 3	Enhanced Commissioning	2
2			Credit 4	Enhanced Refrigerant Management	2
1	2		Credit 5	Measurement and Verification	3
		2	Credit 6	Green Power	2
3	4	7	**Materials and Resources**	Possible Points:	**14**
Y			Prereq 1	Storage and Collection of Recyclables	
		3	Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
		1	Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
2			Credit 2	Construction Waste Management	1 to 2
		2	Credit 3	Materials Reuse	1 to 2
			Materials and Resources, Continued		
Y	?	N			
	2		Credit 4	Recycled Content	1 to 2
	2		Credit 5	Regional Materials	1 to 2
		1	Credit 6	Rapidly Renewable Materials	1
1			Credit 7	Certified Wood	1
8	7		**Indoor Environmental Quality**	Possible Points:	**15**
Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1			Credit 1	Outdoor Air Delivery Monitoring	1
	1		Credit 2	Increased Ventilation	1
1			Credit 3.1	Construction IAQ Management Plan—During Construction	1
	1		Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
1			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
1			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
1			Credit 4.3	Low-Emitting Materials—Flooring Systems	1
1			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
	1		Credit 5	Indoor Chemical and Pollutant Source Control	1
	1		Credit 6.1	Controllability of Systems—Lighting	1
	1		Credit 6.2	Controllability of Systems—Thermal Comfort	1
1			Credit 7.1	Thermal Comfort—Design	1
1			Credit 7.2	Thermal Comfort—Verification	1
	1		Credit 8.1	Daylight and Views—Daylight	1
	1		Credit 8.2	Daylight and Views—Views	1
2	2		**Innovation and Design Process**	Possible Points:	**6**
1			Credit 1.1	Innovation in Design: Specific Title	1
			Credit 1.2	Innovation in Design: Specific Title	1
			Credit 1.3	Innovation in Design: Specific Title	1
	1		Credit 1.4	Innovation in Design: Specific Title	1
	1		Credit 1.5	Innovation in Design: Specific Title	1
1			Credit 2	LEED Accredited Professional	1
3		1	**Regional Priority Credits**	Possible Points:	**4**
1			Credit 1.1	Regional Priority: Specific Credit	1
1			Credit 1.2	Regional Priority: Specific Credit	1
1			Credit 1.3	Regional Priority: Specific Credit	1
		1	Credit 1.4	Regional Priority: Specific Credit	1
50	34	24	**Total**	Possible Points:	**110**

Certified 40 to 49 points   Silver 50 to 59 points   Gold 60 to 79 points   Platinum 80 to 110

Figure 5-15: North Block LEED Checklist



LEED 2009 for New Construction and Major Renovations

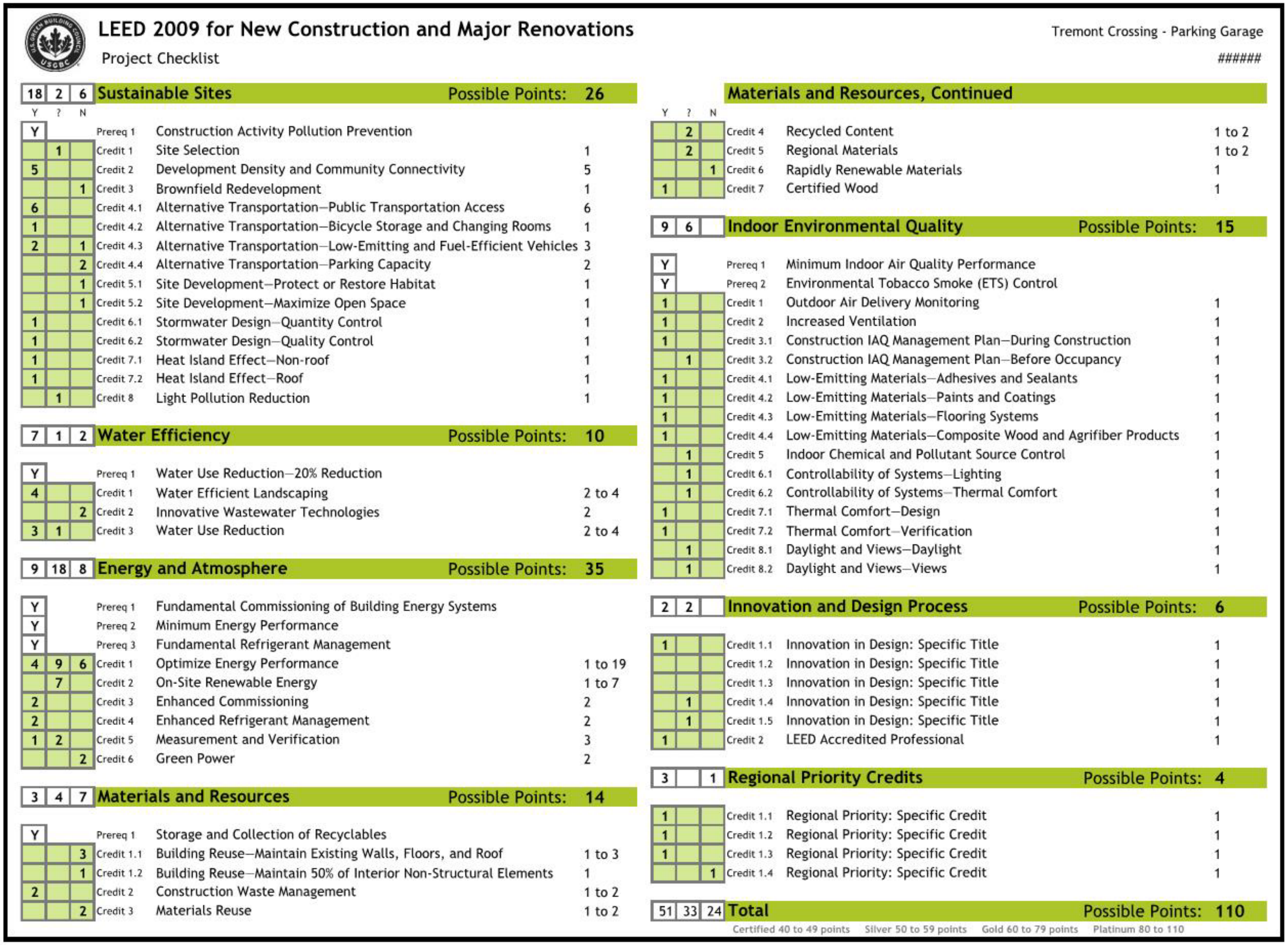
Project Checklist

Tremont Crossing - North Block
######

Y	?	N			
18	2	6	**Sustainable Sites**	Possible Points:	26
Y			Prereq 1	Construction Activity Pollution Prevention	
	1		Credit 1	Site Selection	1
5			Credit 2	Development Density and Community Connectivity	5
		1	Credit 3	Brownfield Redevelopment	1
6			Credit 4.1	Alternative Transportation—Public Transportation Access	6
1			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
2		1	Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
		2	Credit 4.4	Alternative Transportation—Parking Capacity	2
		1	Credit 5.1	Site Development—Protect or Restore Habitat	1
		1	Credit 5.2	Site Development—Maximize Open Space	1
1			Credit 6.1	Stormwater Design—Quantity Control	1
1			Credit 6.2	Stormwater Design—Quality Control	1
1			Credit 7.1	Heat Island Effect—Non-roof	1
1			Credit 7.2	Heat Island Effect—Roof	1
	1		Credit 8	Light Pollution Reduction	1
7	1	2	**Water Efficiency**	Possible Points:	10
Y			Prereq 1	Water Use Reduction—20% Reduction	
4			Credit 1	Water Efficient Landscaping	2 to 4
		2	Credit 2	Innovative Wastewater Technologies	2
3	1		Credit 3	Water Use Reduction	2 to 4
9	18	8	**Energy and Atmosphere**	Possible Points:	35
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
4	9	6	Credit 1	Optimize Energy Performance	1 to 19
	7		Credit 2	On-Site Renewable Energy	1 to 7
2			Credit 3	Enhanced Commissioning	2
2			Credit 4	Enhanced Refrigerant Management	2
1	2		Credit 5	Measurement and Verification	3
		2	Credit 6	Green Power	2
3	4	7	**Materials and Resources**	Possible Points:	14
Y			Prereq 1	Storage and Collection of Recyclables	
		3	Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
		1	Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
2			Credit 2	Construction Waste Management	1 to 2
		2	Credit 3	Materials Reuse	1 to 2
			Materials and Resources, Continued		
Y	?	N			
	2		Credit 4	Recycled Content	1 to 2
	2		Credit 5	Regional Materials	1 to 2
		1	Credit 6	Rapidly Renewable Materials	1
1			Credit 7	Certified Wood	1
8	7		**Indoor Environmental Quality**	Possible Points:	15
Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1			Credit 1	Outdoor Air Delivery Monitoring	1
	1		Credit 2	Increased Ventilation	1
1			Credit 3.1	Construction IAQ Management Plan—During Construction	1
	1		Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
1			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
1			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
1			Credit 4.3	Low-Emitting Materials—Flooring Systems	1
1			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
	1		Credit 5	Indoor Chemical and Pollutant Source Control	1
	1		Credit 6.1	Controllability of Systems—Lighting	1
	1		Credit 6.2	Controllability of Systems—Thermal Comfort	1
1			Credit 7.1	Thermal Comfort—Design	1
1			Credit 7.2	Thermal Comfort—Verification	1
	1		Credit 8.1	Daylight and Views—Daylight	1
	1		Credit 8.2	Daylight and Views—Views	1
2	2		**Innovation and Design Process**	Possible Points:	6
1			Credit 1.1	Innovation in Design: Specific Title	1
			Credit 1.2	Innovation in Design: Specific Title	1
			Credit 1.3	Innovation in Design: Specific Title	1
	1		Credit 1.4	Innovation in Design: Specific Title	1
	1		Credit 1.5	Innovation in Design: Specific Title	1
1			Credit 2	LEED Accredited Professional	1
3		1	**Regional Priority Credits**	Possible Points:	4
1			Credit 1.1	Regional Priority: Specific Credit	1
1			Credit 1.2	Regional Priority: Specific Credit	1
1			Credit 1.3	Regional Priority: Specific Credit	1
		1	Credit 1.4	Regional Priority: Specific Credit	1
50	34	24	**Total**	Possible Points:	110

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

Figure 5-16: South Block (Parking Garage) LEED Checklist



LEED 2009 for New Construction and Major Renovations

Project Checklist

Tremont Crossing - Parking Garage

######

Y	?	N			
18	2	6	**Sustainable Sites**		Possible Points: 26
Y			Prereq 1	Construction Activity Pollution Prevention	
	1		Credit 1	Site Selection	1
5			Credit 2	Development Density and Community Connectivity	5
		1	Credit 3	Brownfield Redevelopment	1
6			Credit 4.1	Alternative Transportation—Public Transportation Access	6
1			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
2		1	Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
		2	Credit 4.4	Alternative Transportation—Parking Capacity	2
		1	Credit 5.1	Site Development—Protect or Restore Habitat	1
		1	Credit 5.2	Site Development—Maximize Open Space	1
1			Credit 6.1	Stormwater Design—Quantity Control	1
1			Credit 6.2	Stormwater Design—Quality Control	1
1			Credit 7.1	Heat Island Effect—Non-roof	1
1			Credit 7.2	Heat Island Effect—Roof	1
	1		Credit 8	Light Pollution Reduction	1
7	1	2	**Water Efficiency**		Possible Points: 10
Y			Prereq 1	Water Use Reduction—20% Reduction	
4			Credit 1	Water Efficient Landscaping	2 to 4
		2	Credit 2	Innovative Wastewater Technologies	2
3	1		Credit 3	Water Use Reduction	2 to 4
9	18	8	**Energy and Atmosphere**		Possible Points: 35
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
4	9	6	Credit 1	Optimize Energy Performance	1 to 19
	7		Credit 2	On-Site Renewable Energy	1 to 7
2			Credit 3	Enhanced Commissioning	2
2			Credit 4	Enhanced Refrigerant Management	2
1	2		Credit 5	Measurement and Verification	3
		2	Credit 6	Green Power	2
3	4	7	**Materials and Resources**		Possible Points: 14
Y			Prereq 1	Storage and Collection of Recyclables	
		3	Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
		1	Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
2			Credit 2	Construction Waste Management	1 to 2
		2	Credit 3	Materials Reuse	1 to 2

Y	?	N			
			Materials and Resources, Continued		
	2		Credit 4	Recycled Content	1 to 2
	2		Credit 5	Regional Materials	1 to 2
		1	Credit 6	Rapidly Renewable Materials	1
1			Credit 7	Certified Wood	1
9	6		**Indoor Environmental Quality**		Possible Points: 15
Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1			Credit 1	Outdoor Air Delivery Monitoring	1
1			Credit 2	Increased Ventilation	1
1			Credit 3.1	Construction IAQ Management Plan—During Construction	1
	1		Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
1			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
1			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
1			Credit 4.3	Low-Emitting Materials—Flooring Systems	1
1			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
	1		Credit 5	Indoor Chemical and Pollutant Source Control	1
	1		Credit 6.1	Controllability of Systems—Lighting	1
	1		Credit 6.2	Controllability of Systems—Thermal Comfort	1
1			Credit 7.1	Thermal Comfort—Design	1
1			Credit 7.2	Thermal Comfort—Verification	1
	1		Credit 8.1	Daylight and Views—Daylight	1
	1		Credit 8.2	Daylight and Views—Views	1
2	2		**Innovation and Design Process**		Possible Points: 6
1			Credit 1.1	Innovation in Design: Specific Title	1
			Credit 1.2	Innovation in Design: Specific Title	1
			Credit 1.3	Innovation in Design: Specific Title	1
	1		Credit 1.4	Innovation in Design: Specific Title	1
	1		Credit 1.5	Innovation in Design: Specific Title	1
1			Credit 2	LEED Accredited Professional	1
3		1	**Regional Priority Credits**		Possible Points: 4
1			Credit 1.1	Regional Priority: Specific Credit	1
1			Credit 1.2	Regional Priority: Specific Credit	1
1			Credit 1.3	Regional Priority: Specific Credit	1
		1	Credit 1.4	Regional Priority: Specific Credit	1
51	33	24	**Total**		Possible Points: 110

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

6.0 INFRASTRUCTURE SYSTEMS

6.1 Overview of Utility Services

The existing infrastructure surrounding the site of Tremont Crossing is anticipated to be of adequate capacity to service the needs of the Project. As outlined in the Project PNF filing, there are existing sanitary sewer, storm drainage, water, gas, electric, and telecommunications lines in Tremont Street. There are existing sewer, storm drainage, water, gas, and electric lines in Whittier Street. There are sewer, gas, and electric lines in Downing Street, including the 72-inch by 96-inch, Stony Brook Conduit combined sewer. Included among the utilities that run through the Site is the Stony Brook Interceptor combined sewer. A detailed discussion on the relocation of the Interceptor is included in Section 7.3.5 Sewer Relocation and in the PNF filing.

Prior to demolition, the Proponent will cut and cap all existing storm drain, sanitary sewer and water services that are not proposed for reuse on the Project site. A Termination Verification Approval Form for a Demolition Permit will be completed and submitted to the City of Boston Inspectional Services Department (ISD) as required.

Approval of Site Plans and a General Service Application are required from Boston Water and Sewer Commission (BWSC) for construction and activation of sewer, water, and storm drainage service connections. The final sewer and water connections, as well as the Project's stormwater management system, will be designed in conformance with BWSC's design standards, Requirements for Site Plans, Regulations Governing the Use of Sanitary and Combined Sewers and Storm Drains, and Regulations Governing the Use of the Water Distribution Facilities of the Boston Water and Sewer Commission.

A Drainage Discharge Permit Application will be submitted to BWSC for any required construction dewatering. The appropriate approvals from the Massachusetts Department of Environmental Protection (MassDEP) and the U.S. Environmental Protection Agency (EPA) will also be sought.

6.2 Water System

6.2.1 *Existing Water Service*

BWSC owns, operates, and maintains the water distribution systems in the vicinity of the Project Site. The extent of existing water distribution in the vicinity of the Project Site was shown on Figure 3-4 of the Project PNF. All existing water services will be cut and capped prior to demolition, as required by BWSC. Existing hydrants will be removed and relocated in coordination with Boston Fire Department (BFD) service needs.

6.2.2 *Estimated Proposed Water Demand*

The estimated proposed water demand for the Project is based on the estimated sanitary sewer flow (see Table 6-1), with a factor of 1.1 applied to account for consumption and other losses. Based on this formula, the Project's estimated peak water demand for domestic uses is 169,098 -gallons per day. The domestic water will be supplied by the BWSC water system.

Based on discussions with BWSC, there are no expected water capacity problems in the vicinity of the Project Site. Prior to full design, this will be confirmed by flow testing by BWSC. The Project's engineer will coordinate water demand and availability with BWSC during Project design to ensure the Project needs are met while maintaining adequate water flows to the surrounding neighborhood.

6.2.3 *Proposed Water Service*

It is anticipated that service connections will be connected to either the existing 12-inch ductile iron (DI) low pressure water main built in 1996 located on the far side of Tremont Street or the newly installed water loop to be constructed as part of this Project, located in East and South Drives. Final service locations will be coordinated with BWSC. Metering will be conducted in accordance with BWSC requirements including the installation of meter transmission units (MTU's) to comply with BWSC's automatic meter reading system. Appropriate gate valves and backflow prevention devices will also be installed on each water service to allow individual services to be shut off and to prevent potential backflow of non-potable water or other contaminants into the public water supply. See Figure 6-1 for proposed water service connections.

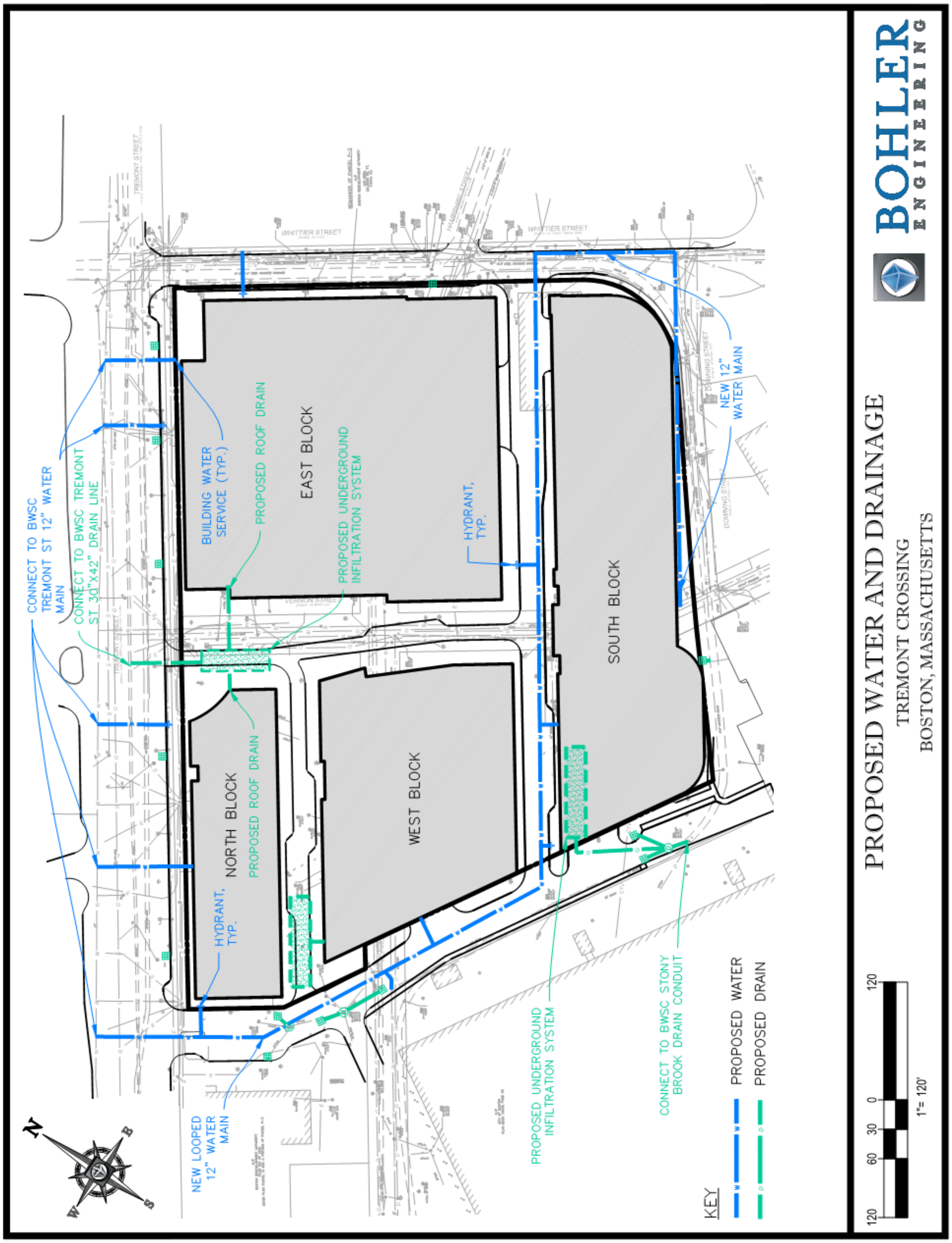
The Project is also expected to include multiple fire protection services. The size and location of these service connections will be coordinated between the Project's engineer and the BWSC. Appropriate gate valves and backflow prevention devices will also be installed on each fire protection service to allow individual services to be shut off and to prevent potential backflow of non-potable water or other contaminants into the public water supply. It is assumed that the Project will include internal booster pumps to ensure adequate water pressure to all standpipes and sprinkler systems. See Figure 6-1 for proposed fire protection service connections.

In order to provide appropriate fire protection around the Project perimeter, several additional fire hydrants are being proposed on the abutting streets/road network, including relocation of existing hydrants on Whittier Street and the addition of hydrants on Tremont Street, South Drive and East Drive. The final number and location of hydrants will be coordinated with the Boston Fire Department.

6.2.4 *Water Supply Conservation and Mitigation*

The Project will be LEED certifiable in accordance with the BRA's Article 37 Green Building program. As such, various water conservation measures such as low-flow toilets and urinals, restricted flow faucets, and sensor operated sinks, toilets, and urinals may be incorporated in order to meet the LEED water conservation requirements. Specific water conservation measures to be included in the Project will be more fully described as the building designs develop.

Figure 6-1: Proposed Water and Drainage



6.3 Sanitary Sewer System

6.3.1 *Existing Sanitary Sewer System*

BWSC owns, operates, and maintains the sanitary and combined sewer mains on and in the vicinity of the Project Site.

The extent of existing sanitary sewer distribution in the vicinity of the Project Site was shown on Figure 3-6 of the Project PNF. The Proponent anticipates utilizing the existing 12-inch separated sewer main in Tremont Street for two proposed service connections and the relocated Stony Brook Interceptor in Whittier Street for the remainder.

All existing sanitary sewer services will be cut and capped prior to demolition, as required by BWSC.

6.3.2 *Estimated Proposed Sanitary Flow*

The Massachusetts Department of Environmental Protection (MassDEP) establishes sewer generation rates for various types of establishments in a section of the State Environmental Code Title V (Title V), 310 CMR 15.203. Based on an estimate of the Project's building program, Table 6-1 gives the estimated proposed sanitary sewer flows expected to be generated by the Project. Based on these Title V sewer generation rates, the project is expected to produce approximately 153,725-gallons/day of sewer flow. The proposed sewer generation calculation will be refined as the building tenants are confirmed and final sewer generation flows will be coordinated with BWSC.

Table 6-1: Sewer Generation

Unit Type	Program	Sewer Generation Rate	Sewer Flow (gpd)
East Block Multifamily (Residential)	385 units, 668 beds	110 gallons/day/bedroom	73,480
West Block Multifamily (Residential)	300 units, 439 beds	110 gallons/day/bedroom	48,290
Whittier Townhouses	9 units, 23 beds	110 gallons/day/bedroom	2,530
Retail	400,000 sq. ft.	50 gallons/day/1,000 sq. ft.	20,000
Office	105,000 sq. ft.	75 gallons/day/1,000 sq. ft.	7,875
Museum	31,000 sq. ft.	50 gallons/day/1,000 sq. ft.	1,550
Parking Garage	1,371 spaces	-	-
Total Sewer Generation			**153,725**

Based on preliminary calculations and discussions with BWSC, there are no sewer capacity problems in the vicinity of the Project Site. The Project's engineer will coordinate final, proposed sewer flows and available capacity with BWSC during Project design to ensure the Project needs are met without disruption of service to the surrounding area.

6.3.3 *Proposed Sanitary Sewer Connections*

Due to the size of the Project, the Project will require multiple service connections to the BWSC sewer systems in the surrounding streets. Service connections are anticipated to occur in Tremont Street and Whittier Street as well as to the relocated Stony Brook Interceptor in the rear (south) of the Project Site. The size and location of these service connections will be coordinated between the Project's plumbing engineer and the BWSC. Any restaurant space will include separate sewers from the kitchen(s) through appropriately sized grease trap(s). Floor drains from the covered levels of the parking garage will be collected and routed through an approved oil/grease separator prior to discharge into the sanitary sewer system.

All sewer connections will be constructed so as to minimize effects on adjacent streets, sidewalks, and other areas within the public right-of-way. All sewer service connections will be kept separate from storm drain connections in accordance with BWSC requirements. Where connecting to a combined sewer system, these separate connections will be provided to allow future connections to separated sanitary and storm drain systems when they are constructed by BWSC. See Figure 6-2 for proposed sanitary sewer service connections.

6.3.4 *Sewer System Mitigation*

The sanitary sewer connections are subject to approval by the municipal sewer system owner, BWSC, as part of the Site Plan approval process. As part of the project mitigation, the Project will need to mitigate inflow and infiltration (I/I) into the BWSC sewer system, and ultimately the MWRA regional wastewater system, at a rate of 4-gallons for every 1-gallon of new sewer flow. Currently, the BWSC calculates the monetary amount required to fulfill the 4:1 Inflow Reduction requirement by multiplying the estimated wastewater flow by 4 and then by $2.41.

One of the major components of I/I removal will be the replacement of the portion of the Stony Brook Interceptor identified in Section 6.3.1. Older brick pipelines tend to have cracks and/or breaks in their walls, gaps at section joint or manhole connections and old abandoned service connections. These points in the main are all potential sources of groundwater infiltration. Given the depth of the main and the length of the section of main to be replaced, the volume of infiltration is assumed to be significant and eliminating that groundwater flow from the water being sent to the MWRA for treatment will be significantly reduced. This infrastructure improvement project may satisfy a portion of the 4:1 sewer mitigation requirements identified above and the mitigation fee may be reduced accordingly.

Another significant improvement, relative to the reduction of stormwater flows being unnecessarily treated at the MWRA treatment facility, is that the Project will direct the roof runoff and the majority of the Project Site to separated storm sewer systems. Under today's conditions, approximately ½ of the site's stormwater runoff is collected in catch basins that are piped directly into combined sewer systems. As part of the BWSC's ongoing effort to separate the sanitary sewer mains from the storm sewer mains, the Project flows will be directed to previously separated storm mains and only a small portion of the sidewalk and patio areas will remain flowing into the combined sewer system. These areas are shown on the Existing and Proposed Watershed figures in Section 6.4.2.

The Project's proponent and engineer will work with BWSC to determine the volume of removal associated with the Stony Brook Conduit work and identify additional I/I measures that may be taken to improve over existing conditions.

Additionally, as stated in the Water Supply Conservation and Mitigation Section, various measures for water use reduction, which translates directly into wastewater reduction, are being implemented into the design which will also benefit the overall goal of reducing the volume of flows being sent to the MWRA wastewater treatment facility.

6.4 Storm Drainage System

6.4.1 *Existing Storm Drainage System*

The existing Project Site is a combination of paved parking lot, one building, grassed areas, and lightly wooded areas. Runoff from portions of the active parking lot in the southwest side of the Project Site currently flows into catch basins that connect to the BWSC drainage system. Runoff from the remainder of this parking lot, as well as from the grassed and lightly wooded areas on Site, sheet flows off Site to the various surrounding streets and/or properties. While it is not clear where runoff from the roof of the existing building is directed, there are catch basins that collect runoff from the paved area surrounding this building and direct it to a drainage main in Downing Street that connects to the combined sewer in that same street.

The Existing Watershed Map included in this Section identifies the existing infrastructure surrounding the Project and where existing site flows are being routed to currently.

Any existing storm drainage services will be cut and capped prior to demolition, as required by BWSC.

6.4.2 *Proposed Storm Drainage System*

The proposed stormwater management system will be designed to comply with BWSC requirements. Stormwater runoff will be collected and treated on-site, as necessary, and will be routed to subsurface infiltration systems to the maximum extent practicable in an effort to reduce the impact on the BWSC drainage system. At a minimum, on-site systems will be designed with a capacity of 1-inch over the Project site. For larger storms, these systems will be equipped with overflow connections to the municipal system. Appropriate stormwater best management practices (BMP's) are to be included in the project to improve the quality of stormwater runoff discharged from the Project Site, to promote infiltration to groundwater, and to ensure peak flows are at or below existing levels. Overflow connections from the underground infiltration/detention areas are proposed to handle larger, less frequent storm events and will discharge to the BWSC drain system. See Figure 6-1 for a schematic design of the proposed storm drainage connection points and underground stormwater infiltration/detention systems. A long term operations and maintenance plan will be used to assist the Property Manager in maintaining the stormwater BMP's in appropriate operational condition.

Since the Project will disturb more than one acre of land, construction will require the submittal of a Notice of Intent (NOI) for coverage under the Construction General Permit (CGP) as part of the Environmental Protection Agency's (EPA's) National Pollutant Discharge Elimination System (NPDES). Conformance with NPDES will require the preparation of a Stormwater Pollution Prevention Plan (SWPPP) for the Project's construction and performance of applicable SWPPP Site inspections. As part of conformance with the SWPPP and NPDES, appropriate erosion and sedimentation (E&S) controls will be installed to prevent sediment laden stormwater runoff from leaving the Site and entering the BWSC drainage system. E&S controls may include structural methods such as catch basin inlet controls, hay bales, silt fence, and silt socks as well as non-structural methods such as minimizing the extent and duration of exposed soils. E&S controls will be maintained as necessary until all disturbed areas have been stabilized through the placement of pavement, structure, or established vegetative cover and will conform to the Water Quality section of the City of Boston Environment Department Guidelines for Construction.

Figure 6-2: Proposed Sanitary Sewer & Stony Brook Relocation

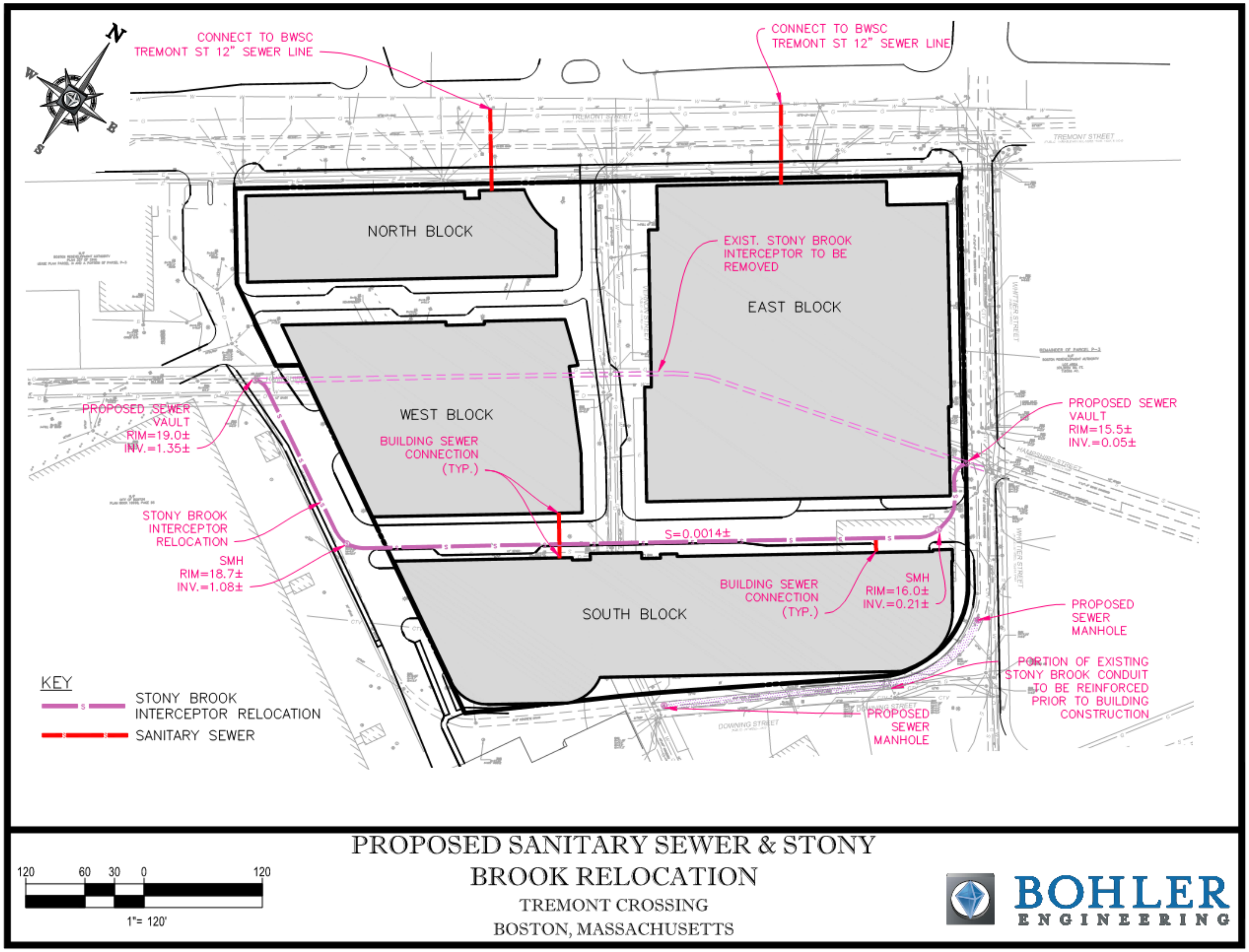
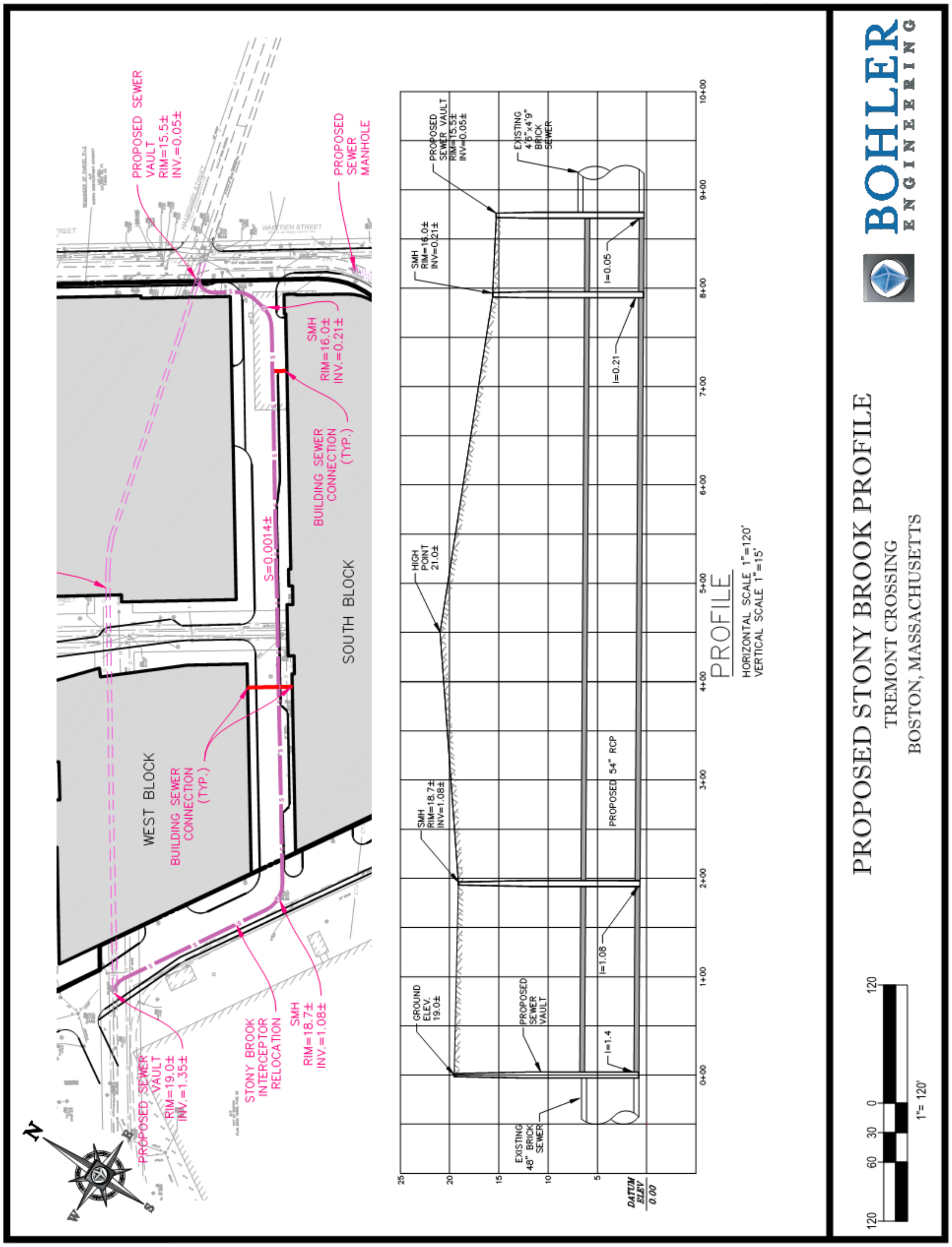


Figure 6-3: Proposed Stony Brook Profile

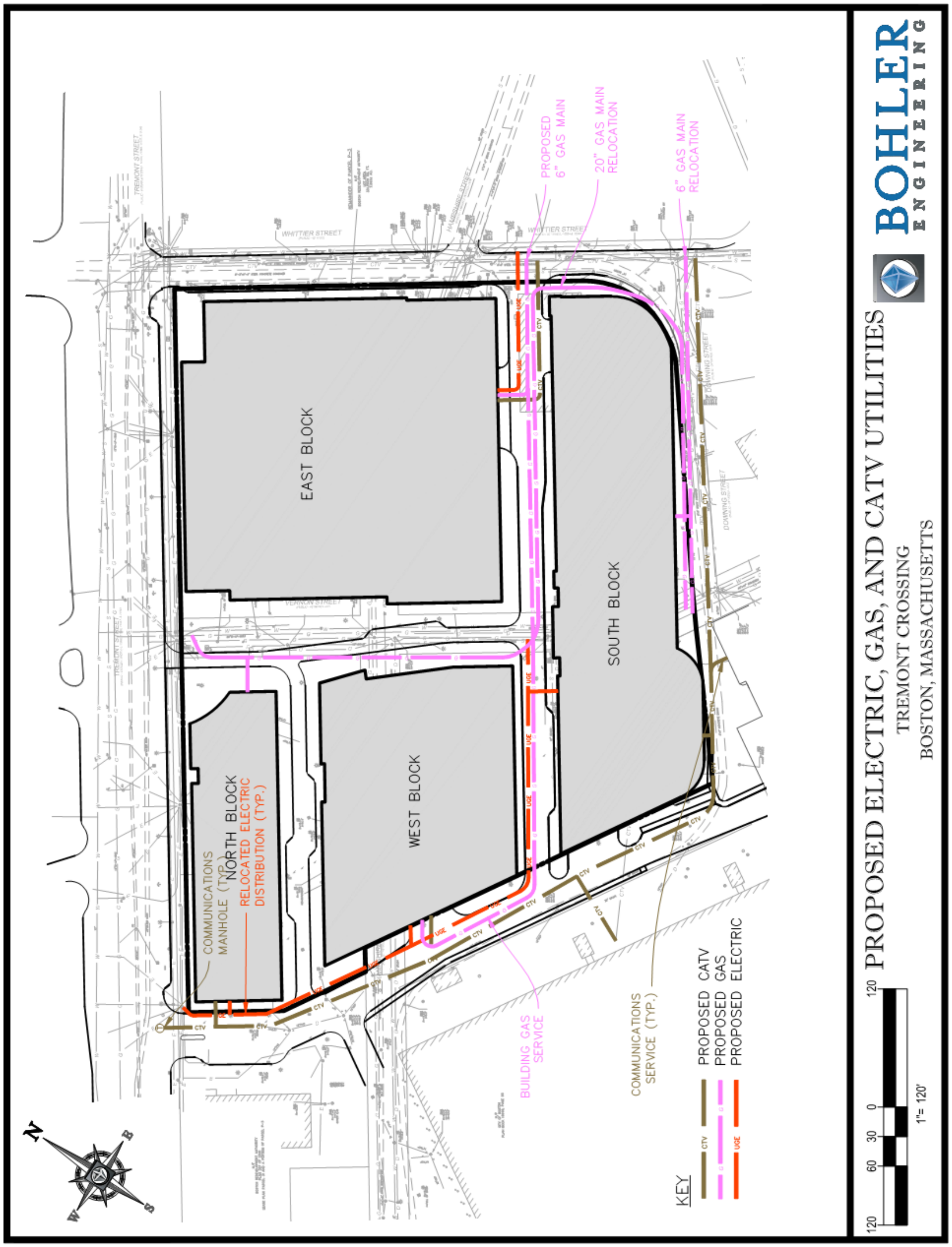


6.5 Energy and Telecommunications

The extent of existing energy and telecommunications in the vicinity of the Project Site was shown on Figure 3-8 of the Project PNF. All energy and telecommunications connections will be coordinated with the appropriate utility companies and the City of Boston.

As the building has developed, preliminary locations for electrical and communications rooms have been identified and the appropriate service connection points have been identified on the Proposed Energy and Telecom Utilities Figure.

Figure 6-4: Proposed Electric, Gas and CATV Utilities



6.6 Existing Conditions Survey

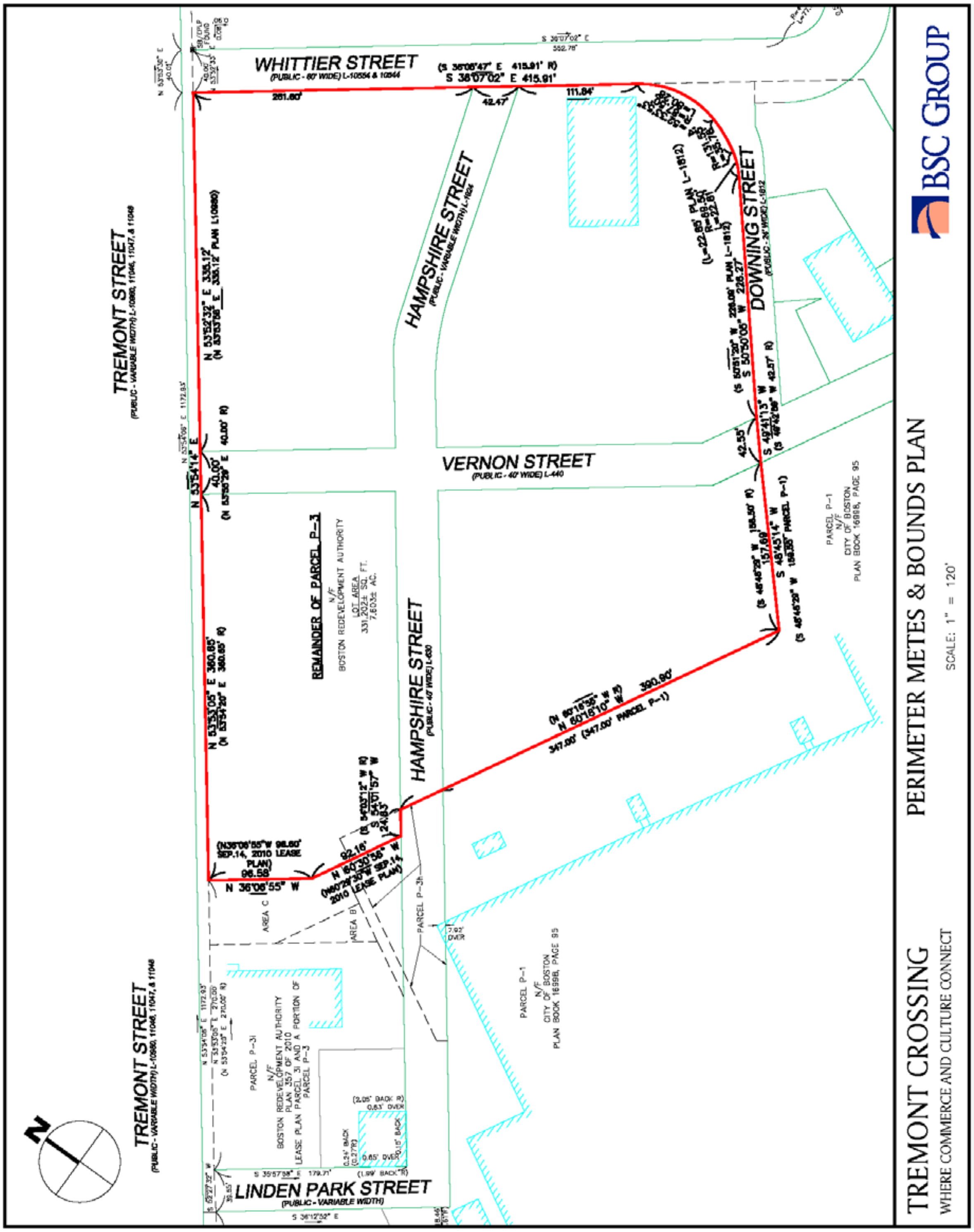
In order to better understand the existing conditions and infrastructure on and immediately adjacent to the Project Site, a topographic survey and perimeter survey was performed. A copy of the Existing Conditions Plan is included in the PNF, Section 3.8.7. Figure 6-4 shows an updated metes & bounds plan showing the boundary of Parcel-3 with bearings, distances and overall parcel area. The perimeter defined as the Project boundary was coordinated with the BRA legal staff during the preparation of the DPIR and is identified as the "Remainder of Parcel P-3".

Other Parcels anticipated to be impacted by the development of the roadway network

As identified in this document and the PNF, the Project has been designed to maintain all building footprints within the defined development perimeter of Parcel-3. Given the nature of this development and the existing property improvements adjacent to the Site, the Project is proposing to modify and redefine the existing roadway network. Figure 6-5 shows portions of adjacent parcels that are expected to be impacted by the roadway network. The South Drive is proposed over portions of Parcel 3 (BRA controlled), Parcel 3-H (BRA controlled) and Parcel-1 (City of Boston controlled) and existing public ways (City of Boston controlled). The Whittier Street widening required to accommodate 2-way traffic on a portion of Whittier Street is proposed over a portion of Parcel-3 (BRA controlled). This widening is proposed as an Easement to allow appropriate Pedestrian Zone widths and Greenscape and Furnishing Zones.

In this regard, a Letter of Cooperation, previously included in the PNF, memorializes an understanding in concept between the Proponent and BPS. Additionally, the Proponent met with BPS officials during the preparation of the DPIR and Supplemental DPIR to better understand their needs, current and future, particularly along South Drive and have factored those needs into the current design.

Figure 6-5: Perimeter Metes & Bounds Plan



Roadway Network

The Project Site is bound on the northwest by Tremont Street, a major public roadway of variable width running generally in a southwest to northeast direction from Malcolm X Boulevard/Columbus Avenue to Charles Street through Boston, Massachusetts. Whittier Street between Tremont Street and Downing Street, all public ways, provides the project's northeastern boundary. Additionally, the paper streets Vernon Street and Hampshire Street run north-south and east-west through the Project Site and Downing Street runs along the southeastly side of the Site from Whittier Street to Vernon Street. The existing roadway network is shown on Figure 6-6. In order to facilitate construction of the Project, a portion of both Hampshire and Vernon Street will be discontinued through the street discontinuance process with the Boston Public Improvement Commission (PIC). The proposed limit of discontinuation of these roadways is shown on Figure 6-6.

To provide access to and circulation around the Project Site, two new internal site driveways are proposed. South Drive will be located along the southwest edge of the project site and East Drive bisects the site, creating three distinct city blocks. South Drive will also provide shared access to Whittier Health Center, Madison Park High School and the Project. The ultimate status of these roads as public ways, private ways or private driveways will be determined through further discussion with PWD, BTD, and PIC, as well as the abutting land owners, with the initial intent for these to remain as private driveways.

The Project calls for the existing Whittier Street right-of-way (ROW), adjacent to the Project Site, to be reconfigured within its current 40-foot ROW. The reconfiguration requires an additional 15-feet to accommodate the proposed improvements, therefore a 15-foot Easement is proposed to be granted from Parcel 3 to the City. The widening allows this portion of Whittier Street to provide two-way vehicular travel while maintaining 7-foot parking lanes on both sides. This easement will also provide the additional width required to fully develop the sidewalk section in compliance with the Boston Complete Street standards, inclusive of 5-foot wide greenscape and furnishing zone and a minimum 6-foot wide dedicated pedestrian zone.

The Proposed Roadway Network as described above is shown on Figure 6-7. Section 3 of this Second Supplement provides additional information on the traffic improvements along these roadways. Section 4.1.4 provides additional information on the pedestrian accommodations along these roadways.

Figure 6-6: Existing Roadway Network

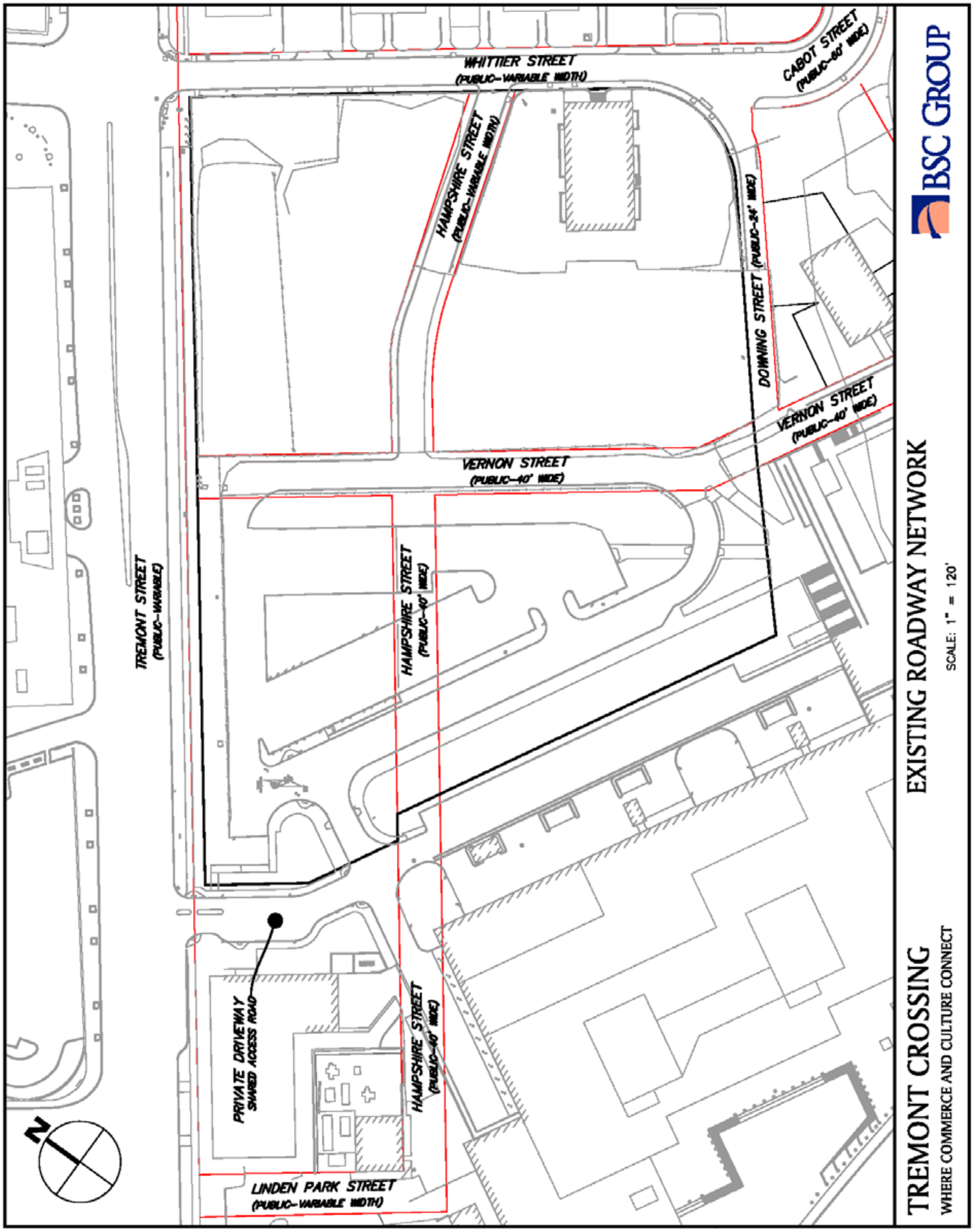
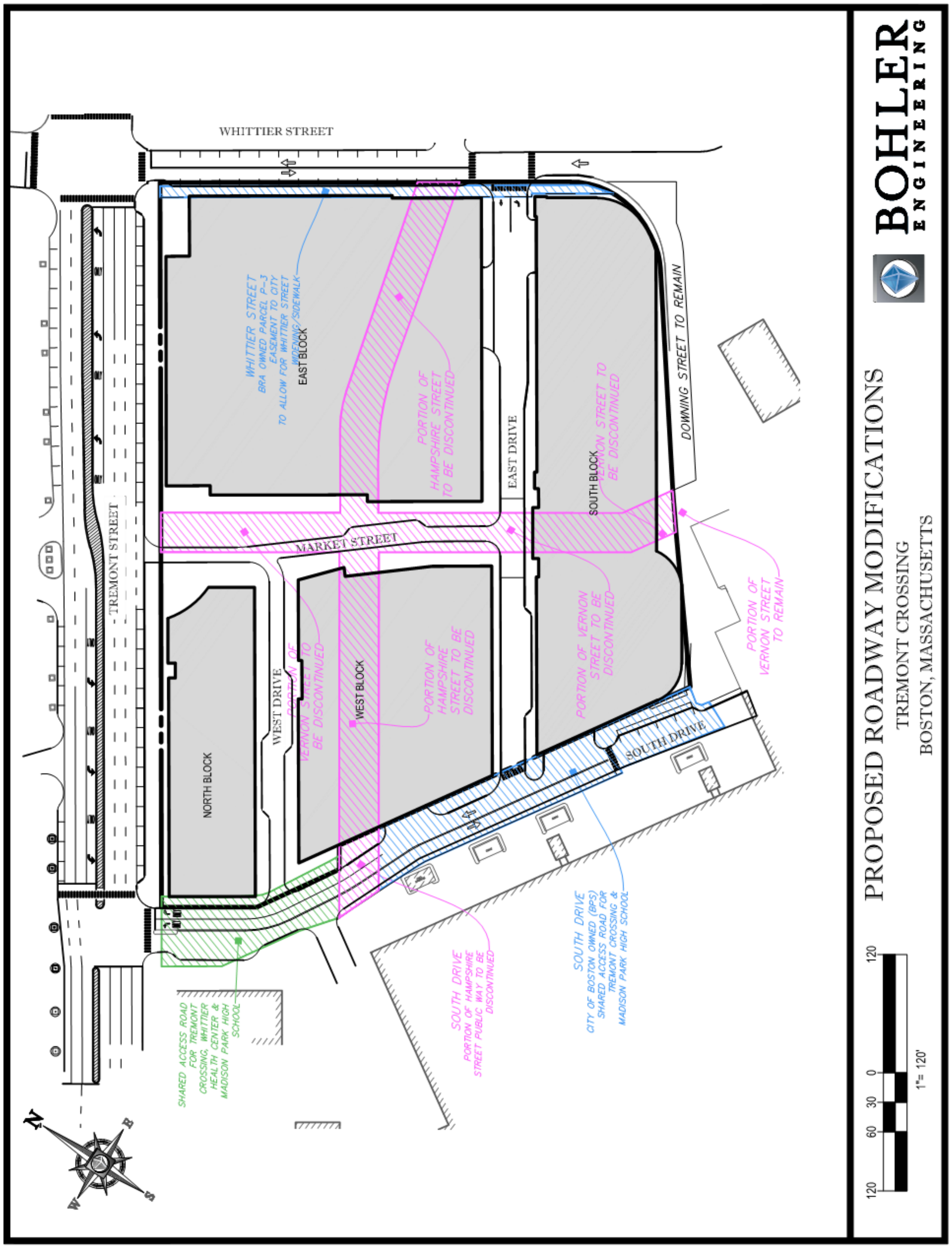
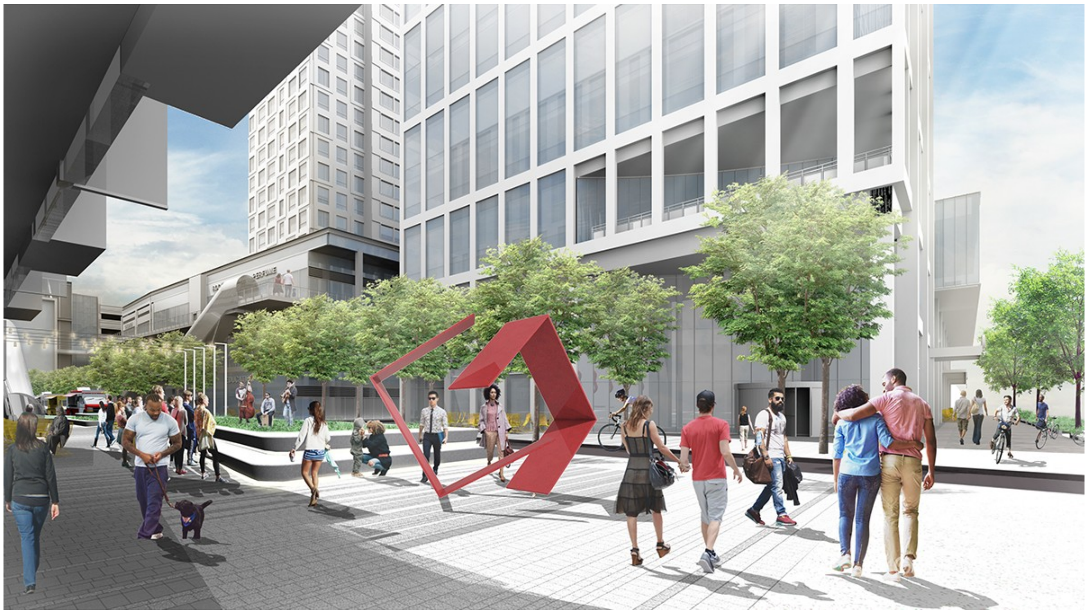


Figure 6-7: Proposed Roadway Modifications



TREMONT CROSSING

WHERE COMMERCE AND CULTURE CONNECT



Second Supplement to

Draft Project Impact Report

APPENDIX

Submitted to:
BOSTON REDEVELOPMENT AUTHORITY
One City Hall Square
Boston, MA 02201

Submitted by:
P-3 PARTNERS, LLC
222 Newbury Street, 4th Floor
Boston, MA 02116

In Association with:
Cambridge Seven Associates
Bohler Engineering
Halvorson Design Partnership
GEI Consultants, Inc.
BSC Group
DLA Piper LLC
Brown Rudnick LLP

AUGUST 8, 2016

TABLE OF APPENDICES

APPENDIX 1

TREMONT CROSSING PROJECT INFORMATION REQUEST

BOSTON
REDEVELOPMENT
AUTHORITY

June 16, 2016

To: Barry Feldman, P3 Partners LLC
Barry Gaither, P3 Partners LLC

Copy: Brian Golden, Director
Teresa Polhemus, Executive Secretary
Jonathan Greeley, Director of Development Review

From: Dana Whiteside, Deputy Director, Community Economic Development

Re: Tremont Crossing Project
Information Request

This memorandum is being provided per discussion between P3 Partners and senior staff of today and as follow-up to recently held meetings – most notably March 19th, June 3rd and June 13th – during which review of the Tremont Crossing Development took place.

In light of revisions which P3 Partners has made to the Tremont Crossing Development which constitute important changes to the overall scope of development in comparison to the proposal outlined in the Supplemental Development Project Impact Report (SDPIR) submitted to the agency on February 11, 2016, it recommended that P3 Partners provide corresponding information from studies and analysis which reflect the current project scope.

The list below represents items which have been referenced in various staff/development team working sessions throughout the Tentative Designation process. Materials from these studies/analysis will result in what will be tantamount to a Revised Supplemental Draft Project Impact Report.

To facilitate continuation of the Article 80 Process and to allow for appropriate review of by staff from respective agencies as well as to accommodate for related public review and comment period, it is requested that materials/Revised Supplemental Draft Project Impact Report be submitted not later than July 8, 2016.

- **Key Submission Items**
    - **Studies**
        - Massing/Design strategy
        - Revised architectural plan
        - Transportation Study/Analysis
            - Site focus as well as consideration of at least ½ mile radius of site with focus on roadways, intersections and connections between the site and the area
        - Environmental
            - Wind Tunnel
            - Shadow
            - Daylight Analysis
            - Air
            - Solar
            - Geotech
            - Sustainable Development/Green Buildings
                - Preliminary Energy Modeling
                - Clean/Renewable Energy Analysis
                - Utility Energy Efficiency Program participation
        - Infrastructure analysis for site with consideration of the impacts of all proposed enhancements for the surrounding area (particularly Whitter Health Center; Whittier Apartments; Reggie Lewis Community Center and the high school). This will also be useful for any prospective MassWorks Infrastructure Grant application submittal.

- **Key Review by Other Regulatory Entities (advisory to BRA Board)**
    - Boston Civic Design Commission
    - Boston Water & Sewer Commission
    - Boston Transportation Department
    - Department of Neighborhood Development
    - Disability Commission (See attached Accessibility Checklist)
    - Parks Commission
    - Environment (See attached Article 37 Requirements)
        - Inter-Agency Green Building Committee
    - Department of Public Works
    - Public Improvements Commission

APPENDIX 2

TRAFFIC

Appendix A: Traffic Count Data
Appendix B: Crash Rate Worksheets
Appendix C: Trip Generation Calculations
Appendix D: Background Traffic Data
Appendix E: Signal Warrant Analysis
Appendix F: Shared Parking Analysis
Appendix G: Capacity Analyses Worksheets
Appendix H: Queue Length Figures
Appendix I: Proposed Improvement Plans

Appendix A: Traffic Count Data

N/S: Tremont Street/ Columbus Ave (Rt 28
E/W: Malcom X Blvd/ Tremont Street
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

PRECISION
DATA
INDUSTRIES, LLC
P.O. Box 301 Berlin, MA 01503
Office: 508.481.3999 Fax: 508.545.1234
Email: datarequests@pdillc.com

File Name : 122774 A
Site Code : 23155.00
Start Date : 1/28/2012
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	Tremont Street (Route 28) From North				Malcom X Boulevard From East			Columbus Avenue (Route 28) From South				Tremont Street From West			
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	Right	Thru	Left	U-Turn	Right	Thru	Left	Int. Total
11:00 AM	38	134	44	3	70	44	15	24	158	20	0	23	46	37	656
11:15 AM	40	125	39	4	67	65	18	15	183	21	0	19	62	34	692
11:30 AM	41	138	38	4	55	73	11	19	174	28	1	27	68	34	711
11:45 AM	53	148	36	4	63	72	18	21	187	30	0	17	38	41	728
Total	172	545	157	15	255	254	62	79	702	99	1	86	214	146	2787
12:00 PM	40	134	31	1	57	64	16	10	181	22	0	28	66	36	686
12:15 PM	43	160	28	1	72	60	11	20	182	20	0	15	43	35	690
12:30 PM	44	151	32	1	58	53	14	13	190	25	0	36	44	45	706
12:45 PM	38	173	29	3	66	59	18	10	168	27	1	34	47	40	713
Total	165	618	120	6	253	236	59	53	721	94	1	113	200	156	2795
Grand Total	337	1163	277	21	508	490	121	132	1423	193	2	199	414	302	5582
Apprch %	18.7	64.7	15.4	1.2	45.4	43.8	10.8	7.5	81.3	11	0.1	21.7	45.2	33	
Total %	6	20.8	5	0.4	9.1	8.8	2.2	2.4	25.5	3.5	0	3.6	7.4	5.4	
Cars	333	1134	228	21	462	469	118	130	1389	190	2	192	403	297	5368
% Cars	98.8	97.5	82.3	100	90.9	95.7	97.5	98.5	97.6	98.4	100	96.5	97.3	98.3	96.2
Heavy Vehicles	4	29	49	0	46	21	3	2	34	3	0	7	11	5	214
% Heavy Vehicles	1.2	2.5	17.7	0	9.1	4.3	2.5	1.5	2.4	1.6	0	3.5	2.7	1.7	3.8

	Tremont Street (Route 28) From North					Malcom X Boulevard From East				Columbus Avenue (Route 28) From South					Tremont Street From West				
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	App. Total	Int. Total

Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 11:15 AM

11:15 AM	40	125	**39**	**4**	208	**67**	65	**18**	150	15	183	21	0	219	19	62	34	115	692
11:30 AM	41	138	38	4	221	55	**73**	11	139	19	174	28	**1**	222	27	**68**	34	129	711
11:45 AM	**53**	**148**	36	4	**241**	63	72	18	**153**	**21**	**187**	**30**		**238**	17	38	**41**	96	**728**
12:00 PM	40	134	31	1	206	57	64	16	137	10	181	22	0	213	**28**	66	36	**130**	686
Total Volume	174	545	144	13	876	242	274	63	579	65	725	101	1	892	91	234	145	470	2817
% App. Total	19.9	62.2	16.4	1.5		41.8	47.3	10.9		7.3	81.3	11.3	0.1		19.4	49.8	30.9		
PHF	.821	.921	.923	.813	.909	.903	.938	.875	.946	.774	.969	.842	.250	.937	.813	.860	.884	.904	.967
Cars	173	533	120	13	839	215	262	62	539	64	708	101	1	874	89	228	144	461	2713
% Cars	99.4	97.8	83.3	100	95.8	88.8	95.6	98.4	93.1	98.5	97.7	100	100	98.0	97.8	97.4	99.3	98.1	96.3
Heavy Vehicles	1	12	24	0	37	27	12	1	40	1	17	0	0	18	2	6	1	9	104
% Heavy Vehicles	0.6	2.2	16.7	0	4.2	11.2	4.4	1.6	6.9	1.5	2.3	0	0	2.0	2.2	2.6	0.7	1.9	3.7

N/S: Tremont Street/ Columbus Ave (Rt 28
E/W: Malcom X Blvd/ Tremont Street
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

File Name : 122774 A
Site Code : 23155.00
Start Date : 1/28/2012

Groups Printed- Cars

	Tremont Street (Route 28) From North				Malcom X Boulevard From East			Columbus Avenue (Route 28) From South				Tremont Street From West			
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	Right	Thru	Left	U-Turn	Right	Thru	Left	Int. Total
11:00 AM	38	126	36	3	66	43	13	24	153	19	0	21	44	36	622
11:15 AM	40	124	32	4	63	62	18	15	180	21	0	18	60	34	671
11:30 AM	40	133	32	4	48	71	11	18	169	28	1	26	67	33	681
11:45 AM	53	146	31	4	56	68	18	21	181	30	0	17	37	41	703
Total	171	529	131	15	233	244	60	78	683	98	1	82	208	144	2677
12:00 PM	40	130	25	1	48	61	15	10	178	22	0	28	64	36	658
12:15 PM	42	157	22	1	68	57	11	19	178	20	0	15	41	35	666
12:30 PM	43	148	25	1	53	51	14	13	188	23	0	34	44	44	681
12:45 PM	37	170	25	3	60	56	18	10	162	27	1	33	46	38	686
Total	162	605	97	6	229	225	58	52	706	92	1	110	195	153	2691
Grand Total	333	1134	228	21	462	469	118	130	1389	190	2	192	403	297	5368
Apprch %	19.4	66.1	13.3	1.2	44	44.7	11.2	7.6	81.2	11.1	0.1	21.5	45.2	33.3	
Total %	6.2	21.1	4.2	0.4	8.6	8.7	2.2	2.4	25.9	3.5	0	3.6	7.5	5.5	

Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 11:15 AM

	Tremont Street (Route 28) From North					Malcom X Boulevard From East				Columbus Avenue (Route 28) From South					Tremont Street From West				
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	App. Total	Int. Total
11:15 AM	40	124	**32**	**4**	200	**63**	62	**18**	**143**	15	180	21	0	216	18	60	34	112	671
11:30 AM	40	133	32	4	209	48	**71**	11	130	18	169	28	**1**	216	26	**67**	33	126	681
11:45 AM	**53**	**146**	31	4	**234**	56	68	18	142	**21**	**181**	**30**		**232**	17	37	**41**	95	**703**
12:00 PM	40	130	25	1	196	48	61	15	124	10	178	22	0	210	**28**	64	36	**128**	658
Total Volume	173	533	120	13	839	215	262	62	539	64	708	101	1	874	89	228	144	461	2713
% App. Total	20.6	63.5	14.3	1.5		39.9	48.6	11.5		7.3	81	11.6	0.1		19.3	49.5	31.2		
PHF	.816	.913	.938	.813	.896	.853	.923	.861	.942	.762	.978	.842	.250	.942	.795	.851	.878	.900	.965

PRECISION
DATA
INDUSTRIES, LLC
P.O. Box 301 Berlin, MA 01503
Office: 508.481.3999 Fax: 508.545.1234
Email: datarequests@pdillc.com

N/S: Tremont Street/ Columbus Ave (Rt 28
E/W: Malcom X Blvd/ Tremont Street
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

File Name : 122774 A
Site Code : 23155.00
Start Date : 1/28/2012
Page No : 1

Groups Printed- Heavy Vehicles

	Tremont Street (Route 28) From North				Malcom X Boulevard From East			Columbus Avenue (Route 28) From South				Tremont Street From West			
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	Right	Thru	Left	U-Turn	Right	Thru	Left	Int. Total
11:00 AM	0	8	8	0	4	1	2	0	5	1	0	2	2	1	34
11:15 AM	0	1	7	0	4	3	0	0	3	0	0	1	2	0	21
11:30 AM	1	5	6	0	7	2	0	1	5	0	0	1	1	1	30
11:45 AM	0	2	5	0	7	4	0	0	6	0	0	0	1	0	25
Total	1	16	26	0	22	10	2	1	19	1	0	4	6	2	110
12:00 PM	0	4	6	0	9	3	1	0	3	0	0	0	2	0	28
12:15 PM	1	3	6	0	4	3	0	1	4	0	0	0	2	0	24
12:30 PM	1	3	7	0	5	2	0	0	2	2	0	2	0	1	25
12:45 PM	1	3	4	0	6	3	0	0	6	0	0	1	1	2	27
Total	3	13	23	0	24	11	1	1	15	2	0	3	5	3	104
Grand Total	4	29	49	0	46	21	3	2	34	3	0	7	11	5	214
Apprch %	4.9	35.4	59.8	0	65.7	30	4.3	5.1	87.2	7.7	0	30.4	47.8	21.7	
Total %	1.9	13.6	22.9	0	21.5	9.8	1.4	0.9	15.9	1.4	0	3.3	5.1	2.3	

	Tremont Street (Route 28) From North					Malcom X Boulevard From East				Columbus Avenue (Route 28) From South					Tremont Street From West				
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 11:00 AM																			
11:00 AM	0	**8**	**8**	0	**16**	4	1	**2**	7	0	5	**1**	**0**	**6**	**2**	**2**	**1**	**5**	**34**
11:15 AM	0	1	7	0	8	4	3	0	7	0	3	0	0	3	1	2	0	3	21
11:30 AM	**1**	5	6	0	12	**7**	2	0	9	**1**									
11:45 AM	**0**	**2**	**5**	**0**	**7**	**7**	**4**	0	**11**	0	**6**	0	0	6	0	1	0	1	25
Total Volume	1	16	26	0	43	22	10	2	34	1	19	1	0	21	4	6	2	12	110
% App. Total	2.3	37.2	60.5	0		64.7	29.4	5.9		4.8	90.5	4.8	0		33.3	50	16.7		
PHF	.250	.500	.813	.000	.672	.786	.625	.250	.773	.250	.792	.250	.000	.875	.500	.750	.500	.600	.809

N/S: Tremont Street/ Columbus Ave (Rt 28
E/W: Malcom X Blvd/ Tremont Street
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

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Email: datarequests@pdillc.com

File Name : 122774 A
Site Code : 23155.00
Start Date : 1/28/2012
Page No : 1

Groups Printed- Peds and Bicycles

	Tremont Street (Route 28) From North				Malcom X Boulevard From East				Columbus Avenue (Route 28) From South				Tremont Street From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
11:00 AM	0	0	0	17	0	0	0	20	0	0	0	29	0	0	0	11	77
11:15 AM	0	0	0	29	0	0	0	20	0	0	0	21	0	0	1	12	83
11:30 AM	0	0	0	32	0	0	0	20	0	0	0	17	0	0	0	19	88
11:45 AM	0	0	0	40	0	0	0	19	0	0	0	30	0	1	0	14	104
Total	0	0	0	118	0	0	0	79	0	0	0	97	0	1	1	56	352
12:00 PM	0	0	0	30	1	0	0	21	0	0	0	41	0	1	0	13	107
12:15 PM	0	2	0	31	0	0	0	28	0	0	0	14	0	0	0	19	94
12:30 PM	0	0	0	38	0	0	0	10	0	2	0	49	0	0	0	34	133
12:45 PM	0	0	0	52	0	0	0	12	0	0	0	27	0	1	0	32	124
Total	0	2	0	151	1	0	0	71	0	2	0	131	0	2	0	98	458
Grand Total	0	2	0	269	1	0	0	150	0	2	0	228	0	3	1	154	810
Apprch %	0	0.7	0	99.3	0.7	0	0	99.3	0	0.9	0	99.1	0	1.9	0.6	97.5	
Total %	0	0.2	0	33.2	0.1	0	0	18.5	0	0.2	0	28.1	0	0.4	0.1	19	

Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 12:00 PM

	Tremont Street (Route 28) From North					Malcom X Boulevard From East					Columbus Avenue (Route 28) From South					Tremont Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
12:00 PM	0	0	0	30	30	**1**	0	0	21	22	0	0	0	41	41	0	**1**	0	13	14	107
12:15 PM	0	**2**	0	31	33	0	0	0	**28**	**28**	0	0	0	14	14	0	0	0	19	19	94
12:30 PM	0	0	0	38	38	0	0	0	10	10	0	**2**		**49**	**51**	0	0	0	**34**	**34**	**133**
12:45 PM	0	0	0	**52**	**52**	0	0	0	12	12	0	0	0	27	27	0	1	0	32	33	124
Total Volume	0	2	0	151	153	1	0	0	71	72	0	2	0	131	133	0	2	0	98	100	458
% App. Total	0	1.3	0	98.7		1.4	0	0	98.6		0	1.5	0	98.5		0	2	0	98		
PHF	.000	.250	.000	.726	.736	.250	.000	.000	.634	.643	.000	.250	.000	.668	.652	.000	.500	.000	.721	.735	.861

N/S: Tremont Street/ Columbus Ave (Rt 28
E/W: Malcom X Blvd/ Tremont Street
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

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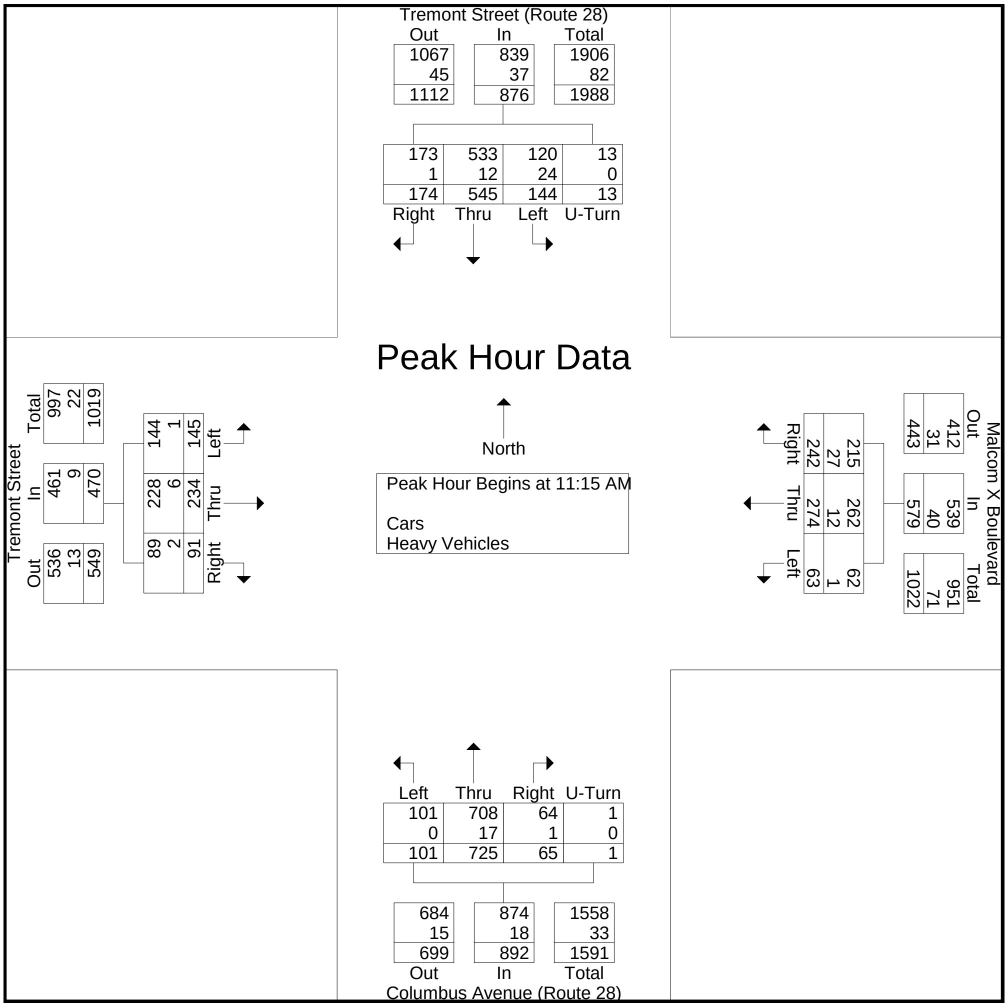
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 11:15 AM																			
11:15 AM	40	125	**39**	**4**	208	**67**	65	**18**	150	15	183	21	0	219	19	62	34	115	692
11:30 AM	41	138	38	4	221	55	**73**	11	139	19	174	28	**1**	222	27	**68**	34	129	711
11:45 AM	**53**	**148**	36	4	**241**	63	72	18	**153**	**21**	**187**	**30**		**238**	17	38	**41**	96	**728**
12:00 PM	40	134	31	1	206	57	64	16	137	10	181	22	0	213	**28**	66	36	**130**	686
Total Volume	174	545	144	13	876	242	274	63	579	65	725	101	1	892	91	234	145	470	2817
% App. Total	19.9	62.2	16.4	1.5		41.8	47.3	10.9		7.3	81.3	11.3	0.1		19.4	49.8	30.9		
PHF	.821	.921	.923	.813	.909	.903	.938	.875	.946	.774	.969	.842	.250	.937	.813	.860	.884	.904	.967
Cars	173	533	120	13	839	215	262	62	539	64	708	101	1	874	89	228	144	461	2713
% Cars	99.4	97.8	83.3	100	95.8	88.8	95.6	98.4	93.1	98.5	97.7	100	100	98.0	97.8	97.4	99.3	98.1	96.3
Heavy Vehicles	1	12	24	0	37	27	12	1	40	1	17	0	0	18	2	6	1	9	104
% Heavy Vehicles	0.6	2.2	16.7	0	4.2	11.2	4.4	1.6	6.9	1.5	2.3	0	0	2.0	2.2	2.6	0.7	1.9	3.7



N/S: Prentis Street/ Driveway
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

PRECISION
DATA
INDUSTRIES, LLC
P.O. Box 301 Berlin, MA 01503
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Email: datarequests@pdillc.com

File Name : 122774 B
Site Code : 23155.00
Start Date : 1/28/2012
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	Prentis Street From North		Tremont Street (Route 28) From East			Tremont Street (Route 28) From West			
Start Time	Right	Left	Right	Thru	U-Turn	Thru	Left	U-Turn	Int. Total
11:00 AM	11	13	11	193	12	240	22	1	503
11:15 AM	6	7	13	203	7	274	20	0	530
11:30 AM	5	12	7	220	4	250	16	0	514
11:45 AM	5	13	9	225	1	281	16	0	550
Total	27	45	40	841	24	1045	74	1	2097
12:00 PM	2	20	10	190	5	252	25	0	504
12:15 PM	6	12	12	235	4	278	18	0	565
12:30 PM	5	13	9	201	2	271	18	0	519
12:45 PM	5	11	17	239	2	276	11	0	561
Total	18	56	48	865	13	1077	72	0	2149
Grand Total	45	101	88	1706	37	2122	146	1	4246
Apprch %	30.8	69.2	4.8	93.2	2	93.5	6.4	0	
Total %	1.1	2.4	2.1	40.2	0.9	50	3.4	0	
Cars	44	99	87	1625	37	2035	145	1	4073
% Cars	97.8	98	98.9	95.3	100	95.9	99.3	100	95.9
Heavy Vehicles	1	2	1	81	0	87	1	0	173
% Heavy Vehicles	2.2	2	1.1	4.7	0	4.1	0.7	0	4.1

	Prentis Street From North			Tremont Street (Route 28) From East				Tremont Street (Route 28) From West				
Start Time	Right	Left	App. Total	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 12:00 PM												
12:00 PM	2	**20**	**22**	10	190	**5**	205	252	**25**	0	277	504
12:15 PM	**6**	12	18	12	235	4	251	**278**	18	0	**296**	**565**
12:30 PM	5	13	18	9	201	2	212	271	18	0	289	519
12:45 PM	5	11	16	**17**	**239**	2	**258**	276	11	0	287	561
Total Volume	18	56	74	48	865	13	926	1077	72	0	1149	2149
% App. Total	24.3	75.7		5.2	93.4	1.4		93.7	6.3	0		
PHF	.750	.700	.841	.706	.905	.650	.897	.969	.720	.000	.970	.951
Cars	18	55	73	47	826	13	886	1032	72	0	1104	2063
% Cars	100	98.2	98.6	97.9	95.5	100	95.7	95.8	100	0	96.1	96.0
Heavy Vehicles	0	1	1	1	39	0	40	45	0	0	45	86
% Heavy Vehicles	0	1.8	1.4	2.1	4.5	0	4.3	4.2	0	0	3.9	4.0

N/S: Prentis Street/ Driveway
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

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Groups Printed- Cars

	Prentis Street From North		Tremont Street (Route 28) From East			Tremont Street (Route 28) From West			
Start Time	Right	Left	Right	Thru	U-Turn	Thru	Left	U-Turn	Int. Total
11:00 AM	10	13	11	179	12	229	22	1	477
11:15 AM	6	6	13	194	7	266	20	0	512
11:30 AM	5	12	7	209	4	238	15	0	490
11:45 AM	5	13	9	217	1	270	16	0	531
Total	26	44	40	799	24	1003	73	1	2010
12:00 PM	2	20	9	181	5	239	25	0	481
12:15 PM	6	12	12	224	4	269	18	0	545
12:30 PM	5	12	9	191	2	264	18	0	501
12:45 PM	5	11	17	230	2	260	11	0	536
Total	18	55	47	826	13	1032	72	0	2063
Grand Total	44	99	87	1625	37	2035	145	1	4073
Apprch %	30.8	69.2	5	92.9	2.1	93.3	6.6	0	
Total %	1.1	2.4	2.1	39.9	0.9	50	3.6	0	

	Prentis Street From North			Tremont Street (Route 28) From East				Tremont Street (Route 28) From West				
Start Time	Right	Left	App. Total	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 12:00 PM												
12:00 PM	2	**20**	**22**	9	181	**5**	195	239	**25**	0	264	481
12:15 PM	**6**	12	18	12	224	4	240	**269**	18	0	**287**	**545**
12:30 PM	5	12	17	9	191	2	202	264	18	0	282	501
12:45 PM	5	11	16	**17**	**230**	2	**249**	260	11	0	271	536
Total Volume	18	55	73	47	826	13	886	1032	72	0	1104	2063
% App. Total	24.7	75.3		5.3	93.2	1.5		93.5	6.5	0		
PHF	.750	.688	.830	.691	.898	.650	.890	.959	.720	.000	.962	.946

N/S: Prentis Street/ Driveway
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

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Site Code : 23155.00
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Groups Printed- Heavy Vehicles

	Prentis Street From North		Tremont Street (Route 28) From East			Tremont Street (Route 28) From West			
Start Time	Right	Left	Right	Thru	U-Turn	Thru	Left	U-Turn	Int. Total
11:00 AM	1	0	0	14	0	11	0	0	26
11:15 AM	0	1	0	9	0	8	0	0	18
11:30 AM	0	0	0	11	0	12	1	0	24
11:45 AM	0	0	0	8	0	11	0	0	19
Total	1	1	0	42	0	42	1	0	87
12:00 PM	0	0	1	9	0	13	0	0	23
12:15 PM	0	0	0	11	0	9	0	0	20
12:30 PM	0	1	0	10	0	7	0	0	18
12:45 PM	0	0	0	9	0	16	0	0	25
Total	0	1	1	39	0	45	0	0	86
Grand Total	1	2	1	81	0	87	1	0	173
Apprch %	33.3	66.7	1.2	98.8	0	98.9	1.1	0	
Total %	0.6	1.2	0.6	46.8	0	50.3	0.6	0	

	Prentis Street From North			Tremont Street (Route 28) From East				Tremont Street (Route 28) From West				
Start Time	Right	Left	App. Total	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 11:00 AM												
11:00 AM	**1**	0	**1**	0	**14**	0	**14**	11	0	0	11	**26**
11:15 AM	0	**1**										
11:30 AM	**0**	**0**	**0**	**0**	**11**	**0**	**11**	**12**	**1**	0	**13**	24
11:45 AM	0	0	0	0	8	0	8	11	0	0	11	19
Total Volume	1	1	2	0	42	0	42	42	1	0	43	87
% App. Total	50	50		0	100	0		97.7	2.3	0		
PHF	.250	.250	.500	.000	.750	.000	.750	.875	.250	.000	.827	.837

N/S: Prentis Street/ Driveway
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

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Groups Printed- Peds and Bicycles

	Prentis Street From North			Tremont Street (Route 28) From East			Tremont Street (Route 28) From West			
Start Time	Right	Left	Peds	Right	Thru	Peds	Thru	Left	Peds	Int. Total
11:00 AM	0	0	5	0	0	4	0	0	3	12
11:15 AM	0	1	5	0	0	0	0	0	1	7
11:30 AM	0	0	13	0	0	0	1	0	6	20
11:45 AM	1	0	7	0	0	1	0	0	0	9
Total	1	1	30	0	0	5	1	0	10	48
12:00 PM	0	0	3	0	1	9	0	0	0	13
12:15 PM	0	0	3	0	1	3	1	0	0	8
12:30 PM	0	0	10	0	1	7	0	0	4	22
12:45 PM	0	0	2	0	0	1	0	0	1	4
Total	0	0	18	0	3	20	1	0	5	47
Grand Total	1	1	48	0	3	25	2	0	15	95
Apprch %	2	2	96	0	10.7	89.3	11.8	0	88.2	
Total %	1.1	1.1	50.5	0	3.2	26.3	2.1	0	15.8	

	Prentis Street From North				Tremont Street (Route 28) From East				Tremont Street (Route 28) From West				
Start Time	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 11:45 AM													
11:45 AM	**1**	0	7	8	0	0	1	1	0	0	0	0	9
12:00 PM	0	0	3	3	0	**1**	**9**	**10**	0	0	0	0	13
12:15 PM	0	0	3	3	0	1	3	4	**1**	0	0	1	8
12:30 PM	0	0	**10**	**10**	0	1	7	8	0	0	**4**	**4**	**22**
Total Volume	1	0	23	24	0	3	20	23	1	0	4	5	52
% App. Total	4.2	0	95.8		0	13	87		20	0	80		
PHF	.250	.000	.575	.600	.000	.750	.556	.575	.250	.000	.250	.313	.591

N/S: Prentis Street/ Driveway
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

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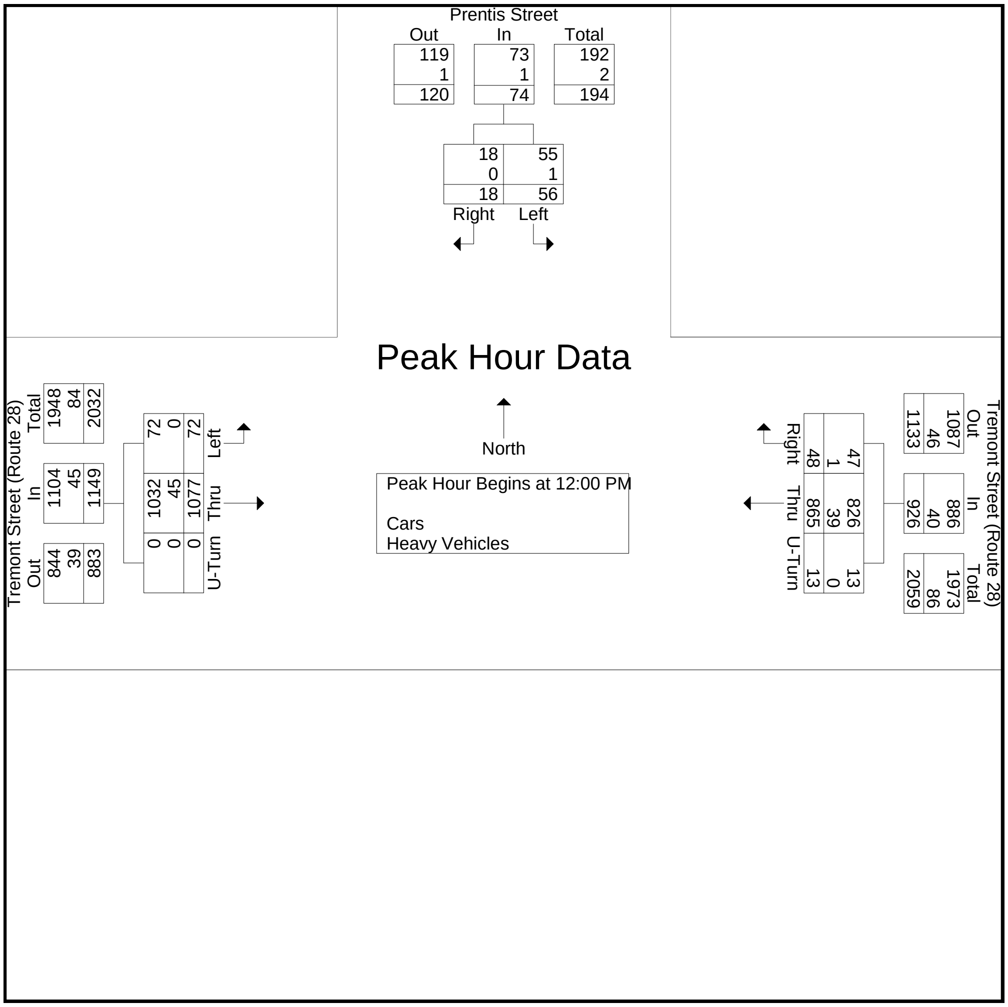
	Prentis Street From North			Tremont Street (Route 28) From East				Tremont Street (Route 28) From West				
Start Time	Right	Left	App. Total	Right	Thru	U-Turn	App. Total	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 12:00 PM												
12:00 PM	2	**20**	**22**	10	190	**5**	205	252	**25**	0	277	504
12:15 PM	**6**	12	18	12	235	4	251	**278**	18	0	**296**	**565**
12:30 PM	5	13	18	9	201	2	212	271	18	0	289	519
12:45 PM	5	11	16	**17**	**239**	2	**258**	276	11	0	287	561
Total Volume	18	56	74	48	865	13	926	1077	72	0	1149	2149
% App. Total	24.3	75.7		5.2	93.4	1.4		93.7	6.3	0		
PHF	.750	.700	.841	.706	.905	.650	.897	.969	.720	.000	.970	.951
Cars	18	55	73	47	826	13	886	1032	72	0	1104	2063
% Cars	100	98.2	98.6	97.9	95.5	100	95.7	95.8	100	0	96.1	96.0
Heavy Vehicles	0	1	1	1	39	0	40	45	0	0	45	86
% Heavy Vehicles	0	1.8	1.4	2.1	4.5	0	4.3	4.2	0	0	3.9	4.0



N/S: Ruggles Street/ Whittier Street
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

File Name : 122774 C
Site Code : 23155.00
Start Date : 1/28/2012

Groups Printed- Cars - Heavy Vehicles

	Ruggles Street From North			Tremont Street (Route 28) From East				Whittier Street From South			Tremont Street (Route 28) From West				
Start Time	Right	Thru	Left	Right	Thru	Left	U-Turn	Right	Thru	Left	Right	Thru	Left	U-Turn	Int. Total
11:00 AM	25	0	88	84	199	0	4	4	1	1	0	203	28	7	644
11:15 AM	32	0	75	84	178	0	3	3	0	2	0	239	30	9	655
11:30 AM	31	0	92	86	192	0	3	3	0	2	0	250	26	5	690
11:45 AM	19	0	84	88	210	0	5	5	0	4	0	260	26	4	705
Total	107	0	339	342	779	0	15	15	1	9	0	952	110	25	2694
12:00 PM	33	0	90	94	187	0	2	2	0	2	0	257	38	4	709
12:15 PM	35	0	90	87	196	0	8	8	1	2	0	262	36	5	730
12:30 PM	26	0	89	99	179	0	2	3	0	1	0	263	27	8	697
12:45 PM	30	0	92	101	224	0	2	2	0	7	0	259	32	4	753
Total	124	0	361	381	786	0	14	15	1	12	0	1041	133	21	2889
Grand Total	231	0	700	723	1565	0	29	30	2	21	0	1993	243	46	5583
Apprch %	24.8	0	75.2	31.2	67.5	0	1.3	56.6	3.8	39.6	0	87.3	10.6	2	
Total %	4.1	0	12.5	13	28	0	0.5	0.5	0	0.4	0	35.7	4.4	0.8	
Cars	175	0	668	706	1545	0	29	29	2	21	0	1957	191	46	5369
% Cars	75.8	0	95.4	97.6	98.7	0	100	96.7	100	100	0	98.2	78.6	100	96.2
Heavy Vehicles	56	0	32	17	20	0	0	1	0	0	0	36	52	0	214
% Heavy Vehicles	24.2	0	4.6	2.4	1.3	0	0	3.3	0	0	0	1.8	21.4	0	3.8

	Ruggles Street From North				Tremont Street (Route 28) From East					Whittier Street From South				Tremont Street (Route 28) From West					
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 12:00 PM																			
12:00 PM	33	0	90	123	94	187	0	2	283	2	0	2	4	0	257	**38**	4	299	709
12:15 PM	**35**	0	90	**125**	87	196	0	**8**	291	**8**	**1**	2	**11**	0	262	36	5	**303**	730
12:30 PM	26	0	89	115	99	179	0	2	280	3	0	1	4	0	**263**	27	**8**	298	697
12:45 PM	30	0	**92**	122	**101**	**224**	0	2	**327**	2	0	**7**							**753**
Total Volume	124	0	361	485	381	786	0	14	1181	15	1	12	28	0	1041	133	21	1195	2889
% App. Total	25.6	0	74.4		32.3	66.6	0	1.2		53.6	3.6	42.9		0	87.1	11.1	1.8		
PHF	.886	.000	.981	.970	.943	.877	.000	.438	.903	.469	.250	.429	.636	.000	.990	.875	.656	.986	.959
Cars	96	0	342	438	374	776	0	14	1164	14	1	12	27	0	1027	103	21	1151	2780
% Cars	77.4	0	94.7	90.3	98.2	98.7	0	100	98.6	93.3	100	100	96.4	0	98.7	77.4	100	96.3	96.2
Heavy Vehicles	28	0	19	47	7	10	0	0	17	1	0	0	1	0	14	30	0	44	109
% Heavy Vehicles	22.6	0	5.3	9.7	1.8	1.3	0	0	1.4	6.7	0	0	3.6	0	1.3	22.6	0	3.7	3.8

N/S: Ruggles Street/ Whittier Street
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

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Groups Printed- Cars

	Ruggles Street From North			Tremont Street (Route 28) From East				Whittier Street From South			Tremont Street (Route 28) From West				
Start Time	Right	Thru	Left	Right	Thru	Left	U-Turn	Right	Thru	Left	Right	Thru	Left	U-Turn	Int. Total
11:00 AM	16	0	85	81	195	0	4	4	1	1	0	198	21	7	613
11:15 AM	25	0	74	83	177	0	3	3	0	2	0	235	25	9	636
11:30 AM	25	0	87	85	188	0	3	3	0	2	0	242	22	5	662
11:45 AM	13	0	80	83	209	0	5	5	0	4	0	255	20	4	678
Total	79	0	326	332	769	0	15	15	1	9	0	930	88	25	2589
12:00 PM	25	0	87	91	183	0	2	2	0	2	0	255	28	4	679
12:15 PM	26	0	84	85	195	0	8	8	1	2	0	259	30	5	703
12:30 PM	19	0	84	98	177	0	2	2	0	1	0	260	21	8	672
12:45 PM	26	0	87	100	221	0	2	2	0	7	0	253	24	4	726
Total	96	0	342	374	776	0	14	14	1	12	0	1027	103	21	2780
Grand Total	175	0	668	706	1545	0	29	29	2	21	0	1957	191	46	5369
Apprch %	20.8	0	79.2	31	67.8	0	1.3	55.8	3.8	40.4	0	89.2	8.7	2.1	
Total %	3.3	0	12.4	13.1	28.8	0	0.5	0.5	0	0.4	0	36.4	3.6	0.9	

Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 12:00 PM

	Ruggles Street From North				Tremont Street (Route 28) From East					Whittier Street From South				Tremont Street (Route 28) From West					
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
12:00 PM	25	0	**87**	112	91	183	0	2	276	2	0	2	4	0	255	28	4	287	679
12:15 PM	**26**	0	84	110	85	195	0	**8**	288	**8**	**1**	2	**11**	0	259	**30**	5	**294**	703
12:30 PM	19	0	84	103	98	177	0	2	277	2	0	1	3	0	**260**	21	**8**	289	672
12:45 PM	26	0	87	**113**	**100**	**221**	0	2	**323**	2	0	**7**							**726**
Total Volume	96	0	342	438	374	776	0	14	1164	14	1	12	27	0	1027	103	21	1151	2780
% App. Total	21.9	0	78.1		32.1	66.7	0	1.2		51.9	3.7	44.4		0	89.2	8.9	1.8		
PHF	.923	.000	.983	.969	.935	.878	.000	.438	.901	.438	.250	.429	.614	.000	.988	.858	.656	.979	.957

N/S: Ruggles Street/ Whittier Street
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Groups Printed- Heavy Vehicles

	Ruggles Street From North			Tremont Street (Route 28) From East				Whittier Street From South			Tremont Street (Route 28) From West				
Start Time	Right	Thru	Left	Right	Thru	Left	U-Turn	Right	Thru	Left	Right	Thru	Left	U-Turn	Int. Total
11:00 AM	9	0	3	3	4	0	0	0	0	0	0	5	7	0	31
11:15 AM	7	0	1	1	1	0	0	0	0	0	0	4	5	0	19
11:30 AM	6	0	5	1	4	0	0	0	0	0	0	8	4	0	28
11:45 AM	6	0	4	5	1	0	0	0	0	0	0	5	6	0	27
Total	28	0	13	10	10	0	0	0	0	0	0	22	22	0	105
12:00 PM	8	0	3	3	4	0	0	0	0	0	0	2	10	0	30
12:15 PM	9	0	6	2	1	0	0	0	0	0	0	3	6	0	27
12:30 PM	7	0	5	1	2	0	0	1	0	0	0	3	6	0	25
12:45 PM	4	0	5	1	3	0	0	0	0	0	0	6	8	0	27
Total	28	0	19	7	10	0	0	1	0	0	0	14	30	0	109
Grand Total	56	0	32	17	20	0	0	1	0	0	0	36	52	0	214
Apprch %	63.6	0	36.4	45.9	54.1	0	0	100	0	0	0	40.9	59.1	0	
Total %	26.2	0	15	7.9	9.3	0	0	0.5	0	0	0	16.8	24.3	0	

	Ruggles Street From North				Tremont Street (Route 28) From East					Whittier Street From South				Tremont Street (Route 28) From West					
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 11:30 AM																			
11:30 AM	6	0	5	11	1	**4**	0	0	5	0	0	0	0	0	**8**	4	0	**12**	28
11:45 AM	6	0	4	10	**5**	1	0	0	6	0	0	0	0	0	5	6	0	11	27
12:00 PM	8	0	3	11	3	4	0	0	**7**	0	0	0	0	0	2	**10**	0	12	**30**
12:15 PM	**9**	0	**6**	**15**	2	1	0	0	3	0	0	0	0	0	3	6	0	9	27
Total Volume	29	0	18	47	11	10	0	0	21	0	0	0	0	0	18	26	0	44	112
% App. Total	61.7	0	38.3		52.4	47.6	0	0		0	0	0		0	40.9	59.1	0		
PHF	.806	.000	.750	.783	.550	.625	.000	.000	.750	.000	.000	.000	.000	.000	.563	.650	.000	.917	.933

N/S: Ruggles Street/ Whittier Street
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

PRECISION
DATA
INDUSTRIES, LLC
P.O. Box 301 Berlin, MA 01503
Office: 508.481.3999 Fax: 508.545.1234
Email: datarequests@pdillc.com

File Name : 122774 C
Site Code : 23155.00
Start Date : 1/28/2012
Page No : 1

Groups Printed- Peds and Bicycles

	Ruggles Street From North				Tremont Street (Route 28) From East				Whittier Street From South				Tremont Street (Route 28) From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
11:00 AM	0	0	0	5	0	0	0	2	0	0	0	10	0	0	0	1	18
11:15 AM	0	0	0	4	0	0	0	1	0	1	0	17	0	1	0	4	28
11:30 AM	0	0	1	12	0	0	0	4	0	0	0	18	0	0	0	1	36
11:45 AM	0	0	0	2	0	0	0	1	0	0	0	36	0	0	0	0	39
Total	0	0	1	23	0	0	0	8	0	1	0	81	0	1	0	6	121
12:00 PM	1	0	0	1	0	0	0	3	0	0	0	14	0	0	0	1	20
12:15 PM	0	0	0	3	1	2	0	7	0	1	0	15	0	1	0	2	32
12:30 PM	0	0	0	8	0	0	0	0	0	2	0	6	0	2	0	2	20
12:45 PM	0	0	0	5	1	0	0	1	0	0	0	9	0	0	0	6	22
Total	1	0	0	17	2	2	0	11	0	3	0	44	0	3	0	11	94
Grand Total	1	0	1	40	2	2	0	19	0	4	0	125	0	4	0	17	215
Apprch %	2.4	0	2.4	95.2	8.7	8.7	0	82.6	0	3.1	0	96.9	0	19	0	81	
Total %	0.5	0	0.5	18.6	0.9	0.9	0	8.8	0	1.9	0	58.1	0	1.9	0	7.9	

	Ruggles Street From North					Tremont Street (Route 28) From East					Whittier Street From South					Tremont Street (Route 28) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	0	0	**1**	**12**	**13**	0	0	0	4	4	0	0	0	18	18	0	0	0	1	1	36
11:45 AM	0	0	0	2	2	0	0	0	1	1	0	0	0	**36**	**36**	0	0	0	0	0	**39**
12:00 PM	**1**																				
12:15 PM	**0**	**0**	**0**	**3**	**3**	**1**	**2**	**0**	**7**	**10**	0	**1**	**0**	**15**	**16**	**0**	**1**	0	**2**	**3**	32
Total Volume	1	0	1	18	20	1	2	0	15	18	0	1	0	83	84	0	1	0	4	5	127
% App. Total	5	0	5	90		5.6	11.1	0	83.3		0	1.2	0	98.8		0	20	0	80		
PHF	.250	.000	.250	.375	.385	.250	.250	.000	.536	.450	.000	.250	.000	.576	.583	.000	.250	.000	.500	.417	.814

N/S: Ruggles Street/ Whittier Street
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

PRECISION
D A T A
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File Name : 122774 C
Site Code : 23155.00
Start Date : 1/28/2012
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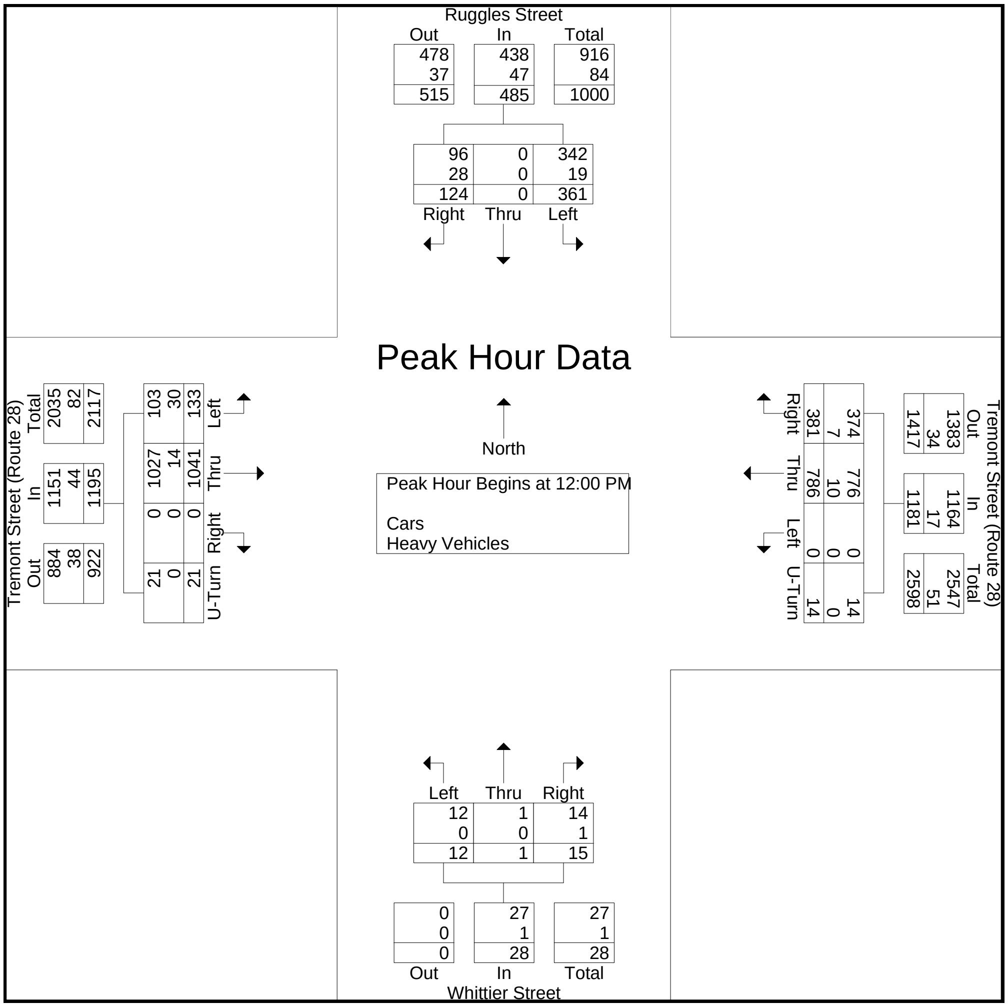
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 12:00 PM

	Ruggles Street From North				Tremont Street (Route 28) From East					Whittier Street From South				Tremont Street (Route 28) From West					
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
12:00 PM	33	0	90	123	94	187	0	2	283	2	0	2	4	0	257	**38**	4	299	709
12:15 PM	**35**	0	90	**125**	87	196	0	**8**	291	**8**	**1**	2	**11**	0	262	36	5	**303**	730
12:30 PM	26	0	89	115	99	179	0	2	280	3	0	1	4	0	**263**	27	**8**	298	697
12:45 PM	30	0	**92**	122	**101**	**224**	0	2	**327**	2	0	**7**							**753**
Total Volume	124	0	361	485	381	786	0	14	1181	15	1	12	28	0	1041	133	21	1195	2889
% App. Total	25.6	0	74.4		32.3	66.6	0	1.2		53.6	3.6	42.9		0	87.1	11.1	1.8		
PHF	.886	.000	.981	.970	.943	.877	.000	.438	.903	.469	.250	.429	.636	.000	.990	.875	.656	.986	.959
Cars	96	0	342	438	374	776	0	14	1164	14	1	12	27	0	1027	103	21	1151	2780
% Cars	77.4	0	94.7	90.3	98.2	98.7	0	100	98.6	93.3	100	100	96.4	0	98.7	77.4	100	96.3	96.2
Heavy Vehicles	28	0	19	47	7	10	0	0	17	1	0	0	1	0	14	30	0	44	109
% Heavy Vehicles	22.6	0	5.3	9.7	1.8	1.3	0	0	1.4	6.7	0	0	3.6	0	1.3	22.6	0	3.7	3.8



N/S: Columbus Avenue/ Ruggles Street
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

File Name : 122774 D
Site Code : 23155.00
Start Date : 1/28/2012
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	Columbus Avenue From North			Tremont Street (Route 28) From East			Ruggles Street From South			Tremont Street (Route 28) From West			
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Int. Total
11:00 AM	8	0	0	0	275	0	0	0	0	18	271	0	572
11:15 AM	8	0	0	0	266	0	0	0	0	19	302	0	595
11:30 AM	3	0	0	0	277	0	0	0	0	26	319	0	625
11:45 AM	11	0	0	0	284	0	0	0	0	21	331	0	647
Total	30	0	0	0	1102	0	0	0	0	84	1223	0	2439
12:00 PM	12	0	0	0	280	0	0	0	0	20	335	0	647
12:15 PM	12	0	0	0	270	0	0	0	0	31	335	0	648
12:30 PM	8	0	0	0	272	0	0	0	0	20	336	0	636
12:45 PM	10	0	0	0	312	0	0	0	0	21	337	0	680
Total	42	0	0	0	1134	0	0	0	0	92	1343	0	2611
Grand Total	72	0	0	0	2236	0	0	0	0	176	2566	0	5050
Apprch %	100	0	0	0	100	0	0	0	0	6.4	93.6	0	
Total %	1.4	0	0	0	44.3	0	0	0	0	3.5	50.8	0	
Cars	71	0	0	0	2201	0	0	0	0	168	2504	0	4944
% Cars	98.6	0	0	0	98.4	0	0	0	0	95.5	97.6	0	97.9
Heavy Vehicles	1	0	0	0	35	0	0	0	0	8	62	0	106
% Heavy Vehicles	1.4	0	0	0	1.6	0	0	0	0	4.5	2.4	0	2.1

	Columbus Avenue From North				Tremont Street (Route 28) From East				Ruggles Street From South				Tremont Street (Route 28) From West				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 12:00 PM																	
12:00 PM	**12**	0	0	**12**	0	280	0	280	0	0	0	0	20	335	0	355	647
12:15 PM	12	0	0	12	0	270	0	270	0	0	0	0	**31**	335	0	**366**	648
12:30 PM	8	0	0	8	0	272	0	272	0	0	0	0	20	336	0	356	636
12:45 PM	10	0	0	10	0	**312**	0	**312**	0	0	0	0	21	**337**	0	358	**680**
Total Volume	42	0	0	42	0	1134	0	1134	0	0	0	0	92	1343	0	1435	2611
% App. Total	100	0	0		0	100	0		0	0	0		6.4	93.6	0		
PHF	.875	.000	.000	.875	.000	.909	.000	.909	.000	.000	.000	.000	.742	.996	.000	.980	.960
Cars	41	0	0	41	0	1119	0	1119	0	0	0	0	88	1313	0	1401	2561
% Cars	97.6	0	0	97.6	0	98.7	0	98.7	0	0	0	0	95.7	97.8	0	97.6	98.1
Heavy Vehicles	1	0	0	1	0	15	0	15	0	0	0	0	4	30	0	34	50
% Heavy Vehicles	2.4	0	0	2.4	0	1.3	0	1.3	0	0	0	0	4.3	2.2	0	2.4	1.9

N/S: Columbus Avenue/ Ruggles Street
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

PRECISION
DATA
INDUSTRIES, LLC
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File Name : 122774 D
Site Code : 23155.00
Start Date : 1/28/2012
Page No : 1

Groups Printed- Cars

	Columbus Avenue From North			Tremont Street (Route 28) From East			Ruggles Street From South			Tremont Street (Route 28) From West			
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Int. Total
11:00 AM	8	0	0	0	268	0	0	0	0	18	263	0	557
11:15 AM	8	0	0	0	264	0	0	0	0	18	297	0	587
11:30 AM	3	0	0	0	272	0	0	0	0	25	307	0	607
11:45 AM	11	0	0	0	278	0	0	0	0	19	324	0	632
Total	30	0	0	0	1082	0	0	0	0	80	1191	0	2383
12:00 PM	12	0	0	0	274	0	0	0	0	20	330	0	636
12:15 PM	11	0	0	0	268	0	0	0	0	29	328	0	636
12:30 PM	8	0	0	0	269	0	0	0	0	19	328	0	624
12:45 PM	10	0	0	0	308	0	0	0	0	20	327	0	665
Total	41	0	0	0	1119	0	0	0	0	88	1313	0	2561
Grand Total	71	0	0	0	2201	0	0	0	0	168	2504	0	4944
Apprch %	100	0	0	0	100	0	0	0	0	6.3	93.7	0	
Total %	1.4	0	0	0	44.5	0	0	0	0	3.4	50.6	0	

	Columbus Avenue From North				Tremont Street (Route 28) From East				Ruggles Street From South				Tremont Street (Route 28) From West				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 12:00 PM																	
12:00 PM	**12**	0	0	**12**	0	274	0	274	0	0	0	0	20	**330**	0	350	636
12:15 PM	11	0	0	11	0	268	0	268	0	0	0	0	**29**	328	0	**357**	636
12:30 PM	8	0	0	8	0	269	0	269	0	0	0	0	19	328	0	347	624
12:45 PM	10	0	0	10	0	**308**	0	**308**	0	0	0	0	20	327	0	347	**665**
Total Volume	41	0	0	41	0	1119	0	1119	0	0	0	0	88	1313	0	1401	2561
% App. Total	100	0	0		0	100	0		0	0	0		6.3	93.7	0		
PHF	.854	.000	.000	.854	.000	.908	.000	.908	.000	.000	.000	.000	.759	.995	.000	.981	.963

N/S: Columbus Avenue/ Ruggles Street
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

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File Name : 122774 D
Site Code : 23155.00
Start Date : 1/28/2012
Page No : 1

Groups Printed- Heavy Vehicles

	Columbus Avenue From North			Tremont Street (Route 28) From East			Ruggles Street From South			Tremont Street (Route 28) From West			
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Int. Total
11:00 AM	0	0	0	0	7	0	0	0	0	0	8	0	15
11:15 AM	0	0	0	0	2	0	0	0	0	1	5	0	8
11:30 AM	0	0	0	0	5	0	0	0	0	1	12	0	18
11:45 AM	0	0	0	0	6	0	0	0	0	2	7	0	15
Total	0	0	0	0	20	0	0	0	0	4	32	0	56
12:00 PM	0	0	0	0	6	0	0	0	0	0	5	0	11
12:15 PM	1	0	0	0	2	0	0	0	0	2	7	0	12
12:30 PM	0	0	0	0	3	0	0	0	0	1	8	0	12
12:45 PM	0	0	0	0	4	0	0	0	0	1	10	0	15
Total	1	0	0	0	15	0	0	0	0	4	30	0	50
Grand Total	1	0	0	0	35	0	0	0	0	8	62	0	106
Apprch %	100	0	0	0	100	0	0	0	0	11.4	88.6	0	
Total %	0.9	0	0	0	33	0	0	0	0	7.5	58.5	0	

	Columbus Avenue From North				Tremont Street (Route 28) From East				Ruggles Street From South				Tremont Street (Route 28) From West				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 11:00 AM																	
11:00 AM	0	0	0	0	0	**7**	0	**7**	0	0	0	0	0	8	0	8	15
11:15 AM	0	0	0	0	0	2	0	2	0	0	0	0	1	5	0	6	8
11:30 AM	0	0	0	0	0	5	0	5	0	0	0	0	1	**12**	0	**13**	**18**
11:45 AM	0	0	0	0	0	6	0	6	0	0	0	0	**2**	7	0	9	15
Total Volume	0	0	0	0	0	20	0	20	0	0	0	0	4	32	0	36	56
% App. Total	0	0	0		0	100	0		0	0	0		11.1	88.9	0		
PHF	.000	.000	.000	.000	.000	.714	.000	.714	.000	.000	.000	.000	.500	.667	.000	.692	.778

N/S: Columbus Avenue/ Ruggles Street
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

File Name : 122774 D
Site Code : 23155.00
Start Date : 1/28/2012
Page No : 1

Groups Printed- Peds and Bicycles

	Columbus Avenue From North				Tremont Street (Route 28) From East				Ruggles Street From South				Tremont Street (Route 28) From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
11:00 AM	0	0	0	6	0	0	0	10	0	0	0	8	1	0	0	1	26
11:15 AM	0	0	0	4	0	0	0	5	0	0	0	11	0	1	0	1	22
11:30 AM	0	0	0	10	0	0	0	16	0	0	0	18	1	0	0	0	45
11:45 AM	0	0	0	2	0	0	0	8	0	0	0	36	0	0	0	2	48
Total	0	0	0	22	0	0	0	39	0	0	0	73	2	1	0	4	141
12:00 PM	0	0	0	6	0	0	0	13	0	0	0	19	0	0	0	1	39
12:15 PM	2	0	0	6	0	1	0	15	0	0	0	7	0	0	0	8	39
12:30 PM	0	0	0	2	0	0	0	10	0	0	0	7	0	0	0	3	22
12:45 PM	0	0	0	4	0	1	0	11	0	0	0	3	0	0	0	2	21
Total	2	0	0	18	0	2	0	49	0	0	0	36	0	0	0	14	121
Grand Total	2	0	0	40	0	2	0	88	0	0	0	109	2	1	0	18	262
Apprch %	4.8	0	0	95.2	0	2.2	0	97.8	0	0	0	100	9.5	4.8	0	85.7	
Total %	0.8	0	0	15.3	0	0.8	0	33.6	0	0	0	41.6	0.8	0.4	0	6.9	

	Columbus Avenue From North					Tremont Street (Route 28) From East					Ruggles Street From South					Tremont Street (Route 28) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	0	0	0	**10**	**10**	0	0	0	**16**	**16**	0	0	0	18	18	**1**	**0**	**0**	**0**	**1**	**45**
11:45 AM	**0**	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**8**	**8**	**0**	**0**	**0**	**36**	**36**	0	0	0	2	2	**48**
12:00 PM	0	0	0	6	6	0	0	0	13	13	0	0	0	19	19	0	0	0	1	1	39
12:15 PM	**2**						**1**												**8**	**8**	39
Total Volume	2	0	0	24	26	0	1	0	52	53	0	0	0	80	80	1	0	0	11	12	171
% App. Total	7.7	0	0	92.3		0	1.9	0	98.1		0	0	0	100		8.3	0	0	91.7		
PHF	.250	.000	.000	.600	.650	.000	.250	.000	.813	.828	.000	.000	.000	.556	.556	.250	.000	.000	.344	.375	.891

N/S: Columbus Avenue/ Ruggles Street
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

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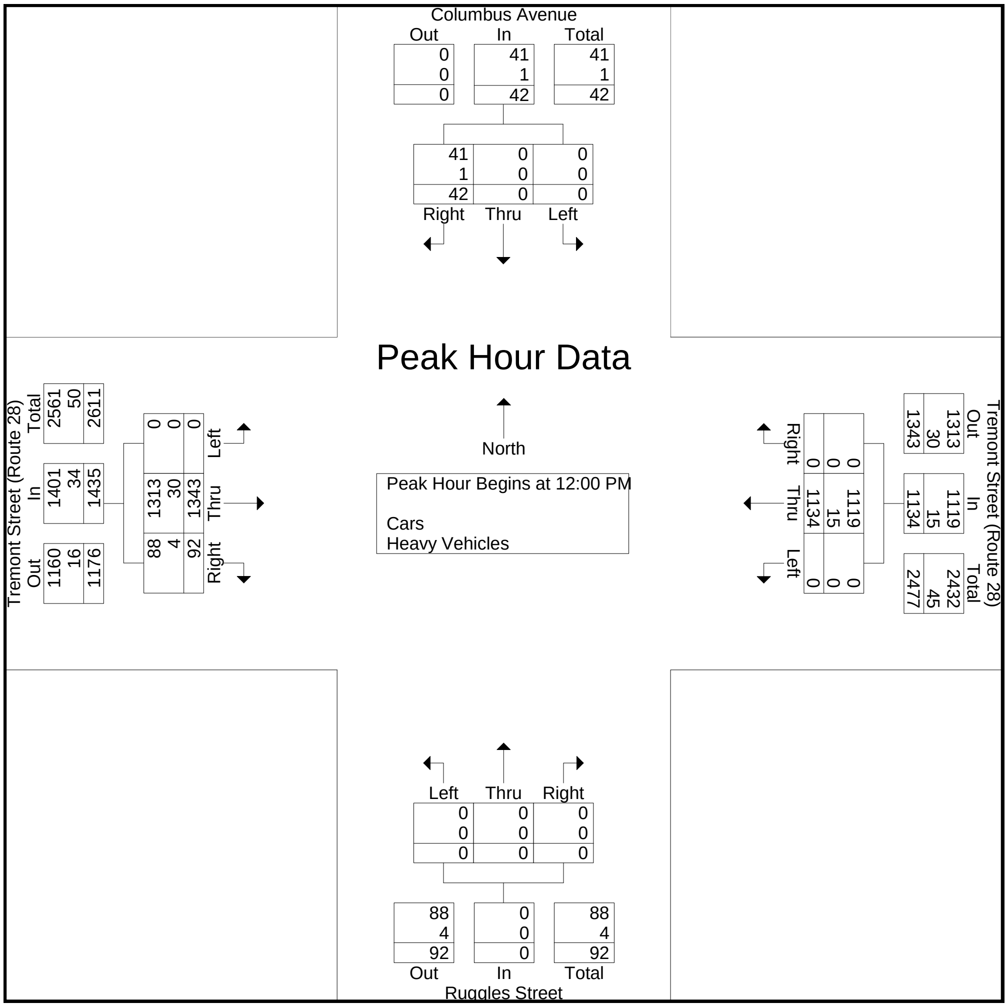
	Columbus Avenue From North				Tremont Street (Route 28) From East				Ruggles Street From South				Tremont Street (Route 28) From West				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 12:00 PM																	
12:00 PM	**12**	0	0	**12**	0	280	0	280	0	0	0	0	20	335	0	355	647
12:15 PM	12	0	0	12	0	270	0	270	0	0	0	0	**31**	335	0	**366**	648
12:30 PM	8	0	0	8	0	272	0	272	0	0	0	0	20	336	0	356	636
12:45 PM	10	0	0	10	0	**312**	0	**312**	0	0	0	0	21	**337**	0	358	**680**
Total Volume	42	0	0	42	0	1134	0	1134	0	0	0	0	92	1343	0	1435	2611
% App. Total	100	0	0		0	100	0		0	0	0		6.4	93.6	0		
PHF	.875	.000	.000	.875	.000	.909	.000	.909	.000	.000	.000	.000	.742	.996	.000	.980	.960
Cars	41	0	0	41	0	1119	0	1119	0	0	0	0	88	1313	0	1401	2561
% Cars	97.6	0	0	97.6	0	98.7	0	98.7	0	0	0	0	95.7	97.8	0	97.6	98.1
Heavy Vehicles	1	0	0	1	0	15	0	15	0	0	0	0	4	30	0	34	50
% Heavy Vehicles	2.4	0	0	2.4	0	1.3	0	1.3	0	0	0	0	4.3	2.2	0	2.4	1.9



N/S: Melnea Cass Boulevard
E/W:Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

File Name : 122774 E
Site Code : 23155.00
Start Date : 1/28/2012
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	Melnea Cass Boulevard From North			Tremont Street From East			Melnea Cass Boulevard (Route 28) From South			Tremont Street (Route 28) From West			
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Int. Total
11:00 AM	34	7	0	2	67	9	12	15	174	172	85	21	598
11:15 AM	21	5	0	1	83	8	14	16	162	172	99	32	613
11:30 AM	43	8	3	1	73	2	7	14	160	185	94	36	626
11:45 AM	43	14	3	1	76	2	8	22	167	180	112	38	666
Total	141	34	6	5	299	21	41	67	663	709	390	127	2503
12:00 PM	40	12	1	5	78	8	10	22	164	204	89	34	667
12:15 PM	39	12	2	5	75	8	6	19	156	205	102	28	657
12:30 PM	36	16	1	1	81	9	8	21	157	208	109	28	675
12:45 PM	44	10	1	4	89	8	16	13	182	202	98	37	704
Total	159	50	5	15	323	33	40	75	659	819	398	127	2703
Grand Total	300	84	11	20	622	54	81	142	1322	1528	788	254	5206
Apprch %	75.9	21.3	2.8	2.9	89.4	7.8	5.2	9.2	85.6	59.5	30.7	9.9	
Total %	5.8	1.6	0.2	0.4	11.9	1	1.6	2.7	25.4	29.4	15.1	4.9	
Cars	298	80	10	11	614	53	79	127	1294	1490	773	248	5077
% Cars	99.3	95.2	90.9	55	98.7	98.1	97.5	89.4	97.9	97.5	98.1	97.6	97.5
Heavy Vehicles	2	4	1	9	8	1	2	15	28	38	15	6	129
% Heavy Vehicles	0.7	4.8	9.1	45	1.3	1.9	2.5	10.6	2.1	2.5	1.9	2.4	2.5

	Melnea Cass Boulevard From North				Tremont Street From East				Melnea Cass Boulevard (Route 28) From South				Tremont Street (Route 28) From West				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 12:00 PM																	
12:00 PM	40	12	1	53	**5**	78	8	91	10	**22**	164	196	204	89	34	327	667
12:15 PM	39	12	**2**	53	5	75	8	88	6	19	156	181	205	102	28	335	657
12:30 PM	36	**16**	1	53	1	81	**9**	91	8	21	157	186	**208**	**109**	28	**345**	675
12:45 PM	**44**	10	1	**55**	4	**89**	8	**101**	**16**	13	**182**	**211**	202	98	**37**	337	**704**
Total Volume	159	50	5	214	15	323	33	371	40	75	659	774	819	398	127	1344	2703
% App. Total	74.3	23.4	2.3		4	87.1	8.9		5.2	9.7	85.1		60.9	29.6	9.4		
PHF	.903	.781	.625	.973	.750	.907	.917	.918	.625	.852	.905	.917	.984	.913	.858	.974	.960
Cars	159	49	4	212	9	319	32	360	40	71	649	760	796	394	125	1315	2647
% Cars	100	98.0	80.0	99.1	60.0	98.8	97.0	97.0	100	94.7	98.5	98.2	97.2	99.0	98.4	97.8	97.9
Heavy Vehicles	0	1	1	2	6	4	1	11	0	4	10	14	23	4	2	29	56
% Heavy Vehicles	0	2.0	20.0	0.9	40.0	1.2	3.0	3.0	0	5.3	1.5	1.8	2.8	1.0	1.6	2.2	2.1

N/S: Melnea Cass Boulevard
E/W:Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

PRECISION
DATA
INDUSTRIES, LLC
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File Name : 122774 E
Site Code : 23155.00
Start Date : 1/28/2012
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Groups Printed- Cars

	Melnea Cass Boulevard From North			Tremont Street From East			Melnea Cass Boulevard (Route 28) From South			Tremont Street (Route 28) From West			
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Int. Total
11:00 AM	34	7	0	1	64	9	12	11	168	166	84	21	577
11:15 AM	21	5	0	0	83	8	14	14	160	171	97	31	604
11:30 AM	42	7	3	0	72	2	7	12	156	180	88	34	603
11:45 AM	42	12	3	1	76	2	6	19	161	177	110	37	646
Total	139	31	6	2	295	21	39	56	645	694	379	123	2430
12:00 PM	40	12	0	3	77	8	10	20	159	199	89	34	651
12:15 PM	39	12	2	3	74	8	6	18	155	201	100	27	645
12:30 PM	36	16	1	0	80	9	8	20	155	201	108	28	662
12:45 PM	44	9	1	3	88	7	16	13	180	195	97	36	689
Total	159	49	4	9	319	32	40	71	649	796	394	125	2647
Grand Total	298	80	10	11	614	53	79	127	1294	1490	773	248	5077
Apprch %	76.8	20.6	2.6	1.6	90.6	7.8	5.3	8.5	86.3	59.3	30.8	9.9	
Total %	5.9	1.6	0.2	0.2	12.1	1	1.6	2.5	25.5	29.3	15.2	4.9	

	Melnea Cass Boulevard From North				Tremont Street From East				Melnea Cass Boulevard (Route 28) From South				Tremont Street (Route 28) From West				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 12:00 PM																	
12:00 PM	40	12	0	52	**3**	77	8	88	10	**20**	159	189	199	89	34	322	651
12:15 PM	39	12	**2**	53	3	74	8	85	6	18	155	179	**201**	100	27	328	645
12:30 PM	36	**16**	1	53	0	80	**9**	89	8	20	155	183	201	**108**	28	**337**	662
12:45 PM	**44**	9	1	**54**	3	**88**	7	**98**	**16**	13	**180**	**209**	195	97	**36**	328	**689**
Total Volume	159	49	4	212	9	319	32	360	40	71	649	760	796	394	125	1315	2647
% App. Total	75	23.1	1.9		2.5	88.6	8.9		5.3	9.3	85.4		60.5	30	9.5		
PHF	.903	.766	.500	.981	.750	.906	.889	.918	.625	.888	.901	.909	.990	.912	.868	.976	.960

N/S: Melnea Cass Boulevard
E/W:Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

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Groups Printed- Heavy Vehicles

	Melnea Cass Boulevard From North			Tremont Street From East			Melnea Cass Boulevard (Route 28) From South			Tremont Street (Route 28) From West			
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Int. Total
11:00 AM	0	0	0	1	3	0	0	4	6	6	1	0	21
11:15 AM	0	0	0	1	0	0	0	2	2	1	2	1	9
11:30 AM	1	1	0	1	1	0	0	2	4	5	6	2	23
11:45 AM	1	2	0	0	0	0	2	3	6	3	2	1	20
Total	2	3	0	3	4	0	2	11	18	15	11	4	73
12:00 PM	0	0	1	2	1	0	0	2	5	5	0	0	16
12:15 PM	0	0	0	2	1	0	0	1	1	4	2	1	12
12:30 PM	0	0	0	1	1	0	0	1	2	7	1	0	13
12:45 PM	0	1	0	1	1	1	0	0	2	7	1	1	15
Total	0	1	1	6	4	1	0	4	10	23	4	2	56
Grand Total	2	4	1	9	8	1	2	15	28	38	15	6	129
Apprch %	28.6	57.1	14.3	50	44.4	5.6	4.4	33.3	62.2	64.4	25.4	10.2	
Total %	1.6	3.1	0.8	7	6.2	0.8	1.6	11.6	21.7	29.5	11.6	4.7	

	Melnea Cass Boulevard From North				Tremont Street From East				Melnea Cass Boulevard (Route 28) From South				Tremont Street (Route 28) From West				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 11:00 AM																	
11:00 AM	0	0	0	0	**1**	**3**	0	**4**	0	**4**	**6**	10	**6**	1	0	7	21
11:15 AM	0	0	0	0	1	0	0	1	0	2	2	4	1	2	1	4	9
11:30 AM	**1**	1	0	2	1	1	0	2	0	2	4	6	5	**6**	**2**	**13**	**23**
11:45 AM	1	**2**	0	**3**	0	0	0	0	**2**	3	6	**11**	3	2	1	6	20
Total Volume	2	3	0	5	3	4	0	7	2	11	18	31	15	11	4	30	73
% App. Total	40	60	0		42.9	57.1	0		6.5	35.5	58.1		50	36.7	13.3		
PHF	.500	.375	.000	.417	.750	.333	.000	.438	.250	.688	.750	.705	.625	.458	.500	.577	.793

N/S: Melnea Cass Boulevard
E/W:Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

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Groups Printed- Peds and Bicycles

	Melnea Cass Boulevard From North				Tremont Street From East				Melnea Cass Boulevard (Route 28) From South				Tremont Street (Route 28) From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
11:00 AM	0	0	0	5	0	0	0	1	0	0	0	1	0	0	0	2	9
11:15 AM	0	0	0	6	0	0	0	1	0	0	0	1	1	0	0	2	11
11:30 AM	0	0	0	8	0	0	0	3	0	0	0	4	0	0	0	1	16
11:45 AM	0	0	0	5	0	0	0	5	0	0	0	10	0	0	0	2	22
Total	0	0	0	24	0	0	0	10	0	0	0	16	1	0	0	7	58
12:00 PM	0	0	0	2	0	0	0	2	0	0	0	2	0	0	0	0	6
12:15 PM	0	0	0	5	0	0	0	1	0	0	0	0	0	0	0	1	7
12:30 PM	0	0	0	4	0	0	0	2	0	0	0	2	1	1	0	1	11
12:45 PM	0	0	0	5	0	0	0	4	0	0	0	2	0	0	0	0	11
Total	0	0	0	16	0	0	0	9	0	0	0	6	1	1	0	2	35
Grand Total	0	0	0	40	0	0	0	19	0	0	0	22	2	1	0	9	93
Apprch %	0	0	0	100	0	0	0	100	0	0	0	100	16.7	8.3	0	75	
Total %	0	0	0	43	0	0	0	20.4	0	0	0	23.7	2.2	1.1	0	9.7	

	Melnea Cass Boulevard From North					Tremont Street From East					Melnea Cass Boulevard (Route 28) From South					Tremont Street (Route 28) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:00 AM																					
11:00 AM	0	0	0	5	5	0	0	0	1	1	0	0	0	1	1	0	0	0	**2**	**2**	**9**
11:15 AM	**0**	**0**	**0**	**6**	**6**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**2**	**3**	11
11:30 AM	0	0	0	**8**	**8**	0	0	0	3	3	0	0	0	4	4	0	0	0	1	1	16
11:45 AM	0	0	0	5	5	0	0	0	**5**	**5**	0	0	0	**10**	**10**	0	0	0	2	2	**22**
Total Volume	0	0	0	24	24	0	0	0	10	10	0	0	0	16	16	1	0	0	7	8	58
% App. Total	0	0	0	100		0	0	0	100		0	0	0	100		12.5	0	0	87.5		
PHF	.000	.000	.000	.750	.750	.000	.000	.000	.500	.500	.000	.000	.000	.400	.400	.250	.000	.000	.875	.667	.659

N/S: Melnea Cass Boulevard
E/W:Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

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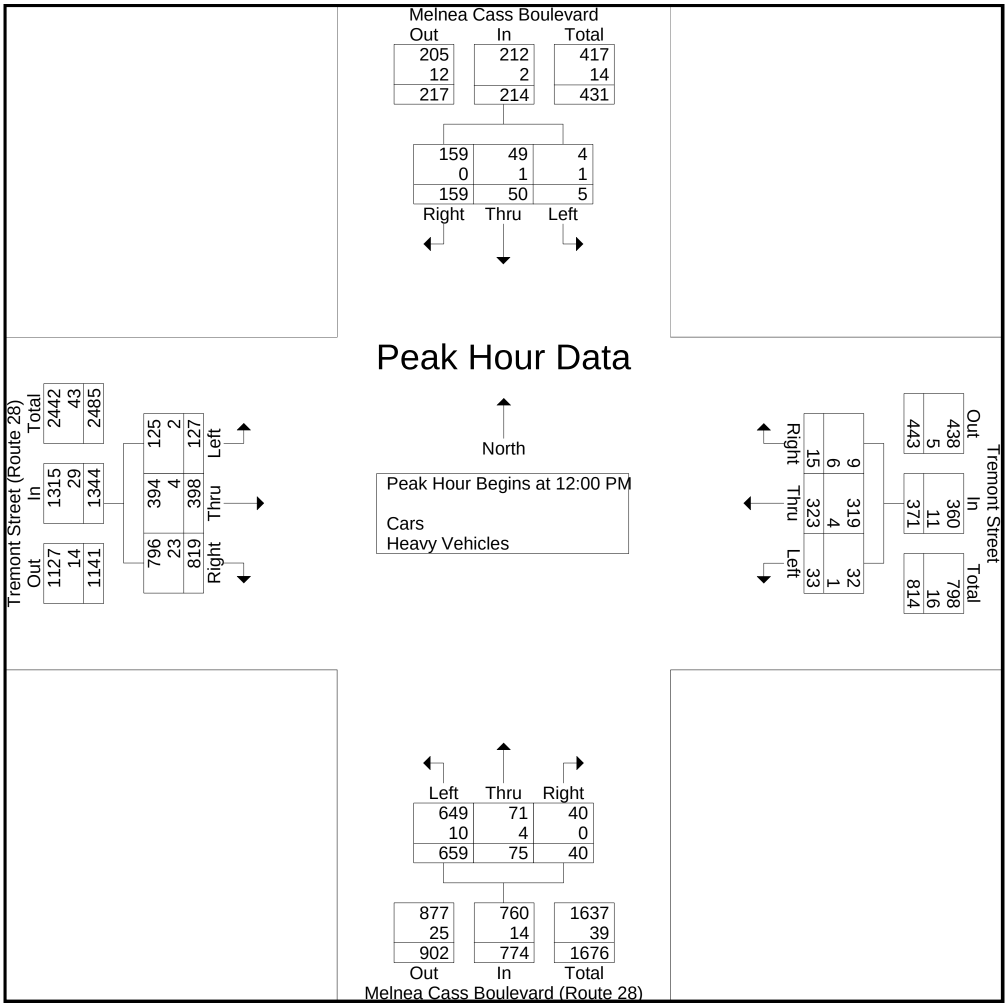
	Melnea Cass Boulevard From North				Tremont Street From East				Melnea Cass Boulevard (Route 28) From South				Tremont Street (Route 28) From West				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 12:00 PM																	
12:00 PM	40	12	1	53	**5**	78	8	91	10	**22**	164	196	204	89	34	327	667
12:15 PM	39	12	**2**	53	5	75	8	88	6	19	156	181	205	102	28	335	657
12:30 PM	36	**16**	1	53	1	81	**9**	91	8	21	157	186	**208**	**109**	28	**345**	675
12:45 PM	**44**	10	1	**55**	4	**89**	8	**101**	**16**	13	**182**	**211**	202	98	**37**	337	**704**
Total Volume	159	50	5	214	15	323	33	371	40	75	659	774	819	398	127	1344	2703
% App. Total	74.3	23.4	2.3		4	87.1	8.9		5.2	9.7	85.1		60.9	29.6	9.4		
PHF	.903	.781	.625	.973	.750	.907	.917	.918	.625	.852	.905	.917	.984	.913	.858	.974	.960
Cars	159	49	4	212	9	319	32	360	40	71	649	760	796	394	125	1315	2647
% Cars	100	98.0	80.0	99.1	60.0	98.8	97.0	97.0	100	94.7	98.5	98.2	97.2	99.0	98.4	97.8	97.9
Heavy Vehicles	0	1	1	2	6	4	1	11	0	4	10	14	23	4	2	29	56
% Heavy Vehicles	0	2.0	20.0	0.9	40.0	1.2	3.0	3.0	0	5.3	1.5	1.8	2.8	1.0	1.6	2.2	2.1



N/S: Prentis Street/ Driveway
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

PRECISION
DATA
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File Name : 122774 F
Site Code : 23155.00
Start Date : 1/28/2012
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Groups Printed- Cars - Heavy Vehicles

	Tremont Street (Route 28) From East			Driveway From South			Tremont Street (Route 28) From West			
Start Time	Thru	Left	Peds	Right	Left	Peds	Right	Thru	Peds	Int. Total
11:00 AM	0	0	0	14	0	0	26	0	0	40
11:15 AM	0	0	0	16	0	0	17	0	0	33
11:30 AM	0	0	0	22	0	0	19	0	0	41
11:45 AM	0	0	0	22	0	0	15	0	0	37
Total	0	0	0	74	0	0	77	0	0	151
12:00 PM	0	1	0	22	0	0	10	0	0	33
12:15 PM	0	0	0	44	0	0	16	0	0	60
12:30 PM	0	0	0	24	0	0	11	0	0	35
12:45 PM	0	0	0	30	0	0	9	0	0	39
Total	0	1	0	120	0	0	46	0	0	167
Grand Total	0	1	0	194	0	0	123	0	0	318
Apprch %	0	100	0	100	0	0	100	0	0	
Total %	0	0.3	0	61	0	0	38.7	0	0	
Cars	0	1	0	194	0	0	123	0	0	318
% Cars	0	100	0	100	0	0	100	0	0	100
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0

	Tremont Street (Route 28) From East				Driveway From South				Tremont Street (Route 28) From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total

Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 11:30 AM

11:30 AM	0	0	0	0	22	0	0	22	**19**	0	0	**19**	41
11:45 AM	0	0	0	0	22	0	0	22	15	0	0	15	37
12:00 PM	0	**1**		**1**	22	0	0	22	10	0	0	10	33
12:15 PM	0	0	0	0	**44**	0	0	**44**	16	0	0	16	**60**
Total Volume	0	1	0	1	110	0	0	110	60	0	0	60	171
% App. Total	0	100	0		100	0	0		100	0	0		
PHF	.000	.250	.000	.250	.625	.000	.000	.625	.789	.000	.000	.789	.713
Cars	0	1	0	1	110	0	0	110	60	0	0	60	171
% Cars	0	100	0	100	100	0	0	100	100	0	0	100	100
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0

N/S: Prentis Street/ Driveway
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

PRECISION
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Start Date : 1/28/2012
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Groups Printed- Cars

	Tremont Street (Route 28) From East			Driveway From South			Tremont Street (Route 28) From West			
Start Time	Thru	Left	Peds	Right	Left	Peds	Right	Thru	Peds	Int. Total
11:00 AM	0	0	0	14	0	0	26	0	0	40
11:15 AM	0	0	0	16	0	0	17	0	0	33
11:30 AM	0	0	0	22	0	0	19	0	0	41
11:45 AM	0	0	0	22	0	0	15	0	0	37
Total	0	0	0	74	0	0	77	0	0	151
12:00 PM	0	1	0	22	0	0	10	0	0	33
12:15 PM	0	0	0	44	0	0	16	0	0	60
12:30 PM	0	0	0	24	0	0	11	0	0	35
12:45 PM	0	0	0	30	0	0	9	0	0	39
Total	0	1	0	120	0	0	46	0	0	167
Grand Total	0	1	0	194	0	0	123	0	0	318
Apprch %	0	100	0	100	0	0	100	0	0	
Total %	0	0.3	0	61	0	0	38.7	0	0	

	Tremont Street (Route 28) From East				Driveway From South				Tremont Street (Route 28) From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 11:30 AM													
11:30 AM	0	0	0	0	22	0	0	22	**19**	0	0	**19**	41
11:45 AM	0	0	0	0	22	0	0	22	15	0	0	15	37
12:00 PM	0	**1**		**1**	22	0	0	22	10	0	0	10	33
12:15 PM	0	0	0	0	**44**	0	0	**44**	16	0	0	16	**60**
Total Volume	0	1	0	1	110	0	0	110	60	0	0	60	171
% App. Total	0	100	0		100	0	0		100	0	0		
PHF	.000	.250	.000	.250	.625	.000	.000	.625	.789	.000	.000	.789	.713

N/S: Prentis Street/ Driveway
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

File Name : 122774 F
Site Code : 23155.00
Start Date : 1/28/2012

Groups Printed- Heavy Vehicles

	Tremont Street (Route 28) From East			Driveway From South			Tremont Street (Route 28) From West			
Start Time	Thru	Left	Peds	Right	Left	Peds	Right	Thru	Peds	Int. Total
11:00 AM	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	0	0	0	0
12:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0	0	0	0	0	0	
Total %										

	Tremont Street (Route 28) From East				Driveway From South				Tremont Street (Route 28) From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 11:00 AM													
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

N/S: Prentis Street/ Driveway
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

File Name : 122774 F
Site Code : 23155.00
Start Date : 1/28/2012
Page No : 1

Groups Printed- Peds and Bicycles

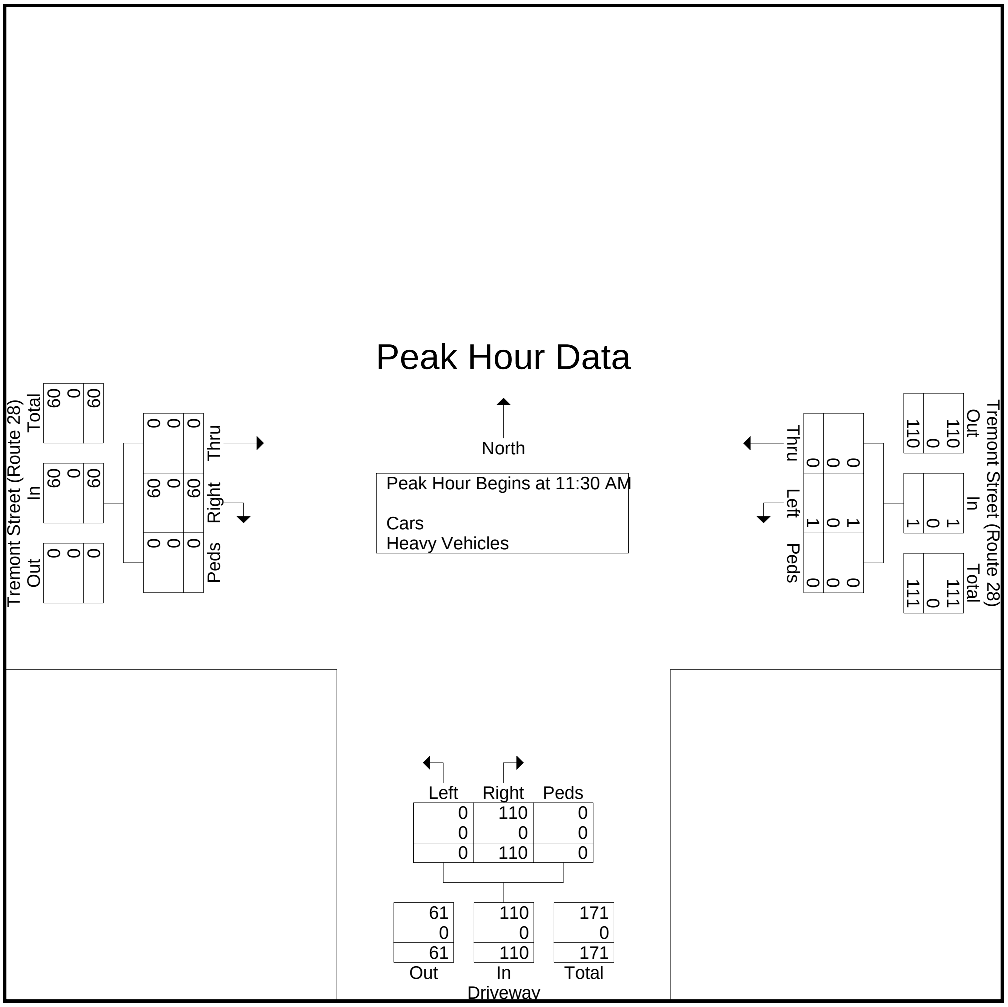
	Tremont Street (Route 28) From East			Driveway From South			Tremont Street (Route 28) From West			
Start Time	Thru	Left	Peds	Right	Left	Peds	Right	Thru	Peds	Int. Total
11:00 AM	0	0	0	0	0	31	0	0	0	31
11:15 AM	0	0	0	0	0	36	0	0	0	36
11:30 AM	0	0	0	0	0	70	0	0	0	70
11:45 AM	0	0	0	0	0	71	0	0	0	71
Total	0	0	0	0	0	208	0	0	0	208
12:00 PM	0	0	0	0	0	65	0	0	0	65
12:15 PM	0	0	0	0	0	55	0	0	0	55
12:30 PM	0	0	0	0	0	54	0	0	0	54
12:45 PM	0	0	0	0	0	41	0	0	0	41
Total	0	0	0	0	0	215	0	0	0	215
Grand Total	0	0	0	0	0	423	0	0	0	423
Apprch %	0	0	0	0	0	100	0	0	0	
Total %	0	0	0	0	0	100	0	0	0	

	Tremont Street (Route 28) From East				Driveway From South				Tremont Street (Route 28) From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 11:30 AM													
11:30 AM	0	0	0	0	0	0	70	70	0	0	0	0	70
11:45 AM	0	0	0	0	0	0	**71**	**71**	0	0	0	0	**71**
12:00 PM	0	0	0	0	0	0	65	65	0	0	0	0	65
12:15 PM	0	0	0	0	0	0	55	55	0	0	0	0	55
Total Volume	0	0	0	0	0	0	261	261	0	0	0	0	261
% App. Total	0	0	0		0	0	100		0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.919	.919	.000	.000	.000	.000	.919

N/S: Prentis Street/ Driveway
E/W: Tremont Street (Route 28)
City, State: Roxbury, MA
Client: BSC Group, Inc/ J. Lunsford

File Name : 122774 F
Site Code : 23155.00
Start Date : 1/28/2012
Page No : 1

	Tremont Street (Route 28) From East				Driveway From South				Tremont Street (Route 28) From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 11:30 AM													
11:30 AM	0	0	0	0	22	0	0	22	**19**	0	0	**19**	41
11:45 AM	0	0	0	0	22	0	0	22	15	0	0	15	37
12:00 PM	0	**1**		**1**	22	0	0	22	10	0	0	10	33
12:15 PM	0	0	0	0	**44**	0	0	**44**	16	0	0	16	**60**
Total Volume	0	1	0	1	110	0	0	110	60	0	0	60	171
% App. Total	0	100	0		100	0	0		100	0	0		
PHF	.000	.250	.000	.250	.625	.000	.000	.625	.789	.000	.000	.789	.713
Cars	0	1	0	1	110	0	0	110	60	0	0	60	171
% Cars	0	100	0	100	100	0	0	100	100	0	0	100	100
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0



PRECISION
DATA
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Office: 508.481.3999 Fax: 508.545.1234
Email: datarequests@pdillc.com

N/S: Ruggles Street/ Whittier Street
E/W: Tremont Street
City, State: Boston, MA
Client: HSH/ J. SanClemente

File Name : 123026 E
Site Code : 2011046_
Start Date : 9/25/2012
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	Ruggles Street From North				**Tremont Street From East**				**Whittier Street From South**				**Tremont Street From West**				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
07:00 AM	19	0	108	0	134	165	0	1	4	9	6	0	0	267	49	0	762
07:15 AM	43	0	121	0	134	172	0	0	3	10	9	0	0	310	49	0	851
07:30 AM	35	0	157	0	153	201	0	4	4	12	7	0	0	309	39	0	921
07:45 AM	26	0	135	0	119	177	0	0	1	8	14	0	0	334	51	0	865
Total	123	0	521	0	540	715	0	5	12	39	36	0	0	1220	188	0	3399
08:00 AM	21	0	113	0	106	196	0	0	11	2	4	0	0	351	60	0	864
08:15 AM	29	0	87	0	113	158	0	3	5	3	4	0	0	341	33	0	776
08:30 AM	27	0	100	0	99	170	0	3	5	7	8	0	0	339	64	1	823
08:45 AM	23	0	105	0	121	180	0	1	3	4	12	0	0	310	60	0	819
Total	100	0	405	0	439	704	0	7	24	16	28	0	0	1341	217	1	3282
Grand Total	223	0	926	0	979	1419	0	12	36	55	64	0	0	2561	405	1	6681
Apprch %	19.4	0	80.6	0	40.6	58.9	0	0.5	23.2	35.5	41.3	0	0	86.3	13.7	0	
Total %	3.3	0	13.9	0	14.7	21.2	0	0.2	0.5	0.8	1	0	0	38.3	6.1	0	
Cars	123	0	815	0	903	1303	0	11	33	50	59	0	0	2441	302	1	6041
% Cars	55.2	0	88	0	92.2	91.8	0	91.7	91.7	90.9	92.2	0	0	95.3	74.6	100	90.4
Heavy Vehicles	100	0	111	0	76	116	0	1	3	5	5	0	0	120	103	0	640
% Heavy Vehicles	44.8	0	12	0	7.8	8.2	0	8.3	8.3	9.1	7.8	0	0	4.7	25.4	0	9.6

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 07:15 AM

	Ruggles Street From North					**Tremont Street From East**					**Whittier Street From South**					**Tremont Street From West**					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
07:15 AM	**43**	**0**	**121**	**0**	**164**	**134**	**172**	**0**	**0**	**306**	**3**	**10**	**9**	**0**	**22**	**0**	**310**	**49**	**0**	**359**	**851**
07:30 AM	**35**	**0**	**157**	**0**	**192**	**153**	**201**	**0**	**4**	**358**	**4**	**12**	7	0	**23**	0	309	39	0	348	**921**
07:45 AM	**26**	**0**	**135**	**0**	**161**	**119**	**177**	**0**	**0**	**296**	**1**	**8**	**14**	**0**	**23**	**0**	**334**	**51**	**0**	**385**	**865**
08:00 AM	**21**	**0**	**113**	**0**	**134**	**106**	**196**	**0**	**0**	**302**	**11**	**2**	**4**	**0**	**17**	**0**	**351**	**60**	0	**411**	**864**
Total Volume	125	0	526	0	651	512	746	0	4	1262	19	32	34	0	85	0	1304	199	0	1503	3501
% App. Total																					
PHF	.727	.000	.838	.000	.848	.837	.928	.000	.250	.881	.432	.667	.607	.000	.924	.000	.929	.829	.000	.914	.950
Cars	75	0	479	0	554	478	687	0	4	1169	17	29	31	0	77	0	1252	146	0	1398	3198
% Cars	60.0	0	91.1	0	85.1	93.4	92.1	0	100	92.6	89.5	90.6	91.2	0	90.6	0	96.0	73.4	0	93.0	91.3
Heavy Vehicles																					
% Heavy Vehicles	40.0	0	8.9	0	14.9	6.6	7.9	0	0	7.4	10.5	9.4	8.8	0	9.4	0	4.0	26.6	0	7.0	8.7

N/S: Ruggles Street/ Whittier Street
E/W: Tremont Street
City, State: Boston, MA
Client: HSH/ J. SanClemente

PRECISION
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File Name : 123026 E
Site Code : 2011046_
Start Date : 9/25/2012
Page No : 1

Groups Printed- Cars

	Ruggles Street From North				**Tremont Street From East**				**Whittier Street From South**				**Tremont Street From West**				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
07:00 AM	8	0	92	0	120	147	0	1	4	8	6	0	0	247	37	0	670
07:15 AM	27	0	111	0	126	157	0	0	3	8	9	0	0	298	33	0	772
07:30 AM	23	0	145	0	142	186	0	4	4	11	5	0	0	293	30	0	843
07:45 AM	14	0	120	0	111	161	0	0	1	8	13	0	0	323	36	0	787
Total	72	0	468	0	499	651	0	5	12	35	33	0	0	1161	136	0	3072
08:00 AM	11	0	103	0	99	183	0	0	9	2	4	0	0	338	47	0	796
08:15 AM	16	0	70	0	97	145	0	3	5	3	4	0	0	325	23	0	691
08:30 AM	13	0	87	0	93	158	0	3	4	7	7	0	0	319	48	1	740
08:45 AM	11	0	87	0	115	166	0	0	3	3	11	0	0	298	48	0	742
Total	51	0	347	0	404	652	0	6	21	15	26	0	0	1280	166	1	2969
Grand Total	123	0	815	0	903	1303	0	11	33	50	59	0	0	2441	302	1	6041
Apprch %	13.1	0	86.9	0	40.7	58.8	0	0.5	23.2	35.2	41.5	0	0	89	11	0	
Total %	2	0	13.5	0	14.9	21.6	0	0.2	0.5	0.8	1	0	0	40.4	5	0	

	Ruggles Street From North					**Tremont Street From East**					**Whittier Street From South**					**Tremont Street From West**					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	**27**	**0**	**111**	**0**	**138**	**126**	**157**	**0**	**0**	**283**	**3**	**8**	**9**	**0**	**20**	**0**	**298**	**33**	**0**	**331**	**772**
07:30 AM	**23**	**0**	**145**	**0**	**168**	**142**	**186**	**0**	**4**	**332**	**4**	**11**	5	0	20	0	293	30	0	323	**843**
07:45 AM	**14**	**0**	**120**	**0**	**134**	**111**	**161**	**0**	**0**	**272**	**1**	**8**	**13**	**0**	**22**	0	323	36	0	359	787
08:00 AM	11	0	103	0	114	99	183	0	0	282	**9**						**338**	**47**	0	**385**	
Total Volume	75	0	479	0	554	478	687	0	4	1169	17	29	31	0	77	0	1252	146	0	1398	3198
% App. Total																					
PHF	.694	.000	.826	.000	.824	.842	.923	.000	.250	.880	.472	.659	.596	.000	.875	.000	.926	.777	.000	.908	.948

N/S: Ruggles Street/ Whittier Street
E/W: Tremont Street
City, State: Boston, MA
Client: HSH/ J. SanClemente

PRECISION
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File Name : 123026 E
Site Code : 2011046_
Start Date : 9/25/2012
Page No : 1

Groups Printed- Heavy Vehicles

	Ruggles Street From North				**Tremont Street From East**				**Whittier Street From South**				**Tremont Street From West**				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
07:00 AM	11	0	16	0	14	18	0	0	0	1	0	0	0	20	12	0	92
07:15 AM	16	0	10	0	8	15	0	0	0	2	0	0	0	12	16	0	79
07:30 AM	12	0	12	0	11	15	0	0	0	1	2	0	0	16	9	0	78
07:45 AM	12	0	15	0	8	16	0	0	0	0	1	0	0	11	15	0	78
Total	51	0	53	0	41	64	0	0	0	4	3	0	0	59	52	0	327
08:00 AM	10	0	10	0	7	13	0	0	2	0	0	0	0	13	13	0	68
08:15 AM	13	0	17	0	16	13	0	0	0	0	0	0	0	16	10	0	85
08:30 AM	14	0	13	0	6	12	0	0	1	0	1	0	0	20	16	0	83
08:45 AM	12	0	18	0	6	14	0	1	0	1	1	0	0	12	12	0	77
Total	49	0	58	0	35	52	0	1	3	1	2	0	0	61	51	0	313
Grand Total	100	0	111	0	76	116	0	1	3	5	5	0	0	120	103	0	640
Apprch %	47.4	0	52.6	0	39.4	60.1	0	0.5	23.1	38.5	38.5	0	0	53.8	46.2	0	
Total %	15.6	0	17.3	0	11.9	18.1	0	0.2	0.5	0.8	0.8	0	0	18.8	16.1	0	

	Ruggles Street From North					**Tremont Street From East**					**Whittier Street From South**					**Tremont Street From West**					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	11	0	**16**	**0**	**27**	**14**	**18**	**0**	**0**	**32**	**0**	**1**	**0**	**0**	**1**	**0**	**20**	**12**	**0**	**32**	**92**
07:15 AM	**16**	**0**	**10**	**0**	**26**	**8**	**15**	**0**	**0**	**23**	**0**	**2**	0	0	2	0	12	**16**	0	28	79
07:30 AM	12	0	12	0	24	11	15	0	0	26	0	1	**2**		**3**	0	16	9	0	25	78
07:45 AM	12	0	15	0	27	8	16	0	0	24	0	0	1	0	1	0	11	15	0	26	78
Total Volume	51	0	53	0	104	41	64	0	0	105	0	4	3	0	7	0	59	52	0	111	327
% App. Total	49	0	51	0		39	61	0	0		0	57.1	42.9	0		0	53.2	46.8	0		
PHF	.797	.000	.828	.000	.963	.732	.889	.000	.000	.820	.000	.500	.375	.000	.583	.000	.738	.813	.000	.867	.889

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Groups Printed- Peds and Bikes

	Ruggles Street From North				**Tremont Street From East**				**Whittier Street From South**				**Tremont Street From West**				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	0	0	0	2	0	1	0	1	0	0	0	10	0	1	0	3	18
07:15 AM	0	0	1	0	1	0	0	4	0	0	0	8	0	2	0	0	16
07:30 AM	0	0	1	3	1	0	0	1	0	0	0	3	0	2	1	1	13
07:45 AM	0	0	2	8	0	0	0	6	0	0	0	10	0	3	0	3	32
Total	0	0	4	13	2	1	0	12	0	0	0	31	0	8	1	7	79
08:00 AM	0	0	2	0	2	0	0	2	0	0	0	3	0	0	0	0	9
08:15 AM	0	0	0	1	0	0	0	6	0	0	0	11	0	3	1	0	22
08:30 AM	0	0	4	0	0	1	0	0	0	1	0	2	0	3	1	0	12
08:45 AM	0	0	3	0	0	0	0	3	0	1	0	11	0	7	0	0	25
Total	0	0	9	1	2	1	0	11	0	2	0	27	0	13	2	0	68
Grand Total	0	0	13	14	4	2	0	23	0	2	0	58	0	21	3	7	147
Apprch %	0	0	48.1	51.9	13.8	6.9	0	79.3	0	3.3	0	96.7	0	67.7	9.7	22.6	
Total %	0	0	8.8	9.5	2.7	1.4	0	15.6	0	1.4	0	39.5	0	14.3	2	4.8	

	Ruggles Street From North					**Tremont Street From East**					**Whittier Street From South**					**Tremont Street From West**					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	0	0	2	2	0	**1**	**0**	**1**	**2**	**0**	**0**	**0**	**10**	**10**	0	1	0	**3**	4	18
07:15 AM	0	0	1	0	1	**1**	0	0	4	5	0	0	0	8	8	0	2	0	0	2	16
07:30 AM	0	0	1	3	4	1	0	0	1	2	0	0	0	3	3	0	2	**1**	1	4	13
07:45 AM	0	0	**2**	**8**	**10**	0	0	0	**6**	**6**							**3**			**6**	**32**
Total Volume	0	0	4	13	17	2	1	0	12	15	0	0	0	31	31	0	8	1	7	16	79
% App. Total	0	0	23.5	76.5		13.3	6.7	0	80		0	0	0	100		0	50	6.2	43.8		
PHF	.000	.000	.500	.406	.425	.500	.250	.000	.500	.625	.000	.000	.000	.775	.775	.000	.667	.250	.583	.667	.617

N/S: Ruggles Street/ Whittier Street
E/W: Tremont Street
City, State: Boston, MA
Client: HSH/ J. SanClemente

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File Name : 123026 E
Site Code : 2011046_
Start Date : 9/25/2012
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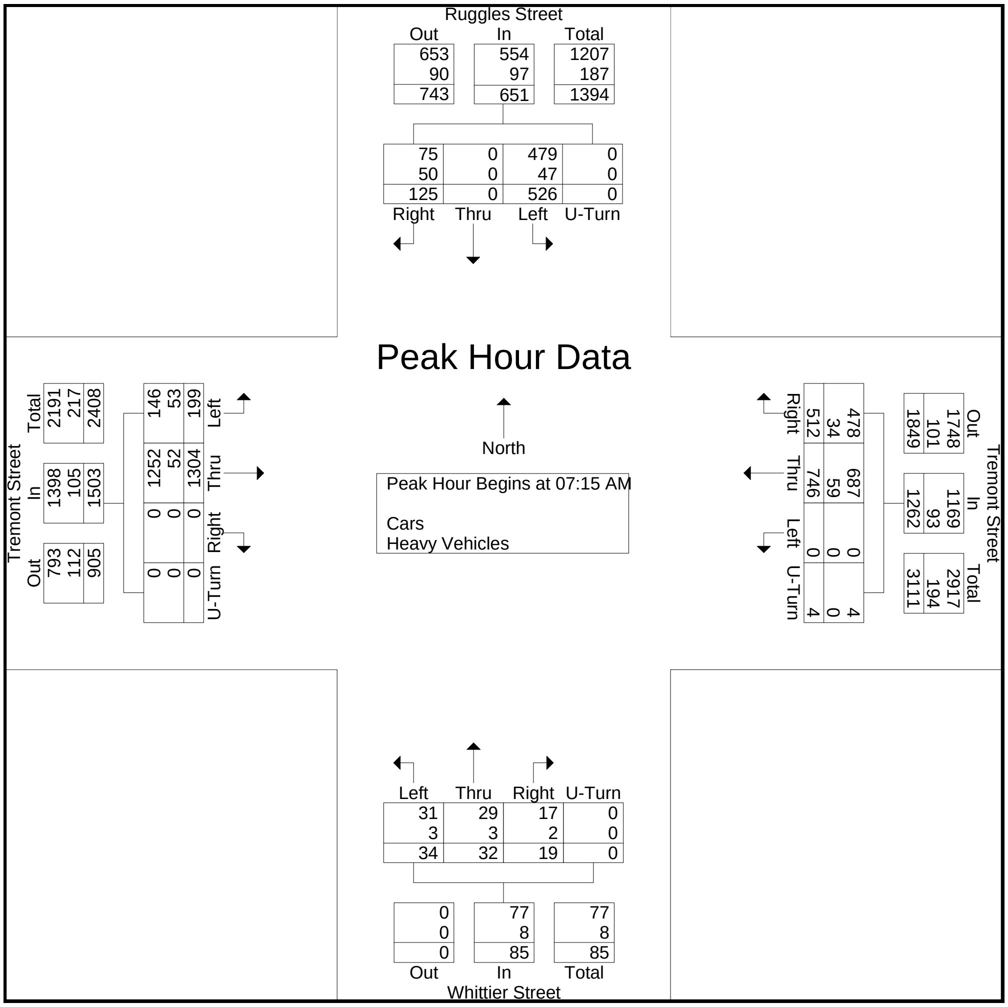
	Ruggles Street From North					Tremont Street From East					Whittier Street From South					Tremont Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	43	0	121	0	164	134	172	0	0	306	3	10	9	0	22	0	310	49	0	359	851
07:30 AM	35	0	157	0	192	153	201	0	4	358	4	12	7	0	23	0	309	39	0	348	921
07:45 AM	26	0	135	0	161	119	177	0	0	296	1	8	14	0	23	0	334	51	0	385	865
08:00 AM	21	0	113	0	134	106	196	0	0	302	11	2	4	0	17	0	351	60	0	411	864
Total Volume	125	0	526	0	651	512	746	0	4	1262	19	32	34	0	85	0	1304	199	0	1503	3501
% App. Total																					
PHF	.727	.000	.838	.000	.848	.837	.928	.000	.250	.881	.432	.667	.607	.000	.924	.000	.929	.829	.000	.914	.950
Cars	75	0	479	0	554	478	687	0	4	1169	17	29	31	0	77	0	1252	146	0	1398	3198
% Cars	60.0	0	91.1	0	85.1	93.4	92.1	0	100	92.6	89.5	90.6	91.2	0	90.6	0	96.0	73.4	0	93.0	91.3
Heavy Vehicles																					
% Heavy Vehicles	40.0	0	8.9	0	14.9	6.6	7.9	0	0	7.4	10.5	9.4	8.8	0	9.4	0	4.0	26.6	0	7.0	8.7



N/S: Ruggles Street/ Whittier Street
E/W: Tremont Street
City, State: Boston, MA
Client: HSH/ J. SanClemente

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File Name : 123026 EE
Site Code : 2011046_
Start Date : 9/25/2012
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	Ruggles Street From North				Tremont Street From East				Whittier Street From South				Tremont Street From West				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
04:00 PM	61	0	131	0	141	206	0	2	9	3	7	0	0	307	15	0	882
04:15 PM	23	0	156	0	114	195	0	0	7	1	14	0	0	282	39	0	831
04:30 PM	41	0	129	0	122	168	0	0	13	4	6	0	0	280	42	0	805
04:45 PM	34	0	143	0	147	181	0	1	6	5	10	0	0	264	30	0	821
Total	159	0	559	0	524	750	0	3	35	13	37	0	0	1133	126	0	3339
05:00 PM	33	0	126	0	99	179	0	2	9	3	5	0	0	266	58	0	780
05:15 PM	64	0	125	0	137	222	0	3	9	2	18	0	0	301	39	0	920
05:30 PM	27	0	142	0	158	200	0	1	12	9	24	0	0	262	34	0	869
05:45 PM	47	0	110	0	139	222	0	0	6	5	15	0	0	275	23	0	842
Total	171	0	503	0	533	823	0	6	36	19	62	0	0	1104	154	0	3411
Grand Total	330	0	1062	0	1057	1573	0	9	71	32	99	0	0	2237	280	0	6750
Apprch %	23.7	0	76.3	0	40.1	59.6	0	0.3	35.1	15.8	49	0	0	88.9	11.1	0	
Total %	4.9	0	15.7	0	15.7	23.3	0	0.1	1.1	0.5	1.5	0	0	33.1	4.1	0	
Cars	330	0	978	0	981	1540	0	9	67	32	98	0	0	2132	280	0	6447
% Cars	100	0	92.1	0	92.8	97.9	0	100	94.4	100	99	0	0	95.3	100	0	95.5
Heavy Vehicles	0	0	84	0	76	33	0	0	4	0	1	0	0	105	0	0	303
% Heavy Vehicles	0	0	7.9	0	7.2	2.1	0	0	5.6	0	1	0	0	4.7	0	0	4.5

	Ruggles Street From North					Tremont Street From East					Whittier Street From South					Tremont Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	33	0	126	0	159	99	179	0	2	280	9	3	5	0	17	0	266	**58**	0	324	780
05:15 PM	**64**				**189**	137	**222**		**3**	**362**							**301**			**340**	**920**
05:30 PM	**27**	**0**	**142**	**0**	**169**	**158**	200	0	1	359	**12**	**9**	**24**	**0**	**45**	0	262	34	0	296	869
05:45 PM	47	0	110	0	157	139	222	0	0	361	6	5	15	0	26	0	275	23	0	298	842
Total Volume	171	0	503	0	674	533	823	0	6	1362	36	19	62	0	117	0	1104	154	0	1258	3411
% App. Total																					
PHF	.668	.000	.886	.000	.892	.843	.927	.000	.500	.941	.750	.528	.646	.000	.650	.000	.917	.664	.000	.925	.927
Cars	171	0	468	0	639	502	812	0	6	1320	35	19	61	0	115	0	1062	154	0	1216	3290
% Cars	100	0	93.0	0	94.8	94.2	98.7	0	100	96.9	97.2	100	98.4	0	98.3	0	96.2	100	0	96.7	96.5
Heavy Vehicles																					
% Heavy Vehicles	0	0	7.0	0	5.2	5.8	1.3	0	0	3.1	2.8	0	1.6	0	1.7	0	3.8	0	0	3.3	3.5

N/S: Ruggles Street/ Whittier Street
E/W: Tremont Street
City, State: Boston, MA
Client: HSH/ J. SanClemente

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File Name : 123026 EE
Site Code : 2011046_
Start Date : 9/25/2012
Page No : 1

Groups Printed- Cars

	Ruggles Street From North				**Tremont Street From East**				**Whittier Street From South**				**Tremont Street From West**				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
04:00 PM	61	0	122	0	125	201	0	2	8	3	7	0	0	288	15	0	832
04:15 PM	23	0	141	0	101	188	0	0	7	1	14	0	0	270	39	0	784
04:30 PM	41	0	119	0	111	163	0	0	11	4	6	0	0	266	42	0	763
04:45 PM	34	0	128	0	142	176	0	1	6	5	10	0	0	246	30	0	778
Total	159	0	510	0	479	728	0	3	32	13	37	0	0	1070	126	0	3157
05:00 PM	33	0	115	0	90	173	0	2	9	3	5	0	0	257	58	0	745
05:15 PM	64	0	119	0	129	218	0	3	9	2	18	0	0	291	39	0	892
05:30 PM	27	0	132	0	152	199	0	1	11	9	23	0	0	248	34	0	836
05:45 PM	47	0	102	0	131	222	0	0	6	5	15	0	0	266	23	0	817
Total	171	0	468	0	502	812	0	6	35	19	61	0	0	1062	154	0	3290
Grand Total	330	0	978	0	981	1540	0	9	67	32	98	0	0	2132	280	0	6447
Apprch %	25.2	0	74.8	0	38.8	60.9	0	0.4	34	16.2	49.7	0	0	88.4	11.6	0	
Total %	5.1	0	15.2	0	15.2	23.9	0	0.1	1	0.5	1.5	0	0	33.1	4.3	0	

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 05:00 PM

	Ruggles Street From North					**Tremont Street From East**					**Whittier Street From South**					**Tremont Street From West**					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
05:00 PM	33	0	115	0	148	90	173	0	2	265	9	3	5	0	17	0	257	**58**	0	315	745
05:15 PM	**64**				**183**	129	218	0	**3**	350	9	2	18	0	29	0	**291**			**330**	**892**
05:30 PM	**27**	**0**	**132**	**0**	**159**	**152**	199	0	1	352	**11**	**9**	**23**	**0**	**43**	0	248	34	0	282	836
05:45 PM	47	0	102	0	149	131	**222**			**353**											
Total Volume	171	0	468	0	639	502	812	0	6	1320	35	19	61	0	115	0	1062	154	0	1216	3290
% App. Total																					
PHF	.668	.000	.886	.000	.873	.826	.914	.000	.500	.935	.795	.528	.663	.000	.669	.000	.912	.664	.000	.921	.922

N/S: Ruggles Street/ Whittier Street
E/W: Tremont Street
City, State: Boston, MA
Client: HSH/ J. SanClemente

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Site Code : 2011046_
Start Date : 9/25/2012
Page No : 1

Groups Printed- Heavy Vehicles

	Ruggles Street From North				**Tremont Street From East**				**Whittier Street From South**				**Tremont Street From West**				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
04:00 PM	0	0	9	0	16	5	0	0	1	0	0	0	0	19	0	0	50
04:15 PM	0	0	15	0	13	7	0	0	0	0	0	0	0	12	0	0	47
04:30 PM	0	0	10	0	11	5	0	0	2	0	0	0	0	14	0	0	42
04:45 PM	0	0	15	0	5	5	0	0	0	0	0	0	0	18	0	0	43
Total	0	0	49	0	45	22	0	0	3	0	0	0	0	63	0	0	182
05:00 PM	0	0	11	0	9	6	0	0	0	0	0	0	0	9	0	0	35
05:15 PM	0	0	6	0	8	4	0	0	0	0	0	0	0	10	0	0	28
05:30 PM	0	0	10	0	6	1	0	0	1	0	1	0	0	14	0	0	33
05:45 PM	0	0	8	0	8	0	0	0	0	0	0	0	0	9	0	0	25
Total	0	0	35	0	31	11	0	0	1	0	1	0	0	42	0	0	121
Grand Total	0	0	84	0	76	33	0	0	4	0	1	0	0	105	0	0	303
Apprch %	0	0	100	0	69.7	30.3	0	0	80	0	20	0	0	100	0	0	
Total %	0	0	27.7	0	25.1	10.9	0	0	1.3	0	0.3	0	0	34.7	0	0	

	Ruggles Street From North					**Tremont Street From East**					**Whittier Street From South**					**Tremont Street From West**					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	0	9	0	9	**16**	5	0	0	**21**	**1**	**0**	**0**	**0**	**1**	**0**	**19**	**0**	**0**	**19**	**50**
04:15 PM	**0**	**0**	**15**	**0**	**15**	13	**7**	**0**	**0**	**20**	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**0**	**0**	**12**	**47**
04:30 PM	**0**	**0**	**10**	**0**	**10**	**11**	**5**	**0**	**0**	**16**	**2**	**0**	**0**	**0**	**2**	0	14	0	0	14	42
04:45 PM	0	0	15	0	15	5	5	0	0	10	0	0	0	0	0	0	18	0	0	18	43
Total Volume	0	0	49	0	49	45	22	0	0	67	3	0	0	0	3	0	63	0	0	63	182
% App. Total	0	0	100	0		67.2	32.8	0	0		100	0	0	0		0	100	0	0		
PHF	.000	.000	.817	.000	.817	.703	.786	.000	.000	.798	.375	.000	.000	.000	.375	.000	.829	.000	.000	.829	.910

N/S: Ruggles Street/ Whittier Street
E/W: Tremont Street
City, State: Boston, MA
Client: HSH/ J. SanClemente

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Site Code : 2011046_
Start Date : 9/25/2012
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Groups Printed- Peds and Bikes

	Ruggles Street From North				**Tremont Street From East**				**Whittier Street From South**				**Tremont Street From West**				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
04:00 PM	0	0	0	4	0	2	0	8	0	0	1	21	0	2	0	2	40
04:15 PM	1	0	0	0	0	0	0	1	0	0	0	12	0	1	0	4	19
04:30 PM	1	0	1	0	0	0	0	2	0	0	1	16	0	2	0	6	29
04:45 PM	1	0	3	0	0	0	0	4	0	0	0	16	0	0	0	11	35
Total	3	0	4	4	0	2	0	15	0	0	2	65	0	5	0	23	123
05:00 PM	1	0	2	0	0	1	0	8	2	0	0	11	0	2	0	4	31
05:15 PM	0	0	3	1	0	3	0	5	0	1	0	14	0	2	0	9	38
05:30 PM	1	0	3	0	0	0	0	15	0	0	0	19	0	2	0	3	43
05:45 PM	0	0	0	0	1	5	0	37	0	0	0	14	0	2	0	4	63
Total	2	0	8	1	1	9	0	65	2	1	0	58	0	8	0	20	175
Grand Total	5	0	12	5	1	11	0	80	2	1	2	123	0	13	0	43	298
Apprch %	22.7	0	54.5	22.7	1.1	12	0	87	1.6	0.8	1.6	96.1	0	23.2	0	76.8	
Total %	1.7	0	4	1.7	0.3	3.7	0	26.8	0.7	0.3	0.7	41.3	0	4.4	0	14.4	

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 05:00 PM

	Ruggles Street From North					**Tremont Street From East**					**Whittier Street From South**					**Tremont Street From West**					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
05:00 PM	**1**	**0**	**2**	**0**	**3**	**0**	**1**	**0**	**8**	**9**	**2**	**0**	**0**	**11**	**13**	**0**	**2**	**0**	**4**	**6**	**31**
05:15 PM	**0**	**0**	**3**	**1**	**4**	0	3	0	5	8	0	**1**	0	14	15	0	2	0	**9**	**11**	**38**
05:30 PM	**1**	**0**	**3**	**0**	**4**	**0**	**0**	**0**	**15**	**15**	**0**	**0**	**0**	**19**	**19**	0	2	0	3	5	43
05:45 PM	0	0	0	0	0	**1**	**5**		**37**	**43**											**63**
Total Volume	2	0	8	1	11	1	9	0	65	75	2	1	0	58	61	0	8	0	20	28	175
% App. Total	18.2	0	72.7	9.1		1.3	12	0	86.7		3.3	1.6	0	95.1		0	28.6	0	71.4		
PHF	.500	.000	.667	.250	.688	.250	.450	.000	.439	.436	.250	.250	.000	.763	.803	.000	1.00	.000	.556	.636	.694

N/S: Ruggles Street/ Whittier Street
E/W: Tremont Street
City, State: Boston, MA
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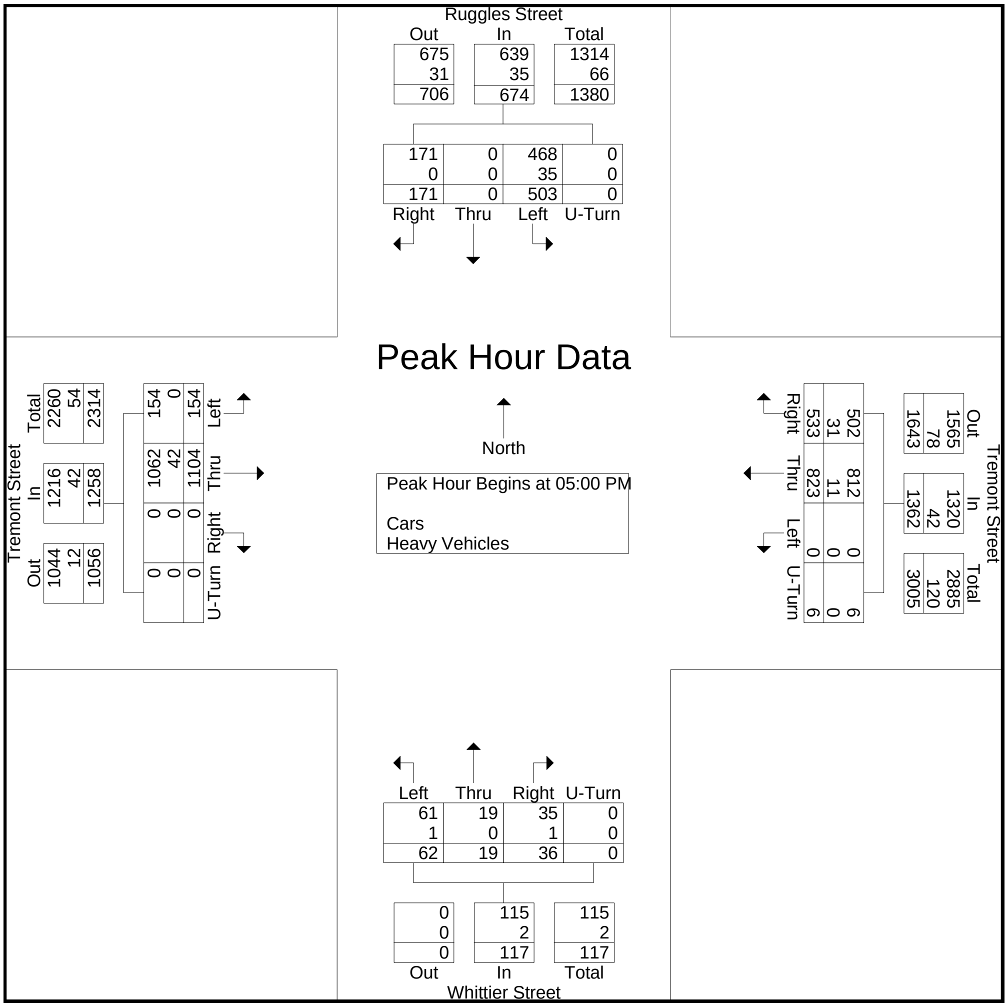
	Ruggles Street From North					Tremont Street From East					Whittier Street From South					Tremont Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	33	0	126	0	159	99	179	0	2	280	9	3	5	0	17	0	266	**58**	0	324	780
05:15 PM	**64**				**189**	137	**222**		**3**	**362**							**301**			**340**	**920**
05:30 PM	**27**	**0**	**142**	**0**	**169**	**158**	200	0	1	359	**12**	**9**	**24**	**0**	**45**	0	262	34	0	296	869
05:45 PM	47	0	110	0	157	139	222	0	0	361	6	5	15	0	26	0	275	23	0	298	842
Total Volume	171	0	503	0	674	533	823	0	6	1362	36	19	62	0	117	0	1104	154	0	1258	3411
% App. Total																					
PHF	.668	.000	.886	.000	.892	.843	.927	.000	.500	.941	.750	.528	.646	.000	.650	.000	.917	.664	.000	.925	.927
Cars	171	0	468	0	639	502	812	0	6	1320	35	19	61	0	115	0	1062	154	0	1216	3290
% Cars	100	0	93.0	0	94.8	94.2	98.7	0	100	96.9	97.2	100	98.4	0	98.3	0	96.2	100	0	96.7	96.5
Heavy Vehicles																					
% Heavy Vehicles	0	0	7.0	0	5.2	5.8	1.3	0	0	3.1	2.8	0	1.6	0	1.7	0	3.8	0	0	3.3	3.5



N/S: Columbus Avenue/ Ruggles Street
E/W: Tremont Street
City, State: Boston, MA
Client: HSH/ J. SanClemente

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File Name : 123026 F
Site Code : 2011046_
Start Date : 9/25/2012
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	Columbus Avenue From North				**Tremont Street From East**				**Ruggles Street From South**				**Tremont Street From West**				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
07:00 AM	7	0	0	0	0	308	0	0	0	0	0	0	30	355	0	0	700
07:15 AM	11	0	0	0	0	303	0	0	0	0	0	0	35	377	0	0	726
07:30 AM	10	0	0	0	0	344	0	0	0	0	0	0	30	455	0	0	839
07:45 AM	9	0	0	0	0	292	0	0	0	0	0	0	28	446	0	0	775
Total	37	0	0	0	0	1247	0	0	0	0	0	0	123	1633	0	0	3040
08:00 AM	13	0	0	0	0	265	0	0	0	0	0	0	33	463	0	0	774
08:15 AM	8	0	0	0	0	275	0	0	0	0	0	0	30	411	0	0	724
08:30 AM	9	0	0	0	0	279	0	0	0	0	0	0	33	386	0	0	707
08:45 AM	11	0	0	0	0	316	0	0	0	0	0	0	24	417	0	0	768
Total	41	0	0	0	0	1135	0	0	0	0	0	0	120	1677	0	0	2973
Grand Total	78	0	0	0	0	2382	0	0	0	0	0	0	243	3310	0	0	6013
Apprch %	100	0	0	0	0	100	0	0	0	0	0	0	6.8	93.2	0	0	
Total %	1.3	0	0	0	0	39.6	0	0	0	0	0	0	4	55	0	0	
Cars	56	0	0	0	0	2212	0	0	0	0	0	0	204	3122	0	0	5594
% Cars	71.8	0	0	0	0	92.9	0	0	0	0	0	0	84	94.3	0	0	93
Heavy Vehicles	22	0	0	0	0	170	0	0	0	0	0	0	39	188	0	0	419
% Heavy Vehicles	28.2	0	0	0	0	7.1	0	0	0	0	0	0	16	5.7	0	0	7

	Columbus Avenue From North					**Tremont Street From East**					**Ruggles Street From South**					**Tremont Street From West**					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	11	0	0	0	11	0	303	0	0	303	0	0	0	0	0	**35**	377	0	0	412	726
07:30 AM	10	0	0	0	10	0	**344**			**344**											**839**
07:45 AM	**9**	**0**	**0**	**0**	**9**	**0**	**292**	**0**	**0**	**292**	**0**	**0**	**0**	**0**	**0**	**28**	**446**	**0**	**0**	**474**	**775**
08:00 AM	**13**	**0**	**0**	**0**	**13**	0	265	0	0	265	0	0	0	0	0	33	**463**	**0**	**0**	**496**	**774**
Total Volume	43	0	0	0	43	0	1204	0	0	1204	0	0	0	0	0	126	1741	0	0	1867	3114
% App. Total																					
PHF	.827	.000	.000	.000	.827	.000	.875	.000	.000	.875	.000	.000	.000	.000	.000	.900	.940	.000	.000	.941	.928
Cars	35	0	0	0	35	0	1123	0	0	1123	0	0	0	0	0	109	1661	0	0	1770	2928
% Cars	81.4	0	0	0	81.4	0	93.3	0	0	93.3	0	0	0	0	0	86.5	95.4	0	0	94.8	94.0
Heavy Vehicles																					
% Heavy Vehicles	18.6	0	0	0	18.6	0	6.7	0	0	6.7	0	0	0	0	0	13.5	4.6	0	0	5.2	6.0

N/S: Columbus Avenue/ Ruggles Street
E/W: Tremont Street
City, State: Boston, MA
Client: HSH/ J. SanClemente

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File Name : 123026 F
Site Code : 2011046_
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Groups Printed- Cars

	Columbus Avenue From North				**Tremont Street From East**				**Ruggles Street From South**				**Tremont Street From West**				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
07:00 AM	4	0	0	0	0	282	0	0	0	0	0	0	23	325	0	0	634
07:15 AM	9	0	0	0	0	287	0	0	0	0	0	0	31	360	0	0	687
07:30 AM	7	0	0	0	0	321	0	0	0	0	0	0	26	431	0	0	785
07:45 AM	7	0	0	0	0	267	0	0	0	0	0	0	24	427	0	0	725
Total	27	0	0	0	0	1157	0	0	0	0	0	0	104	1543	0	0	2831
08:00 AM	12	0	0	0	0	248	0	0	0	0	0	0	28	443	0	0	731
08:15 AM	5	0	0	0	0	252	0	0	0	0	0	0	27	382	0	0	666
08:30 AM	5	0	0	0	0	264	0	0	0	0	0	0	28	364	0	0	661
08:45 AM	7	0	0	0	0	291	0	0	0	0	0	0	17	390	0	0	705
Total	29	0	0	0	0	1055	0	0	0	0	0	0	100	1579	0	0	2763
Grand Total	56	0	0	0	0	2212	0	0	0	0	0	0	204	3122	0	0	5594
Apprch %	100	0	0	0	0	100	0	0	0	0	0	0	6.1	93.9	0	0	
Total %	1	0	0	0	0	39.5	0	0	0	0	0	0	3.6	55.8	0	0	

	Columbus Avenue From North					**Tremont Street From East**					**Ruggles Street From South**					**Tremont Street From West**					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	9	0	0	0	9	0	287	0	0	287	0	0	0	0	0	**31**	360	0	0	391	687
07:30 AM	7	0	0	0	7	0	**321**			**321**											**785**
07:45 AM	**7**	**0**	**0**	**0**	**7**	**0**	**267**	**0**	**0**	**267**	**0**	**0**	**0**	**0**	**0**	**24**	**427**	**0**	**0**	**451**	**725**
08:00 AM	**12**	**0**	**0**	**0**	**12**	0	248	0	0	248	0	0	0	0	0	28	**443**	**0**	**0**	**471**	**731**
Total Volume	35	0	0	0	35	0	1123	0	0	1123	0	0	0	0	0	109	1661	0	0	1770	2928
% App. Total																					
PHF	.729	.000	.000	.000	.729	.000	.875	.000	.000	.875	.000	.000	.000	.000	.000	.879	.937	.000	.000	.939	.932

N/S: Columbus Avenue/ Ruggles Street
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Groups Printed- Heavy Vehicles

	Columbus Avenue From North				**Tremont Street From East**				**Ruggles Street From South**				**Tremont Street From West**				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
07:00 AM	3	0	0	0	0	26	0	0	0	0	0	0	7	30	0	0	66
07:15 AM	2	0	0	0	0	16	0	0	0	0	0	0	4	17	0	0	39
07:30 AM	3	0	0	0	0	23	0	0	0	0	0	0	4	24	0	0	54
07:45 AM	2	0	0	0	0	25	0	0	0	0	0	0	4	19	0	0	50
Total	10	0	0	0	0	90	0	0	0	0	0	0	19	90	0	0	209
08:00 AM	1	0	0	0	0	17	0	0	0	0	0	0	5	20	0	0	43
08:15 AM	3	0	0	0	0	23	0	0	0	0	0	0	3	29	0	0	58
08:30 AM	4	0	0	0	0	15	0	0	0	0	0	0	5	22	0	0	46
08:45 AM	4	0	0	0	0	25	0	0	0	0	0	0	7	27	0	0	63
Total	12	0	0	0	0	80	0	0	0	0	0	0	20	98	0	0	210
Grand Total	22	0	0	0	0	170	0	0	0	0	0	0	39	188	0	0	419
Apprch %	100	0	0	0	0	100	0	0	0	0	0	0	17.2	82.8	0	0	
Total %	5.3	0	0	0	0	40.6	0	0	0	0	0	0	9.3	44.9	0	0	

	Columbus Avenue From North					**Tremont Street From East**					**Ruggles Street From South**					**Tremont Street From West**					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	1	0	0	0	1	0	17	0	0	17	0	0	0	0	0	5	20	0	0	25	43
08:15 AM	3	0	0	0	3	0	23	0	0	23	0	0	0	0	0	3	**29**	**0**	**0**	**32**	**58**
08:30 AM	**4**	**0**	**0**	**0**	**4**	0	15	0	0	15	0	0	0	0	0	5	22	0	0	27	46
08:45 AM	4	0	0	0	4	0	**25**			**25**						**7**	27	0	0	**34**	**63**
Total Volume	12	0	0	0	12	0	80	0	0	80	0	0	0	0	0	20	98	0	0	118	210
% App. Total	100	0	0	0		0	100	0	0		0	0	0	0		16.9	83.1	0	0		
PHF	.750	.000	.000	.000	.750	.000	.800	.000	.000	.800	.000	.000	.000	.000	.000	.714	.845	.000	.000	.868	.833

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Groups Printed- Peds and Bikes

	Columbus Avenue From North				**Tremont Street From East**				**Ruggles Street From South**				**Tremont Street From West**				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	0	0	0	7	0	2	0	36	0	0	0	7	0	1	0	3	56
07:15 AM	0	0	0	5	0	2	0	28	0	0	0	6	0	3	0	5	49
07:30 AM	0	0	0	3	0	1	0	13	0	0	0	3	1	2	0	3	26
07:45 AM	1	0	0	8	0	0	0	22	0	0	0	8	0	6	0	4	49
Total	1	0	0	23	0	5	0	99	0	0	0	24	1	12	0	15	180
08:00 AM	0	0	0	9	0	1	0	38	0	0	0	0	0	3	0	5	56
08:15 AM	0	0	0	5	0	1	0	31	0	0	0	5	0	3	0	0	45
08:30 AM	0	0	0	7	0	0	0	24	0	0	0	0	1	6	0	0	38
08:45 AM	0	0	0	12	0	0	0	18	0	0	0	0	0	12	0	0	42
Total	0	0	0	33	0	2	0	111	0	0	0	5	1	24	0	5	181
Grand Total	1	0	0	56	0	7	0	210	0	0	0	29	2	36	0	20	361
Apprch %	1.8	0	0	98.2	0	3.2	0	96.8	0	0	0	100	3.4	62.1	0	34.5	
Total %	0.3	0	0	15.5	0	1.9	0	58.2	0	0	0	8	0.6	10	0	5.5	

	Columbus Avenue From North					**Tremont Street From East**					**Ruggles Street From South**					**Tremont Street From West**					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	**1**	**0**	**0**	**8**	**9**	0	0	0	22	22	0	0	0	**8**	**8**	0	**6**	**0**	**4**	**10**	**49**
08:00 AM	**0**	**0**	**0**	**9**	**9**	**0**	**1**	**0**	**38**	**39**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**5**	8	**56**
08:15 AM	**0**	**0**	**0**	**5**	**5**	**0**	**1**	**0**	**31**	**32**	**0**	**0**	**0**	**5**	**5**	**0**	**3**	**0**	**0**	**3**	**45**
08:30 AM	**0**	**0**	**0**	**7**	**7**	**0**	**0**	**0**	**24**	**24**	**0**	**0**	**0**	**0**	**0**	**1**	6	0	0	7	38
Total Volume	1	0	0	29	30	0	2	0	115	117	0	0	0	13	13	1	18	0	9	28	188
% App. Total	3.3	0	0	96.7		0	1.7	0	98.3		0	0	0	100		3.6	64.3	0	32.1		
PHF	.250	.000	.000	.806	.833	.000	.500	.000	.757	.750	.000	.000	.000	.406	.406	.250	.750	.000	.450	.700	.839

N/S: Columbus Avenue/ Ruggles Street
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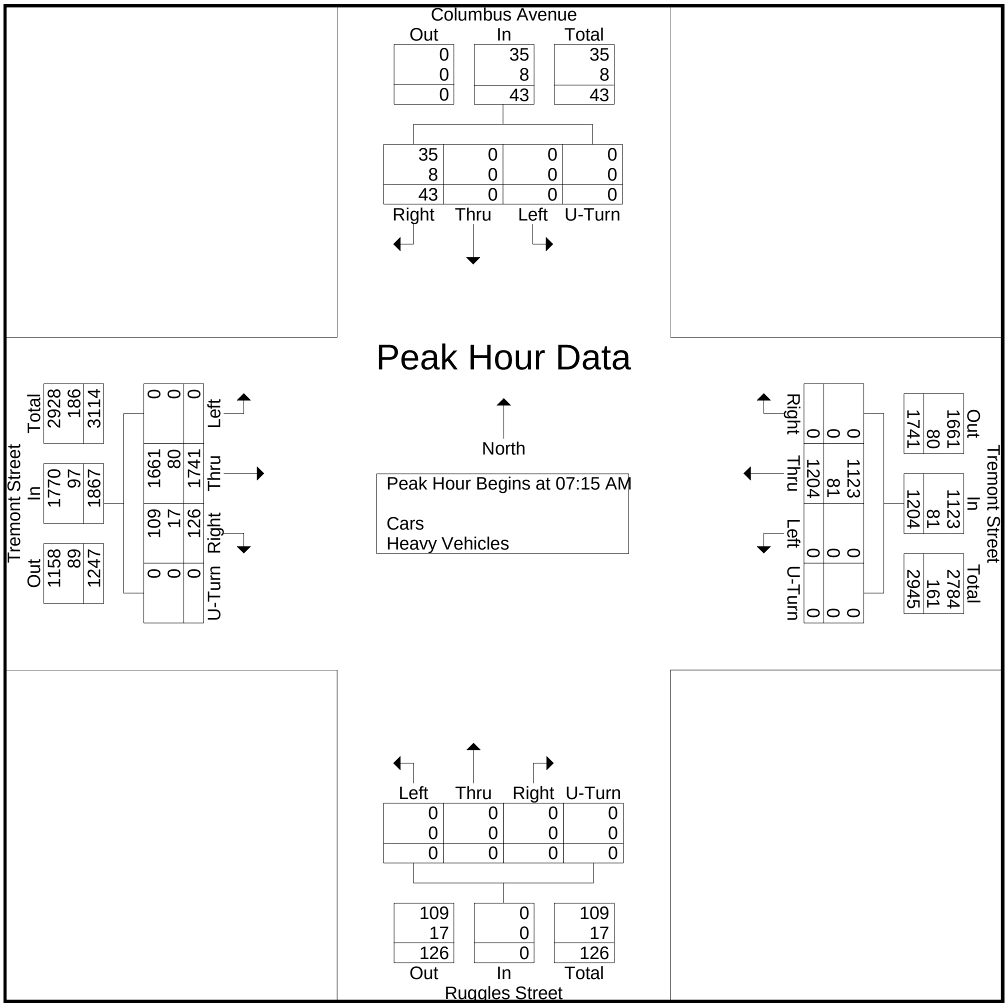
	Columbus Avenue From North					Tremont Street From East					Ruggles Street From South					Tremont Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	11	0	0	0	11	0	303	0	0	303	0	0	0	0	0	**35**	377	0	0	412	726
07:30 AM	10	0	0	0	10	0	**344**			**344**											**839**
07:45 AM	**9**	**0**	**0**	**0**	**9**	**0**	**292**	**0**	**0**	**292**	**0**	**0**	**0**	**0**	**0**	**28**	**446**	**0**	**0**	**474**	**775**
08:00 AM	**13**	**0**	**0**	**0**	**13**	0	265	0	0	265	0	0	0	0	0	33	**463**	**0**	**0**	**496**	774
Total Volume	43	0	0	0	43	0	1204	0	0	1204	0	0	0	0	0	126	1741	0	0	1867	3114
% App. Total																					
PHF	.827	.000	.000	.000	.827	.000	.875	.000	.000	.875	.000	.000	.000	.000	.000	.900	.940	.000	.000	.941	.928
Cars	35	0	0	0	35	0	1123	0	0	1123	0	0	0	0	0	109	1661	0	0	1770	2928
% Cars	81.4	0	0	0	81.4	0	93.3	0	0	93.3	0	0	0	0	0	86.5	95.4	0	0	94.8	94.0
Heavy Vehicles																					
% Heavy Vehicles	18.6	0	0	0	18.6	0	6.7	0	0	6.7	0	0	0	0	0	13.5	4.6	0	0	5.2	6.0



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Groups Printed- Cars - Heavy Vehicles

	Columbus Avenue From North				**Tremont Street From East**				**Ruggles Street From South**				**Tremont Street From West**				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
04:00 PM	20	0	0	0	0	272	0	0	0	0	0	0	66	383	0	0	741
04:15 PM	19	0	0	0	0	272	0	0	0	0	0	0	51	407	0	0	749
04:30 PM	27	0	0	0	0	261	0	0	0	0	0	0	44	374	0	0	706
04:45 PM	24	0	0	0	0	300	0	0	0	0	0	0	46	381	0	0	751
Total	90	0	0	0	0	1105	0	0	0	0	0	0	207	1545	0	0	2947
05:00 PM	25	0	0	0	0	272	0	0	0	0	0	0	52	359	0	0	708
05:15 PM	35	0	0	0	0	295	0	0	0	0	0	0	70	392	0	0	792
05:30 PM	32	0	0	0	0	318	0	0	0	0	0	0	62	355	0	0	767
05:45 PM	30	0	0	0	0	271	0	0	0	0	0	0	38	353	0	0	692
Total	122	0	0	0	0	1156	0	0	0	0	0	0	222	1459	0	0	2959
Grand Total	212	0	0	0	0	2261	0	0	0	0	0	0	429	3004	0	0	5906
Apprch %	100	0	0	0	0	100	0	0	0	0	0	0	12.5	87.5	0	0	
Total %	3.6	0	0	0	0	38.3	0	0	0	0	0	0	7.3	50.9	0	0	
Cars	183	0	0	0	0	2178	0	0	0	0	0	0	405	2839	0	0	5605
% Cars	86.3	0	0	0	0	96.3	0	0	0	0	0	0	94.4	94.5	0	0	94.9
Heavy Vehicles	29	0	0	0	0	83	0	0	0	0	0	0	24	165	0	0	301
% Heavy Vehicles	13.7	0	0	0	0	3.7	0	0	0	0	0	0	5.6	5.5	0	0	5.1

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 04:45 PM

	Columbus Avenue From North					**Tremont Street From East**					**Ruggles Street From South**					**Tremont Street From West**					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
04:45 PM	24	0	0	0	24	0	300	0	0	300	0	0	0	0	0	46	381	0	0	427	751
05:00 PM	25	0	0	0	25	0	272	0	0	272	0	0	0	0	0	52	359	0	0	411	708
05:15 PM	**35**	**0**	**0**	**0**	**35**	0	295	0	0	295	0	0	0	0	0	**70**	**392**	**0**	**0**	**462**	**792**
05:30 PM	**32**	**0**	**0**	**0**	**32**	**0**	**318**	**0**	**0**	**318**	**0**	**0**	**0**	**0**	**0**	**62**	**355**	**0**	**0**	**417**	**767**
Total Volume	116	0	0	0	116	0	1185	0	0	1185	0	0	0	0	0	230	1487	0	0	1717	3018
% App. Total																					
PHF	.829	.000	.000	.000	.829	.000	.932	.000	.000	.932	.000	.000	.000	.000	.000	.821	.948	.000	.000	.929	.953
Cars	101	0	0	0	101	0	1154	0	0	1154	0	0	0	0	0	218	1405	0	0	1623	2878
% Cars	87.1	0	0	0	87.1	0	97.4	0	0	97.4	0	0	0	0	0	94.8	94.5	0	0	94.5	95.4
Heavy Vehicles																					
% Heavy Vehicles	12.9	0	0	0	12.9	0	2.6	0	0	2.6	0	0	0	0	0	5.2	5.5	0	0	5.5	4.6

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Groups Printed- Cars

	Columbus Avenue From North				**Tremont Street From East**				**Ruggles Street From South**				**Tremont Street From West**				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
04:00 PM	17	0	0	0	0	255	0	0	0	0	0	0	62	359	0	0	693
04:15 PM	14	0	0	0	0	256	0	0	0	0	0	0	48	387	0	0	705
04:30 PM	24	0	0	0	0	247	0	0	0	0	0	0	39	351	0	0	661
04:45 PM	22	0	0	0	0	291	0	0	0	0	0	0	43	352	0	0	708
Total	77	0	0	0	0	1049	0	0	0	0	0	0	192	1449	0	0	2767
05:00 PM	21	0	0	0	0	262	0	0	0	0	0	0	51	340	0	0	674
05:15 PM	30	0	0	0	0	287	0	0	0	0	0	0	65	380	0	0	762
05:30 PM	28	0	0	0	0	314	0	0	0	0	0	0	59	333	0	0	734
05:45 PM	27	0	0	0	0	266	0	0	0	0	0	0	38	337	0	0	668
Total	106	0	0	0	0	1129	0	0	0	0	0	0	213	1390	0	0	2838
Grand Total	183	0	0	0	0	2178	0	0	0	0	0	0	405	2839	0	0	5605
Apprch %	100	0	0	0	0	100	0	0	0	0	0	0	12.5	87.5	0	0	
Total %	3.3	0	0	0	0	38.9	0	0	0	0	0	0	7.2	50.7	0	0	

	Columbus Avenue From North					**Tremont Street From East**					**Ruggles Street From South**					**Tremont Street From West**					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	22	0	0	0	22	0	291	0	0	291	0	0	0	0	0	43	352	0	0	395	708
05:00 PM	21	0	0	0	21	0	262	0	0	262	0	0	0	0	0	51	340	0	0	391	674
05:15 PM	**30**	**0**	**0**	**0**	**30**	0	287	0	0	287	0	0	0	0	0	**65**	**380**	**0**	**0**	**445**	**762**
05:30 PM	**28**	**0**	**0**	**0**	**28**	**0**	**314**	**0**	**0**	**314**	**0**	**0**	**0**	**0**	**0**	**59**	**333**	**0**	**0**	**392**	**734**
Total Volume	101	0	0	0	101	0	1154	0	0	1154	0	0	0	0	0	218	1405	0	0	1623	2878
% App. Total																					
PHF	.842	.000	.000	.000	.842	.000	.919	.000	.000	.919	.000	.000	.000	.000	.000	.838	.924	.000	.000	.912	.944

N/S: Columbus Avenue/ Ruggles Street
E/W: Tremont Street
City, State: Boston, MA
Client: HSH/ J. SanClemente

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Email: datarequests@pdillc.com

File Name : 123026 FF
Site Code : 2011046_
Start Date : 9/25/2012
Page No : 1

Groups Printed- Heavy Vehicles

	Columbus Avenue **From North**				**Tremont Street** **From East**				**Ruggles Street** **From South**				**Tremont Street** **From West**				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
04:00 PM	3	0	0	0	0	17	0	0	0	0	0	0	4	24	0	0	48
04:15 PM	5	0	0	0	0	16	0	0	0	0	0	0	3	20	0	0	44
04:30 PM	3	0	0	0	0	14	0	0	0	0	0	0	5	23	0	0	45
04:45 PM	2	0	0	0	0	9	0	0	0	0	0	0	3	29	0	0	43
Total	13	0	0	0	0	56	0	0	0	0	0	0	15	96	0	0	180
05:00 PM	4	0	0	0	0	10	0	0	0	0	0	0	1	19	0	0	34
05:15 PM	5	0	0	0	0	8	0	0	0	0	0	0	5	12	0	0	30
05:30 PM	4	0	0	0	0	4	0	0	0	0	0	0	3	22	0	0	33
05:45 PM	3	0	0	0	0	5	0	0	0	0	0	0	0	16	0	0	24
Total	16	0	0	0	0	27	0	0	0	0	0	0	9	69	0	0	121
Grand Total	29	0	0	0	0	83	0	0	0	0	0	0	24	165	0	0	301
Apprch %	100	0	0	0	0	100	0	0	0	0	0	0	12.7	87.3	0	0	
Total %	9.6	0	0	0	0	27.6	0	0	0	0	0	0	8	54.8	0	0	

	Columbus Avenue **From North**					**Tremont Street** **From East**					**Ruggles Street** **From South**					**Tremont Street** **From West**					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 04:00 PM

04:00 PM	3	0	0	0	3	0	**17**	**0**	**0**	**17**	**0**	**0**	**0**	**0**	**0**	**4**	**24**	**0**	**0**	**28**	**48**
04:15 PM	**5**	**0**	**0**	**0**	**5**	0	16	0	0	16	0	0	0	0	0	3	20	0	0	23	44
04:30 PM	3	0	0	0	3	0	14	0	0	14	0	0	0	0	0	**5**	23	0	0	28	45
04:45 PM	2	0	0	0	2	0	9	0	0	9	0	0	0	0	0	3	**29**			**32**	
Total Volume	13	0	0	0	13	0	56	0	0	56	0	0	0	0	0	15	96	0	0	111	180
% App. Total	100	0	0	0		0	100	0	0		0	0	0	0		13.5	86.5	0	0		
PHF	.650	.000	.000	.000	.650	.000	.824	.000	.000	.824	.000	.000	.000	.000	.000	.750	.828	.000	.000	.867	.938

N/S: Columbus Avenue/ Ruggles Street
E/W: Tremont Street
City, State: Boston, MA
Client: HSH/ J. SanClemente

PRECISION
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Email: datarequests@pdillc.com

File Name : 123026 FF
Site Code : 2011046_
Start Date : 9/25/2012
Page No : 1

Groups Printed- Peds and Bikes

	Columbus Avenue From North				**Tremont Street From East**				**Ruggles Street From South**				**Tremont Street From West**				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
04:00 PM	0	0	0	0	0	3	0	32	0	0	0	10	0	0	0	3	48
04:15 PM	1	0	0	0	0	0	0	66	0	0	0	14	0	2	0	4	87
04:30 PM	0	0	0	0	0	0	0	37	0	0	0	5	0	2	0	2	46
04:45 PM	0	0	0	0	0	0	0	44	0	0	0	6	0	2	0	0	52
Total	1	0	0	0	0	3	0	179	0	0	0	35	0	6	0	9	233
05:00 PM	0	0	0	0	0	1	0	39	0	0	0	16	0	2	0	4	62
05:15 PM	2	0	0	0	0	4	0	44	0	0	0	17	0	4	0	9	80
05:30 PM	0	0	0	0	0	0	0	34	0	0	0	11	2	3	0	12	62
05:45 PM	0	0	0	2	0	2	0	29	0	0	0	16	0	2	0	8	59
Total	2	0	0	2	0	7	0	146	0	0	0	60	2	11	0	33	263
Grand Total	3	0	0	2	0	10	0	325	0	0	0	95	2	17	0	42	496
Apprch %	60	0	0	40	0	3	0	97	0	0	0	100	3.3	27.9	0	68.9	
Total %	0.6	0	0	0.4	0	2	0	65.5	0	0	0	19.2	0.4	3.4	0	8.5	

	Columbus Avenue From North					**Tremont Street From East**					**Ruggles Street From South**					**Tremont Street From West**					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	0	0	0	0	0	1	0	39	40	0	0	0	16	16	0	2	0	4	6	62
05:15 PM	**2**	**0**	**0**	**0**	**2**	0	**4**	**0**	**44**	**48**	**0**	**0**	**0**	**17**	**17**	0	**4**	**0**	**9**	**13**	**80**
05:30 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**34**	**34**	**0**	**0**	**0**	**11**	**11**	**2**	3	0	**12**	**17**	**62**
05:45 PM	**0**	**0**	**0**	**2**	**2**	**0**	**2**	**0**	**29**	**31**	**0**	**0**	**0**	**16**	**16**	**0**	**2**	**0**	**8**	**10**	**59**
Total Volume	2	0	0	2	4	0	7	0	146	153	0	0	0	60	60	2	11	0	33	46	263
% App. Total	50	0	0	50		0	4.6	0	95.4		0	0	0	100		4.3	23.9	0	71.7		
PHF	.250	.000	.000	.250	.500	.000	.438	.000	.830	.797	.000	.000	.000	.882	.882	.250	.688	.000	.688	.676	.822

N/S: Columbus Avenue/ Ruggles Street
E/W: Tremont Street
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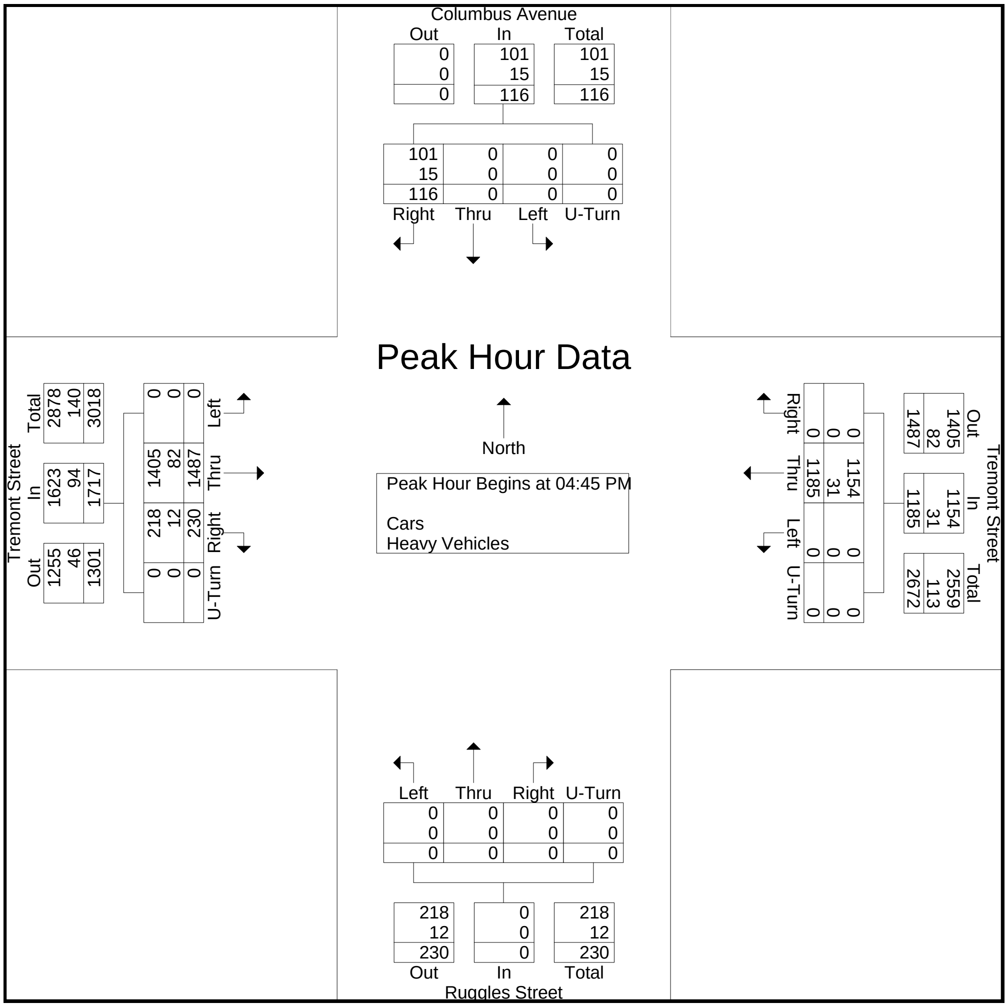
	Columbus Avenue From North					Tremont Street From East					Ruggles Street From South					Tremont Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	24	0	0	0	24	0	300	0	0	300	0	0	0	0	0	46	381	0	0	427	751
05:00 PM	25	0	0	0	25	0	272	0	0	272	0	0	0	0	0	52	359	0	0	411	708
05:15 PM	**35**	**0**	**0**	**0**	**35**	0	295	0	0	295	0	0	0	0	0	**70**	**392**	**0**	**0**	**462**	**792**
05:30 PM	**32**	**0**	**0**	**0**	**32**	**0**	**318**	**0**	**0**	**318**	**0**	**0**	**0**	**0**	**0**	**62**	**355**	**0**	**0**	**417**	**767**
Total Volume	116	0	0	0	116	0	1185	0	0	1185	0	0	0	0	0	230	1487	0	0	1717	3018
% App. Total																					
PHF	.829	.000	.000	.000	.829	.000	.932	.000	.000	.932	.000	.000	.000	.000	.000	.821	.948	.000	.000	.929	.953
Cars	101	0	0	0	101	0	1154	0	0	1154	0	0	0	0	0	218	1405	0	0	1623	2878
% Cars	87.1	0	0	0	87.1	0	97.4	0	0	97.4	0	0	0	0	0	94.8	94.5	0	0	94.5	95.4
Heavy Vehicles																					
% Heavy Vehicles	12.9	0	0	0	12.9	0	2.6	0	0	2.6	0	0	0	0	0	5.2	5.5	0	0	5.5	4.6



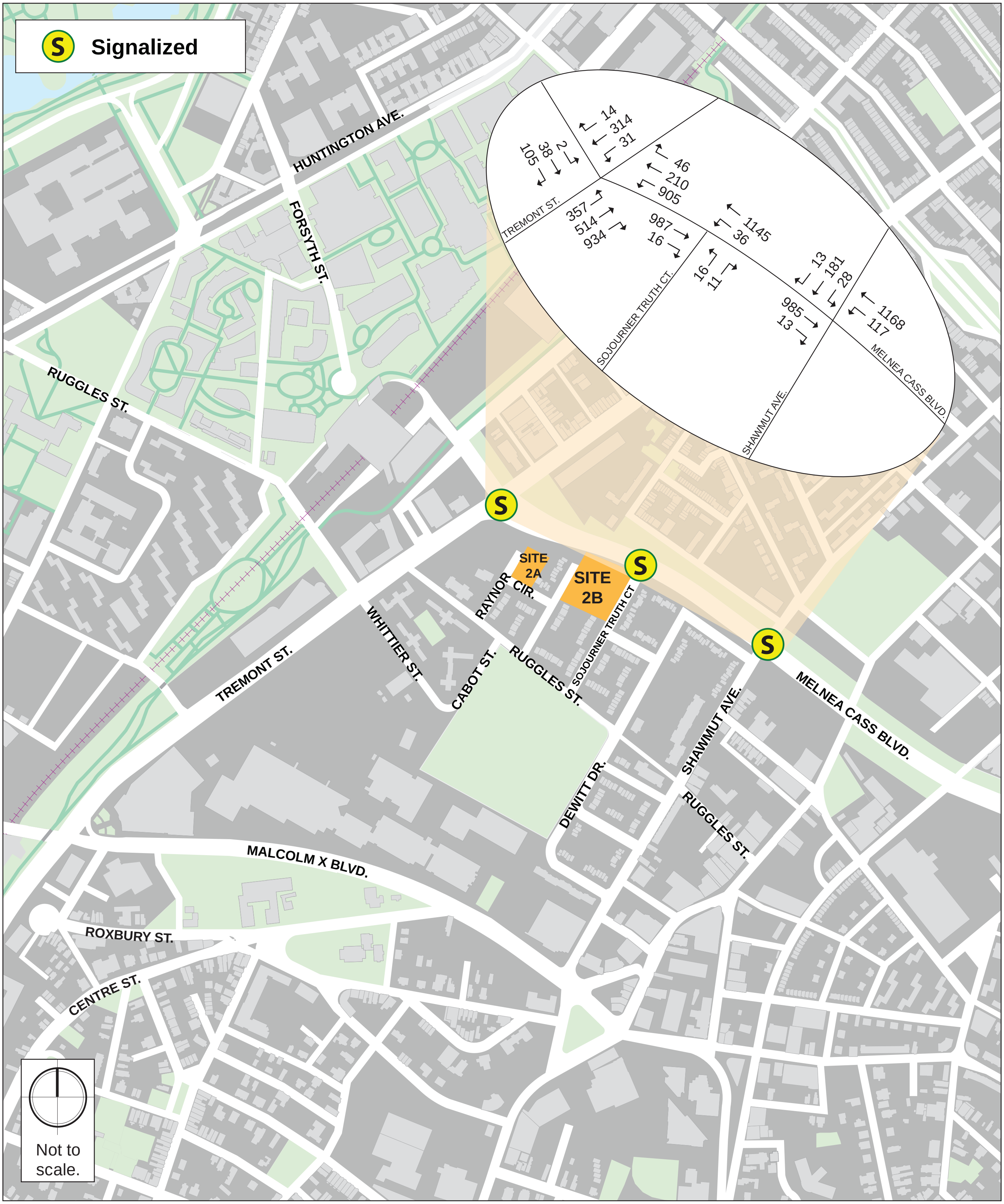


Figure 7.2

Existing Conditions (2014) Turning Movement Volumes, a.m. Peak Hour

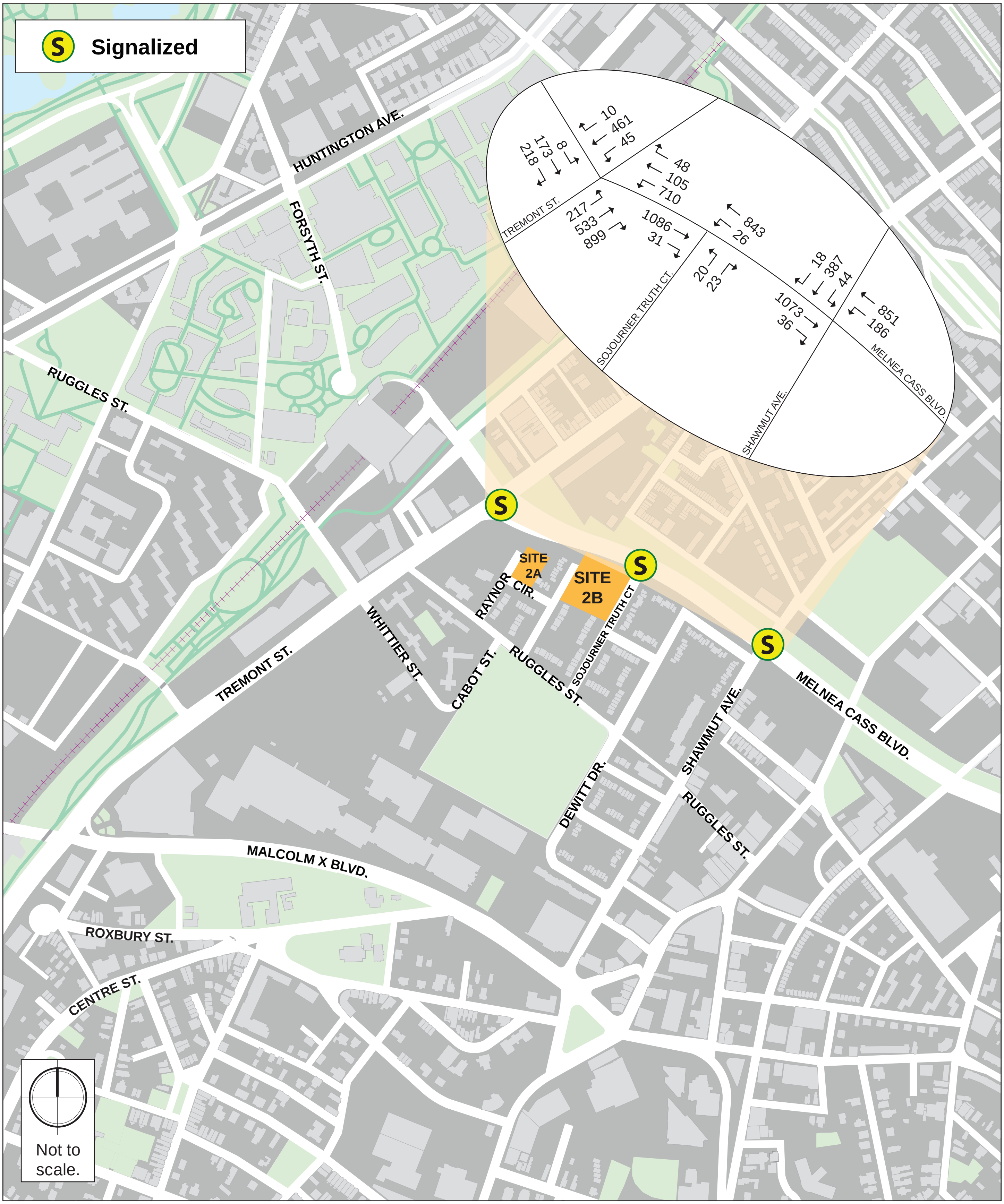


Figure 7.3

Existing Conditions (2014) Turning Movement Volumes, p.m. Peak Hour

Appendix B: Crash Rate Worksheets

MassHighway

CRASH RATE WORKSHEET

CITY/TOTWN : Boston

COUNT DATE :

DISTRICT : 6

UNSIGNALIZED : ☐

SIGNALIZED : ☒

MHD USE ONLY

Source # ☐

~ INTERSECTION DATA ~

MAJOR STREET : Tremont Street

MINOR STREET(S) : Malcolm X Boulevard

Columbus Avenue

ST # ☐

ST # ☐

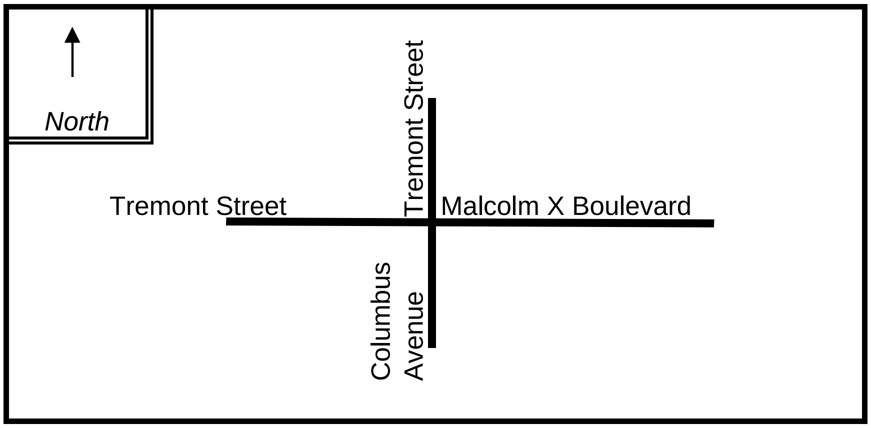
ST # ☐

ST # ☐

ST # ☐

INTERSECTION DIAGRAM

(Label Approaches)



INTERSECTION REF # ☐

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**Total Entering Vehicles**
DIRECTION :	EB	WB	NB	SB		
VOLUMES (PM) :	743	773	1,070	853		**3,439**

" K " FACTOR : **0.066**

APPROACH ADT : **52,106**

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 2

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : **0.67**

CRASH RATE CALCULATION : **0.04**

RATE = $\frac{(A * 1,000,000)}{(ADT * 365)}$

Comments :

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT : 6

UNSIGNALIZED : ☐

SIGNALIZED : ☒ X

MHD USE ONLY

Source # ☐

~ INTERSECTION DATA ~

MAJOR STREET : Tremont Street

MINOR STREET(S) : Melnea Cass Boulevard

ST # ☐

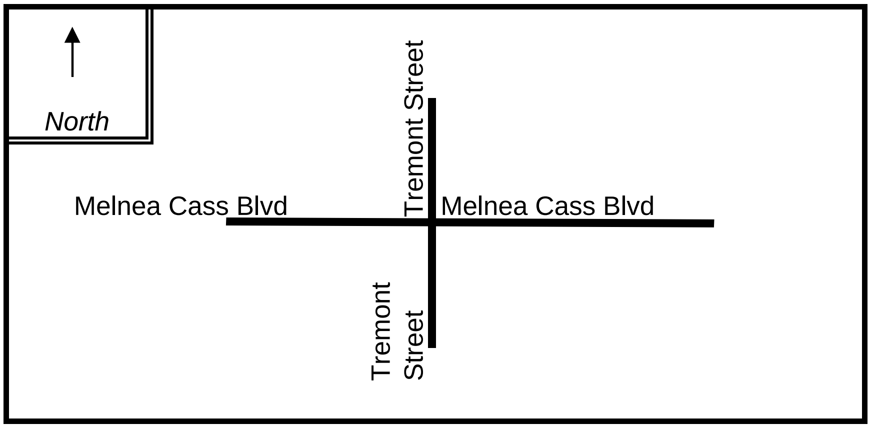
ST # ☐

ST # ☐

ST # ☐

ST # ☐

INTERSECTION DIAGRAM (Label Approaches)



INTERSECTION REF # ☐

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**Total Entering Vehicles**
DIRECTION :	EB	WB	NB	SB		
VOLUMES (PM) :	407	905	1,687	528		**3,527**

" K " FACTOR : **0.066**

APPROACH ADT : **53,439**

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 4

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : **1.33**

CRASH RATE CALCULATION : 0.07

RATE = $\frac{(A * 1,000,000)}{(ADT * 365)}$

Comments :

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT : 6

UNSIGNALIZED : ☐

SIGNALIZED : ☒ X

MHD USE ONLY

Source # ☐

~ INTERSECTION DATA ~

MAJOR STREET : Tremont Street

ST # ☐

MINOR STREET(S) : Ruggles Street

ST # ☐

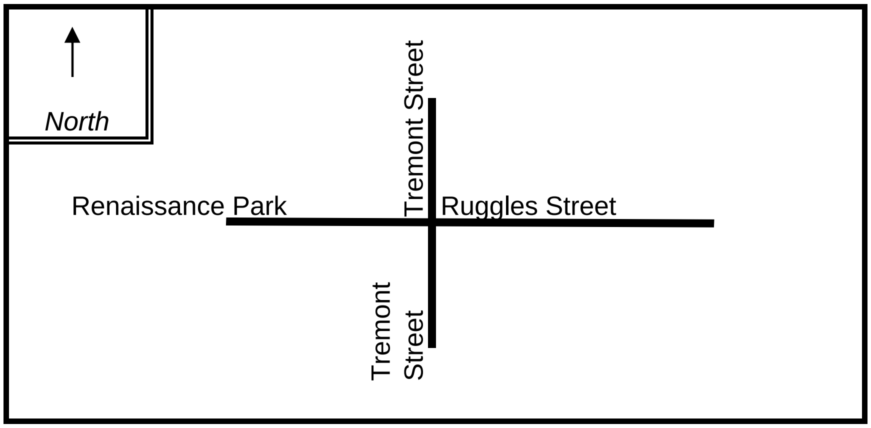
Renaissance Park

ST # ☐

ST # ☐

ST # ☐

INTERSECTION DIAGRAM (Label Approaches)



INTERSECTION REF # ☐

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**Total Entering Vehicles**
DIRECTION :	EB	NB	SB			
VOLUMES (PM) :	120	1,769	1,246			**3,135**

" K " FACTOR : **0.066**

APPROACH ADT : **47,500**

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 6

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : **2.00**

CRASH RATE CALCULATION : **0.12**

RATE = $\frac{(A * 1,000,000)}{(ADT * 365)}$

Comments :

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT : 6

UNSIGNALIZED : ☐

SIGNALIZED : ☒

MHD USE ONLY

Source # ☐

~ INTERSECTION DATA ~

MAJOR STREET : Tremont Street

MINOR STREET(S) : Prentiss Street

ST # ☐

ST # ☐

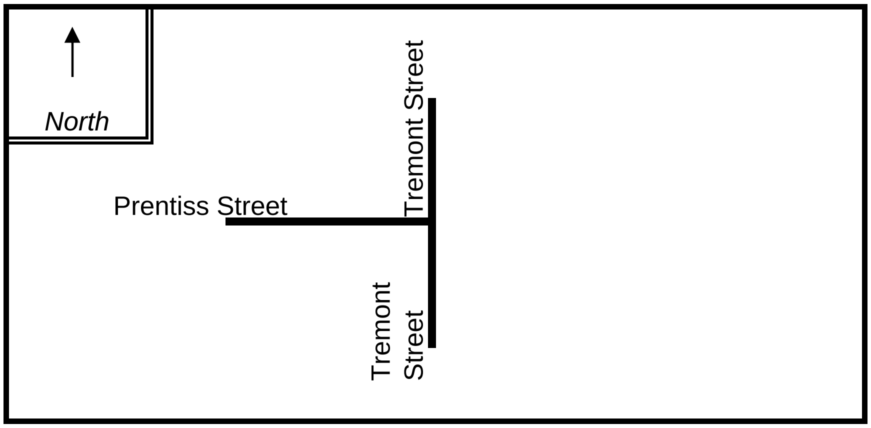
ST # ☐

ST # ☐

ST # ☐

INTERSECTION DIAGRAM

(Label Approaches)



INTERSECTION REF # ☐

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**Total Entering Vehicles**
DIRECTION :	EB	NB	SB			
VOLUMES (PM) :	297	1,288	1,230			**2,815**

" K " FACTOR : **0.066**

APPROACH ADT : **42,652**

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 2

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : **0.67**

CRASH RATE CALCULATION : 0.04

RATE = $\frac{(A * 1,000,000)}{(ADT * 365)}$

Comments :

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT : 6

UNSIGNALIZED : ☐

SIGNALIZED : ☒

MHD USE ONLY

Source # ☐

~ INTERSECTION DATA ~

MAJOR STREET : Tremont Street

ST # ☐

MINOR STREET(S) : Ruggles Street

ST # ☐

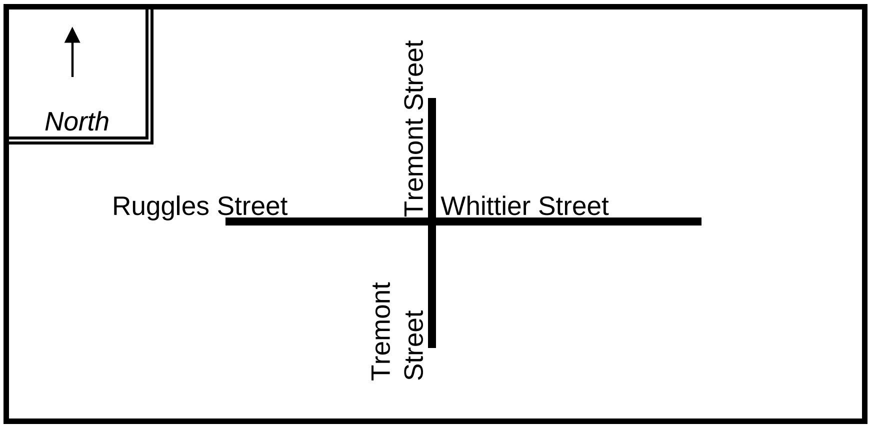
Whittier Street

ST # ☐

ST # ☐

ST # ☐

INTERSECTION DIAGRAM (Label Approaches)



INTERSECTION REF # ☐

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**Total Entering Vehicles**
DIRECTION :	EB	WB	NB	SB		
VOLUMES (PM) :	691	120	1,308	1,421		**3,540**

" K " FACTOR : **0.066**

APPROACH ADT : **53,636**

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 0

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : **0.00**

CRASH RATE CALCULATION :

$$\text{RATE} = \frac{(A * 1,000,000)}{(ADT * 365)}$$

Comments :

Appendix C: Trip Generation Calculations

ITE Trip Generation Manual, 9th Edition, 2012

LUC 220 Apartments
695 Dwelling Units

	Equation	R^2	Enter	Exit	Total	Enter	Exit
Weekday Daily	T = 6.06 (x) + 123.56	0.87	50%	50%	4335	2168	2167
Weekday AM	T = 0.49 (x) + 3.73	0.83	20%	80%	344	69	275
Weekday PM	T = 0.55 (x) + 17.65	0.77	65%	35%	400	260	140
Saturday Midday	0.52		50%	50%	361	181	180

LUC 580 Museum
31 1000 SF G.F.A.

	Rate		Enter	Exit	Total	Enter	Exit
Weekday Daily	0.98		50%	50%	30	15	15
Weekday AM	0.28		86%	14%	9	8	1
Weekday PM	0.18		16%	84%	6	1	5
Saturday Midday	0.66		71%	29%	20	15	5

LUC 710 General Office Building
105 1000 SF G.F.A.

	Equation / Rate	R^2	Enter	Exit	Total	Enter	Exit
Weekday Daily	Ln (T) = 0.76 Ln (x) + 3.68	0.81	50%	50%	1362	681	681
Weekday AM	Ln (T) = 0.80 Ln (x) + 1.57	0.83	88%	12%	199	176	23
Weekday PM	T = 1.12 (x) + 78.45	0.82	17%	83%	196	34	162
Saturday Midday	0.43		54%	46%	45	25	20

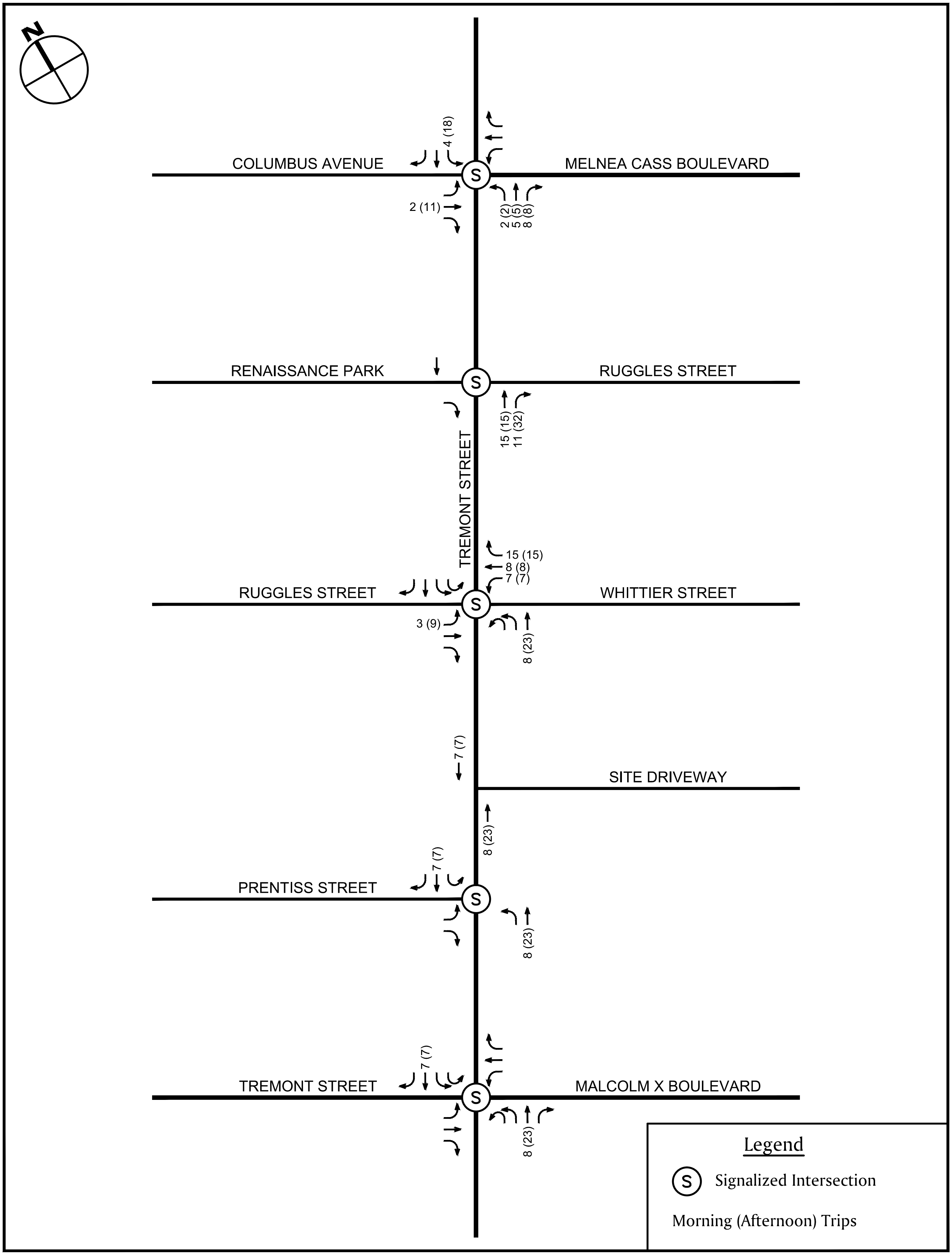
LUC 820 Shopping Center
304 1000 SF G.L.A.

	Equation	R^2	Enter	Exit	Total	Enter	Exit
Weekday Daily	Ln (T) = 0.65 Ln (x) + 5.83	0.79	50%	50%	13990	6995	6995
Weekday AM	0.96		62%	38%	292	182	110
Weekday PM	Ln (T) = 0.67 Ln (x) + 3.31	0.81	48%	52%	1262	606	656
Saturday Midday	Ln (T) = 0.65 Ln (x) + 3.78	0.83	52%	48%	1801	937	864

LUC 857 Discount Club
92 1000 SF G.F.A.

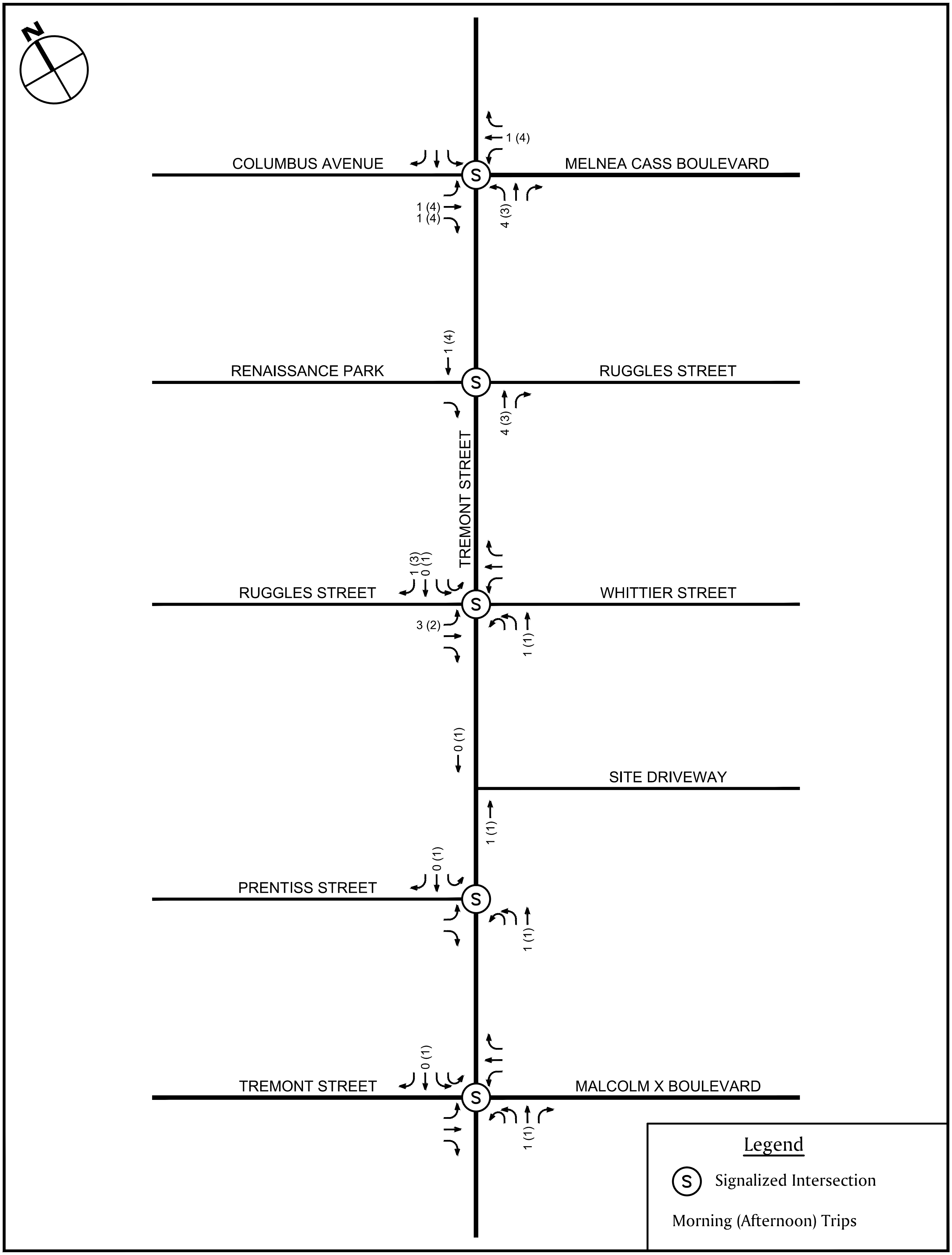
	Equation	R^2	Enter	Exit	Total	Enter	Exit
Weekday Daily	41.80		50%	50%	3846	1923	1923
Weekday AM	0.49		70%	30%	45	32	13
Weekday PM	4.18		50%	50%	385	193	192
Saturday Midday	6.37		49%	51%	586	288	298

Appendix D: Background Traffic Data



Whittier Choice Neighborhood
Tremont Crossing
Boston, Massachusetts

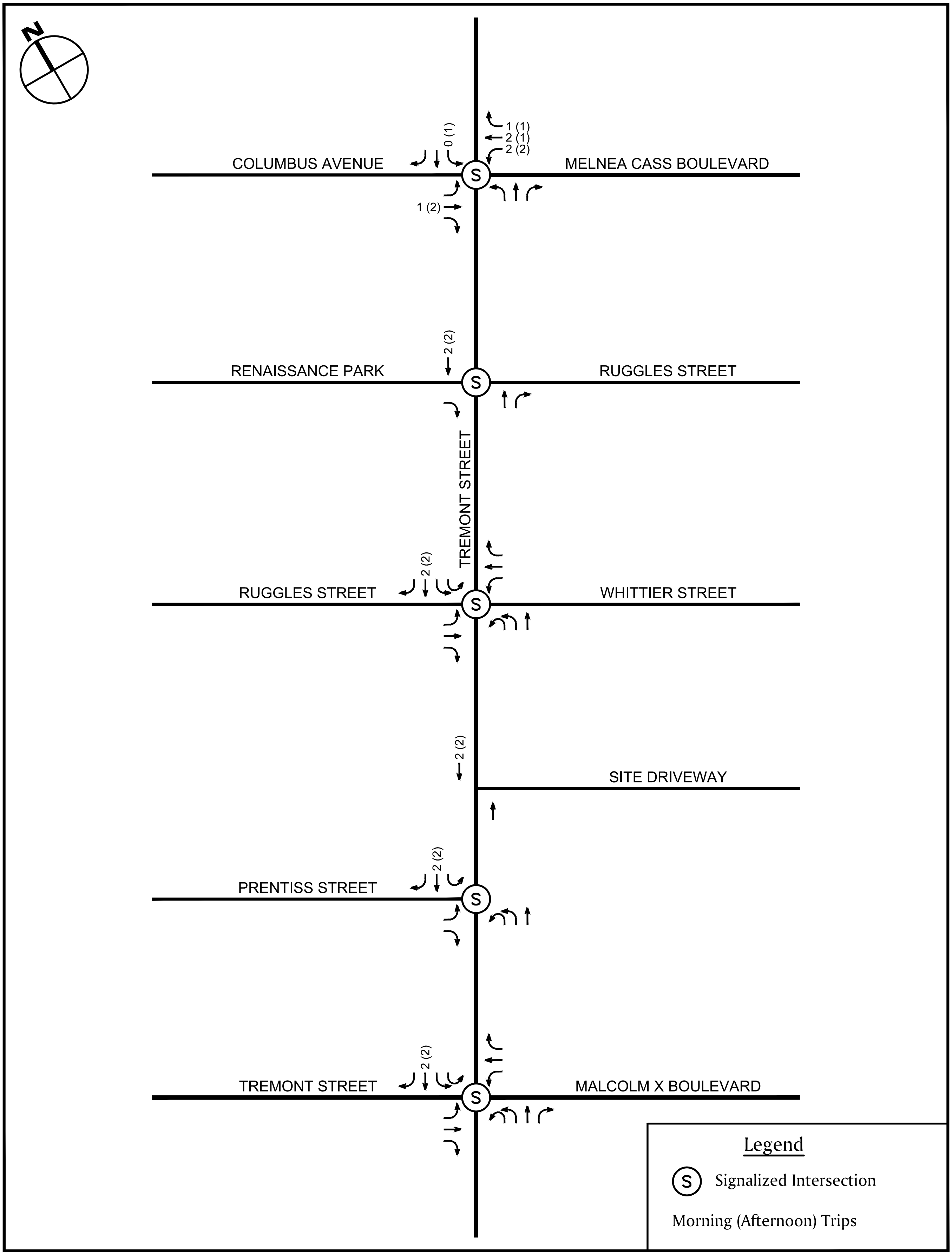
Not to Scale



Northeastern Science and Engineering Building
Tremont Crossing
Boston, Massachusetts

Not to Scale

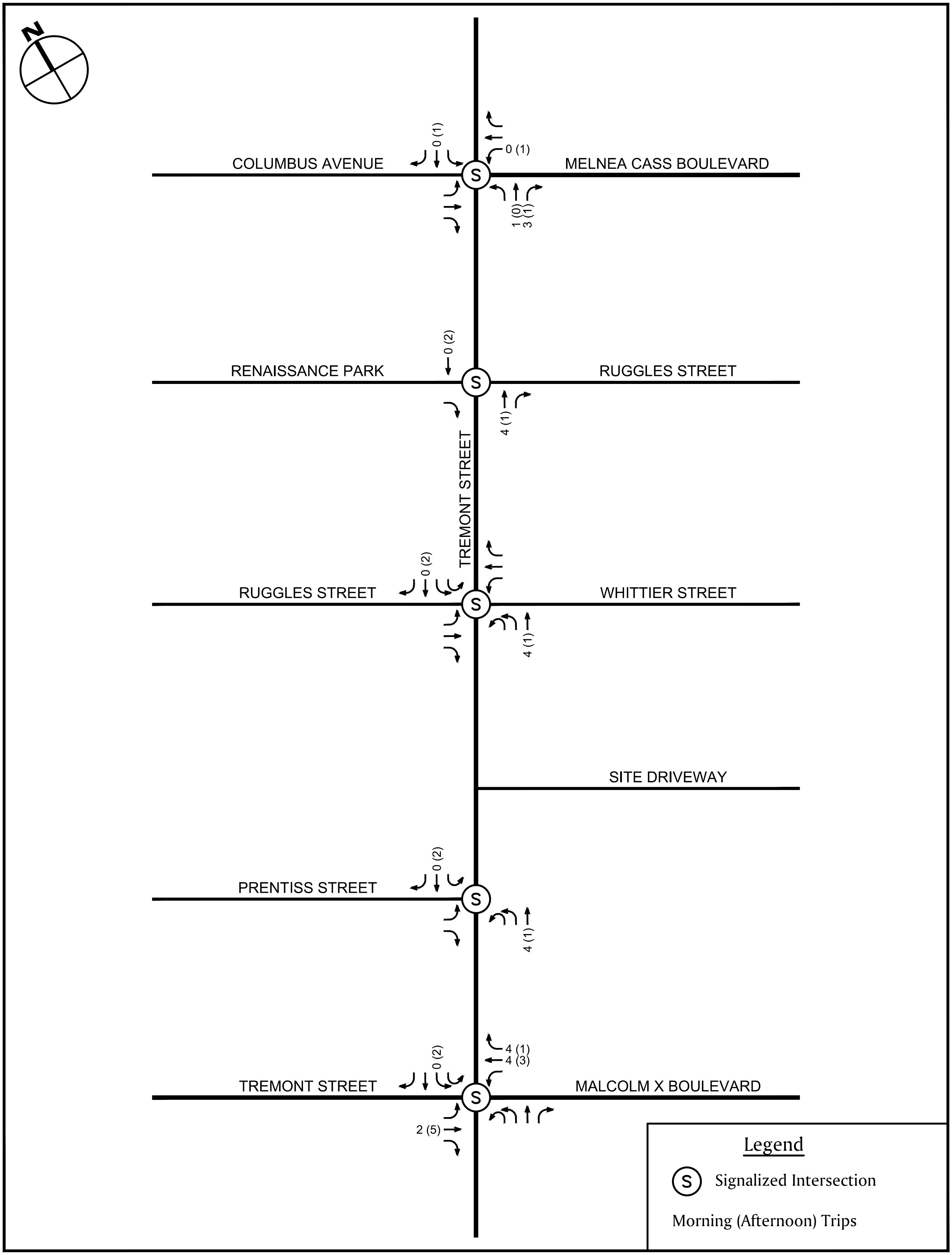
BSC GROUP



Madison Park Infill Sites
Tremont Crossing
Boston, Massachusetts

Not to Scale

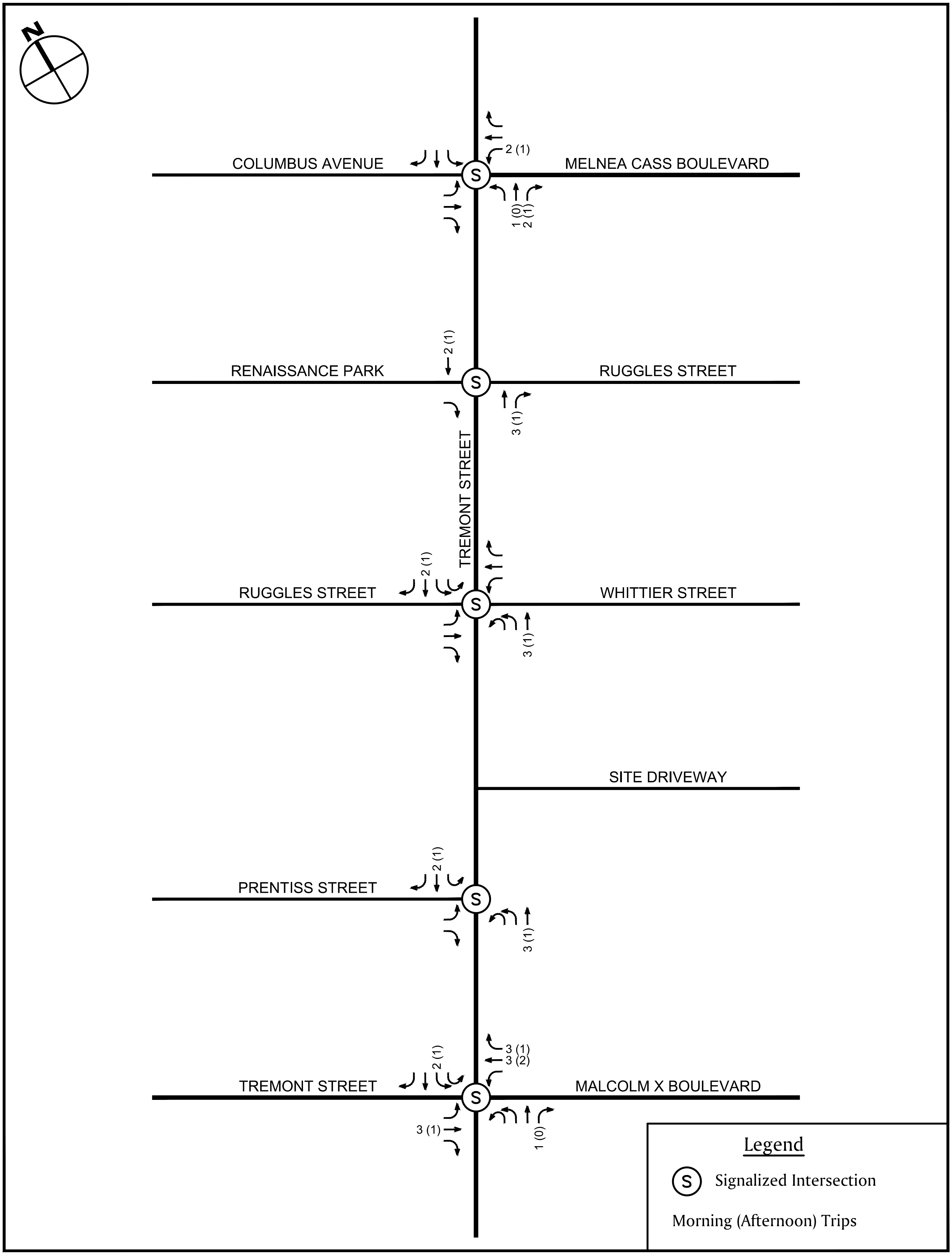
BSC GROUP



2451 Washington Street
Tremont Crossing
Boston, Massachusetts

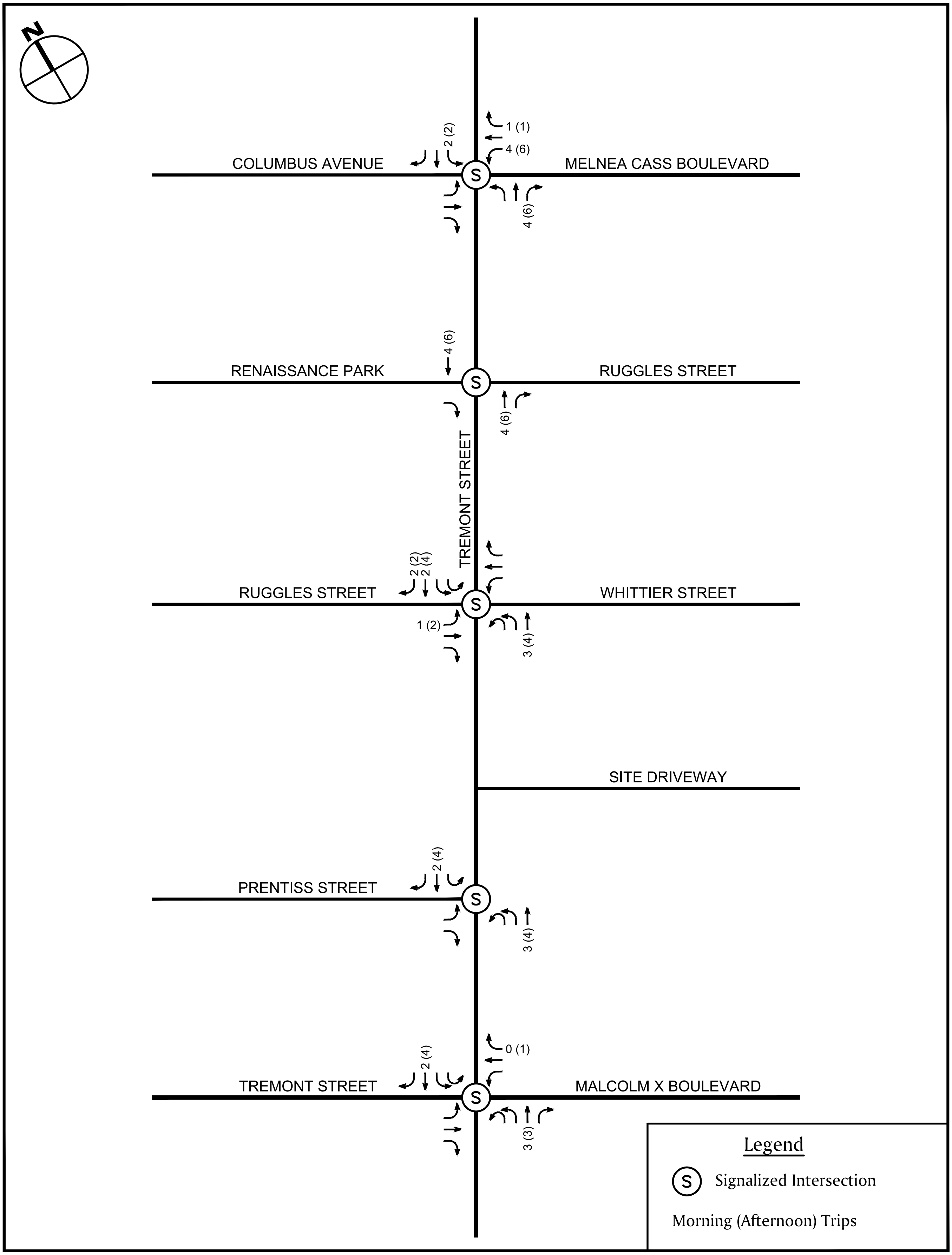
Not to Scale

BSC GROUP



Bartlett Place
Tremont Crossing
Boston, Massachusetts

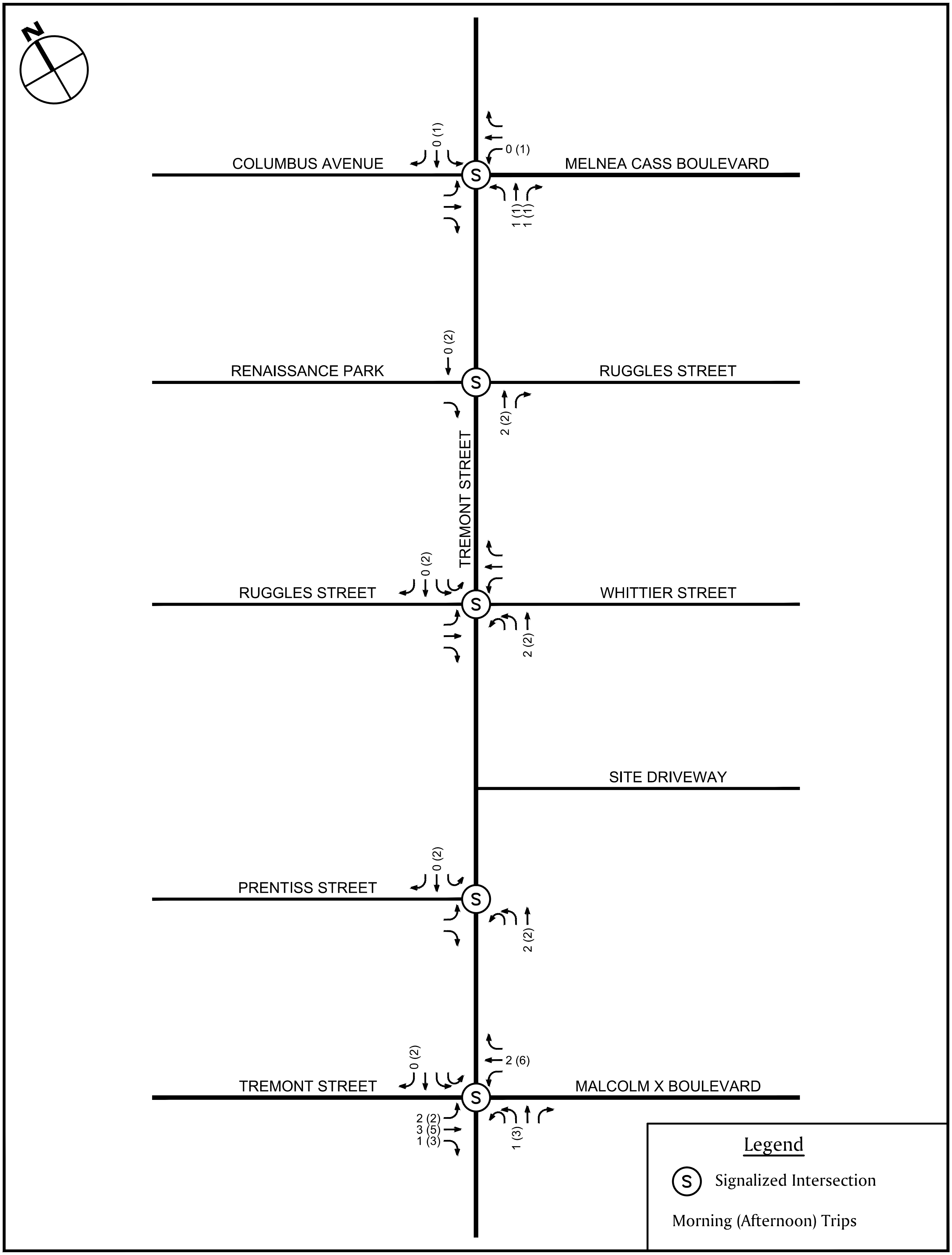
Not to Scale



Parcel 9
Tremont Crossing
Boston, Massachusetts

Not to Scale

BSC GROUP



1486 Tremont Street
Tremont Crossing
Boston, Massachusetts

Not to Scale

BSC GROUP

Appendix E: Signal Warrant Analysis

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                       HCS+: MUTCD Signal Warrants Release 5.5

Analyst: JML                          Intersection: Tremont St at Site Drive
Agency: BSC Group                     Jurisdiction: District 6
Date: 2/21/2012                       Units: U.S. Customary
Project ID: 23155.00 Tremont Crossing Analysis Year: 2012
EW Street: Site Drive                 NS Street: Tremont Street

______________________________General Information__________________________

Major St. Speed (mph): 30             Population: Not less than 10000
Nearest Signal (ft): 200              Coordinated Signal System: Y
Crashes per Yr: 0

________________________________School Crossing____________________________

Students in Highest Hour: 0
Adequate Gaps in Period: 0
Minutes in Period: 0

________________________________Roadway Network____________________________

Two Major Routes: 0
Weekend Count: 0
5-yr Growth Factor: 0

______________________________Geometry and Traffic_________________________
           |  Eastbound     |  Westbound     |  Northbound    |  Southbound    |
           | L    T    R    | L    T    R    | L    T    R    | L    T    R    |
           |______________ |_______________|_______________|_______________|
No. Lanes  |   0   0   0   |   1   0   1   |   0   3   1   |   1   3   0   |
LaneUsage  |               | L     LR   R  |       T    R  | L     LT      |


____________________________________Results________________________________

Warrant 1: Eight-Hour Vehicular Volume                                  [X]
1 A. Minimum Vehicular Volumes                                          [ ]
1 B. Interruption of Continuous Traffic                                 [X]
1 80% Vehicular --and-- Interruption Volumes                            [ ]

Warrant 2: Four-Hour Vehicular Volume
2 A. Four-Hour Vehicular Volumes                                        [X]

Warrant 3: Peak Hour                                                    [X]
3 A. Peak-Hour Conditions                                               [ ]
3 B. Peak-Hour Vehicular Volume Hours Met                               [X]

Warrant 4: Pedestrian Volume                                            [ ]
4 A. Pedestrian Volumes                                                 [ ]
4 B. Gaps Same Period                                                   [ ]

Warrant 5: School Crossing                                              [ ]
5 A. Student Volumes                                                    [ ]
5 B. Gaps Same Period                                                   [ ]

Warrant 6: Coordinated Signal System
6 Degree of Platooning                                                  [X]

Warrant 7: Crash Experience                                             [ ]
7 A. Adequate trials of alternatives                                    [ ]
```

```
7 B. Reported crashes                                                    [ ]
7 80% Volumes for Warrants 1A, 1B --or-- 4                               [X]

Warrant 8: Roadway Network                                               [ ]
8 A. Weekday Volume                                                      [ ]
8 B. Weekend Volume                                                      [ ]
______________________________ Summary ____________________________________
       Major  Minor  Total  Delay    1A    1A   1B     1B   2     3A    3B
Hours  Volume Volume Volume (Veh-hr) 100%  80%  100%   80%  100%  100% 100%
09-10 | 3308 | 133  | 3441 |  0.0   | No  | No  | Yes | Yes | Yes| No  | No
10-11 | 0    | 0    | 0    |  0.0   | No  | No  | No  | No  | No | No  | No
11-12 | 0    | 0    | 0    |  0.0   | No  | No  | No  | No  | No | No  | No
12-13 | 0    | 0    | 0    |  0.0   | No  | No  | No  | No  | No | No  | No
13-14 | 2699 | 389  | 3088 |  0.0   | Yes | Yes | Yes | Yes | Yes| No  | Yes
14-15 | 2648 | 401  | 3049 |  0.0   | Yes | Yes | Yes | Yes | Yes| No  | Yes
15-16 | 2980 | 429  | 3409 |  0.0   | Yes | Yes | Yes | Yes | Yes| No  | Yes
16-17 | 2804 | 420  | 3224 |  0.0   | Yes | Yes | Yes | Yes | Yes| No  | Yes
17-18 | 3302 | 466  | 3768 |  0.0   | Yes | Yes | Yes | Yes | Yes| No  | Yes
18-19 | 3430 | 430  | 3860 |  0.0   | Yes | Yes | Yes | Yes | Yes| No  | Yes
19-20 | 2724 | 361  | 3085 |  0.0   | Yes | Yes | Yes | Yes | Yes| No  | Yes
20-21 | 0    | 0    | 0    |  0.0   | No  | No  | No  | No  | No | No  | No
Total | 23895| 3029 | 26924|        | 7   | 7   | 8   | 8   | 8  | 0   | 7

Traffic Volumes (vph)
      |   Eastbound    |   Westbound    |   Northbound   |   Southbound    |
      |  L    T    R   |  L    T    R   |  L    T    R   |  L    T    R    |
      | 0    0    0    | 133  0    0    | 0    2127 0    | 0    1181 0     |
      | 0    0    0    | 0    0    0    | 0    0    0    | 0    0    0     |
      | 0    0    0    | 0    0    0    | 0    0    0    | 0    0    0     |
      | 0    0    0    | 0    0    0    | 0    0    0    | 0    0    0     |
      | 0    0    0    | 389  0    0    | 0    1344 0    | 0    1355 0     |
      | 0    0    0    | 401  0    0    | 0    1319 0    | 0    1329 0     |
      | 0    0    0    | 429  0    0    | 0    1486 0    | 0    1494 0     |
      | 0    0    0    | 420  0    0    | 0    1397 0    | 0    1407 0     |
      | 0    0    0    | 466  0    0    | 0    1647 0    | 0    1655 0     |
      | 0    0    0    | 430  0    0    | 0    1712 0    | 0    1718 0     |
      | 0    0    0    | 361  0    0    | 0    1357 0    | 0    1367 0     |
      | 0    0    0    | 0    0    0    | 0    0    0    | 0    0    0     |

Pedestrian Volumes and Gaps (Per Hour)
      |  Volume   Gap  |  Volume   Gap  |  Volume   Gap  |  Volume   Gap   |
      |   0       0    |   0       0    |   0       0    |   0       0     |
      |   0       0    |   0       0    |   0       0    |   0       0     |
      |   0       0    |   0       0    |   0       0    |   0       0     |
      |   0       0    |   0       0    |   0       0    |   0       0     |
      |   0       0    |   0       0    |   0       0    |   0       0     |
      |   0       0    |   0       0    |   0       0    |   0       0     |
      |   0       0    |   0       0    |   0       0    |   0       0     |
      |   0       0    |   0       0    |   0       0    |   0       0     |
      |   0       0    |   0       0    |   0       0    |   0       0     |
      |   0       0    |   0       0    |   0       0    |   0       0     |
      |   0       0    |   0       0    |   0       0    |   0       0     |
      |   0       0    |   0       0    |   0       0    |   0       0     |
                                                                           !
Delay |sec/veh  veh-hrs|sec/veh  veh-hrs|sec/veh  veh-hrs|sec/veh  veh-hrs|
      | 0.0      0.0    | 0.0      0.0    | 0.0      0.0    | 0.0      0.0     |
      | 0.0      0.0    | 0.0      0.0    | 0.0      0.0    | 0.0      0.0     |
      | 0.0      0.0    | 0.0      0.0    | 0.0      0.0    | 0.0      0.0     |
      | 0.0      0.0    | 0.0      0.0    | 0.0      0.0    | 0.0      0.0     |
      | 0.0      0.0    | 0.0      0.0    | 0.0      0.0    | 0.0      0.0     |
      | 0.0      0.0    | 0.0      0.0    | 0.0      0.0    | 0.0      0.0     |
```

```
| 0.0       0.0    | 0.0       0.0    | 0.0       0.0    | 0.0       0.0    |
| 0.0       0.0    | 0.0       0.0    | 0.0       0.0    | 0.0       0.0    |
| 0.0       0.0    | 0.0       0.0    | 0.0       0.0    | 0.0       0.0    |
| 0.0       0.0    | 0.0       0.0    | 0.0       0.0    | 0.0       0.0    |
| 0.0       0.0    | 0.0       0.0    | 0.0       0.0    | 0.0       0.0    |
| 0.0       0.0    | 0.0       0.0    | 0.0       0.0    | 0.0       0.0    |
```

Appendix F: Shared Parking Analysis

Table
Project: Tremont Crossing
Description: Shared Parking Analysis

8/2/2016

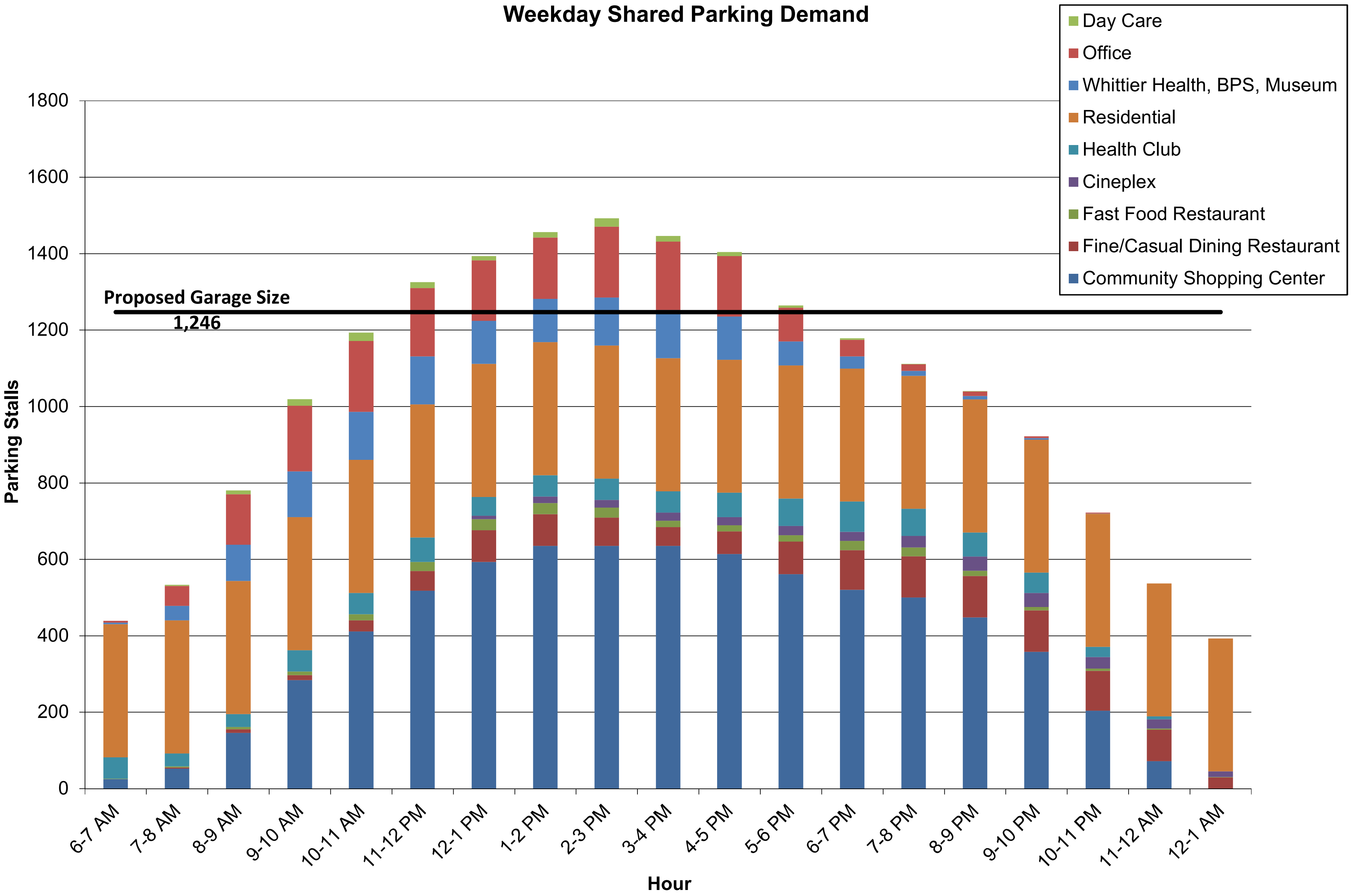
SHARED PARKING DEMAND SUMMARY

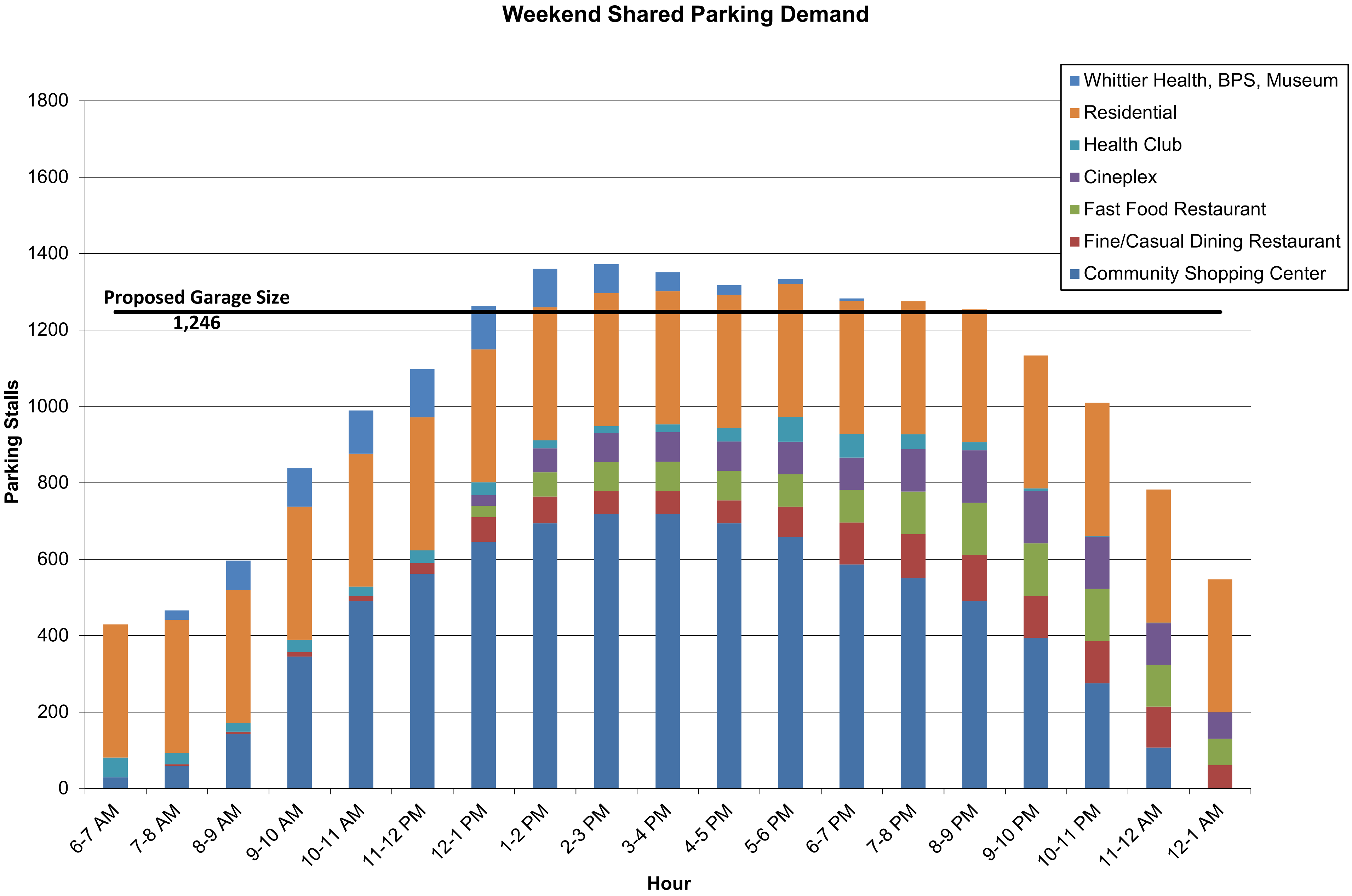
PEAK MONTH: DECEMBER -- PEAK PERIOD: 2 PM, WEEKDAY

			Weekday					Weekend					Weekday			Weekend		
Land Use	**Project Data Quantity**	**Unit**	**Base Rate**	**Mode Adj**	**Non-Captive Ratio**	**Project Rate**	**Unit**	**Base Rate**	**Mode Adj**	**Non-Captive Ratio**	**Project Rate**	**Unit**	**Peak Hr Adj 2 PM**	**Peak Mo Adj December**	**Estimated Parking Demand**	**Peak Hr Adj 1 PM**	**Peak Mo Adj December**	**Estimated Parking Demand**
Community Shopping Center (<400 ksf)	294,154	sf GLA	2.90	0.53	0.95	1.46	/ksf GLA	3.20	0.54	0.95	1.64	/ksf GLA	1.00	1.00	429	0.95	1.00	459
Employee			0.70	1.00	1.00	0.70	/ksf GLA	0.80	1.00	1.00	0.80	/ksf GLA	1.00	1.00	206	1.00	1.00	235
Fine/Casual Dining Restaurant	6,295	sf GLA	15.25	1.00	0.95	14.49	/ksf GLA	17.00	1.00	0.95	16.15	/ksf GLA	0.65	1.00	59	0.55	1.00	56
Employee			2.75	1.00	1.00	2.75	/ksf GLA	3.00	1.00	1.00	3.00	/ksf GLA	0.90	1.00	15	0.75	1.00	14
Fast Food Restaurant	6,500	sf GLA	11.00	0.50	0.80	4.40	/ksf GLA	11.00	0.50	0.80	4.40	/ksf GLA	0.90	1.00	26	1.00	1.00	29
Employee			0.00	1.00	1.00	0.00	/ksf GLA	0.00	1.00	1.00	0.00	/ksf GLA	0.95	1.00	0	1.00	1.00	0
Cineplex	752	seats	0.19	1.00	1.00	0.19	/seat	0.26	1.00	1.00	0.26	/seat	0.55	0.23	18	0.45	0.67	59
Employee			0.01	1.00	1.00	0.01	/seat	0.01	1.00	1.00	0.01	/seat	0.60	0.50	2	0.60	0.80	4
Health Club	50,113	sf GLA	6.60	0.50	0.50	1.65	/ksf GLA	5.50	0.50	0.50	1.38	/ksf GLA	0.70	0.90	52	0.30	0.90	19
Employee			0.40	0.50	0.50	0.10	/ksf GLA	0.25	0.50	0.50	0.06	/ksf GLA	0.75	1.00	4	0.50	1.00	2
Residential, Rental, Shared Spaces	695	units	0.00	1.00	1.00	0.00	/unit	0.00	1.00	1.00	0.00	/unit	0.70	1.00	0	0.70	1.00	0
Reserved	1	sp/unit	1	1.00	1.00	1	/unit	1	1.00	1.00	1	/unit	1.00	1.00	348	1.00	1.00	348
Guest	695	units	0	1.00	1.00	0	/unit	0	1.00	1.00	0	/unit	0.20	1.00	0	0.20	1.00	0
Whittier Health, BPS, Museum	42,000	sf GLA	0.00	1.00	1.00	0.00	/ksf GLA	0.01	1.00	1.00	0.01	/ksf GLA	1.00	1.00	0	0.80	1.00	0
Employee			3.00	1.00	1.00	3.00	/ksf GLA	3.00	1.00	1.00	3.00	/ksf GLA	1.00	1.00	126	0.80	1.00	101
Office 100 to 500 ksf	104,000	sf GLA	0.25	0.44	1.00	0.11	/ksf GLA	0.03	0.44	1.00	0.01	/ksf GLA	1.00	1.00	11	0.80	1.00	1
Employee			4.00	0.44	0.95	1.67	/ksf GLA	4.00	0.44	0.95	1.67	/ksf GLA	1.00	1.00	174	0.80	1.00	139
Day Care	4,377	sf GLA	2.70	1.00	1.00	2.70	/ksf GLA	0.00	1.00	1.00	0.00	/ksf GLA	1.00	1.00	12	0.80	1.00	0
Employee			2.31	1.00	1.00	2.31	/ksf GLA	0.00	1.00	1.00	0.00	/ksf GLA	1.00	1.00	10	0.80	1.00	0
													Customer		607	Customer		623
													Employee		537	Employee		495
													Reserved		348	Reserved		348
													Total		1492	Total		1466

ULI base data have been modified from default values.

Shared Parking Reduction	48%	49%


Weekday Shared Parking Demand
Day Care
Office
Whittier Health, BPS, Museum
Residential
Health Club
Cineplex
Fast Food Restaurant
Fine/Casual Dining Restaurant
Community Shopping Center
Proposed Garage Size
1,246
Parking Stalls
1800
1600
1400
1200
1000
800
600
400
200
0
6-7 AM
7-8 AM
8-9 AM
9-10 AM
10-11 AM
11-12 PM
12-1 PM
1-2 PM
2-3 PM
3-4 PM
4-5 PM
5-6 PM
6-7 PM
7-8 PM
8-9 PM
9-10 PM
10-11 PM
11-12 AM
12-1 AM
Hour


Weekend Shared Parking Demand
Whittier Health, BPS, Museum
Residential
Health Club
Cineplex
Fast Food Restaurant
Fine/Casual Dining Restaurant
Community Shopping Center
Proposed Garage Size
1,246
Parking Stalls
1800
1600
1400
1200
1000
800
600
400
200
0
6-7 AM
7-8 AM
8-9 AM
9-10 AM
10-11 AM
11-12 PM
12-1 PM
1-2 PM
2-3 PM
3-4 PM
4-5 PM
5-6 PM
6-7 PM
7-8 PM
8-9 PM
9-10 PM
10-11 PM
11-12 AM
12-1 AM
Hour

Appendix G: Capacity Analysis Worksheets

Capacity Summary Tables

Table G-1: LOS Summary – Weekday Morning Peak Hour

	2016 Existing				2021 Future No-Build				2021 Future Build			
	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)
SIGNALIZED INTERSECTIONS												
Tremont St / Melnea Cass Blvd / Columbus Ave												
Columbus Ave EB LT	52.2	D	0.39	46	52.0	D	0.42	49	66.3	E	0.41	51
Columbus Ave EB R	>80.0	F	0.09	34	>80.0	F	0.10	36	>80.0	F	0.10	38
Melnea Cass Blvd WB L	>80.0	F	1.12	650	>80.0	F	1.14	670	>80.0	F	1.16	690
Melnea Cass Blvd WB TR	48.5	D	0.70	336	49.7	D	0.72	349	49.7	D	0.72	349
Tremont St NB LT	31.0	C	0.91	456	35.4	D	0.95	509	54.3	D	0.99	466
Tremont St NB R	2.4	A	0.71	317	2.7	A	0.74	356	2.7	A	0.75	274
Tremont St SB LTR	54.5	D	1.24	318	63.8	E	1.50	352	69.0	E	1.30	383
Overall	*49.9*	*D*	*0.98*		*54.3*	*D*	*1.01*		*63.0*	*E*	*1.05*	
Tremont St / Ruggles St / Renaissance St												
Renaissance St EB R	46.9	D	0.05	0	46.9	D	0.05	0	46.9	D	0.05	0
Tremont St NB TR	4.6	A	0.63	8	4.2	A	0.66	15	6.1	A	0.73	148
Tremont St SB T	2.9	A	0.40	83	3.2	A	0.41	83	17.0	B	0.42	311
Overall	*4.7*	*A*	*0.52*		*4.6*	*A*	*0.54*		*10.8*	*B*	*0.59*	
Tremont St / Ruggles St / Whittier St												
Ruggles St EB L	59.7	E	0.89	367	62.0	E	0.91	382	>80.0	F	0.96	403
Ruggles St EB TR	-	-	-	-	-	-	-	-	>80.0	F	0.21	146
Ruggles St EB R	>80.0	F	0.15	116	>80.0	F	0.15	121	-	-	-	-
Whittier St WB LTR	59.5	E	0.55	113	61.7	E	0.66	145	71.4	E	0.78	181
Tremont St NB L	78.6	E	0.95	198	68.9	E	0.97	194	>80.0	F	1.02	400
Tremont St NB T	9.8	A	0.63	257	11.6	B	0.67	259	17.3	B	0.89	445
Tremont St SB L	-	-	-	-	-	-	-	-	>80.0	F	0.51	75
Tremont St SB T	27.3	C	0.82	570	33.4	C	0.88	586	46.7	D	0.88	520
Tremont St SB R	23.4	C	0.70	667	26.8	C	0.74	685	31.1	C	0.74	636
Overall	*35.6*	*D*	*0.83*		*37.9*	*D*	*0.87*		*51.2*	*D*	*0.96*	

Abbreviations: EB = Eastbound, WB = Westbound, NB = Northbound, SB = Southbound, L = Left, T = Through, R = Right

Table G-1: LOS Summary – Weekday Morning Peak Hour

	2016 Existing				2021 Future No-Build				2021 Future Build			
	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)
SIGNALIZED INTERSECTIONS												
Tremont St / Prentiss St												
Prentiss St EB LR	>80.0	F	0.88	231	>80.0	F	0.89	235	62.7	E	0.73	213
Tremont St NB LT	-	-	-	-	-	-	-	-	-	-	-	-
Tremont St NB L	-	-	-	-	-	-	-	-	73.8	E	0.84	216
Tremont St NB T	54.6	D	1.04	752	65.3	E	1.07	761	24.0	C	0.92	606
Tremont St SB TR	>80.0	F	1.39	829	>80.0	F	1.39	860	17.8	B	0.86	130
Overall	*>80.0*	*F*	*1.05*		*>80.0*	*F*	*1.08*		*28.6*	*C*	*0.89*	
Tremont St / Malcolm X Blvd / Columbus Ave												
Tremont St EB LTR	>80.0	F	1.40	530	>80.0	F	1.44	551	>80.0	F	1.50	573
Malcolm X Blvd WB LT	>80.0	F	1.48	428	>80.0	F	1.57	448	>80.0	F	1.63	454
Malcolm X Blvd WB R	0.6	A	0.28	0	0.6	A	0.28	0	0.6	A	0.29	0
Columbus Ave NB L	>80.0	F	1.03	322	>80.0	F	1.05	330	>80.0	F	1.05	330
Columbus Ave NB TR	>80.0	F	1.11	745	>80.0	F	1.13	768	>80.0	F	1.16	789
Tremont St SB L	>80.0	F	1.05	115	>80.0	F	1.07	114	>80.0	F	1.11	200
Tremont St SB TR	48.8	D	0.65	232	49.5	D	0.67	232	57.9	E	0.69	341
Overall	*>80.0*	*F*	*1.03*		*>80.0*	*F*	*1.07*		*>80.0*	*F*	*1.10*	
Tremont St / Site Drive												
Site Drive WB L									61.0	E	0.29	76
Site Drive WB R									56.2	E	0.04	41
Tremont St NB T									0.4	A	0.58	13
Tremont St NB R	Not Applicable				Not Applicable				0.0	A	0.13	0
Tremont St SB L									59.3	E	0.73	136
Tremont St SB T									66.5	E	0.86	518
Overall									*24.8*	*C*	*0.70*	

Abbreviations: EB = Eastbound, WB = Westbound, NB = Northbound, SB = Southbound, L = Left, T = Through, R = Right

Table G-2: LOS Summary – Weekday Evening Peak Hour

	2016 Existing				2021 Future No-Build				2021 Future Build			
	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)
SIGNALIZED INTERSECTIONS												
Tremont St / Melnea Cass Blvd / Columbus Ave												
Columbus Ave EB LT	>80.0	F	0.95	316	>80.0	F	1.03	359	>80.0	F	0.98	357
Columbus Ave EB R	59.5	E	0.31	101	53.4	D	0.37	100	79.7	E	0.53	184
Melnea Cass Blvd WB L	67.5	E	0.94	463	69.0	E	0.95	485	79.5	E	1.00	546
Melnea Cass Blvd WB TR	42.6	D	0.47	208	42.5	D	0.49	219	41.6	D	0.47	219
Tremont St NB LT	58.8	E	1.00	412	78.0	E	1.06	462	>80.0	F	1.20	484
Tremont St NB R	2.1	A	0.68	242	2.3	A	0.70	279	2.6	A	0.73	439
Tremont St SB LTR	61.3	E	0.94	409	>80.0	F	1.57	498	>80.0	F	1.57	553
Overall	*47.5*	*D*	*0.97*		*63.0*	*E*	*1.05*		*>80.0*	*F*	*1.10*	
Tremont St / Ruggles St / Renaissance St												
Renaissance St EB R	48.5	D	0.22	90	48.8	D	0.25	98	49.7	D	0.33	122
Tremont St NB TR	4.0	A	0.59	17	3.8	A	0.62	29	2.3	A	0.65	74
Tremont St SB T	3.2	A	0.42	110	3.3	A	0.43	99	8.9	A	0.49	305
Overall	*5.4*	*A*	*0.51*		*5.3*	*A*	*0.54*		*6.8*	*A*	*0.59*	
Tremont St / Ruggles St / Whittier St												
Ruggles St EB L	47.5	D	0.81	314	48.5	D	0.83	325	54.0	D	0.82	343
Ruggles St EB TR	-	-	-	-	-	-	-	-	75.5	E	0.33	189
Ruggles St EB R	>80.0	F	0.18	135	>80.0	F	0.18	136	-	-	-	-
Whittier St WB LTR	53.9	D	0.47	155	55.6	E	0.58	193	63.5	E	0.76	270
Tremont St NB L	>80.0	F	0.93	225	>80.0	F	0.94	216	>80.0	F	0.96	370
Tremont St NB T	27.1	C	0.58	280	28.4	C	0.62	292	64.0	E	0.88	582
Tremont St SB L	-	-	-	-	-	-	-	-	>80.0	F	1.03	227
Tremont St SB T	51.0	D	0.88	635	57.4	E	0.93	661	>80.0	F	1.12	741
Tremont St SB R	22.1	C	0.73	562	24.5	C	0.76	610	29.2	C	0.81	725
Overall	*51.0*	*D*	*0.80*		*53.3*	*D*	*0.84*		*72.8*	*E*	*0.98*	

Abbreviations: EB = Eastbound, WB = Westbound, NB = Northbound, SB = Southbound, L = Left, T = Through, R = Right

Table G-2 cont'd: LOS Summary – Weekday Evening Peak Hour

	2016 Existing				2021 Future No-Build				2021 Future Build			
	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)
SIGNALIZED INTERSECTIONS												
Tremont St / Prentiss St												
Prentiss St EB LR	>80.0	F	0.93	418	>80.0	F	0.94	425	>80.0	F	1.04	476
Tremont St NB LT	-	-	-	-	-	-	-	-	-	-	-	-
Tremont St NB L	-	-	-	-	-	-	-	-	>80.0	F	1.00	117
Tremont St NB T	37.1	D	0.88	349	39.5	D	0.92	358	39.7	D	0.94	272
Tremont St SB TR	>80.0	F	1.14	927	>80.0	F	1.17	931	20.5	C	0.90	126
Overall	*65.8*	*E*	*0.92*		*73.0*	*E*	*0.94*		*41.6*	*D*	*0.97*	
Tremont St / Malcolm X Blvd / Columbus Ave												
Tremont St EB LTR	>80.0	F	1.37	608	>80.0	F	1.43	637	>80.0	F	1.49	680
Malcolm X Blvd WB LT	>80.0	F	1.40	451	>80.0	F	1.48	475	>80.0	F	1.55	483
Malcolm X Blvd WB R	47.7	D	0.25	92	47.8	D	0.26	94	47.9	D	0.27	97
Columbus Ave NB L	>80.0	F	0.95	309	>80.0	F	0.98	321	>80.0	F	0.98	321
Columbus Ave NB TR	73.2	E	0.97	485	>80.0	F	1.01	515	>80.0	F	1.06	547
Tremont St SB L	>80.0	F	1.09	173	>80.0	F	1.12	170	>80.0	F	1.21	273
Tremont St SB TR	78.1	E	1.04	401	>80.0	F	1.07	398	>80.0	F	1.19	644
Overall	*>80.0*	*F*	*0.94*		*>80.0*	*F*	*0.97*		*>80.0*	*F*	*1.05*	
Tremont St / Site Drive												
Site Drive WB L									56.6	E	0.60	222
Site Drive WB R									55.3	E	0.13	72
Tremont St NB T									1.2	A	0.55	16
Tremont St NB R	Not Applicable				Not Applicable				0.0	A	0.09	0
Tremont St SB L									78.8	E	0.83	118
Tremont St SB T									59.5	E	1.05	654
Overall									*32.6*	*C*	*0.86*	

Abbreviations: EB = Eastbound, WB = Westbound, NB = Northbound, SB = Southbound, L = Left, T = Through, R = Right

Table G-3: LOS Summary – Saturday Midday Peak Hour

	2016 Existing				2021 Future No-Build				2021 Future Build			
	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)
SIGNALIZED INTERSECTIONS												
Tremont St / Melnea Cass Blvd / Columbus Ave												
Columbus Ave EB LT	52.2	D	0.47	91	52.3	D	0.48	91	52.3	D	0.48	91
Columbus Ave EB R	49.9	D	0.14	49	49.9	D	0.14	49	51.5	D	0.37	76
Melnea Cass Blvd WB L	48.5	D	0.84	305	47.7	D	0.84	308	47.8	D	0.86	333
Melnea Cass Blvd WB TR	35.0	D	0.34	123	34.7	C	0.34	126	33.2	C	0.32	124
Tremont St NB LT	13.3	B	0.60	205	13.9	B	0.62	213	28.2	C	0.79	337
Tremont St NB R	1.7	A	0.62	270	1.7	A	0.62	273	1.9	A	0.66	159
Tremont St SB LTR	23.4	C	0.39	202	23.8	C	0.40	205	27.9	C	0.55	282
Overall	*23.2*	*C*	*0.76*		*23.2*	*C*	*0.76*		*26.8*	*C*	*0.84*	
Tremont St / Ruggles St / Renaissance St												
Renaissance St EB R	37.3	D	0.05	0	37.3	D	0.05	0	37.3	D	0.05	6
Tremont St NB TR	5.1	A	0.53	8	5.1	A	0.54	8	6.7	A	0.60	240
Tremont St SB T	3.0	A	0.40	80	3.1	A	0.41	83	8.0	A	0.47	108
Overall	*4.9*	*A*	*0.42*		*5.0*	*A*	*0.42*		*7.9*	*A*	*0.48*	
Tremont St / Ruggles St / Whittier St												
Ruggles St EB L	38.0	D	0.72	138	38.2	D	0.73	143	58.9	E	0.74	199
Ruggles St EB TR	-	-	-	-	-	-	-	-	>80.0	F	0.33	150
Ruggles St EB R	>80.0	F	0.12	66	>80.0	F	0.12	67	-	-	-	-
Whittier St WB LTR	50.7	D	0.11	33	50.7	D	0.11	33	49.7	D	0.32	77
Tremont St NB L	>80.0	F	3.79	378	>80.0	F	3.84	382	54.8	D	0.89	284
Tremont St NB T	11.6	B	0.41	191	11.8	B	0.42	197	31.2	C	0.62	425
Tremont St SB L	-	-	-	-	-	-	-	-	46.7	D	0.63	154
Tremont St SB T	19.8	B	0.71	522	20.1	C	0.72	529	34.9	C	0.82	571
Tremont St SB R	7.1	A	0.52	400	7.2	A	0.52	408	31.5	C	0.57	444
Overall	*>80.0*	*F*	*1.14*		*>80.0*	*F*	*1.16*		*42.2*	*D*	*0.78*	

Abbreviations: EB = Eastbound, WB = Westbound, NB = Northbound, SB = Southbound, L = Left, T = Through, R = Right

Table G-3 cont'd: LOS Summary – Saturday Midday Peak Hour

	2016 Existing				2021 Future No-Build				2021 Future Build			
	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)	Ave. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)
SIGNALIZED INTERSECTIONS												
Tremont St / Prentiss St												
Prentiss St EB LR	52.6	D	0.51	104	52.6	D	0.52	105	53.6	D	0.54	110
Tremont St NB LT	-	-	-	-	-	-	-	-	-	-	-	-
Tremont St NB L	-	-	-	-	-	-	-	-	64.6	E	0.66	81
Tremont St NB T	14.3	B	0.59	390	14.6	B	0.61	395	38.6	D	0.91	462
Tremont St SB TR	14.1	B	0.83	530	14.5	B	0.84	542	12.1	B	0.72	87
Overall	*15.6*	*B*	*0.64*		*15.9*	*B*	*0.65*		*27.7*	*C*	*0.77*	
Tremont St / Malcolm X Blvd / Columbus Ave												
Tremont St EB LTR	58.8	E	0.87	255	60.2	E	0.89	262	>80.0	F	1.06	352
Malcolm X Blvd WB LT	>80.0	F	0.98	244	>80.0	F	0.99	248	>80.0	F	1.02	253
Malcolm X Blvd WB R	42.2	D	0.23	62	42.3	D	0.23	62	42.5	D	0.25	64
Columbus Ave NB L	55.4	E	0.63	155	55.9	E	0.63	157	55.9	E	0.63	157
Columbus Ave NB TR	43.8	D	0.73	394	44.1	D	0.74	401	46.7	D	0.81	447
Tremont St SB L	>80.0	F	1.17	227	>80.0	F	1.18	225	>80.0	F	1.33	330
Tremont St SB TR	49.1	D	0.71	364	49.5	D	0.72	371	51.1	D	0.88	458
Overall	58.9	E	0.72		*60.0*	*E*	*0.73*		*73.0*	*E*	*0.82*	
Tremont St / Site Drive												
Site Drive WB L									47.5	D	0.68	273
Site Drive WB R									42.5	D	0.15	65
Tremont St NB T									0.9	A	0.50	12
Tremont St NB R	Not Applicable				Not Applicable				0.0	A	0.14	0
Tremont St SB L									36.7	D	0.83	144
Tremont St SB T									21.8	C	0.60	463+
Overall									*16.8*	*B*	*0.70*	

Abbreviations: EB = Eastbound, WB = Westbound, NB = Northbound, SB = Southbound, L = Left, T = Through, R = Right

2012 Existing Conditions

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations		↱	↑↑↑	↱		↑↑
Traffic Volume (veh/h)	0	26	1520	278	0	973
Future Volume (Veh/h)	0	26	1520	278	0	973
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	28	1652	302	0	1058
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			452			496
pX, platoon unblocked	0.76					
vC, conflicting volume	2181	551			1954	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1924	551			1954	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	94			100	
cM capacity (veh/h)	45	478			295	

Direction, Lane #	NW 1	NE 1	NE 2	NE 3	NE 4	SW 1	SW 2
Volume Total	28	551	551	551	302	529	529
Volume Left	0	0	0	0	0	0	0
Volume Right	28	0	0	0	302	0	0
cSH	478	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.06	0.32	0.32	0.32	0.18	0.31	0.31
Queue Length 95th (ft)	5	0	0	0	0	0	0
Control Delay (s)	13.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B						
Approach Delay (s)	13.0	0.0				0.0	
Approach LOS	B						

Intersection Summary

Average Delay	0.1		
Intersection Capacity Utilization	39.4%	ICU Level of Service	A
Analysis Period (min)	15		

192: Columbus Avenue /Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd

2/4/2016

	→	←	↖	↰	↑	↘	↓
Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	696	476	340	173	1509	131	777
v/c Ratio	1.37	1.48	0.28	1.03	1.09	1.05	0.64
Control Delay	210.0	270.9	0.6	137.2	96.7	85.0	51.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	210.0	270.9	0.6	137.2	96.7	85.0	51.4
Queue Length 50th (ft)	~435	~313	0	~167	~647	~127	268
Queue Length 95th (ft)	#530	#428	0	#322	#745	m115	m232
Internal Link Dist (ft)	381	1183			1304		709
Turn Bay Length (ft)				205		205	
Base Capacity (vph)	508	322	1232	168	1387	125	1220
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.37	1.48	0.28	1.03	1.09	1.05	0.64

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

192: Columbus Avenue /Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd

2/4/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations		↰↑↱			↰↑	↱	↰	↑↑↱			↰	↑↑↱
Traffic Volume (vph)	172	303	124	60	396	326	163	1352	67	4	119	577
Future Volume (vph)	172	303	124	60	396	326	163	1352	67	4	119	577
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor		0.95			0.95	1.00	1.00	0.91			1.00	0.91
Frt		0.97			1.00	0.85	1.00	0.99			1.00	0.97
Flt Protected		0.99			0.99	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)		2926			2954	1232	1577	4455			1171	3915
Flt Permitted		0.55			0.63	1.00	0.95	1.00			0.95	1.00
Satd. Flow (perm)		1626			1882	1232	1577	4455			1171	3915
Peak-hour factor, PHF	0.86	0.86	0.86	0.96	0.96	0.96	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	200	352	144	62	412	340	173	1438	71	4	127	614
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	696	0	0	476	340	173	1509	0	0	131	777
Heavy Vehicles (%)	8%	5%	6%	11%	9%	18%	3%	4%	5%	0%	40%	8%
Parking (#/hr)												20
Turn Type	pm+pt	NA		Perm	NA	Free	Prot	NA		Prot	Prot	NA
Protected Phases	3	3 4			4		5	1		5	5	1
Permitted Phases	3 4			4		Free						
Actuated Green, G (s)		30.0			21.0	140.0	13.0	40.8			13.0	40.8
Effective Green, g (s)		34.0			24.0	140.0	15.0	42.8			15.0	42.8
Actuated g/C Ratio		0.24			0.17	1.00	0.11	0.31			0.11	0.31
Clearance Time (s)					7.0		6.0	6.0			6.0	6.0
Vehicle Extension (s)					2.0		2.0	2.0			2.0	2.0
Lane Grp Cap (vph)		497			322	1232	168	1361			125	1196
v/s Ratio Prot		c0.11					0.11	c0.34			c0.11	0.20
v/s Ratio Perm		0.23			c0.25	c0.28						
v/c Ratio		1.40			1.48	0.28	1.03	1.11			1.05	0.65
Uniform Delay, d1		53.0			58.0	0.0	62.5	48.6			62.5	42.1
Progression Factor		0.87			1.00	1.00	1.00	1.00			0.76	1.15
Incremental Delay, d2		189.2			231.3	0.6	77.5	59.9			37.8	0.3
Delay (s)		235.3			289.3	0.6	140.0	108.5			85.5	48.8
Level of Service		F			F	A	F	F			F	D
Approach Delay (s)		235.3			169.0			111.8				54.1
Approach LOS		F			F			F				D

Intersection Summary

HCM 2000 Control Delay	131.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	84.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	153
Future Volume (vph)	153
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.94
Adj. Flow (vph)	163
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Heavy Vehicles (%)	7%
Parking (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

611: Tremont Street & Ruggles St/Whittier St

Lane Group	EBL	EBR	WBT	NEL	NET	SWT	SWR
Lane Group Flow (vph)	606	148	123	224	1475	811	539
v/c Ratio	0.89	0.49	0.57	0.95	0.63	0.82	0.74
Control Delay	62.7	36.6	62.3	79.4	10.4	29.8	28.9
Queue Delay	2.3	0.0	0.0	44.3	0.2	5.4	0.0
Total Delay	65.0	36.6	62.3	123.6	10.6	35.2	28.9
Queue Length 50th (ft)	260	43	100	201	244	356	460
Queue Length 95th (ft)	#367	116	113	m198	m257	#570	#667
Internal Link Dist (ft)			271		416	238	
Turn Bay Length (ft)				200			
Base Capacity (vph)	695	304	354	235	2354	994	738
Starvation Cap Reductn	31	0	0	0	0	132	0
Spillback Cap Reductn	0	0	0	52	198	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.91	0.49	0.35	1.22	0.68	0.94	0.73

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
611: Tremont Street & Ruggles St/Whittier St

Timing Plan: 2016 Baseline AM
2/4/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰↰		↱		✥		↰	↑↑↑			↑↑	↱
Traffic Volume (vph)	533	0	130	35	32	19	206	1357	0	0	779	517
Future Volume (vph)	533	0	130	35	32	19	206	1357	0	0	779	517
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	16	12	11	11	12	12	11	11
Total Lost time (s)	4.0		4.0		4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	0.97		1.00		1.00		1.00	0.91			0.95	1.00
Frpb, ped/bikes	1.00		1.00		0.99		1.00	1.00			1.00	0.95
Flpb, ped/bikes	1.00		1.00		0.99		1.00	1.00			1.00	1.00
Frt	1.00		0.85		0.97		1.00	1.00			1.00	0.85
Flt Protected	0.95		1.00		0.98		0.95	1.00			1.00	1.00
Satd. Flow (prot)	2865		989		1676		1266	4257			2935	1268
Flt Permitted	0.95		1.00		0.98		0.95	1.00			1.00	1.00
Satd. Flow (perm)	2865		989		1676		1266	4257			2935	1268
Peak-hour factor, PHF	0.88	0.88	0.88	0.70	0.70	0.70	0.92	0.92	0.92	0.96	0.96	0.96
Adj. Flow (vph)	606	0	148	50	46	27	224	1475	0	0	811	539
RTOR Reduction (vph)	0	0	121	0	8	0	0	0	0	0	0	0
Lane Group Flow (vph)	606	0	27	0	115	0	224	1475	0	0	811	539
Confl. Peds. (#/hr)	8		9	9		8	20					20
Heavy Vehicles (%)	10%	0%	42%	14%	0%	14%	24%	6%	67%	0%	7%	5%
Parking (#/hr)				15		0						
Turn Type	Prot		Over	Perm	NA		Prot	NA			NA	pm+ov
Protected Phases	3		1		4		1	6			2	3
Permitted Phases				4								2
Actuated Green, G (s)	31.2		24.0		15.4		24.0	75.4			45.4	76.6
Effective Green, g (s)	33.2		26.0		17.4		26.0	77.4			47.4	80.6
Actuated g/C Ratio	0.24		0.19		0.12		0.19	0.55			0.34	0.58
Clearance Time (s)	6.0		6.0		6.0		6.0	6.0			6.0	6.0
Vehicle Extension (s)	2.0		2.0		2.0		2.0	2.0			2.0	2.0
Lane Grp Cap (vph)	679		183		208		235	2353			993	766
v/s Ratio Prot	c0.21		0.03				c0.18	0.35			c0.28	0.17
v/s Ratio Perm					0.07							0.26
v/c Ratio	0.89		0.15		0.55		0.95	0.63			0.82	0.70
Uniform Delay, d1	51.7		47.7		57.6		56.4	21.4			42.3	21.2
Progression Factor	0.90		4.15		1.00		1.04	0.44			0.48	1.00
Incremental Delay, d2	13.4		0.1		1.8		19.8	0.3			7.0	2.3
Delay (s)	59.7		198.1		59.5		78.6	9.8			27.3	23.4
Level of Service	E		F		E		E	A			C	C
Approach Delay (s)		86.9			59.5			18.9			25.8	
Approach LOS		F			E			B			C	

Intersection Summary

HCM 2000 Control Delay	35.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

3082: Tremont Street & Renaissance Park/Ruggles St

Lane Group	EBR	NET	SWT
Lane Group Flow (vph)	60	1987	1280
v/c Ratio	0.20	0.64	0.40
Control Delay	1.6	4.6	3.0
Queue Delay	0.0	0.4	1.6
Total Delay	1.6	5.0	4.5
Queue Length 50th (ft)	0	309	40
Queue Length 95th (ft)	0	8	m83
Internal Link Dist (ft)		238	380
Turn Bay Length (ft)			
Base Capacity (vph)	329	3129	3223
Starvation Cap Reductn	0	527	1680
Spillback Cap Reductn	7	151	305
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.19	0.76	0.83

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations			↱					↑↑↱			↑↑↑	
Traffic Volume (vph)	0	0	43	0	0	0	0	1800	127	0	1242	0
Future Volume (vph)	0	0	43	0	0	0	0	1800	127	0	1242	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	16	12	11	12	12	11	12
Total Lost time (s)			4.0					4.0			4.0	
Lane Util. Factor			1.00					0.91			0.91	
Frpb, ped/bikes			1.00					0.99			1.00	
Flpb, ped/bikes			1.00					1.00			1.00	
Frt			0.86					0.99			1.00	
Flt Protected			1.00					1.00			1.00	
Satd. Flow (prot)			1174					4126			4257	
Flt Permitted			1.00					1.00			1.00	
Satd. Flow (perm)			1174					4126			4257	
Peak-hour factor, PHF	0.72	0.72	0.72	0.92	0.92	0.92	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	0	60	0	0	0	0	1856	131	0	1280	0
RTOR Reduction (vph)	0	0	49	0	0	0	0	5	0	0	0	0
Lane Group Flow (vph)	0	0	11	0	0	0	0	1982	0	0	1280	0
Confl. Peds. (#/hr)									12			
Heavy Vehicles (%)	0%	0%	26%	0%	0%	0%	0%	7%	18%	0%	6%	0%
Turn Type			Prot					NA			NA	
Protected Phases			5					1			1	
Permitted Phases												
Actuated Green, G (s)			25.0					105.0			105.0	
Effective Green, g (s)			26.0					106.0			106.0	
Actuated g/C Ratio			0.19					0.76			0.76	
Clearance Time (s)			5.0					5.0			5.0	
Vehicle Extension (s)			2.0					2.0			2.0	
Lane Grp Cap (vph)			218					3123			3223	
v/s Ratio Prot			c0.01					c0.48			0.30	
v/s Ratio Perm												
v/c Ratio			0.05					0.63			0.40	
Uniform Delay, d1			46.9					7.9			5.9	
Progression Factor			1.00					0.49			0.48	
Incremental Delay, d2			0.0					0.7			0.1	
Delay (s)			46.9					4.6			2.9	
Level of Service			D					A			A	
Approach Delay (s)		46.9			0.0			4.6			2.9	
Approach LOS		D			A			A			A	

Intersection Summary

HCM 2000 Control Delay	4.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	45.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

3098: Tremont Street /Tremont St & Melnea Cass Boulevard

	→	↘	↙	←	↑	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	50	130	961	303	1081	1094	427
v/c Ratio	0.39	0.57	1.12	0.70	0.91	0.71	1.24dl
Control Delay	57.2	21.6	113.3	54.4	28.3	7.6	55.1
Queue Delay	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Total Delay	57.2	22.2	113.3	54.4	28.3	7.6	55.1
Queue Length 50th (ft)	37	22	~516	247	342	247	180
Queue Length 95th (ft)	m46	m34	#650	336	#456	317	#318
Internal Link Dist (ft)	197			732	380		216
Turn Bay Length (ft)			350				
Base Capacity (vph)	243	320	861	435	1183	1532	554
Starvation Cap Reductn	0	47	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.48	1.12	0.70	0.91	0.71	0.77

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.
dl Defacto Left Lane. Recode with 1 though lane as a left lane.

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱	↰↰	↱			↰↑	↱		↰↱	
Traffic Volume (vph)	2	38	108	923	211	47	365	528	963	31	321	14
Future Volume (vph)	2	38	108	923	211	47	365	528	963	31	321	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	13	12	13	13	12	12	11	16	12	14	12
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00	0.97	1.00			0.95	1.00		0.95	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.99		1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt		1.00	0.85	1.00	0.97			1.00	0.85		0.99	
Flt Protected		1.00	1.00	0.95	1.00			0.98	1.00		0.99	
Satd. Flow (prot)		1626	1398	3015	1525			2914	1532		3183	
Flt Permitted		1.00	1.00	0.95	1.00			0.60	1.00		0.57	
Satd. Flow (perm)		1626	1398	3015	1525			1794	1532		1841	
Peak-hour factor, PHF	0.38	0.84	0.83	0.96	0.86	0.81	0.82	0.83	0.88	0.54	0.93	0.55
Adj. Flow (vph)	5	45	130	961	245	58	445	636	1094	57	345	25
RTOR Reduction (vph)	0	0	120	0	0	0	0	0	0	0	3	0
Lane Group Flow (vph)	0	50	10	961	303	0	0	1081	1094	0	424	0
Confl. Peds. (#/hr)									8			
Heavy Vehicles (%)	0%	9%	4%	8%	12%	15%	5%	6%	6%	20%	3%	36%
Turn Type	Split	NA	Perm	Split	NA		pm+pt	NA	Free	Perm	NA	
Protected Phases	5	5		6	6		7	1 7			1	
Permitted Phases			5				1 7		Free	1		
Actuated Green, G (s)		11.0	11.0	40.0	40.0			73.0	140.0		42.0	
Effective Green, g (s)		11.0	11.0	40.0	40.0			73.0	140.0		42.0	
Actuated g/C Ratio		0.08	0.08	0.29	0.29			0.52	1.00		0.30	
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0						2.0	
Lane Grp Cap (vph)		127	109	861	435			1183	1532		552	
v/s Ratio Prot		0.03		c0.32	0.20			c0.20				
v/s Ratio Perm			0.01					c0.27	c0.71		0.23	
v/c Ratio		0.39	0.09	1.12	0.70			0.91	0.71		1.24dl	
Uniform Delay, d1		61.3	59.9	50.0	44.6			30.6	0.0		44.6	
Progression Factor		0.84	1.56	1.00	1.00			0.66	1.00		1.00	
Incremental Delay, d2		0.6	0.1	67.8	3.9			10.7	2.4		9.9	
Delay (s)		52.2	93.4	117.8	48.5			31.0	2.4		54.5	
Level of Service		D	F	F	D			C	A		D	
Approach Delay (s)		82.0			101.2			16.7			54.5	
Approach LOS		F			F			B			D	

Intersection Summary

HCM 2000 Control Delay	49.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	85.3%	ICU Level of Service	E
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group

Queues

Timing Plan: 2016 Baseline AM

4023: Tremont Street & Prentiss St

2/4/2016

	↗	↑	↓
Lane Group	EBL	NBT	SBT
Lane Group Flow (vph)	196	2105	1005
v/c Ratio	0.89	1.01	1.39dl
Control Delay	93.5	39.2	137.8
Queue Delay	0.0	0.0	0.0
Total Delay	93.5	39.2	137.8
Queue Length 50th (ft)	170	616	~355
Queue Length 95th (ft)	#231	m#752	#829
Internal Link Dist (ft)	258	709	372
Turn Bay Length (ft)			
Base Capacity (vph)	231	2079	843
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.85	1.01	1.19

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.
dl Defacto Left Lane. Recode with 1 though lane as a left lane.

Movement	EBL	EBR	NBU	NBL	NBT	SBU	SBT	SBR
Lane Configurations	↰↱				↰↑↑		↑↱	
Traffic Volume (vph)	123	28	1	254	1619	56	777	139
Future Volume (vph)	123	28	1	254	1619	56	777	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	12	11	12	11	12
Total Lost time (s)	4.0				4.0		4.0	
Lane Util. Factor	1.00				0.91		0.95	
Frt	0.98				1.00		0.98	
Flt Protected	0.96				0.99		1.00	
Satd. Flow (prot)	1501				4210		2465	
Flt Permitted	0.96				0.66		0.59	
Satd. Flow (perm)	1501				2785		1457	
Peak-hour factor, PHF	0.77	0.77	0.92	0.89	0.89	0.92	0.97	0.97
Adj. Flow (vph)	160	36	1	285	1819	61	801	143
RTOR Reduction (vph)	6	0	0	0	0	0	8	0
Lane Group Flow (vph)	190	0	0	0	2105	0	997	0
Heavy Vehicles (%)	11%	7%	2%	3%	7%	2%	13%	10%
Parking (#/hr)							20	
Turn Type	Prot		custom	pm+pt	NA	Perm	NA	
Protected Phases	5			6	1 6		1	
Permitted Phases			6	1 6		1		
Actuated Green, G (s)	19.1				91.9		76.9	
Effective Green, g (s)	20.1				93.9		77.9	
Actuated g/C Ratio	0.14				0.67		0.56	
Clearance Time (s)	5.0						5.0	
Vehicle Extension (s)	2.0						2.0	
Lane Grp Cap (vph)	215				2030		810	
v/s Ratio Prot	c0.13				c0.12			
v/s Ratio Perm					0.58		c0.68	
v/c Ratio	0.88				1.04		1.39dl	
Uniform Delay, d1	58.8				23.0		31.0	
Progression Factor	1.00				1.35		1.85	
Incremental Delay, d2	31.2				23.4		111.8	
Delay (s)	90.0				54.6		169.2	
Level of Service	F				D		F	
Approach Delay (s)	90.0				54.6		169.2	
Approach LOS	F				D		F	

Intersection Summary

HCM 2000 Control Delay	91.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	90.6%	ICU Level of Service	E
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group

7: Tremont Street & Site Driveway

2/4/2016

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations		↱	↑↑↑	↱		↑↑
Traffic Volume (veh/h)	0	177	1299	51	0	1231
Future Volume (Veh/h)	0	177	1299	51	0	1231
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	192	1412	55	0	1338
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			300			648
pX, platoon unblocked	0.83	0.80			0.80	
vC, conflicting volume	2081	471			1467	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	435	0			697	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	78			100	
cM capacity (veh/h)	457	865			714	

Direction, Lane #	NW 1	NE 1	NE 2	NE 3	NE 4	SW 1	SW 2
Volume Total	192	471	471	471	55	669	669
Volume Left	0	0	0	0	0	0	0
Volume Right	192	0	0	0	55	0	0
cSH	865	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.22	0.28	0.28	0.28	0.03	0.39	0.39
Queue Length 95th (ft)	21	0	0	0	0	0	0
Control Delay (s)	10.3	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B						
Approach Delay (s)	10.3	0.0				0.0	
Approach LOS	B						

Intersection Summary

Average Delay	0.7		
Intersection Capacity Utilization	42.7%	ICU Level of Service	A
Analysis Period (min)	15		

192: Columbus Avenue/Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd

2/4/2016

	→	←	↖	↖	↑	↘	↓
Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	766	521	320	192	1052	188	1092
v/c Ratio	1.34	1.40	0.63	0.95	0.95	1.09	1.02
Control Delay	199.3	236.6	10.8	111.6	68.8	123.1	66.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	199.3	236.6	10.8	111.6	68.8	123.1	66.9
Queue Length 50th (ft)	~474	~332	0	176	~426	~197	~453
Queue Length 95th (ft)	#608	#451	92	#309	#485	m#173	m#401
Internal Link Dist (ft)	381	1186			1304		709
Turn Bay Length (ft)				205		205	
Base Capacity (vph)	571	372	511	202	1109	172	1069
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.34	1.40	0.63	0.95	0.95	1.09	1.02

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis — Timing Plan: 2016 Baseline PM

192: Columbus Avenue/Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd — 2/4/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations		↰↑↱			↰↑	↱		↰	↑↑↱			↰
Traffic Volume (vph)	185	359	199	78	401	294	1	164	816	89	2	180
Future Volume (vph)	185	359	199	78	401	294	1	164	816	89	2	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0		4.0	4.0			4.0
Lane Util. Factor		0.95			0.95	1.00		1.00	0.91			1.00
Frt		0.96			1.00	0.85		1.00	0.99			1.00
Flt Protected		0.99			0.99	1.00		0.95	1.00			0.95
Satd. Flow (prot)		2933			3064	1275		1577	4364			1345
Flt Permitted		0.54			0.60	1.00		0.95	1.00			0.95
Satd. Flow (perm)		1597			1863	1275		1577	4364			1345
Peak-hour factor, PHF	0.97	0.97	0.97	0.92	0.92	0.92	0.86	0.86	0.86	0.86	0.97	0.97
Adj. Flow (vph)	191	370	205	85	436	320	1	191	949	103	2	186
RTOR Reduction (vph)	0	0	0	0	0	256	0	0	0	0	0	0
Lane Group Flow (vph)	0	766	0	0	521	64	0	192	1052	0	0	188
Heavy Vehicles (%)	5%	5%	5%	6%	5%	14%	0%	3%	5%	9%	0%	21%
Parking (#/hr)												
Turn Type	D.P+P	NA		Perm	NA	Perm	Prot	Prot	NA		Prot	Prot
Protected Phases	3	3 4			4		5	5	1		5	5
Permitted Phases	4			4		4						
Actuated Green, G (s)		35.0			25.0	25.0		16.0	32.8			16.0
Effective Green, g (s)		39.0			28.0	28.0		18.0	34.8			18.0
Actuated g/C Ratio		0.28			0.20	0.20		0.13	0.25			0.13
Clearance Time (s)					7.0	7.0		6.0	6.0			6.0
Vehicle Extension (s)					3.0	3.0		2.0	2.0			2.0
Lane Grp Cap (vph)		559			372	255		202	1084			172
v/s Ratio Prot		c0.12						0.12	0.24			c0.14
v/s Ratio Perm		0.26			c0.28	0.05						
v/c Ratio		1.37			1.40	0.25		0.95	0.97			1.09
Uniform Delay, d1		50.5			56.0	47.2		60.6	52.1			61.0
Progression Factor		1.04			1.00	1.00		1.00	1.00			1.38
Incremental Delay, d2		174.3			195.8	0.5		48.8	21.1			51.0
Delay (s)		227.0			251.8	47.7		109.4	73.2			135.1
Level of Service		F			F	D		F	E			F
Approach Delay (s)		227.0			174.1				78.8			
Approach LOS		F			F				E			

Intersection Summary

HCM 2000 Control Delay	128.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	88.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

	↓	↙
Movement	SBT	SBR
Lane Configurations	↑↑↱	
Traffic Volume (vph)	954	105
Future Volume (vph)	954	105
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.0	
Lane Util. Factor	0.91	
Frt	0.99	
Flt Protected	1.00	
Satd. Flow (prot)	4209	
Flt Permitted	1.00	
Satd. Flow (perm)	4209	
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	984	108
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	1092	0
Heavy Vehicles (%)	3%	2%
Parking (#/hr)	15	
Turn Type	NA	
Protected Phases	1	
Permitted Phases		
Actuated Green, G (s)	32.8	
Effective Green, g (s)	34.8	
Actuated g/C Ratio	0.25	
Clearance Time (s)	6.0	
Vehicle Extension (s)	2.0	
Lane Grp Cap (vph)	1046	
v/s Ratio Prot	c0.26	
v/s Ratio Perm		
v/c Ratio	1.04	
Uniform Delay, d1	52.6	
Progression Factor	1.05	
Incremental Delay, d2	23.0	
Delay (s)	78.1	
Level of Service	E	
Approach Delay (s)	86.5	
Approach LOS	F	

Intersection Summary

611: Tremont Street & Ruggles St/Whittier St

Lane Group	EBL	EBR	WBT	NEL	NET	SWT	SWR
Lane Group Flow (vph)	578	207	144	179	1291	916	565
v/c Ratio	0.81	0.59	0.49	0.93	0.58	0.88	0.77
Control Delay	50.2	39.3	52.4	104.3	29.1	52.6	28.2
Queue Delay	1.3	1.2	0.0	16.8	0.0	8.0	0.0
Total Delay	51.5	40.5	52.4	121.1	29.1	60.7	28.2
Queue Length 50th (ft)	237	73	103	168	257	~496	387
Queue Length 95th (ft)	314	135	155	m#225	m280	#635	#562
Internal Link Dist (ft)			271		568	238	
Turn Bay Length (ft)				200			
Base Capacity (vph)	750	351	374	193	2216	1039	748
Starvation Cap Reductn	55	41	0	0	0	102	0
Spillback Cap Reductn	0	0	0	15	0	0	1
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.83	0.67	0.39	1.01	0.58	0.98	0.76

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰↰		↱		✥		↰	↑↑↑			↑↑	↱
Traffic Volume (vph)	509	0	182	65	19	36	159	1149	0	0	879	542
Future Volume (vph)	509	0	182	65	19	36	159	1149	0	0	879	542
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	16	12	11	11	12	12	11	11
Total Lost time (s)	4.0		4.0		4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	0.97		1.00		1.00		1.00	0.91			0.95	1.00
Frpb, ped/bikes	1.00		1.00		0.99		1.00	1.00			1.00	0.94
Flpb, ped/bikes	1.00		1.00		0.99		1.00	1.00			1.00	1.00
Frt	1.00		0.85		0.96		1.00	1.00			1.00	0.85
Flt Protected	0.95		1.00		0.97		0.95	1.00			1.00	1.00
Satd. Flow (prot)	3001		1171		1750		1287	4298			3079	1273
Flt Permitted	0.95		1.00		0.97		0.95	1.00			1.00	1.00
Satd. Flow (perm)	3001		1171		1750		1287	4298			3079	1273
Peak-hour factor, PHF	0.88	0.88	0.88	0.83	0.83	0.83	0.89	0.89	0.89	0.96	0.96	0.96
Adj. Flow (vph)	578	0	207	78	23	43	179	1291	0	0	916	565
RTOR Reduction (vph)	0	0	176	0	12	0	0	0	0	0	0	0
Lane Group Flow (vph)	578	0	31	0	132	0	179	1291	0	0	916	565
Confl. Peds. (#/hr)	13		16	16		13	23					23
Heavy Vehicles (%)	5%	0%	20%	2%	0%	0%	22%	5%	0%	0%	2%	4%
Parking (#/hr)				15		0						
Turn Type	Prot		Over	Perm	NA		Prot	NA			NA	pm+ov
Protected Phases	3		1		4		1	6			2	3
Permitted Phases				4								2
Actuated Green, G (s)	31.4		18.9		20.4		18.9	70.2			45.3	76.7
Effective Green, g (s)	33.4		20.9		22.4		20.9	72.2			47.3	80.7
Actuated g/C Ratio	0.24		0.15		0.16		0.15	0.52			0.34	0.58
Clearance Time (s)	6.0		6.0		6.0		6.0	6.0			6.0	6.0
Vehicle Extension (s)	3.0		2.0		2.0		2.0	2.0			2.0	3.0
Lane Grp Cap (vph)	715		174		280		192	2216			1040	770
v/s Ratio Prot	c0.19		0.03				c0.14	0.30			c0.30	0.18
v/s Ratio Perm					0.08							0.27
v/c Ratio	0.81		0.18		0.47		0.93	0.58			0.88	0.73
Uniform Delay, d1	50.3		52.0		53.4		58.9	23.5			43.7	21.8
Progression Factor	0.82		4.63		1.00		1.18	1.12			0.94	0.86
Incremental Delay, d2	6.4		0.2		0.5		33.9	0.7			10.0	3.4
Delay (s)	47.5		241.1		53.9		103.2	27.1			51.0	22.1
Level of Service	D		F		D		F	C			D	C
Approach Delay (s)		98.6			53.9			36.3			40.0	
Approach LOS		F			D			D			D	

Intersection Summary

HCM 2000 Control Delay	51.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

3082: Tremont Street & Renaissance Park/Ruggles St

	↴	↗	↙
Lane Group	EBR	NET	SWT
Lane Group Flow (vph)	128	1824	1400
v/c Ratio	0.41	0.59	0.42
Control Delay	20.2	3.9	3.2
Queue Delay	0.1	0.2	1.2
Total Delay	20.3	4.1	4.5
Queue Length 50th (ft)	26	5	61
Queue Length 95th (ft)	90	17	110
Internal Link Dist (ft)		238	380
Turn Bay Length (ft)			
Base Capacity (vph)	315	3096	3317
Starvation Cap Reductn	0	419	1600
Spillback Cap Reductn	14	81	714
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.43	0.68	0.82

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations			↱					↑↑↱			↑↑↑	
Traffic Volume (vph)	0	0	120	0	0	0	0	1537	232	0	1246	0
Future Volume (vph)	0	0	120	0	0	0	0	1537	232	0	1246	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	16	12	11	12	12	11	12
Total Lost time (s)			4.0					4.0			4.0	
Lane Util. Factor			1.00					0.91			0.91	
Frpb, ped/bikes			1.00					0.98			1.00	
Flpb, ped/bikes			1.00					1.00			1.00	
Frt			0.86					0.98			1.00	
Flt Protected			1.00					1.00			1.00	
Satd. Flow (prot)			1286					4073			4381	
Flt Permitted			1.00					1.00			1.00	
Satd. Flow (perm)			1286					4073			4381	
Peak-hour factor, PHF	0.94	0.94	0.94	0.92	0.92	0.92	0.97	0.97	0.97	0.89	0.89	0.89
Adj. Flow (vph)	0	0	128	0	0	0	0	1585	239	0	1400	0
RTOR Reduction (vph)	0	0	77	0	0	0	0	14	0	0	0	0
Lane Group Flow (vph)	0	0	51	0	0	0	0	1810	0	0	1400	0
Confl. Peds. (#/hr)									26			
Heavy Vehicles (%)	0%	0%	15%	0%	0%	0%	0%	6%	10%	0%	3%	0%
Turn Type			Prot					NA			NA	
Protected Phases			5					1			1	
Permitted Phases												
Actuated Green, G (s)			25.0					105.0			105.0	
Effective Green, g (s)			26.0					106.0			106.0	
Actuated g/C Ratio			0.19					0.76			0.76	
Clearance Time (s)			5.0					5.0			5.0	
Vehicle Extension (s)			2.0					2.0			2.0	
Lane Grp Cap (vph)			238					3083			3317	
v/s Ratio Prot			c0.04					c0.44			0.32	
v/s Ratio Perm												
v/c Ratio			0.22					0.59			0.42	
Uniform Delay, d1			48.4					7.4			6.1	
Progression Factor			1.00					0.45			0.50	
Incremental Delay, d2			0.2					0.6			0.2	
Delay (s)			48.5					4.0			3.2	
Level of Service			D					A			A	
Approach Delay (s)		48.5			0.0			4.0			3.2	
Approach LOS		D			A			A			A	

Intersection Summary

HCM 2000 Control Delay	5.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	42.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Queues

Timing Plan: 2016 Baseline PM

3098: Tremont Street/Tremont St & Melnea Cass Boulevard

2/4/2016

	→	↘	↙	←	↑	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	228	271	776	190	922	1050	610
v/c Ratio	0.95	0.66	0.94	0.47	1.00	0.68	0.94dl
Control Delay	98.6	18.2	68.8	46.2	56.0	5.5	62.2
Queue Delay	20.4	2.2	0.0	0.0	0.0	0.0	0.0
Total Delay	119.0	20.5	68.8	46.2	56.0	5.5	62.2
Queue Length 50th (ft)	168	51	351	142	~326	100	283
Queue Length 95th (ft)	#316	101	#463	208	#412	242	#409
Internal Link Dist (ft)	203			68	380		136
Turn Bay Length (ft)			350				
Base Capacity (vph)	243	415	861	422	922	1554	670
Starvation Cap Reductn	21	59	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.03	0.76	0.90	0.45	1.00	0.68	0.91

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

HCM Signalized Intersection Capacity Analysis

Timing Plan: 2016 Baseline PM

3098: Tremont Street/Tremont St & Melnea Cass Boulevard

2/4/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱	↰↰	↱			↰↑	↱		↰↱	
Traffic Volume (vph)	8	174	225	745	106	54	220	543	924	45	473	10
Future Volume (vph)	8	174	225	745	106	54	220	543	924	45	473	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	13	12	13	13	12	12	11	16	12	14	12
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00	0.97	1.00			0.95	1.00		0.95	
Frt		1.00	0.85	1.00	0.95			1.00	0.85		1.00	
Flt Protected		1.00	1.00	0.95	1.00			0.99	1.00		0.99	
Satd. Flow (prot)		1626	1398	3015	1480			2929	1554		3224	
Flt Permitted		1.00	1.00	0.95	1.00			0.58	1.00		0.58	
Satd. Flow (perm)		1626	1398	3015	1480			1709	1554		1880	
Peak-hour factor, PHF	0.38	0.84	0.83	0.96	0.86	0.81	0.82	0.83	0.88	0.54	0.93	0.55
Adj. Flow (vph)	21	207	271	776	123	67	268	654	1050	83	509	18
RTOR Reduction (vph)	0	0	206	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	228	65	776	190	0	0	922	1050	0	609	0
Heavy Vehicles (%)	0%	9%	4%	8%	12%	15%	5%	6%	6%	20%	3%	36%
Turn Type	Split	NA	Perm	Split	NA		pm+pt	NA	Free	Perm	NA	
Protected Phases	5	5		6	6		7	1 7			1	
Permitted Phases			5				1 7		Free	1		
Actuated Green, G (s)		20.7	20.7	38.4	38.4			64.9	140.0		49.9	
Effective Green, g (s)		20.7	20.7	38.4	38.4			64.9	140.0		49.9	
Actuated g/C Ratio		0.15	0.15	0.27	0.27			0.46	1.00		0.36	
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0						2.0	
Lane Grp Cap (vph)		240	206	826	405			922	1554		670	
v/s Ratio Prot		c0.14		c0.26	0.13			c0.11				
v/s Ratio Perm			0.05					c0.36	0.68		0.32	
v/c Ratio		0.95	0.31	0.94	0.47			1.00	0.68		0.94dl	
Uniform Delay, d1		59.1	53.3	49.7	42.3			37.5	0.0		42.9	
Progression Factor		0.91	1.11	1.00	1.00			0.82	1.00		1.00	
Incremental Delay, d2		41.5	0.3	17.9	0.3			28.0	2.1		18.4	
Delay (s)		95.2	59.5	67.5	42.6			58.8	2.1		61.3	
Level of Service		F	E	E	D			E	A		E	
Approach Delay (s)		75.8			62.6			28.6			61.3	
Approach LOS		E			E			C			E	

Intersection Summary

HCM 2000 Control Delay	47.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

c Critical Lane Group

Queues
4023: Tremont Street & Prentiss St

Timing Plan: 2016 Baseline PM
2/4/2016

	↗	↑	↓
Lane Group	EBL	NBT	SBT
Lane Group Flow (vph)	350	1370	1281
v/c Ratio	0.93	0.86	1.11
Control Delay	79.6	34.8	83.6
Queue Delay	0.0	0.0	0.0
Total Delay	79.6	34.8	83.6
Queue Length 50th (ft)	284	~320	~786
Queue Length 95th (ft)	#418	m#349	#927
Internal Link Dist (ft)	258	709	220
Turn Bay Length (ft)			
Base Capacity (vph)	393	1596	1155
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.89	0.86	1.11

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
Timing Plan: 2016 Baseline PM

4023: Tremont Street & Prentiss St
2/4/2016

	↱	↘	↰	↑	↰	↓	↙
Movement	EBL	EBR	NBL	NBT	SBU	SBT	SBR
Lane Configurations	Y			↰↑↑		↑↱	
Traffic Volume (vph)	151	146	106	1182	17	1130	83
Future Volume (vph)	151	146	106	1182	17	1130	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	11	12	11	12
Total Lost time (s)	4.0			4.0		4.0	
Lane Util. Factor	1.00			0.91		0.95	
Frt	0.93			1.00		0.99	
Flt Protected	0.98			1.00		1.00	
Satd. Flow (prot)	1475			4174		2668	
Flt Permitted	0.98			0.64		0.91	
Satd. Flow (perm)	1475			2673		2429	
Peak-hour factor, PHF	0.85	0.85	0.94	0.94	0.92	0.96	0.96
Adj. Flow (vph)	178	172	113	1257	18	1177	86
RTOR Reduction (vph)	25	0	0	0	0	3	0
Lane Group Flow (vph)	325	0	0	1370	0	1278	0
Heavy Vehicles (%)	13%	5%	4%	8%	2%	6%	11%
Parking (#/hr)						15	
Turn Type	Prot		pm+pt	NA	Perm	NA	
Protected Phases	5		6	1 6		1	
Permitted Phases			1 6		1		
Actuated Green, G (s)	32.2			73.8		63.8	
Effective Green, g (s)	33.2			75.8		64.8	
Actuated g/C Ratio	0.24			0.54		0.46	
Clearance Time (s)	5.0					5.0	
Vehicle Extension (s)	2.0					2.0	
Lane Grp Cap (vph)	349			1565		1124	
v/s Ratio Prot	c0.22			c0.07			
v/s Ratio Perm				0.41		c0.53	
v/c Ratio	0.93			0.88		1.14	
Uniform Delay, d1	52.3			28.0		37.6	
Progression Factor	1.00			1.23		0.59	
Incremental Delay, d2	30.6			2.8		69.6	
Delay (s)	82.9			37.1		91.8	
Level of Service	F			D		F	
Approach Delay (s)	82.9			37.1		91.8	
Approach LOS	F			D		F	

Intersection Summary

HCM 2000 Control Delay	65.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	95.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

6: Tremont Street & Site Driveway

2/4/2016

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations		↱	↑↑↑	↱		↑↑
Traffic Volume (veh/h)	0	111	1097	61	0	935
Future Volume (Veh/h)	0	111	1097	61	0	935
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	121	1192	66	0	1016
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			302			646
pX, platoon unblocked	0.86	0.87			0.87	
vC, conflicting volume	1700	397			1258	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	586	0			782	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	87			100	
cM capacity (veh/h)	378	945			725	

Direction, Lane #	NW 1	NE 1	NE 2	NE 3	NE 4	SW 1	SW 2
Volume Total	121	397	397	397	66	508	508
Volume Left	0	0	0	0	0	0	0
Volume Right	121	0	0	0	66	0	0
cSH	945	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.13	0.23	0.23	0.23	0.04	0.30	0.30
Queue Length 95th (ft)	11	0	0	0	0	0	0
Control Delay (s)	9.4	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	A						
Approach Delay (s)	9.4	0.0				0.0	
Approach LOS	A						

Intersection Summary

Average Delay	0.5		
Intersection Capacity Utilization	34.7%	ICU Level of Service	A
Analysis Period (min)	15		

192: Columbus Avenue/Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd

	→	←	↖	↰	↑	↘	↓
Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	504	401	287	111	858	167	764
v/c Ratio	0.85	0.98	0.61	0.63	0.70	1.17	0.68
Control Delay	54.5	88.4	11.1	67.0	45.4	144.5	49.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.5	88.4	11.1	67.0	45.4	144.5	49.8
Queue Length 50th (ft)	167	164	0	83	~304	~159	~274
Queue Length 95th (ft)	#255	#244	62	#155	#394	m#227	#364
Internal Link Dist (ft)	381	1188			1304		709
Turn Bay Length (ft)				205		205	
Base Capacity (vph)	593	410	468	177	1230	143	1127
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.98	0.61	0.63	0.70	1.17	0.68

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations		↰↑↱			↰↑	↱		↰	↑↑↱			↰
Traffic Volume (vph)	146	236	92	64	277	244	1	102	732	66	13	145
Future Volume (vph)	146	236	92	64	277	244	1	102	732	66	13	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0		4.0	4.0			4.0
Lane Util. Factor		0.95			0.95	1.00		1.00	0.91			1.00
Frt		0.97			1.00	0.85		1.00	0.99			1.00
Flt Protected		0.98			0.99	1.00		0.95	1.00			0.95
Satd. Flow (prot)		2938			2945	1275		1519	4315			1230
Flt Permitted		0.59			0.75	1.00		0.95	1.00			0.95
Satd. Flow (perm)		1766			2241	1275		1519	4315			1230
Peak-hour factor, PHF	0.94	0.94	0.94	0.85	0.85	0.85	0.93	0.93	0.93	0.93	0.95	0.95
Adj. Flow (vph)	155	251	98	75	326	287	1	110	787	71	14	153
RTOR Reduction (vph)	0	0	0	0	0	234	0	0	0	0	0	0
Lane Group Flow (vph)	0	504	0	0	401	53	0	111	858	0	0	167
Heavy Vehicles (%)	9%	4%	5%	15%	8%	14%	0%	7%	7%	5%	0%	35%
Parking (#/hr)												
Turn Type	pm+pt	NA		Perm	NA	Perm	Prot	Prot	NA		Prot	Prot
Protected Phases	3	3 4			4		5	5	1		5	5
Permitted Phases	3 4			4		4						
Actuated Green, G (s)		28.0			19.0	19.0		12.0	30.6			12.0
Effective Green, g (s)		32.0			22.0	22.0		14.0	32.6			14.0
Actuated g/C Ratio		0.27			0.18	0.18		0.12	0.27			0.12
Clearance Time (s)					7.0	7.0		6.0	6.0			6.0
Vehicle Extension (s)					3.0	3.0		2.0	2.0			2.0
Lane Grp Cap (vph)		578			410	233		177	1172			143
v/s Ratio Prot		c0.08						0.07	c0.20			c0.14
v/s Ratio Perm		0.15			c0.18	0.04						
v/c Ratio		0.87			0.98	0.23		0.63	0.73			1.17
Uniform Delay, d1		42.0			48.8	41.7		50.5	39.7			53.0
Progression Factor		1.13			1.00	1.00		1.00	1.00			0.65
Incremental Delay, d2		11.3			38.2	0.5		4.9	4.1			110.1
Delay (s)		58.8			87.0	42.2		55.4	43.8			144.5
Level of Service		E			F	D		E	D			F
Approach Delay (s)		58.8			68.3				45.1			
Approach LOS		E			E				D			

Intersection Summary

HCM 2000 Control Delay	58.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations	↑↑↱	
Traffic Volume (vph)	550	176
Future Volume (vph)	550	176
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.0	
Lane Util. Factor	0.91	
Frt	0.96	
Flt Protected	1.00	
Satd. Flow (prot)	3956	
Flt Permitted	1.00	
Satd. Flow (perm)	3956	
Peak-hour factor, PHF	0.95	0.95
Adj. Flow (vph)	579	185
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	764	0
Heavy Vehicles (%)	9%	5%
Parking (#/hr)	10	
Turn Type	NA	
Protected Phases	1	
Permitted Phases		
Actuated Green, G (s)	30.6	
Effective Green, g (s)	32.6	
Actuated g/C Ratio	0.27	
Clearance Time (s)	6.0	
Vehicle Extension (s)	2.0	
Lane Grp Cap (vph)	1074	
v/s Ratio Prot	0.19	
v/s Ratio Perm		
v/c Ratio	0.71	
Uniform Delay, d1	39.5	
Progression Factor	1.19	
Incremental Delay, d2	2.3	
Delay (s)	49.1	
Level of Service	D	
Approach Delay (s)	66.2	
Approach LOS	E	

Intersection Summary

611: Tremont Street & Ruggles St/Whittier St

Lane Group	EBL	EBR	WBT	NEL	NET	SWT	SWR
Lane Group Flow (vph)	388	133	33	163	1106	869	414
v/c Ratio	0.72	0.49	0.16	3.79	0.40	0.68	0.53
Control Delay	41.1	21.8	27.3	1319.0	12.9	21.8	9.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Total Delay	41.1	21.8	27.3	1319.0	12.9	22.1	9.6
Queue Length 50th (ft)	89	28	11	~235	94	116	21
Queue Length 95th (ft)	138	66	33	m#378	191	#522	400
Internal Link Dist (ft)			271		566	238	
Turn Bay Length (ft)				200			
Base Capacity (vph)	583	272	423	43	2758	1280	803
Starvation Cap Reductn	0	0	0	0	0	73	5
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.49	0.08	3.79	0.40	0.72	0.52

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEU	NEL	NET	NER	SWU	SWL
Lane Configurations	↰↰		↱		↰↑↱			↰	↑↑↑			
Traffic Volume (vph)	365	0	125	12	1	15	21	134	1051	0	14	0
Future Volume (vph)	365	0	125	12	1	15	21	134	1051	0	14	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	16	12	12	11	11	12	12	12
Total Lost time (s)	4.0		4.0		4.0			4.0	4.0			
Lane Util. Factor	0.97		1.00		1.00			1.00	0.91			
Frpb, ped/bikes	1.00		1.00		0.99			1.00	1.00			
Flpb, ped/bikes	1.00		1.00		1.00			0.98	1.00			
Frt	1.00		0.85		0.93			1.00	1.00			
Flt Protected	0.95		1.00		0.98			0.95	1.00			
Satd. Flow (prot)	2918		1098		1697			1249	4257			
Flt Permitted	0.95		1.00		0.98			0.24	1.00			
Satd. Flow (perm)	2918		1098		1697			309	4257			
Peak-hour factor, PHF	0.94	0.94	0.94	0.83	0.83	0.83	0.95	0.95	0.95	0.95	0.93	0.93
Adj. Flow (vph)	388	0	133	14	1	18	22	141	1106	0	15	0
RTOR Reduction (vph)	0	0	114	0	16	0	0	0	0	0	0	0
Lane Group Flow (vph)	388	0	19	0	17	0	0	163	1106	0	0	0
Confl. Peds. (#/hr)	7		6	6		7		37				
Heavy Vehicles (%)	8%	0%	28%	4%	10%	0%	0%	27%	6%	0%	0%	0%
Parking (#/hr)				5								
Turn Type	Prot		Over	Perm	NA		custom	Prot	NA		Perm	
Protected Phases	3		1!		4			1	6			
Permitted Phases				4			1!				2	
Actuated Green, G (s)	20.2		15.0		8.4			15.0	73.4			
Effective Green, g (s)	22.2		17.0		10.4			17.0	75.4			
Actuated g/C Ratio	0.18		0.14		0.09			0.14	0.63			
Clearance Time (s)	6.0		6.0		6.0			6.0	6.0			
Vehicle Extension (s)	3.0		2.0		2.0			2.0	2.0			
Lane Grp Cap (vph)	539		155		147			43	2674			
v/s Ratio Prot	c0.13		0.02						0.26			
v/s Ratio Perm					0.01			c0.53				
v/c Ratio	0.72		0.12		0.11			3.79	0.41			
Uniform Delay, d1	46.0		45.0		50.5			51.5	11.2			
Progression Factor	0.73		2.09		1.00			1.14	1.00			
Incremental Delay, d2	4.2		0.1		0.1			1303.3	0.4			
Delay (s)	38.0		94.1		50.7			1362.2	11.6			
Level of Service	D		F		D			F	B			
Approach Delay (s)		52.3			50.7				185.1			
Approach LOS		D			D				F			

Intersection Summary

HCM 2000 Control Delay	91.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.8%	ICU Level of Service	D
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

	↙	↲
Movement	SWT	SWR
Lane Configurations	↑↑	↱
Traffic Volume (vph)	794	385
Future Volume (vph)	794	385
Ideal Flow (vphpl)	1900	1900
Lane Width	11	11
Total Lost time (s)	4.0	4.0
Lane Util. Factor	0.95	1.00
Frpb, ped/bikes	1.00	0.91
Flpb, ped/bikes	1.00	1.00
Frt	1.00	0.85
Flt Protected	1.00	1.00
Satd. Flow (prot)	2936	1193
Flt Permitted	0.92	1.00
Satd. Flow (perm)	2707	1193
Peak-hour factor, PHF	0.93	0.93
Adj. Flow (vph)	854	414
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	869	414
Confl. Peds. (#/hr)		37
Heavy Vehicles (%)	7%	7%
Parking (#/hr)		
Turn Type	NA	pm+ov
Protected Phases	2	3
Permitted Phases		2
Actuated Green, G (s)	52.4	72.6
Effective Green, g (s)	54.4	76.6
Actuated g/C Ratio	0.45	0.64
Clearance Time (s)	6.0	6.0
Vehicle Extension (s)	2.0	3.0
Lane Grp Cap (vph)	1227	801
v/s Ratio Prot		0.10
v/s Ratio Perm	c0.32	0.25
v/c Ratio	0.71	0.52
Uniform Delay, d1	26.4	11.7
Progression Factor	0.63	0.56
Incremental Delay, d2	3.3	0.5
Delay (s)	19.8	7.1
Level of Service	B	A
Approach Delay (s)	15.7	
Approach LOS	B	

Intersection Summary

3082: Tremont Street & Renaissance Park/Ruggles St

	↴	↗	↙
Lane Group	EBR	NET	SWT
Lane Group Flow (vph)	65	1575	1205
v/c Ratio	0.18	0.53	0.40
Control Delay	1.5	5.0	3.0
Queue Delay	0.0	0.2	0.4
Total Delay	1.5	5.2	3.4
Queue Length 50th (ft)	0	105	32
Queue Length 95th (ft)	0	8	80
Internal Link Dist (ft)		238	380
Turn Bay Length (ft)			
Base Capacity (vph)	368	2958	2994
Starvation Cap Reductn	0	458	1082
Spillback Cap Reductn	4	0	176
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.18	0.63	0.63

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations			↱					↑↑↱			↑↑↑	
Traffic Volume (vph)	0	0	42	0	0	0	0	1356	93	0	1145	0
Future Volume (vph)	0	0	42	0	0	0	0	1356	93	0	1145	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	16	12	11	12	12	11	12
Total Lost time (s)			4.0					4.0			4.0	
Lane Util. Factor			1.00					0.91			0.91	
Frpb, ped/bikes			1.00					1.00			1.00	
Flpb, ped/bikes			1.00					1.00			1.00	
Frt			0.86					0.99			1.00	
Flt Protected			1.00					1.00			1.00	
Satd. Flow (prot)			1275					4120			4178	
Flt Permitted			1.00					1.00			1.00	
Satd. Flow (perm)			1275					4120			4178	
Peak-hour factor, PHF	0.65	0.65	0.65	0.92	0.92	0.92	0.92	0.92	0.92	0.95	0.95	0.95
Adj. Flow (vph)	0	0	65	0	0	0	0	1474	101	0	1205	0
RTOR Reduction (vph)	0	0	51	0	0	0	0	6	0	0	0	0
Lane Group Flow (vph)	0	0	14	0	0	0	0	1569	0	0	1205	0
Confl. Peds. (#/hr)									7			
Heavy Vehicles (%)	0%	0%	16%	0%	0%	0%	0%	8%	10%	0%	8%	0%
Turn Type			Prot					NA			NA	
Protected Phases			5					1			1	
Permitted Phases												
Actuated Green, G (s)			25.0					85.0			85.0	
Effective Green, g (s)			26.0					86.0			86.0	
Actuated g/C Ratio			0.22					0.72			0.72	
Clearance Time (s)			5.0					5.0			5.0	
Vehicle Extension (s)			2.0					2.0			2.0	
Lane Grp Cap (vph)			276					2952			2994	
v/s Ratio Prot			c0.01					c0.38			0.29	
v/s Ratio Perm												
v/c Ratio			0.05					0.53			0.40	
Uniform Delay, d1			37.2					7.8			6.8	
Progression Factor			1.00					0.57			0.40	
Incremental Delay, d2			0.0					0.6			0.3	
Delay (s)			37.3					5.1			3.0	
Level of Service			D					A			A	
Approach Delay (s)		37.3			0.0			5.1			3.0	
Approach LOS		D			A			A			A	

Intersection Summary

HCM 2000 Control Delay	4.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	37.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Queues

3098: Tremont Street/Tremont St & Melnea Cass Boulevard

	→	↘	↙	←	↑	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	74	194	694	137	640	940	439
v/c Ratio	0.47	0.63	0.84	0.34	0.60	0.62	0.40
Control Delay	60.1	16.0	50.5	35.9	14.1	4.4	25.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.1	16.0	50.5	35.9	14.1	4.4	25.6
Queue Length 50th (ft)	56	0	260	85	79	58	113
Queue Length 95th (ft)	91	49	305	123	205	270	202
Internal Link Dist (ft)	215			623	380		183
Turn Bay Length (ft)			350				
Base Capacity (vph)	285	404	1055	517	1060	1526	1108
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.48	0.66	0.26	0.60	0.62	0.40

Intersection Summary

3098: Tremont Street/Tremont St & Melnea Cass Boulevard

2/4/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱	↰↰	↱			↰↑	↱		↰↑↱	
Traffic Volume (vph)	5	51	161	666	76	40	128	402	827	33	326	15
Future Volume (vph)	5	51	161	666	76	40	128	402	827	33	326	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	13	12	13	13	12	12	11	16	12	14	12
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00	0.97	1.00			0.95	1.00		0.95	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.98		1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt		1.00	0.85	1.00	0.95			1.00	0.85		0.99	
Flt Protected		0.99	1.00	0.95	1.00			0.99	1.00		0.99	
Satd. Flow (prot)		1631	1398	3015	1479			2934	1526		3175	
Flt Permitted		0.99	1.00	0.95	1.00			0.69	1.00		0.77	
Satd. Flow (perm)		1631	1398	3015	1479			2045	1526		2476	
Peak-hour factor, PHF	0.38	0.84	0.83	0.96	0.86	0.81	0.82	0.83	0.88	0.54	0.93	0.55
Adj. Flow (vph)	13	61	194	694	88	49	156	484	940	61	351	27
RTOR Reduction (vph)	0	0	175	0	0	0	0	0	0	0	3	0
Lane Group Flow (vph)	0	74	19	694	137	0	0	640	940	0	436	0
Confl. Peds. (#/hr)									20			
Heavy Vehicles (%)	0%	9%	4%	8%	12%	15%	5%	6%	6%	20%	3%	36%
Turn Type	Split	NA	Perm	Split	NA		pm+pt	NA	Free	Perm	NA	
Protected Phases	5	5		6	6		7	1 7			1	
Permitted Phases			5				1 7		Free	1		
Actuated Green, G (s)		11.5	11.5	32.9	32.9			59.6	120.0		53.6	
Effective Green, g (s)		11.5	11.5	32.9	32.9			59.6	120.0		53.6	
Actuated g/C Ratio		0.10	0.10	0.27	0.27			0.50	1.00		0.45	
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0						2.0	
Lane Grp Cap (vph)		156	133	826	405			1060	1526		1105	
v/s Ratio Prot		0.05		c0.23	0.09			0.03				
v/s Ratio Perm			0.01					0.27	c0.62		0.18	
v/c Ratio		0.47	0.14	0.84	0.34			0.60	0.62		0.39	
Uniform Delay, d1		51.4	49.7	41.1	34.8			21.7	0.0		22.3	
Progression Factor		1.00	1.00	1.00	1.00			0.51	1.00		1.00	
Incremental Delay, d2		0.8	0.2	7.4	0.2			2.3	1.7		1.1	
Delay (s)		52.2	49.9	48.5	35.0			13.3	1.7		23.4	
Level of Service		D	D	D	D			B	A		C	
Approach Delay (s)		50.5			46.3			6.4			23.4	
Approach LOS		D			D			A			C	

Intersection Summary

HCM 2000 Control Delay	23.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

	↗	↑	↓
Lane Group	EBL	NBT	SBT
Lane Group Flow (vph)	87	1248	1086
v/c Ratio	0.54	0.58	0.81
Control Delay	56.8	14.9	17.4
Queue Delay	0.0	0.0	0.0
Total Delay	56.8	14.9	17.4
Queue Length 50th (ft)	57	327	67
Queue Length 95th (ft)	104	m390	m#530
Internal Link Dist (ft)	258	709	222
Turn Bay Length (ft)			
Base Capacity (vph)	215	2141	1346
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.40	0.58	0.81

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

	↗	↘	↖	↑	↰	↓	↙
Movement	EBL	EBR	NBL	NBT	SBU	SBT	SBR
Lane Configurations	↰↱			↰↑↑		↑↱	
Traffic Volume (vph)	57	18	73	1088	13	874	48
Future Volume (vph)	57	18	73	1088	13	874	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	11	12	11	12
Total Lost time (s)	4.0			4.0		4.0	
Lane Util. Factor	1.00			0.91		0.95	
Frt	0.97			1.00		0.99	
Flt Protected	0.96			1.00		1.00	
Satd. Flow (prot)	1543			4132		2602	
Flt Permitted	0.96			0.75		0.93	
Satd. Flow (perm)	1543			3103		2413	
Peak-hour factor, PHF	0.87	0.87	0.93	0.93	0.92	0.86	0.86
Adj. Flow (vph)	66	21	78	1170	14	1016	56
RTOR Reduction (vph)	10	0	0	0	0	3	0
Lane Group Flow (vph)	77	0	0	1248	0	1083	0
Heavy Vehicles (%)	6%	9%	7%	9%	2%	11%	8%
Parking (#/hr)						10	
Turn Type	Prot		pm+pt	NA	Perm	NA	
Protected Phases	5		6	1 6		1	
Permitted Phases			1 6		1		
Actuated Green, G (s)	10.8			75.2		64.2	
Effective Green, g (s)	11.8			77.2		65.2	
Actuated g/C Ratio	0.10			0.64		0.54	
Clearance Time (s)	5.0					5.0	
Vehicle Extension (s)	2.0					2.0	
Lane Grp Cap (vph)	151			2099		1311	
v/s Ratio Prot	c0.05			c0.06			
v/s Ratio Perm				0.32		c0.45	
v/c Ratio	0.51			0.59		0.83	
Uniform Delay, d1	51.4			12.4		22.7	
Progression Factor	1.00			1.09		0.42	
Incremental Delay, d2	1.2			0.9		4.6	
Delay (s)	52.6			14.3		14.1	
Level of Service	D			B		B	
Approach Delay (s)	52.6			14.3		14.1	
Approach LOS	D			B		B	

Intersection Summary

HCM 2000 Control Delay	15.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

2017 No Build Conditions

HCM Unsignalized Intersection Capacity Analysis　　Timing Plan: 2021 No Build AM

9: Tremont Street & Site Driveway

2/4/2016

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations		↱	↑↑↑	↱		↑↑
Traffic Volume (veh/h)	0	26	1560	278	0	998
Future Volume (Veh/h)	0	26	1560	278	0	998
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	28	1696	302	0	1085
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			271			676
pX, platoon unblocked	0.75					
vC, conflicting volume	2238	565			1998	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1985	565			1998	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	94			100	
cM capacity (veh/h)	40	468			283	

Direction, Lane #	NW 1	NE 1	NE 2	NE 3	NE 4	SW 1	SW 2
Volume Total	28	565	565	565	302	542	542
Volume Left	0	0	0	0	0	0	0
Volume Right	28	0	0	0	302	0	0
cSH	468	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.06	0.33	0.33	0.33	0.18	0.32	0.32
Queue Length 95th (ft)	5	0	0	0	0	0	0
Control Delay (s)	13.2	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B						
Approach Delay (s)	13.2	0.0				0.0	
Approach LOS	B						

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	40.1%	ICU Level of Service	A
Analysis Period (min)	15		

192: Columbus Avenue /Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd

2/4/2016

	→	←	↖	↰	↑	↘	↓
Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	719	491	351	177	1542	134	798
v/c Ratio	1.41	1.56	0.28	1.05	1.11	1.07	0.65
Control Delay	227.1	306.2	0.6	142.7	104.9	92.3	52.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	227.1	306.2	0.6	142.7	104.9	92.3	52.2
Queue Length 50th (ft)	~458	~332	0	~175	~670	~133	277
Queue Length 95th (ft)	#551	#448	0	#330	#768	m114	m232
Internal Link Dist (ft)	381	1183			1304		709
Turn Bay Length (ft)				205		205	
Base Capacity (vph)	509	314	1232	168	1387	125	1220
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.41	1.56	0.28	1.05	1.11	1.07	0.65

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations		↰↱			↰↑	↱	↰	↑↑↱			↰	↑↑↱
Traffic Volume (vph)	179	312	127	61	410	337	166	1381	69	4	122	595
Future Volume (vph)	179	312	127	61	410	337	166	1381	69	4	122	595
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor		0.95			0.95	1.00	1.00	0.91			1.00	0.91
Frt		0.97			1.00	0.85	1.00	0.99			1.00	0.97
Flt Protected		0.99			0.99	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)		2926			2954	1232	1577	4455			1170	3917
Flt Permitted		0.55			0.62	1.00	0.95	1.00			0.95	1.00
Satd. Flow (perm)		1632			1831	1232	1577	4455			1170	3917
Peak-hour factor, PHF	0.86	0.86	0.86	0.96	0.96	0.96	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	208	363	148	64	427	351	177	1469	73	4	130	633
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	719	0	0	491	351	177	1542	0	0	134	798
Heavy Vehicles (%)	8%	5%	6%	11%	9%	18%	3%	4%	5%	0%	40%	8%
Parking (#/hr)												20
Turn Type	pm+pt	NA		Perm	NA	Free	Prot	NA		Prot	Prot	NA
Protected Phases	3	3 4			4		5	1		5	5	1
Permitted Phases	3 4			4		Free						
Actuated Green, G (s)		30.0			21.0	140.0	13.0	40.8			13.0	40.8
Effective Green, g (s)		34.0			24.0	140.0	15.0	42.8			15.0	42.8
Actuated g/C Ratio		0.24			0.17	1.00	0.11	0.31			0.11	0.31
Clearance Time (s)					7.0		6.0	6.0			6.0	6.0
Vehicle Extension (s)					2.0		2.0	2.0			2.0	2.0
Lane Grp Cap (vph)		498			313	1232	168	1361			125	1197
v/s Ratio Prot		c0.11					0.11	c0.35			c0.11	0.20
v/s Ratio Perm		0.24			c0.27	c0.28						
v/c Ratio		1.44			1.57	0.28	1.05	1.13			1.07	0.67
Uniform Delay, d1		53.0			58.0	0.0	62.5	48.6			62.5	42.4
Progression Factor		0.92			1.00	1.00	1.00	1.00			0.76	1.16
Incremental Delay, d2		206.3			270.9	0.6	84.3	69.5			46.0	0.3
Delay (s)		255.0			328.9	0.6	146.8	118.1			93.6	49.5
Level of Service		F			F	A	F	F			F	D
Approach Delay (s)		255.0			192.0			121.1				55.9
Approach LOS		F			F			F				E

Intersection Summary

HCM 2000 Control Delay	143.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	86.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	155
Future Volume (vph)	155
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.94
Adj. Flow (vph)	165
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Heavy Vehicles (%)	7%
Parking (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Queues

611: Tremont Street & Ruggles St/Whittier St

Lane Group	EBL	EBR	WBT	NEL	NET	SWT	SWR
Lane Group Flow (vph)	622	150	166	227	1516	828	548
v/c Ratio	0.91	0.49	0.67	0.97	0.67	0.88	0.77
Control Delay	64.6	36.5	64.8	68.9	12.2	35.9	32.8
Queue Delay	2.9	0.0	0.0	42.4	0.1	13.7	0.0
Total Delay	67.6	36.5	64.8	111.3	12.3	49.6	32.8
Queue Length 50th (ft)	267	42	134	205	295	421	476
Queue Length 95th (ft)	#382	121	145	m194	m259	#586	#685
Internal Link Dist (ft)			271		596	238	
Turn Bay Length (ft)				200			
Base Capacity (vph)	695	305	353	235	2273	938	714
Starvation Cap Reductn	29	0	0	0	0	112	0
Spillback Cap Reductn	0	0	0	56	143	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.93	0.49	0.47	1.27	0.71	1.00	0.77

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰↰		↱		✥		↰	↑↑↑			↑↑	↱
Traffic Volume (vph)	547	0	132	42	40	34	209	1395	0	0	795	526
Future Volume (vph)	547	0	132	42	40	34	209	1395	0	0	795	526
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	16	12	11	11	12	12	11	11
Total Lost time (s)	4.0		4.0		4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	0.97		1.00		1.00		1.00	0.91			0.95	1.00
Frpb, ped/bikes	1.00		1.00		0.99		1.00	1.00			1.00	0.95
Flpb, ped/bikes	1.00		1.00		0.99		1.00	1.00			1.00	1.00
Frt	1.00		0.85		0.96		1.00	1.00			1.00	0.85
Flt Protected	0.95		1.00		0.98		0.95	1.00			1.00	1.00
Satd. Flow (prot)	2865		989		1654		1266	4257			2935	1270
Flt Permitted	0.95		1.00		0.98		0.95	1.00			1.00	1.00
Satd. Flow (perm)	2865		989		1654		1266	4257			2935	1270
Peak-hour factor, PHF	0.88	0.88	0.88	0.70	0.70	0.70	0.92	0.92	0.92	0.96	0.96	0.96
Adj. Flow (vph)	622	0	150	60	57	49	227	1516	0	0	828	548
RTOR Reduction (vph)	0	0	122	0	12	0	0	0	0	0	0	0
Lane Group Flow (vph)	622	0	28	0	154	0	227	1516	0	0	828	548
Confl. Peds. (#/hr)	8		9	9		8	20					20
Heavy Vehicles (%)	10%	0%	42%	14%	0%	14%	24%	6%	67%	0%	7%	5%
Parking (#/hr)				15		0						
Turn Type	Prot		Over	Perm	NA		Prot	NA			NA	pm+ov
Protected Phases	3		1		4		1	6			2	3
Permitted Phases				4								2
Actuated Green, G (s)	31.4		24.0		17.9		24.0	72.7			42.7	74.1
Effective Green, g (s)	33.4		26.0		19.9		26.0	74.7			44.7	78.1
Actuated g/C Ratio	0.24		0.19		0.14		0.19	0.53			0.32	0.56
Clearance Time (s)	6.0		6.0		6.0		6.0	6.0			6.0	6.0
Vehicle Extension (s)	2.0		2.0		2.0		2.0	2.0			2.0	2.0
Lane Grp Cap (vph)	683		183		235		235	2271			937	744
v/s Ratio Prot	c0.22		0.03				c0.18	0.36			c0.28	0.18
v/s Ratio Perm					0.09							0.26
v/c Ratio	0.91		0.15		0.66		0.97	0.67			0.88	0.74
Uniform Delay, d1	51.8		47.8		56.8		56.6	23.7			45.2	23.2
Progression Factor	0.89		4.10		1.00		1.03	0.48			0.49	1.02
Incremental Delay, d2	15.6		0.1		4.9		10.7	0.1			11.2	3.1
Delay (s)	62.0		195.8		61.7		68.9	11.6			33.4	26.8
Level of Service	E		F		E		E	B			C	C
Approach Delay (s)		88.0			61.7			19.0			30.8	
Approach LOS		F			E			B			C	

Intersection Summary

HCM 2000 Control Delay	37.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

3082: Tremont Street & Renaissance Park/Ruggles St

	↴	↗	↙
Lane Group	EBR	NET	SWT
Lane Group Flow (vph)	61	2056	1306
v/c Ratio	0.20	0.66	0.41
Control Delay	2.7	4.2	3.2
Queue Delay	0.0	0.5	1.9
Total Delay	2.8	4.7	5.1
Queue Length 50th (ft)	0	342	51
Queue Length 95th (ft)	0	15	m83
Internal Link Dist (ft)		238	380
Turn Bay Length (ft)			
Base Capacity (vph)	325	3123	3223
Starvation Cap Reductn	0	526	1694
Spillback Cap Reductn	8	160	358
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.19	0.79	0.85

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
Timing Plan: 2021 No Build AM

3082: Tremont Street & Renaissance Park/Ruggles St
2/4/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations			↱					↑↑↱			↑↑↑	
Traffic Volume (vph)	0	0	44	0	0	0	0	1855	140	0	1267	0
Future Volume (vph)	0	0	44	0	0	0	0	1855	140	0	1267	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	16	12	11	12	12	11	12
Total Lost time (s)			4.0					4.0			4.0	
Lane Util. Factor			1.00					0.91			0.91	
Frpb, ped/bikes			1.00					0.99			1.00	
Flpb, ped/bikes			1.00					1.00			1.00	
Frt			0.86					0.99			1.00	
Flt Protected			1.00					1.00			1.00	
Satd. Flow (prot)			1174					4120			4257	
Flt Permitted			1.00					1.00			1.00	
Satd. Flow (perm)			1174					4120			4257	
Peak-hour factor, PHF	0.72	0.72	0.72	0.92	0.92	0.92	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	0	61	0	0	0	0	1912	144	0	1306	0
RTOR Reduction (vph)	0	0	50	0	0	0	0	6	0	0	0	0
Lane Group Flow (vph)	0	0	11	0	0	0	0	2050	0	0	1306	0
Confl. Peds. (#/hr)									12			
Heavy Vehicles (%)	0%	0%	26%	0%	0%	0%	0%	7%	18%	0%	6%	0%
Turn Type			Prot					NA			NA	
Protected Phases			5					1			1	
Permitted Phases												
Actuated Green, G (s)			25.0					105.0			105.0	
Effective Green, g (s)			26.0					106.0			106.0	
Actuated g/C Ratio			0.19					0.76			0.76	
Clearance Time (s)			5.0					5.0			5.0	
Vehicle Extension (s)			2.0					2.0			2.0	
Lane Grp Cap (vph)			218					3119			3223	
v/s Ratio Prot			c0.01					c0.50			0.31	
v/s Ratio Perm												
v/c Ratio			0.05					0.66			0.41	
Uniform Delay, d1			46.9					8.2			6.0	
Progression Factor			1.00					0.42			0.53	
Incremental Delay, d2			0.0					0.7			0.0	
Delay (s)			46.9					4.2			3.2	
Level of Service			D					A			A	
Approach Delay (s)		46.9			0.0			4.2			3.2	
Approach LOS		D			A			A			A	

Intersection Summary

HCM 2000 Control Delay	4.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

3098: Tremont Street /Tremont St & Melnea Cass Boulevard

	→	↘	↙	←	↑	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	55	133	982	313	1111	1128	443
v/c Ratio	0.43	0.57	1.14	0.72	0.95	0.74	1.50dl
Control Delay	57.8	21.5	121.9	55.7	32.7	8.6	63.7
Queue Delay	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Total Delay	57.8	22.2	121.9	55.7	32.7	8.6	63.7
Queue Length 50th (ft)	41	22	~537	257	363	281	194
Queue Length 95th (ft)	m49	m36	#670	349	#509	356	#352
Internal Link Dist (ft)	197			732	380		216
Turn Bay Length (ft)			350				
Base Capacity (vph)	243	322	861	435	1174	1532	513
Starvation Cap Reductn	0	47	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.48	1.14	0.72	0.95	0.74	0.86

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.
dl Defacto Left Lane. Recode with 1 though lane as a left lane.

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱	↰↰	↱			↰↑	↱		↰↱	
Traffic Volume (vph)	2	42	110	943	218	49	375	543	993	37	325	14
Future Volume (vph)	2	42	110	943	218	49	375	543	993	37	325	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	13	12	13	13	12	12	11	16	12	14	12
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00	0.97	1.00			0.95	1.00		0.95	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.99		1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt		1.00	0.85	1.00	0.97			1.00	0.85		0.99	
Flt Protected		1.00	1.00	0.95	1.00			0.98	1.00		0.99	
Satd. Flow (prot)		1626	1398	3015	1524			2915	1532		3172	
Flt Permitted		1.00	1.00	0.95	1.00			0.60	1.00		0.53	
Satd. Flow (perm)		1626	1398	3015	1524			1771	1532		1709	
Peak-hour factor, PHF	0.38	0.84	0.83	0.96	0.86	0.81	0.82	0.83	0.88	0.54	0.93	0.55
Adj. Flow (vph)	5	50	133	982	253	60	457	654	1128	69	349	25
RTOR Reduction (vph)	0	0	122	0	0	0	0	0	0	0	3	0
Lane Group Flow (vph)	0	55	11	982	313	0	0	1111	1128	0	440	0
Confl. Peds. (#/hr)									8			
Heavy Vehicles (%)	0%	9%	4%	8%	12%	15%	5%	6%	6%	20%	3%	36%
Turn Type	Split	NA	Perm	Split	NA		pm+pt	NA	Free	Perm	NA	
Protected Phases	5	5		6	6		7	1 7			1	
Permitted Phases			5				1 7		Free	1		
Actuated Green, G (s)		11.2	11.2	40.0	40.0			72.8	140.0		41.8	
Effective Green, g (s)		11.2	11.2	40.0	40.0			72.8	140.0		41.8	
Actuated g/C Ratio		0.08	0.08	0.29	0.29			0.52	1.00		0.30	
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0						2.0	
Lane Grp Cap (vph)		130	111	861	435			1174	1532		510	
v/s Ratio Prot		0.03		c0.33	0.21			c0.21				
v/s Ratio Perm			0.01					c0.28	c0.74		0.26	
v/c Ratio		0.42	0.10	1.14	0.72			0.95	0.74		1.50dl	
Uniform Delay, d1		61.3	59.7	50.0	45.0			31.8	0.0		46.4	
Progression Factor		0.84	1.57	1.00	1.00			0.67	1.00		1.00	
Incremental Delay, d2		0.6	0.1	77.1	4.7			14.2	2.7		17.4	
Delay (s)		52.0	93.6	127.1	49.7			35.4	2.7		63.8	
Level of Service		D	F	F	D			D	A		E	
Approach Delay (s)		81.4			108.4			18.9			63.8	
Approach LOS		F			F			B			E	

Intersection Summary

HCM 2000 Control Delay	54.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

c Critical Lane Group

4023: Tremont Street & Prentiss St

	↗	↑	↓
Lane Group	EBL	NBT	SBT
Lane Group Flow (vph)	198	2155	1031
v/c Ratio	0.89	1.04	1.39dl
Control Delay	94.3	48.3	154.9
Queue Delay	0.0	0.0	0.0
Total Delay	94.3	48.3	154.9
Queue Length 50th (ft)	172	631	~403
Queue Length 95th (ft)	#235	m#761	m#860
Internal Link Dist (ft)	258	709	191
Turn Bay Length (ft)			
Base Capacity (vph)	231	2069	835
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.86	1.04	1.23

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.
dl Defacto Left Lane. Recode with 1 though lane as a left lane.

4023: Tremont Street & Prentiss St

2/4/2016

Movement	EBL	EBR	NBU	NBL	NBT	SBU	SBT	SBR
Lane Configurations	Y				↰↑↑		↑↱	
Traffic Volume (vph)	125	28	1	257	1660	56	800	141
Future Volume (vph)	125	28	1	257	1660	56	800	141
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	12	11	12	11	12
Total Lost time (s)	4.0				4.0		4.0	
Lane Util. Factor	1.00				0.91		0.95	
Frt	0.98				1.00		0.98	
Flt Protected	0.96				0.99		1.00	
Satd. Flow (prot)	1502				4210		2465	
Flt Permitted	0.96				0.65		0.59	
Satd. Flow (perm)	1502				2772		1447	
Peak-hour factor, PHF	0.77	0.77	0.92	0.89	0.89	0.92	0.97	0.97
Adj. Flow (vph)	162	36	1	289	1865	61	825	145
RTOR Reduction (vph)	6	0	0	0	0	0	8	0
Lane Group Flow (vph)	192	0	0	0	2155	0	1023	0
Heavy Vehicles (%)	11%	7%	2%	3%	7%	2%	13%	10%
Parking (#/hr)							20	
Turn Type	Prot		custom	pm+pt	NA	Perm	NA	
Protected Phases	5			6	1 6		1	
Permitted Phases			6	1 6		1		
Actuated Green, G (s)	19.1				91.9		76.9	
Effective Green, g (s)	20.1				93.9		77.9	
Actuated g/C Ratio	0.14				0.67		0.56	
Clearance Time (s)	5.0						5.0	
Vehicle Extension (s)	2.0						2.0	
Lane Grp Cap (vph)	215				2023		805	
v/s Ratio Prot	c0.13				c0.12			
v/s Ratio Perm					0.59		c0.71	
v/c Ratio	0.89				1.07		1.39dl	
Uniform Delay, d1	58.9				23.0		31.0	
Progression Factor	1.00				1.37		1.90	
Incremental Delay, d2	33.2				33.7		128.3	
Delay (s)	92.1				65.3		187.2	
Level of Service	F				E		F	
Approach Delay (s)	92.1				65.3		187.2	
Approach LOS	F				E		F	

Intersection Summary

HCM 2000 Control Delay	104.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	92.4%	ICU Level of Service	F
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

c Critical Lane Group

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations		↱	↑↑↑	↱		↑↑
Traffic Volume (veh/h)	0	177	1347	51	0	1265
Future Volume (Veh/h)	0	177	1347	51	0	1265
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	192	1464	55	0	1375
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			243			704
pX, platoon unblocked	0.83	0.78			0.78	
vC, conflicting volume	2152	488			1519	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	377	0			680	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	77			100	
cM capacity (veh/h)	493	846			709	

Direction, Lane #	NW 1	NE 1	NE 2	NE 3	NE 4	SW 1	SW 2
Volume Total	192	488	488	488	55	688	688
Volume Left	0	0	0	0	0	0	0
Volume Right	192	0	0	0	55	0	0
cSH	846	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.23	0.29	0.29	0.29	0.03	0.40	0.40
Queue Length 95th (ft)	22	0	0	0	0	0	0
Control Delay (s)	10.5	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B						
Approach Delay (s)	10.5	0.0				0.0	
Approach LOS	B						

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	43.7%	ICU Level of Service	A
Analysis Period (min)	15		

192: Columbus Avenue/Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd

2/4/2016

Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	792	539	327	198	1097	193	1120
v/c Ratio	1.40	1.48	0.63	0.98	0.99	1.12	1.05
Control Delay	222.8	269.3	10.9	118.5	76.0	132.3	75.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	222.8	269.3	10.9	118.5	76.0	132.3	75.5
Queue Length 50th (ft)	~503	~355	0	182	~457	~206	~472
Queue Length 95th (ft)	#637	#475	94	#321	#515	m#170	m#398
Internal Link Dist (ft)	381	1186			1304		709
Turn Bay Length (ft)				205		205	
Base Capacity (vph)	566	364	516	202	1110	172	1069
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.40	1.48	0.63	0.98	0.99	1.12	1.05

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations		↰↑↱			↰↑	↱		↰	↑↑↱			↰
Traffic Volume (vph)	190	374	204	79	417	301	1	169	853	90	2	185
Future Volume (vph)	190	374	204	79	417	301	1	169	853	90	2	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0		4.0	4.0			4.0
Lane Util. Factor		0.95			0.95	1.00		1.00	0.91			1.00
Frt		0.96			1.00	0.85		1.00	0.99			1.00
Flt Protected		0.99			0.99	1.00		0.95	1.00			0.95
Satd. Flow (prot)		2935			3065	1275		1577	4366			1345
Flt Permitted		0.53			0.59	1.00		0.95	1.00			0.95
Satd. Flow (perm)		1577			1819	1275		1577	4366			1345
Peak-hour factor, PHF	0.97	0.97	0.97	0.92	0.92	0.92	0.86	0.86	0.86	0.86	0.97	0.97
Adj. Flow (vph)	196	386	210	86	453	327	1	197	992	105	2	191
RTOR Reduction (vph)	0	0	0	0	0	262	0	0	0	0	0	0
Lane Group Flow (vph)	0	792	0	0	539	65	0	198	1097	0	0	193
Heavy Vehicles (%)	5%	5%	5%	6%	5%	14%	0%	3%	5%	9%	0%	21%
Parking (#/hr)												
Turn Type	D.P+P	NA		Perm	NA	Perm	Prot	Prot	NA		Prot	Prot
Protected Phases	3	3 4			4		5	5	1		5	5
Permitted Phases	4			4		4						
Actuated Green, G (s)		35.0			25.0	25.0		16.0	32.8			16.0
Effective Green, g (s)		39.0			28.0	28.0		18.0	34.8			18.0
Actuated g/C Ratio		0.28			0.20	0.20		0.13	0.25			0.13
Clearance Time (s)					7.0	7.0		6.0	6.0			6.0
Vehicle Extension (s)					3.0	3.0		2.0	2.0			2.0
Lane Grp Cap (vph)		555			363	255		202	1085			172
v/s Ratio Prot		c0.12						0.13	0.25			c0.14
v/s Ratio Perm		0.27			c0.30	0.05						
v/c Ratio		1.43			1.48	0.26		0.98	1.01			1.12
Uniform Delay, d1		50.5			56.0	47.2		60.8	52.6			61.0
Progression Factor		1.07			1.00	1.00		1.00	1.00			1.37
Incremental Delay, d2		198.1			232.4	0.5		57.3	30.1			62.5
Delay (s)		252.3			288.4	47.8		118.1	82.7			146.3
Level of Service		F			F	D		F	F			F
Approach Delay (s)		252.3			197.6				88.1			
Approach LOS		F			F				F			

Intersection Summary

HCM 2000 Control Delay	143.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	91.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

	↓	↙
Movement	SBT	SBR
Lane Configurations	↑↑↱	
Traffic Volume (vph)	979	108
Future Volume (vph)	979	108
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.0	
Lane Util. Factor	0.91	
Frt	0.99	
Flt Protected	1.00	
Satd. Flow (prot)	4209	
Flt Permitted	1.00	
Satd. Flow (perm)	4209	
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	1009	111
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	1120	0
Heavy Vehicles (%)	3%	2%
Parking (#/hr)	15	
Turn Type	NA	
Protected Phases	1	
Permitted Phases		
Actuated Green, G (s)	32.8	
Effective Green, g (s)	34.8	
Actuated g/C Ratio	0.25	
Clearance Time (s)	6.0	
Vehicle Extension (s)	2.0	
Lane Grp Cap (vph)	1046	
v/s Ratio Prot	c0.27	
v/s Ratio Perm		
v/c Ratio	1.07	
Uniform Delay, d1	52.6	
Progression Factor	1.05	
Incremental Delay, d2	34.0	
Delay (s)	89.2	
Level of Service	F	
Approach Delay (s)	97.5	
Approach LOS	F	

Intersection Summary

Queues
611: Tremont Street & Ruggles St/Whittier St

Lane Group	EBL	EBR	WBT	NEL	NET	SWT	SWR
Lane Group Flow (vph)	600	209	182	181	1343	940	577
v/c Ratio	0.83	0.59	0.60	0.94	0.62	0.93	0.80
Control Delay	51.2	39.2	56.3	104.1	30.2	58.5	30.9
Queue Delay	1.6	1.2	0.0	23.3	0.0	18.0	0.0
Total Delay	52.8	40.4	56.3	127.4	30.2	76.5	30.9
Queue Length 50th (ft)	245	74	134	170	268	~521	408
Queue Length 95th (ft)	325	136	193	m#216	m292	#661	#610
Internal Link Dist (ft)			271		624	238	
Turn Bay Length (ft)				200			
Base Capacity (vph)	750	353	374	193	2175	1008	736
Starvation Cap Reductn	52	41	0	0	0	94	0
Spillback Cap Reductn	0	0	0	18	0	0	1
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.67	0.49	1.03	0.62	1.03	0.79

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰↰		↱		✣		↰	↑↑↑			↑↑	↱
Traffic Volume (vph)	528	0	184	73	27	51	161	1195	0	0	902	554
Future Volume (vph)	528	0	184	73	27	51	161	1195	0	0	902	554
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	16	12	11	11	12	12	11	11
Total Lost time (s)	4.0		4.0		4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	0.97		1.00		1.00		1.00	0.91			0.95	1.00
Frpb, ped/bikes	1.00		1.00		0.99		1.00	1.00			1.00	0.94
Flpb, ped/bikes	1.00		1.00		0.99		1.00	1.00			1.00	1.00
Frt	1.00		0.85		0.95		1.00	1.00			1.00	0.85
Flt Protected	0.95		1.00		0.98		0.95	1.00			1.00	1.00
Satd. Flow (prot)	3001		1171		1749		1287	4298			3079	1274
Flt Permitted	0.95		1.00		0.98		0.95	1.00			1.00	1.00
Satd. Flow (perm)	3001		1171		1749		1287	4298			3079	1274
Peak-hour factor, PHF	0.88	0.88	0.88	0.83	0.83	0.83	0.89	0.89	0.89	0.96	0.96	0.96
Adj. Flow (vph)	600	0	209	88	33	61	181	1343	0	0	940	577
RTOR Reduction (vph)	0	0	178	0	13	0	0	0	0	0	0	0
Lane Group Flow (vph)	600	0	31	0	169	0	181	1343	0	0	940	577
Confl. Peds. (#/hr)	13		16	16		13	23					23
Heavy Vehicles (%)	5%	0%	20%	2%	0%	0%	22%	5%	0%	0%	2%	4%
Parking (#/hr)				15		0						
Turn Type	Prot		Over	Perm	NA		Prot	NA			NA	pm+ov
Protected Phases	3		1		4		1	6			2	3
Permitted Phases				4								2
Actuated Green, G (s)	31.8		19.0		21.3		19.0	68.9			43.9	75.7
Effective Green, g (s)	33.8		21.0		23.3		21.0	70.9			45.9	79.7
Actuated g/C Ratio	0.24		0.15		0.17		0.15	0.51			0.33	0.57
Clearance Time (s)	6.0		6.0		6.0		6.0	6.0			6.0	6.0
Vehicle Extension (s)	3.0		2.0		2.0		2.0	2.0			2.0	3.0
Lane Grp Cap (vph)	724		175		291		193	2176			1009	761
v/s Ratio Prot	c0.20		0.03				c0.14	0.31			c0.31	0.18
v/s Ratio Perm					0.10							0.27
v/c Ratio	0.83		0.18		0.58		0.94	0.62			0.93	0.76
Uniform Delay, d1	50.4		52.0		53.8		58.9	24.8			45.5	22.8
Progression Factor	0.82		4.67		1.00		1.18	1.11			0.93	0.90
Incremental Delay, d2	7.4		0.2		1.7		33.1	0.8			15.0	4.0
Delay (s)	48.5		242.9		55.6		102.7	28.4			57.4	24.5
Level of Service	D		F		E		F	C			E	C
Approach Delay (s)		98.7			55.6			37.2			44.9	
Approach LOS		F			E			D			D	

Intersection Summary

HCM 2000 Control Delay	53.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

3082: Tremont Street & Renaissance Park/Ruggles St

Lane Group	EBR	NET	SWT
Lane Group Flow (vph)	130	1908	1437
v/c Ratio	0.42	0.62	0.43
Control Delay	22.7	3.7	3.3
Queue Delay	0.2	0.2	2.1
Total Delay	22.9	3.9	5.4
Queue Length 50th (ft)	33	9	77
Queue Length 95th (ft)	98	29	m99
Internal Link Dist (ft)		238	380
Turn Bay Length (ft)			
Base Capacity (vph)	310	3085	3317
Starvation Cap Reductn	0	414	1675
Spillback Cap Reductn	13	91	718
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.44	0.71	0.88

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

3082: Tremont Street & Renaissance Park/Ruggles St

2/4/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations			↗					↑↑↱			↑↑↑	
Traffic Volume (vph)	0	0	122	0	0	0	0	1584	267	0	1279	0
Future Volume (vph)	0	0	122	0	0	0	0	1584	267	0	1279	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	16	12	11	12	12	11	12
Total Lost time (s)			4.0					4.0			4.0	
Lane Util. Factor			1.00					0.91			0.91	
Frpb, ped/bikes			1.00					0.98			1.00	
Flpb, ped/bikes			1.00					1.00			1.00	
Frt			0.86					0.98			1.00	
Flt Protected			1.00					1.00			1.00	
Satd. Flow (prot)			1286					4055			4381	
Flt Permitted			1.00					1.00			1.00	
Satd. Flow (perm)			1286					4055			4381	
Peak-hour factor, PHF	0.94	0.94	0.94	0.92	0.92	0.92	0.97	0.97	0.97	0.89	0.89	0.89
Adj. Flow (vph)	0	0	130	0	0	0	0	1633	275	0	1437	0
RTOR Reduction (vph)	0	0	72	0	0	0	0	17	0	0	0	0
Lane Group Flow (vph)	0	0	58	0	0	0	0	1891	0	0	1437	0
Confl. Peds. (#/hr)									26			
Heavy Vehicles (%)	0%	0%	15%	0%	0%	0%	0%	6%	10%	0%	3%	0%
Turn Type			Prot					NA			NA	
Protected Phases			5					1			1	
Permitted Phases												
Actuated Green, G (s)			25.0					105.0			105.0	
Effective Green, g (s)			26.0					106.0			106.0	
Actuated g/C Ratio			0.19					0.76			0.76	
Clearance Time (s)			5.0					5.0			5.0	
Vehicle Extension (s)			2.0					2.0			2.0	
Lane Grp Cap (vph)			238					3070			3317	
v/s Ratio Prot			c0.05					c0.47			0.33	
v/s Ratio Perm												
v/c Ratio			0.25					0.62			0.43	
Uniform Delay, d1			48.6					7.7			6.1	
Progression Factor			1.00					0.40			0.52	
Incremental Delay, d2			0.2					0.7			0.1	
Delay (s)			48.8					3.8			3.3	
Level of Service			D					A			A	
Approach Delay (s)		48.8			0.0			3.8			3.3	
Approach LOS		D			A			A			A	

Intersection Summary

HCM 2000 Control Delay	5.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Queues

3098: Tremont Street/Tremont St & Melnea Cass Boulevard

	→	↘	↙	←	↑	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	251	280	797	200	947	1083	659
v/c Ratio	1.03	0.68	0.95	0.49	1.06	0.70	1.57dl
Control Delay	117.5	19.4	70.4	46.5	74.0	6.0	118.6
Queue Delay	23.4	2.2	0.0	0.0	0.0	0.0	0.0
Total Delay	140.9	21.6	70.4	46.5	74.0	6.0	118.6
Queue Length 50th (ft)	~204	53	364	151	~386	98	~370
Queue Length 95th (ft)	#359	100	#485	219	#462	279	#498
Internal Link Dist (ft)	203			68	380		136
Turn Bay Length (ft)			350				
Base Capacity (vph)	243	412	861	423	892	1554	585
Starvation Cap Reductn	20	51	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.13	0.78	0.93	0.47	1.06	0.70	1.13

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	193	232	765	113	56	227	556	953	67	481	10
Future Volume (vph)	8	193	232	765	113	56	227	556	953	67	481	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	13	12	13	13	12	12	11	16	12	14	12
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00	0.97	1.00			0.95	1.00		0.95	
Frt		1.00	0.85	1.00	0.95			1.00	0.85		1.00	
Flt Protected		1.00	1.00	0.95	1.00			0.99	1.00		0.99	
Satd. Flow (prot)		1626	1398	3015	1482			2928	1554		3193	
Flt Permitted		1.00	1.00	0.95	1.00			0.56	1.00		0.52	
Satd. Flow (perm)		1626	1398	3015	1482			1651	1554		1670	
Peak-hour factor, PHF	0.38	0.84	0.83	0.96	0.86	0.81	0.82	0.83	0.88	0.54	0.93	0.55
Adj. Flow (vph)	21	230	280	797	131	69	277	670	1083	124	517	18
RTOR Reduction (vph)	0	0	202	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	251	78	797	200	0	0	947	1083	0	658	0
Heavy Vehicles (%)	0%	9%	4%	8%	12%	15%	5%	6%	6%	20%	3%	36%
Turn Type	Split	NA	Perm	Split	NA		pm+pt	NA	Free	Perm	NA	
Protected Phases	5	5		6	6		7	1 7			1	
Permitted Phases			5				1 7		Free	1		
Actuated Green, G (s)		21.0	21.0	39.0	39.0			64.0	140.0		49.0	
Effective Green, g (s)		21.0	21.0	39.0	39.0			64.0	140.0		49.0	
Actuated g/C Ratio		0.15	0.15	0.28	0.28			0.46	1.00		0.35	
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0						2.0	
Lane Grp Cap (vph)		243	209	839	412			891	1554		584	
v/s Ratio Prot		c0.15		c0.26	0.13			c0.11				
v/s Ratio Perm			0.06					0.37	0.70		c0.39	
v/c Ratio		1.03	0.37	0.95	0.49			1.06	0.70		1.57dl	
Uniform Delay, d1		59.5	53.6	49.5	42.1			38.0	0.0		45.5	
Progression Factor		0.91	0.99	1.00	1.00			0.83	1.00		1.00	
Incremental Delay, d2		64.8	0.4	19.5	0.3			46.6	2.3		77.1	
Delay (s)		119.2	53.4	69.0	42.5			78.0	2.3		122.6	
Level of Service		F	D	E	D			E	A		F	
Approach Delay (s)		84.5			63.7			37.6			122.6	
Approach LOS		F			E			D			F	

Intersection Summary

HCM 2000 Control Delay	63.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	91.1%	ICU Level of Service	F
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group

4023: Tremont Street & Prentiss St

Lane Group	EBL	NBT	SBT
Lane Group Flow (vph)	354	1421	1316
v/c Ratio	0.94	0.90	1.15
Control Delay	80.3	36.0	97.4
Queue Delay	0.0	0.0	0.0
Total Delay	80.3	36.0	97.4
Queue Length 50th (ft)	289	~362	~823
Queue Length 95th (ft)	#425	m#358	m#931
Internal Link Dist (ft)	258	709	163
Turn Bay Length (ft)			
Base Capacity (vph)	393	1583	1148
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.90	0.90	1.15

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBU	SBT	SBR
Lane Configurations	↰↱			↰↑↑		↑↑↱	
Traffic Volume (vph)	153	148	107	1229	17	1162	84
Future Volume (vph)	153	148	107	1229	17	1162	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	11	12	11	12
Total Lost time (s)	4.0			4.0		4.0	
Lane Util. Factor	1.00			0.91		0.95	
Frt	0.93			1.00		0.99	
Flt Protected	0.98			1.00		1.00	
Satd. Flow (prot)	1475			4174		2668	
Flt Permitted	0.98			0.63		0.91	
Satd. Flow (perm)	1475			2656		2425	
Peak-hour factor, PHF	0.85	0.85	0.94	0.94	0.92	0.96	0.96
Adj. Flow (vph)	180	174	114	1307	18	1210	88
RTOR Reduction (vph)	25	0	0	0	0	3	0
Lane Group Flow (vph)	329	0	0	1421	0	1313	0
Heavy Vehicles (%)	13%	5%	4%	8%	2%	6%	11%
Parking (#/hr)						15	
Turn Type	Prot		pm+pt	NA	Perm	NA	
Protected Phases	5		6	1 6		1	
Permitted Phases			1 6		1		
Actuated Green, G (s)	32.4			73.6		63.6	
Effective Green, g (s)	33.4			75.6		64.6	
Actuated g/C Ratio	0.24			0.54		0.46	
Clearance Time (s)	5.0					5.0	
Vehicle Extension (s)	2.0					2.0	
Lane Grp Cap (vph)	351			1553		1118	
v/s Ratio Prot	c0.22			c0.07			
v/s Ratio Perm				0.42		c0.54	
v/c Ratio	0.94			0.92		1.17	
Uniform Delay, d1	52.3			29.3		37.7	
Progression Factor	1.00			1.23		0.57	
Incremental Delay, d2	31.5			3.4		84.7	
Delay (s)	83.8			39.5		106.2	
Level of Service	F			D		F	
Approach Delay (s)	83.8			39.5		106.2	
Approach LOS	F			D		F	

Intersection Summary

HCM 2000 Control Delay	73.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	97.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

6: Tremont Street & Site Driveway

2/2/2016

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations		↱	↑↑↑	↱		↑↑
Traffic Volume (veh/h)	0	111	1111	61	1	947
Future Volume (Veh/h)	0	111	1111	61	1	947
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	121	1208	66	1	1029
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			273			675
pX, platoon unblocked	0.86	0.87			0.87	
vC, conflicting volume	1724	403			1274	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	574	0			778	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	87			100	
cM capacity (veh/h)	383	940			723	

Direction, Lane #	NW 1	NE 1	NE 2	NE 3	NE 4	SW 1	SW 2
Volume Total	121	403	403	403	66	344	686
Volume Left	0	0	0	0	0	1	0
Volume Right	121	0	0	0	66	0	0
cSH	940	1700	1700	1700	1700	723	1700
Volume to Capacity	0.13	0.24	0.24	0.24	0.04	0.00	0.40
Queue Length 95th (ft)	11	0	0	0	0	0	0
Control Delay (s)	9.4	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	A					A	
Approach Delay (s)	9.4	0.0				0.0	
Approach LOS	A						

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		

192: Columbus Avenue/Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd

2/2/2016

	→	←	↖	↖	↑	↘	↓
Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	510	405	291	112	869	169	773
v/c Ratio	0.86	0.99	0.62	0.63	0.71	1.18	0.69
Control Delay	55.6	91.4	11.1	67.4	45.6	148.5	49.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.6	91.4	11.1	67.4	45.6	148.5	49.9
Queue Length 50th (ft)	171	166	0	84	~311	~161	~279
Queue Length 95th (ft)	#262	#248	62	#157	#401	m#225	#371
Internal Link Dist (ft)	381	1188			1304		709
Turn Bay Length (ft)				205		205	
Base Capacity (vph)	591	409	471	177	1230	143	1127
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.99	0.62	0.63	0.71	1.18	0.69

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations		↰↑↱			↰↑	↱		↰	↑↑↱			↰
Traffic Volume (vph)	148	239	93	65	280	247	1	103	741	67	13	147
Future Volume (vph)	148	239	93	65	280	247	1	103	741	67	13	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0		4.0	4.0			4.0
Lane Util. Factor		0.95			0.95	1.00		1.00	0.91			1.00
Frt		0.97			1.00	0.85		1.00	0.99			1.00
Flt Protected		0.98			0.99	1.00		0.95	1.00			0.95
Satd. Flow (prot)		2938			2945	1275		1519	4315			1230
Flt Permitted		0.59			0.75	1.00		0.95	1.00			0.95
Satd. Flow (perm)		1757			2235	1275		1519	4315			1230
Peak-hour factor, PHF	0.94	0.94	0.94	0.85	0.85	0.85	0.93	0.93	0.93	0.93	0.95	0.95
Adj. Flow (vph)	157	254	99	76	329	291	1	111	797	72	14	155
RTOR Reduction (vph)	0	0	0	0	0	238	0	0	0	0	0	0
Lane Group Flow (vph)	0	510	0	0	405	53	0	112	869	0	0	169
Heavy Vehicles (%)	9%	4%	5%	15%	8%	14%	0%	7%	7%	5%	0%	35%
Parking (#/hr)												
Turn Type	pm+pt	NA		Perm	NA	Perm	Prot	Prot	NA		Prot	Prot
Protected Phases	3	3 4			4		5	5	1		5	5
Permitted Phases	3 4			4		4						
Actuated Green, G (s)		28.0			19.0	19.0		12.0	30.6			12.0
Effective Green, g (s)		32.0			22.0	22.0		14.0	32.6			14.0
Actuated g/C Ratio		0.27			0.18	0.18		0.12	0.27			0.12
Clearance Time (s)					7.0	7.0		6.0	6.0			6.0
Vehicle Extension (s)					3.0	3.0		2.0	2.0			2.0
Lane Grp Cap (vph)		576			409	233		177	1172			143
v/s Ratio Prot		c0.08						0.07	c0.20			c0.14
v/s Ratio Perm		0.15			c0.18	0.04						
v/c Ratio		0.89			0.99	0.23		0.63	0.74			1.18
Uniform Delay, d1		42.2			48.9	41.8		50.5	39.9			53.0
Progression Factor		1.13			1.00	1.00		1.00	1.00			0.65
Incremental Delay, d2		12.6			41.8	0.5		5.3	4.2			114.4
Delay (s)		60.2			90.7	42.3		55.9	44.1			148.7
Level of Service		E			F	D		E	D			F
Approach Delay (s)		60.2			70.4				45.5			
Approach LOS		E			E				D			

Intersection Summary

HCM 2000 Control Delay	60.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	73.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations	↑↑↱	
Traffic Volume (vph)	557	178
Future Volume (vph)	557	178
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.0	
Lane Util. Factor	0.91	
Frt	0.96	
Flt Protected	1.00	
Satd. Flow (prot)	3956	
Flt Permitted	1.00	
Satd. Flow (perm)	3956	
Peak-hour factor, PHF	0.95	0.95
Adj. Flow (vph)	586	187
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	773	0
Heavy Vehicles (%)	9%	5%
Parking (#/hr)	10	
Turn Type	NA	
Protected Phases	1	
Permitted Phases		
Actuated Green, G (s)	30.6	
Effective Green, g (s)	32.6	
Actuated g/C Ratio	0.27	
Clearance Time (s)	6.0	
Vehicle Extension (s)	2.0	
Lane Grp Cap (vph)	1074	
v/s Ratio Prot	0.20	
v/s Ratio Perm		
v/c Ratio	0.72	
Uniform Delay, d1	39.6	
Progression Factor	1.19	
Incremental Delay, d2	2.4	
Delay (s)	49.5	
Level of Service	D	
Approach Delay (s)	67.3	
Approach LOS	E	

Intersection Summary

611: Tremont Street & Ruggles St/Whittier St

Lane Group	EBL	EBR	WBT	NEL	NET	SWT	SWR
Lane Group Flow (vph)	394	135	33	165	1120	880	419
v/c Ratio	0.73	0.50	0.16	3.84	0.41	0.69	0.53
Control Delay	41.4	22.1	27.3	1339.4	13.1	22.1	9.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Total Delay	41.4	22.1	27.3	1339.4	13.1	22.3	9.8
Queue Length 50th (ft)	91	29	11	~239	98	117	21
Queue Length 95th (ft)	143	67	33	#382	197	#529	408
Internal Link Dist (ft)			271		595	238	
Turn Bay Length (ft)				200			
Base Capacity (vph)	583	272	423	43	2755	1278	802
Starvation Cap Reductn	0	0	0	0	0	68	4
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.50	0.08	3.84	0.41	0.73	0.53

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

Timing Plan: 2021 No Build SA

611: Tremont Street & Ruggles St/Whittier St

2/2/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEU	NEL	NET	NER	SWU	SWL
Lane Configurations	↰↰		↱		✣			↰	↑↑↑			
Traffic Volume (vph)	370	0	127	12	1	15	21	136	1064	0	14	0
Future Volume (vph)	370	0	127	12	1	15	21	136	1064	0	14	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	16	12	12	11	11	12	12	12
Total Lost time (s)	4.0		4.0		4.0			4.0	4.0			
Lane Util. Factor	0.97		1.00		1.00			1.00	0.91			
Frpb, ped/bikes	1.00		1.00		0.99			1.00	1.00			
Flpb, ped/bikes	1.00		1.00		1.00			0.98	1.00			
Frt	1.00		0.85		0.93			1.00	1.00			
Flt Protected	0.95		1.00		0.98			0.95	1.00			
Satd. Flow (prot)	2918		1098		1697			1249	4257			
Flt Permitted	0.95		1.00		0.98			0.24	1.00			
Satd. Flow (perm)	2918		1098		1697			309	4257			
Peak-hour factor, PHF	0.94	0.94	0.94	0.83	0.83	0.83	0.95	0.95	0.95	0.95	0.93	0.93
Adj. Flow (vph)	394	0	135	14	1	18	22	143	1120	0	15	0
RTOR Reduction (vph)	0	0	116	0	16	0	0	0	0	0	0	0
Lane Group Flow (vph)	394	0	19	0	17	0	0	165	1120	0	0	0
Confl. Peds. (#/hr)	7		6	6		7		37				
Heavy Vehicles (%)	8%	0%	28%	4%	10%	0%	0%	27%	6%	0%	0%	0%
Parking (#/hr)				5								
Turn Type	Prot		Over	Perm	NA		custom	Prot	NA		Perm	
Protected Phases	3		1!		4			1	6			
Permitted Phases				4			1!				2	
Actuated Green, G (s)	20.3		15.0		8.4			15.0	73.3			
Effective Green, g (s)	22.3		17.0		10.4			17.0	75.3			
Actuated g/C Ratio	0.19		0.14		0.09			0.14	0.63			
Clearance Time (s)	6.0		6.0		6.0			6.0	6.0			
Vehicle Extension (s)	3.0		2.0		2.0			2.0	2.0			
Lane Grp Cap (vph)	542		155		147			43	2671			
v/s Ratio Prot	c0.14		0.02						0.26			
v/s Ratio Perm					0.01			c0.53				
v/c Ratio	0.73		0.12		0.11			3.84	0.42			
Uniform Delay, d1	46.0		45.0		50.5			51.5	11.3			
Progression Factor	0.73		2.04		1.00			1.15	1.01			
Incremental Delay, d2	4.5		0.1		0.1			1323.9	0.4			
Delay (s)	38.2		91.9		50.7			1382.9	11.8			
Level of Service	D		F		D			F	B			
Approach Delay (s)		51.9			50.7				187.9			
Approach LOS		D			D				F			

Intersection Summary

HCM 2000 Control Delay	92.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

	↙	↲
Movement	SWT	SWR
Lane Configurations	↑↑	↱
Traffic Volume (vph)	804	390
Future Volume (vph)	804	390
Ideal Flow (vphpl)	1900	1900
Lane Width	11	11
Total Lost time (s)	4.0	4.0
Lane Util. Factor	0.95	1.00
Frpb, ped/bikes	1.00	0.91
Flpb, ped/bikes	1.00	1.00
Frt	1.00	0.85
Flt Protected	1.00	1.00
Satd. Flow (prot)	2936	1193
Flt Permitted	0.92	1.00
Satd. Flow (perm)	2706	1193
Peak-hour factor, PHF	0.93	0.93
Adj. Flow (vph)	865	419
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	880	419
Confl. Peds. (#/hr)		37
Heavy Vehicles (%)	7%	7%
Parking (#/hr)		
Turn Type	NA	pm+ov
Protected Phases	2	3
Permitted Phases		2
Actuated Green, G (s)	52.3	72.6
Effective Green, g (s)	54.3	76.6
Actuated g/C Ratio	0.45	0.64
Clearance Time (s)	6.0	6.0
Vehicle Extension (s)	2.0	3.0
Lane Grp Cap (vph)	1224	801
v/s Ratio Prot		0.10
v/s Ratio Perm	c0.33	0.25
v/c Ratio	0.72	0.52
Uniform Delay, d1	26.7	11.8
Progression Factor	0.63	0.56
Incremental Delay, d2	3.4	0.6
Delay (s)	20.1	7.2
Level of Service	C	A
Approach Delay (s)	16.0	
Approach LOS	B	

Intersection Summary

3082: Tremont Street & Renaissance Park/Ruggles St

Lane Group	EBR	NET	SWT
Lane Group Flow (vph)	66	1594	1220
v/c Ratio	0.18	0.54	0.41
Control Delay	2.0	5.1	3.1
Queue Delay	0.0	0.2	0.4
Total Delay	2.0	5.3	3.5
Queue Length 50th (ft)	0	110	33
Queue Length 95th (ft)	0	8	83
Internal Link Dist (ft)		238	380
Turn Bay Length (ft)			
Base Capacity (vph)	366	2958	2994
Starvation Cap Reductn	0	449	1078
Spillback Cap Reductn	4	0	185
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.18	0.64	0.64

Intersection Summary

HCM Signalized Intersection Capacity Analysis Timing Plan: 2021 No Build SA
3082: Tremont Street & Renaissance Park/Ruggles St 2/2/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations			↱					↑↑↱			↑↑↑	
Traffic Volume (vph)	0	0	43	0	0	0	0	1373	94	0	1159	0
Future Volume (vph)	0	0	43	0	0	0	0	1373	94	0	1159	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	16	12	11	12	12	11	12
Total Lost time (s)			4.0					4.0			4.0	
Lane Util. Factor			1.00					0.91			0.91	
Frpb, ped/bikes			1.00					1.00			1.00	
Flpb, ped/bikes			1.00					1.00			1.00	
Frt			0.86					0.99			1.00	
Flt Protected			1.00					1.00			1.00	
Satd. Flow (prot)			1275					4120			4178	
Flt Permitted			1.00					1.00			1.00	
Satd. Flow (perm)			1275					4120			4178	
Peak-hour factor, PHF	0.65	0.65	0.65	0.92	0.92	0.92	0.92	0.92	0.92	0.95	0.95	0.95
Adj. Flow (vph)	0	0	66	0	0	0	0	1492	102	0	1220	0
RTOR Reduction (vph)	0	0	52	0	0	0	0	6	0	0	0	0
Lane Group Flow (vph)	0	0	14	0	0	0	0	1588	0	0	1220	0
Confl. Peds. (#/hr)									7			
Heavy Vehicles (%)	0%	0%	16%	0%	0%	0%	0%	8%	10%	0%	8%	0%
Turn Type			Prot					NA			NA	
Protected Phases			5					1			1	
Permitted Phases												
Actuated Green, G (s)			25.0					85.0			85.0	
Effective Green, g (s)			26.0					86.0			86.0	
Actuated g/C Ratio			0.22					0.72			0.72	
Clearance Time (s)			5.0					5.0			5.0	
Vehicle Extension (s)			2.0					2.0			2.0	
Lane Grp Cap (vph)			276					2952			2994	
v/s Ratio Prot			c0.01					c0.39			0.29	
v/s Ratio Perm												
v/c Ratio			0.05					0.54			0.41	
Uniform Delay, d1			37.2					7.8			6.8	
Progression Factor			1.00					0.57			0.40	
Incremental Delay, d2			0.0					0.6			0.3	
Delay (s)			37.3					5.1			3.1	
Level of Service			D					A			A	
Approach Delay (s)		37.3			0.0			5.1			3.1	
Approach LOS		D			A			A			A	

Intersection Summary

HCM 2000 Control Delay	5.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

3098: Tremont Street/Tremont St & Melnea Cass Boulevard

	→	↘	↙	←	↑	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	75	196	702	141	649	951	443
v/c Ratio	0.48	0.63	0.84	0.34	0.62	0.62	0.41
Control Delay	60.3	15.9	50.0	35.7	14.8	4.6	26.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.3	15.9	50.0	35.7	14.8	4.6	26.1
Queue Length 50th (ft)	57	0	263	87	83	66	115
Queue Length 95th (ft)	91	49	308	126	213	273	205
Internal Link Dist (ft)	215			623	380		183
Turn Bay Length (ft)			350				
Base Capacity (vph)	285	406	1055	517	1047	1526	1092
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.48	0.67	0.27	0.62	0.62	0.41

Intersection Summary

3098: Tremont Street/Tremont St & Melnea Cass Boulevard

2/2/2016

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱	↰↰	↱			↰↑	↱		↰↑↱	
Traffic Volume (vph)	5	52	163	674	77	41	130	407	837	33	330	15
Future Volume (vph)	5	52	163	674	77	41	130	407	837	33	330	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	13	12	13	13	12	12	11	16	12	14	12
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00	0.97	1.00			0.95	1.00		0.95	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.98		1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt		1.00	0.85	1.00	0.95			1.00	0.85		0.99	
Flt Protected		0.99	1.00	0.95	1.00			0.99	1.00		0.99	
Satd. Flow (prot)		1631	1398	3015	1478			2934	1526		3177	
Flt Permitted		0.99	1.00	0.95	1.00			0.69	1.00		0.77	
Satd. Flow (perm)		1631	1398	3015	1478			2036	1526		2464	
Peak-hour factor, PHF	0.38	0.84	0.83	0.96	0.86	0.81	0.82	0.83	0.88	0.54	0.93	0.55
Adj. Flow (vph)	13	62	196	702	90	51	159	490	951	61	355	27
RTOR Reduction (vph)	0	0	177	0	0	0	0	0	0	0	3	0
Lane Group Flow (vph)	0	75	19	702	141	0	0	649	951	0	440	0
Confl. Peds. (#/hr)									20			
Heavy Vehicles (%)	0%	9%	4%	8%	12%	15%	5%	6%	6%	20%	3%	36%
Turn Type	Split	NA	Perm	Split	NA		pm+pt	NA	Free	Perm	NA	
Protected Phases	5	5		6	6		7	1 7			1	
Permitted Phases			5				1 7		Free	1		
Actuated Green, G (s)		11.5	11.5	33.4	33.4			59.1	120.0		53.1	
Effective Green, g (s)		11.5	11.5	33.4	33.4			59.1	120.0		53.1	
Actuated g/C Ratio		0.10	0.10	0.28	0.28			0.49	1.00		0.44	
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0						2.0	
Lane Grp Cap (vph)		156	133	839	411			1047	1526		1090	
v/s Ratio Prot		0.05		c0.23	0.10			0.03				
v/s Ratio Perm			0.01					0.27	c0.62		0.18	
v/c Ratio		0.48	0.14	0.84	0.34			0.62	0.62		0.40	
Uniform Delay, d1		51.4	49.7	40.7	34.5			22.2	0.0		22.7	
Progression Factor		1.00	1.00	1.00	1.00			0.52	1.00		1.00	
Incremental Delay, d2		0.9	0.2	7.0	0.2			2.4	1.7		1.1	
Delay (s)		52.3	49.9	47.7	34.7			13.9	1.7		23.8	
Level of Service		D	D	D	C			B	A		C	
Approach Delay (s)		50.6			45.5			6.7			23.8	
Approach LOS		D			D			A			C	

Intersection Summary

HCM 2000 Control Delay	23.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

	↗	↑	↓
Lane Group	EBL	NBT	SBT
Lane Group Flow (vph)	88	1265	1100
v/c Ratio	0.54	0.60	0.82
Control Delay	57.0	15.2	18.0
Queue Delay	0.0	0.0	0.0
Total Delay	57.0	15.2	18.0
Queue Length 50th (ft)	58	332	68
Queue Length 95th (ft)	105	m395	m#542
Internal Link Dist (ft)	258	709	193
Turn Bay Length (ft)			
Base Capacity (vph)	215	2124	1343
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.41	0.60	0.82

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBU	SBT	SBR
Lane Configurations	↰↱			↰↑↑		↑↱	
Traffic Volume (vph)	58	18	74	1102	13	885	49
Future Volume (vph)	58	18	74	1102	13	885	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	11	12	11	12
Total Lost time (s)	4.0			4.0		4.0	
Lane Util. Factor	1.00			0.91		0.95	
Frt	0.97			1.00		0.99	
Flt Protected	0.96			1.00		1.00	
Satd. Flow (prot)	1544			4132		2602	
Flt Permitted	0.96			0.74		0.93	
Satd. Flow (perm)	1544			3077		2412	
Peak-hour factor, PHF	0.87	0.87	0.93	0.93	0.92	0.86	0.86
Adj. Flow (vph)	67	21	80	1185	14	1029	57
RTOR Reduction (vph)	10	0	0	0	0	3	0
Lane Group Flow (vph)	78	0	0	1265	0	1097	0
Heavy Vehicles (%)	6%	9%	7%	9%	2%	11%	8%
Parking (#/hr)						10	
Turn Type	Prot		pm+pt	NA	Perm	NA	
Protected Phases	5		6	1 6		1	
Permitted Phases			1 6		1		
Actuated Green, G (s)	10.8			75.2		64.2	
Effective Green, g (s)	11.8			77.2		65.2	
Actuated g/C Ratio	0.10			0.64		0.54	
Clearance Time (s)	5.0					5.0	
Vehicle Extension (s)	2.0					2.0	
Lane Grp Cap (vph)	151			2085		1310	
v/s Ratio Prot	c0.05			c0.06			
v/s Ratio Perm				0.33		c0.45	
v/c Ratio	0.52			0.61		0.84	
Uniform Delay, d1	51.4			12.5		23.0	
Progression Factor	1.00			1.09		0.42	
Incremental Delay, d2	1.2			0.9		4.9	
Delay (s)	52.6			14.6		14.5	
Level of Service	D			B		B	
Approach Delay (s)	52.6			14.6		14.5	
Approach LOS	D			B		B	

Intersection Summary

HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

2017 Build Conditions

Queues

9: Tremont Street & Site Dr

Lane Group	WBL	WBR	NET	NER	SWL	SWT
Lane Group Flow (vph)	41	54	1855	179	114	1020
v/c Ratio	0.29	0.27	0.58	0.15	0.73	0.86
Control Delay	66.1	16.9	0.7	0.1	67.3	66.9
Queue Delay	0.0	0.0	1.0	1.8	0.0	1.4
Total Delay	66.1	16.9	1.6	1.9	67.3	68.3
Queue Length 50th (ft)	36	0	2	0	110	437
Queue Length 95th (ft)	76	41	13	m0	m136	518
Internal Link Dist (ft)	481		136			652
Turn Bay Length (ft)				100	250	
Base Capacity (vph)	139	249	3211	1193	212	1183
Starvation Cap Reductn	0	0	984	858	0	0
Spillback Cap Reductn	0	0	0	0	0	56
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.22	0.83	0.53	0.54	0.91

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

9: Tremont Street & Site Dr

Movement	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations	↰	↱	↑↑↑	↱	↰	↑↑
Traffic Volume (vph)	38	50	1707	165	105	938
Future Volume (vph)	38	50	1707	165	105	938
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	10	12
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1593	1425	4577	1425	1486	3185
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1593	1425	4577	1425	1486	3185
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	54	1855	179	114	1020
RTOR Reduction (vph)	0	48	0	25	0	0
Lane Group Flow (vph)	41	6	1855	154	114	1020
Turn Type	Prot	Over	NA	pm+ov	Prot	NA
Protected Phases	9	5	6 10	9	5	2
Permitted Phases				6 10		
Actuated Green, G (s)	12.3	14.8	97.9	110.2	14.8	52.0
Effective Green, g (s)	12.3	14.8	97.9	110.2	14.8	52.0
Actuated g/C Ratio	0.09	0.11	0.70	0.79	0.11	0.37
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	2.0		3.0	2.0	2.0
Lane Grp Cap (vph)	139	150	3200	1172	157	1183
v/s Ratio Prot	c0.03	0.00	c0.41	0.01	c0.08	c0.32
v/s Ratio Perm				0.10		
v/c Ratio	0.29	0.04	0.58	0.13	0.73	0.86
Uniform Delay, d1	59.8	56.2	10.6	3.5	60.6	40.7
Progression Factor	1.00	1.00	0.03	0.00	0.84	1.50
Incremental Delay, d2	1.2	0.0	0.1	0.0	8.6	5.5
Delay (s)	61.0	56.2	0.4	0.0	59.3	66.5
Level of Service	E	E	A	A	E	E
Approach Delay (s)	58.3		0.4			65.8
Approach LOS	E		A			E

Intersection Summary

HCM 2000 Control Delay	24.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

192: Columbus Avenue /Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd

8/1/2016

	→	←	↖	↰	↑	↘	↓
Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	749	491	359	177	1572	139	829
v/c Ratio	1.46	1.63	0.29	1.05	1.13	1.11	0.68
Control Delay	250.7	334.8	0.6	142.7	112.8	148.6	60.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.8
Total Delay	250.7	334.8	0.6	142.7	112.8	148.6	61.5
Queue Length 50th (ft)	~501	~338	0	~175	~691	~145	293
Queue Length 95th (ft)	m#573	#454	0	#330	#789	m#200	341
Internal Link Dist (ft)	381	1183			1304		709
Turn Bay Length (ft)				205		205	
Base Capacity (vph)	512	301	1232	168	1387	125	1217
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	147
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.46	1.63	0.29	1.05	1.13	1.11	0.77

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

192: Columbus Avenue /Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations		↰↑↱			↰↑	↱	↰	↑↑↱			↰	↑↑↱
Traffic Volume (vph)	205	312	127	61	410	345	166	1409	69	4	127	610
Future Volume (vph)	205	312	127	61	410	345	166	1409	69	4	127	610
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor		0.95			0.95	1.00	1.00	0.91			1.00	0.91
Frt		0.97			1.00	0.85	1.00	0.99			1.00	0.97
Flt Protected		0.98			0.99	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)		2924			2954	1232	1577	4455			1170	3911
Flt Permitted		0.55			0.59	1.00	0.95	1.00			0.95	1.00
Satd. Flow (perm)		1648			1762	1232	1577	4455			1170	3911
Peak-hour factor, PHF	0.86	0.86	0.86	0.96	0.96	0.96	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	238	363	148	64	427	359	177	1499	73	4	135	649
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	749	0	0	491	359	177	1572	0	0	139	829
Heavy Vehicles (%)	8%	5%	6%	11%	9%	18%	3%	4%	5%	0%	40%	8%
Parking (#/hr)												20
Turn Type	pm+pt	NA		Perm	NA	Free	Prot	NA		Prot	Prot	NA
Protected Phases	3	3 4			4		5	1		5	5	1
Permitted Phases	3 4			4		Free						
Actuated Green, G (s)		30.0			21.0	140.0	13.0	40.8			13.0	40.8
Effective Green, g (s)		34.0			24.0	140.0	15.0	42.8			15.0	42.8
Actuated g/C Ratio		0.24			0.17	1.00	0.11	0.31			0.11	0.31
Clearance Time (s)					7.0		6.0	6.0			6.0	6.0
Vehicle Extension (s)					2.0		2.0	2.0			2.0	2.0
Lane Grp Cap (vph)		500			302	1232	168	1361			125	1195
v/s Ratio Prot		c0.12					0.11	c0.35			c0.12	0.21
v/s Ratio Perm		0.25			c0.28	c0.29						
v/c Ratio		1.50			1.63	0.29	1.05	1.16			1.11	0.69
Uniform Delay, d1		53.0			58.0	0.0	62.5	48.6			62.5	42.8
Progression Factor		1.06			1.00	1.00	1.00	1.00			0.96	1.31
Incremental Delay, d2		229.3			296.3	0.6	84.3	78.5			95.0	2.0
Delay (s)		285.7			354.3	0.6	146.8	127.1			155.1	57.9
Level of Service		F			F	A	F	F			F	E
Approach Delay (s)		285.7			204.9			129.1				71.9
Approach LOS		F			F			F				E

Intersection Summary

HCM 2000 Control Delay	158.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	88.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	169
Future Volume (vph)	169
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.94
Adj. Flow (vph)	180
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Heavy Vehicles (%)	7%
Parking (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Lane Group	EBL	EBT	WBT	NEL	NET	SWL	SWT	SWR
Lane Group Flow (vph)	626	169	201	240	1704	43	839	548
v/c Ratio	0.96	0.50	0.79	1.02	0.89	0.51	0.88	0.78
Control Delay	96.4	37.1	74.1	126.8	18.3	95.5	47.7	36.7
Queue Delay	10.6	0.0	3.2	0.0	0.0	0.0	13.3	53.4
Total Delay	107.1	37.1	77.3	126.8	18.3	95.5	61.0	90.1
Queue Length 50th (ft)	313	49	160	~212	351	31	400	435
Queue Length 95th (ft)	#403	146	181	#400	#445	75	#520	636
Internal Link Dist (ft)		324	271		652		238	
Turn Bay Length (ft)				280		200		
Base Capacity (vph)	654	338	284	235	1906	91	957	703
Starvation Cap Reductn	34	0	0	0	0	0	118	61
Spillback Cap Reductn	0	0	31	0	0	0	0	271
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.01	0.50	0.79	1.02	0.89	0.47	1.00	1.27

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
611: Tremont Street & Ruggles St/Whittier St

2021 Build AM

8/1/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰↰	↱			✥		↰	↑↑↱		↰	↑↑	↱
Traffic Volume (vph)	551	10	139	42	45	54	221	1552	16	41	805	526
Future Volume (vph)	551	10	139	42	45	54	221	1552	16	41	805	526
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	16	12	11	11	12	11	11	11
Total Lost time (s)	4.0	6.0			4.0		4.0	4.0		5.0	4.0	4.0
Lane Util. Factor	0.97	1.00			1.00		1.00	0.91		1.00	0.95	1.00
Frpb, ped/bikes	1.00	0.98			0.99		1.00	1.00		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.86			0.95		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2865	997			1638		1266	4227		1570	2935	1268
Flt Permitted	0.95	1.00			0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2865	997			1638		1266	4227		1570	2935	1268
Peak-hour factor, PHF	0.88	0.88	0.88	0.70	0.70	0.70	0.92	0.92	0.92	0.96	0.96	0.96
Adj. Flow (vph)	626	11	158	60	64	77	240	1687	17	43	839	548
RTOR Reduction (vph)	0	124	0	0	16	0	0	1	0	0	0	0
Lane Group Flow (vph)	626	45	0	0	185	0	240	1703	0	43	839	548
Confl. Peds. (#/hr)	8		9	9		8	20					20
Heavy Vehicles (%)	10%	0%	42%	14%	0%	14%	24%	6%	67%	0%	7%	5%
Parking (#/hr)				15		0						
Turn Type	Split	NA		Split	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	3	3		4	4		1	6		5	2	3
Permitted Phases												2
Actuated Green, G (s)	30.0	30.0			18.3		24.0	61.1		7.6	43.7	73.7
Effective Green, g (s)	32.0	30.0			20.3		26.0	63.1		7.6	45.7	77.7
Actuated g/C Ratio	0.23	0.21			0.15		0.19	0.45		0.05	0.33	0.56
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0		5.0	6.0	6.0
Vehicle Extension (s)	2.0	2.0			2.0		2.0	2.0		3.0	2.0	2.0
Lane Grp Cap (vph)	654	213			237		235	1905		85	958	739
v/s Ratio Prot	c0.22	0.04			c0.11		c0.19	c0.40		0.03	0.29	0.17
v/s Ratio Perm												0.26
v/c Ratio	0.96	0.21			0.78		1.02	0.89		0.51	0.88	0.74
Uniform Delay, d1	53.3	45.3			57.7		57.0	35.4		64.4	44.5	23.6
Progression Factor	1.36	3.74			1.00		1.26	0.32		1.19	0.82	1.18
Incremental Delay, d2	23.9	0.2			13.7		59.3	5.9		4.3	10.4	3.3
Delay (s)	96.4	169.5			71.4		130.8	17.3		80.7	46.7	31.1
Level of Service	F	F			E		F	B		F	D	C
Approach Delay (s)		111.9			71.4			31.3			41.7	
Approach LOS		F			E			C			D	

Intersection Summary

HCM 2000 Control Delay	51.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	83.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

	↴	↗	↙
Lane Group	EBR	NET	SWT
Lane Group Flow (vph)	61	2235	1359
v/c Ratio	0.21	0.73	0.42
Control Delay	4.4	6.0	17.1
Queue Delay	0.0	0.9	1.0
Total Delay	4.4	6.9	18.1
Queue Length 50th (ft)	0	135	266
Queue Length 95th (ft)	0	m148	m311
Internal Link Dist (ft)		238	380
Turn Bay Length (ft)			
Base Capacity (vph)	317	3075	3223
Starvation Cap Reductn	0	498	1479
Spillback Cap Reductn	16	208	761
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.20	0.87	0.78

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
3082: Tremont Street & Renaissance Park/Ruggles St

2021 Build AM
8/1/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations			↱					↑↑↱			↑↑↑	
Traffic Volume (vph)	0	0	44	0	0	0	0	1900	268	0	1318	0
Future Volume (vph)	0	0	44	0	0	0	0	1900	268	0	1318	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	16	12	11	12	12	11	12
Total Lost time (s)			4.0					4.0			4.0	
Lane Util. Factor			1.00					0.91			0.91	
Frpb, ped/bikes			1.00					0.99			1.00	
Flpb, ped/bikes			1.00					1.00			1.00	
Frt			0.86					0.98			1.00	
Flt Protected			1.00					1.00			1.00	
Satd. Flow (prot)			1174					4048			4257	
Flt Permitted			1.00					1.00			1.00	
Satd. Flow (perm)			1174					4048			4257	
Peak-hour factor, PHF	0.72	0.72	0.72	0.92	0.92	0.92	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	0	61	0	0	0	0	1959	276	0	1359	0
RTOR Reduction (vph)	0	0	50	0	0	0	0	12	0	0	0	0
Lane Group Flow (vph)	0	0	11	0	0	0	0	2223	0	0	1359	0
Confl. Peds. (#/hr)									12			
Heavy Vehicles (%)	0%	0%	26%	0%	0%	0%	0%	7%	18%	0%	6%	0%
Turn Type			Prot					NA			NA	
Protected Phases			5					1			1	
Permitted Phases												
Actuated Green, G (s)			25.0					105.0			105.0	
Effective Green, g (s)			26.0					106.0			106.0	
Actuated g/C Ratio			0.19					0.76			0.76	
Clearance Time (s)			5.0					5.0			5.0	
Vehicle Extension (s)			2.0					2.0			2.0	
Lane Grp Cap (vph)			218					3064			3223	
v/s Ratio Prot			c0.01					c0.55			0.32	
v/s Ratio Perm												
v/c Ratio			0.05					0.73			0.42	
Uniform Delay, d1			46.9					9.2			6.1	
Progression Factor			1.00					0.59			2.79	
Incremental Delay, d2			0.0					0.6			0.0	
Delay (s)			46.9					6.1			17.0	
Level of Service			D					A			B	
Approach Delay (s)		46.9			0.0			6.1			17.0	
Approach LOS		D			A			A			B	

Intersection Summary

HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

3098: Tremont Street /Tremont St & Melnea Cass Boulevard

	→	↘	↙	←	↑	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	53	135	1003	313	1149	1145	478
v/c Ratio	0.41	0.57	1.16	0.72	0.99	0.75	1.30dl
Control Delay	71.3	24.0	130.9	55.7	47.9	8.4	68.9
Queue Delay	0.0	0.7	0.0	0.0	0.0	0.0	0.0
Total Delay	71.3	24.7	130.9	55.7	47.9	8.4	68.9
Queue Length 50th (ft)	47	23	~557	257	334	189	213
Queue Length 95th (ft)	m51	m38	#690	349	#466	274	#383
Internal Link Dist (ft)	197			732	380		216
Turn Bay Length (ft)			350				
Base Capacity (vph)	243	324	861	435	1164	1532	526
Starvation Cap Reductn	0	47	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.22	0.49	1.16	0.72	0.99	0.75	0.91

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.
dl Defacto Left Lane. Recode with 1 though lane as a left lane.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱	↰↰	↱			↰↑	↱		↰↱	
Traffic Volume (vph)	2	40	112	963	218	49	376	573	1008	33	354	20
Future Volume (vph)	2	40	112	963	218	49	376	573	1008	33	354	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	13	12	13	13	12	12	11	16	12	14	12
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00	0.97	1.00			0.95	1.00		0.95	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.99		1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt		1.00	0.85	1.00	0.97			1.00	0.85		0.99	
Flt Protected		1.00	1.00	0.95	1.00			0.98	1.00		0.99	
Satd. Flow (prot)		1626	1398	3015	1524			2916	1532		3163	
Flt Permitted		1.00	1.00	0.95	1.00			0.58	1.00		0.55	
Satd. Flow (perm)		1626	1398	3015	1524			1734	1532		1748	
Peak-hour factor, PHF	0.38	0.84	0.83	0.96	0.86	0.81	0.82	0.83	0.88	0.54	0.93	0.55
Adj. Flow (vph)	5	48	135	1003	253	60	459	690	1145	61	381	36
RTOR Reduction (vph)	0	0	124	0	0	0	0	0	0	0	4	0
Lane Group Flow (vph)	0	53	11	1003	313	0	0	1149	1145	0	474	0
Confl. Peds. (#/hr)									8			
Heavy Vehicles (%)	0%	9%	4%	8%	12%	15%	5%	6%	6%	20%	3%	36%
Turn Type	Split	NA	Perm	Split	NA		pm+pt	NA	Free	Perm	NA	
Protected Phases	5	5		6	6		7	1 7			1	
Permitted Phases			5				1 7		Free	1		
Actuated Green, G (s)		11.1	11.1	40.0	40.0			72.9	140.0		41.9	
Effective Green, g (s)		11.1	11.1	40.0	40.0			72.9	140.0		41.9	
Actuated g/C Ratio		0.08	0.08	0.29	0.29			0.52	1.00		0.30	
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0						2.0	
Lane Grp Cap (vph)		128	110	861	435			1164	1532		523	
v/s Ratio Prot		0.03		c0.33	0.21			c0.22				
v/s Ratio Perm			0.01					c0.30	c0.75		0.27	
v/c Ratio		0.41	0.10	1.16	0.72			0.99	0.75		1.30dl	
Uniform Delay, d1		61.4	59.8	50.0	45.0			33.1	0.0		47.2	
Progression Factor		1.07	1.84	1.00	1.00			1.02	1.00		1.00	
Incremental Delay, d2		0.6	0.1	86.8	4.7			20.5	2.7		21.9	
Delay (s)		66.3	110.1	136.8	49.7			54.3	2.7		69.0	
Level of Service		E	F	F	D			D	A		E	
Approach Delay (s)		97.7			116.1			28.5			69.0	
Approach LOS		F			F			C			E	

Intersection Summary

HCM 2000 Control Delay	63.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.6%	ICU Level of Service	E
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group

4023: Tremont Street & Prentiss St

	↗	↖	↑	↓
Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	198	290	1935	1005
v/c Ratio	0.73	0.84	0.91	0.86
Control Delay	69.3	73.8	25.0	15.0
Queue Delay	0.0	0.0	0.0	0.1
Total Delay	69.3	73.8	25.0	15.2
Queue Length 50th (ft)	166	227	675	80
Queue Length 95th (ft)	213	m216	m606	130
Internal Link Dist (ft)	258		709	136
Turn Bay Length (ft)		150		
Base Capacity (vph)	273	346	2115	1171
Starvation Cap Reductn	0	0	0	8
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.73	0.84	0.91	0.86

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱		↰	↑↑↑	↑↱	
Traffic Volume (vph)	125	28	258	1722	834	141
Future Volume (vph)	125	28	258	1722	834	141
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	13	12	10	11	11	12
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	0.91	0.95	
Frt	0.98		1.00	1.00	0.98	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1502		1472	4217	2457	
Flt Permitted	0.96		0.95	1.00	1.00	
Satd. Flow (perm)	1502		1472	4217	2457	
Peak-hour factor, PHF	0.77	0.77	0.89	0.89	0.97	0.97
Adj. Flow (vph)	162	36	290	1935	860	145
RTOR Reduction (vph)	6	0	0	0	9	0
Lane Group Flow (vph)	192	0	290	1935	996	0
Heavy Vehicles (%)	11%	7%	3%	7%	13%	10%
Parking (#/hr)					20	
Turn Type	Prot		Prot	NA	NA	
Protected Phases	10		1	6	2 9	
Permitted Phases						
Actuated Green, G (s)	23.7		32.0	69.2	64.3	
Effective Green, g (s)	24.7		33.0	70.2	66.3	
Actuated g/C Ratio	0.18		0.24	0.50	0.47	
Clearance Time (s)	5.0		5.0	5.0		
Vehicle Extension (s)	2.0		2.0	2.0		
Lane Grp Cap (vph)	264		346	2114	1163	
v/s Ratio Prot	c0.13		c0.20	c0.46	c0.41	
v/s Ratio Perm						
v/c Ratio	0.73		0.84	0.92	0.86	
Uniform Delay, d1	54.5		51.0	32.2	32.6	
Progression Factor	1.00		1.31	0.67	0.44	
Incremental Delay, d2	8.2		7.1	2.5	3.4	
Delay (s)	62.7		73.8	24.0	17.8	
Level of Service	E		E	C	B	
Approach Delay (s)	62.7			30.5	17.8	
Approach LOS	E			C	B	

Intersection Summary

HCM 2000 Control Delay	28.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

7: Tremont Street & Site Dr

Lane Group	NWL	NWR	NET	NER	SWL	SWT
Lane Group Flow (vph)	166	178	1486	130	152	1332
v/c Ratio	0.60	0.55	0.55	0.11	0.83	1.05
Control Delay	63.2	14.5	1.4	0.1	82.3	59.9
Queue Delay	0.0	0.0	1.7	1.8	0.0	21.9
Total Delay	63.2	14.5	3.2	1.8	82.3	81.8
Queue Length 50th (ft)	141	0	15	0	104	~709
Queue Length 95th (ft)	222	72	m16	m0	m118	m#654
Internal Link Dist (ft)	332		138			650
Turn Bay Length (ft)				80	250	
Base Capacity (vph)	275	340	2722	1170	209	1274
Starvation Cap Reductn	0	0	1005	898	0	0
Spillback Cap Reductn	0	0	0	0	0	87
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.52	0.87	0.48	0.73	1.12

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations	↰	↱	↑↑↑	↱	↰	↑↑
Traffic Volume (vph)	153	164	1367	120	140	1225
Future Volume (vph)	153	164	1367	120	140	1225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	12	12	11	12
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1540	1378	4577	1425	1540	3185
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1540	1378	4577	1425	1540	3185
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	166	178	1486	130	152	1332
RTOR Reduction (vph)	0	157	0	21	0	0
Lane Group Flow (vph)	166	21	1486	109	152	1332
Turn Type	Prot	Over	NA	pm+ov	Prot	NA
Protected Phases	9	5	6 10	9	5	2
Permitted Phases				6 10		
Actuated Green, G (s)	25.0	16.7	83.3	108.3	16.7	56.0
Effective Green, g (s)	25.0	16.7	83.3	108.3	16.7	56.0
Actuated g/C Ratio	0.18	0.12	0.59	0.77	0.12	0.40
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	2.0		3.0	2.0	2.0
Lane Grp Cap (vph)	275	164	2723	1153	183	1274
v/s Ratio Prot	c0.11	0.02	c0.32	0.02	c0.10	c0.42
v/s Ratio Perm				0.06		
v/c Ratio	0.60	0.13	0.55	0.09	0.83	1.05
Uniform Delay, d1	52.9	55.1	17.0	3.9	60.3	42.0
Progression Factor	1.00	1.00	0.07	0.00	1.10	0.70
Incremental Delay, d2	3.7	0.1	0.0	0.0	12.3	30.0
Delay (s)	56.6	55.3	1.2	0.0	78.8	59.5
Level of Service	E	E	A	A	E	E
Approach Delay (s)	55.9		1.1			61.5
Approach LOS	E		A			E

Intersection Summary

HCM 2000 Control Delay	32.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Queues

2021 Build PM

192: Columbus Avenue/Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd

8/1/2016

	→	←	↖	↖	↑	↘	↓
Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	835	539	341	198	1146	208	1239
v/c Ratio	1.46	1.55	0.65	0.98	1.03	1.21	1.17
Control Delay	248.7	299.7	11.0	118.5	85.9	172.2	121.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	248.7	299.7	11.0	118.5	85.9	172.2	121.9
Queue Length 50th (ft)	~547	~363	0	182	~490	~236	~564
Queue Length 95th (ft)	#680	#483	97	#321	#547	m#273	m#644
Internal Link Dist (ft)	381	1186			1304		709
Turn Bay Length (ft)				205		205	
Base Capacity (vph)	571	347	527	202	1110	172	1063
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.46	1.55	0.65	0.98	1.03	1.21	1.17

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations		↰↑↱			↰↑	↱		↰	↑↑↱			↰
Traffic Volume (vph)	232	374	204	79	417	314	1	169	895	90	2	200
Future Volume (vph)	232	374	204	79	417	314	1	169	895	90	2	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0		4.0	4.0			4.0
Lane Util. Factor		0.95			0.95	1.00		1.00	0.91			1.00
Frt		0.96			1.00	0.85		1.00	0.99			1.00
Flt Protected		0.99			0.99	1.00		0.95	1.00			0.95
Satd. Flow (prot)		2936			3065	1275		1577	4370			1345
Flt Permitted		0.54			0.56	1.00		0.95	1.00			0.95
Satd. Flow (perm)		1599			1739	1275		1577	4370			1345
Peak-hour factor, PHF	0.97	0.97	0.97	0.92	0.92	0.92	0.86	0.86	0.86	0.86	0.97	0.97
Adj. Flow (vph)	239	386	210	86	453	341	1	197	1041	105	2	206
RTOR Reduction (vph)	0	0	0	0	0	273	0	0	0	0	0	0
Lane Group Flow (vph)	0	835	0	0	539	68	0	198	1146	0	0	208
Heavy Vehicles (%)	5%	5%	5%	6%	5%	14%	0%	3%	5%	9%	0%	21%
Parking (#/hr)												
Turn Type	D.P+P	NA		Perm	NA	Perm	Prot	Prot	NA		Prot	Prot
Protected Phases	3	3 4			4		5	5	1		5	5
Permitted Phases	4			4		4						
Actuated Green, G (s)		35.0			25.0	25.0		16.0	32.8			16.0
Effective Green, g (s)		39.0			28.0	28.0		18.0	34.8			18.0
Actuated g/C Ratio		0.28			0.20	0.20		0.13	0.25			0.13
Clearance Time (s)					7.0	7.0		6.0	6.0			6.0
Vehicle Extension (s)					3.0	3.0		2.0	2.0			2.0
Lane Grp Cap (vph)		560			347	255		202	1086			172
v/s Ratio Prot		c0.13						0.13	0.26			c0.15
v/s Ratio Perm		0.29			c0.31	0.05						
v/c Ratio		1.49			1.55	0.27		0.98	1.06			1.21
Uniform Delay, d1		50.5			56.0	47.3		60.8	52.6			61.0
Progression Factor		0.96			1.00	1.00		1.00	1.00			1.23
Incremental Delay, d2		228.1			262.8	0.6		57.3	43.1			113.3
Delay (s)		276.6			318.8	47.9		118.1	95.7			188.5
Level of Service		F			F	D		F	F			F
Approach Delay (s)		276.6			213.8				99.0			
Approach LOS		F			F				F			

Intersection Summary

HCM 2000 Control Delay	169.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	95.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

	↓	↲
Movement	SBT	SBR
Lane Configurations	↑↑↱	
Traffic Volume (vph)	1037	165
Future Volume (vph)	1037	165
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.0	
Lane Util. Factor	0.91	
Frt	0.98	
Flt Protected	1.00	
Satd. Flow (prot)	4186	
Flt Permitted	1.00	
Satd. Flow (perm)	4186	
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	1069	170
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	1239	0
Heavy Vehicles (%)	3%	2%
Parking (#/hr)	15	
Turn Type	NA	
Protected Phases	1	
Permitted Phases		
Actuated Green, G (s)	32.8	
Effective Green, g (s)	34.8	
Actuated g/C Ratio	0.25	
Clearance Time (s)	6.0	
Vehicle Extension (s)	2.0	
Lane Grp Cap (vph)	1040	
v/s Ratio Prot	c0.30	
v/s Ratio Perm		
v/c Ratio	1.19	
Uniform Delay, d1	52.6	
Progression Factor	0.95	
Incremental Delay, d2	90.0	
Delay (s)	139.8	
Level of Service	F	
Approach Delay (s)	146.8	
Approach LOS	F	

Intersection Summary

611: Tremont Street & Ruggles St/Whittier St

Lane Group	EBL	EBT	WBT	NEL	NET	SWL	SWT	SWR
Lane Group Flow (vph)	586	279	261	220	1476	107	998	577
v/c Ratio	0.83	0.61	0.78	0.96	0.88	1.03	1.12	0.86
Control Delay	56.9	19.1	64.6	87.0	64.2	169.3	106.6	36.8
Queue Delay	1.5	1.2	0.0	4.6	0.0	0.0	0.4	1.4
Total Delay	58.4	20.3	64.6	91.5	64.2	169.3	106.9	38.1
Queue Length 50th (ft)	274	110	199	208	521	~97	~601	437
Queue Length 95th (ft)	343	189	270	#370	#582	#227	#741	#725
Internal Link Dist (ft)		324	271		650		238	
Turn Bay Length (ft)				280		200		
Base Capacity (vph)	728	461	383	229	1674	104	894	681
Starvation Cap Reductn	45	59	0	0	0	0	62	0
Spillback Cap Reductn	0	0	0	5	0	0	0	26
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.69	0.68	0.98	0.88	1.03	1.20	0.88

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
611: Tremont Street & Ruggles St/Whittier St

2021 Build PM
8/1/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰↰	↑↱			✥		↰	↑↑↱		↰	↑↑	↱
Traffic Volume (vph)	516	26	219	73	45	99	196	1267	46	103	958	554
Future Volume (vph)	516	26	219	73	45	99	196	1267	46	103	958	554
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	16	12	11	11	12	12	11	11
Total Lost time (s)	4.0	6.0			4.0		4.0	4.0		6.0	4.0	4.0
Lane Util. Factor	0.97	1.00			1.00		1.00	0.91		1.00	0.95	1.00
Frpb, ped/bikes	1.00	0.97			0.99		1.00	1.00		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.87			0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3001	1179			1751		1287	4282		1624	3079	1278
Flt Permitted	0.95	1.00			0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3001	1179			1751		1287	4282		1624	3079	1278
Peak-hour factor, PHF	0.88	0.88	0.88	0.83	0.83	0.83	0.89	0.89	0.89	0.96	0.96	0.96
Adj. Flow (vph)	586	30	249	88	54	119	220	1424	52	107	998	577
RTOR Reduction (vph)	0	194	0	0	22	0	0	2	0	0	0	0
Lane Group Flow (vph)	586	85	0	0	239	0	220	1474	0	107	998	577
Confl. Peds. (#/hr)	13		16	16		13	23					23
Heavy Vehicles (%)	5%	0%	20%	2%	0%	0%	22%	5%	0%	0%	2%	4%
Parking (#/hr)				15		0						
Turn Type	Split	NA		Split	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	3	3		4	4		1	6		5	2	3
Permitted Phases												2
Actuated Green, G (s)	31.2	31.2			23.2		23.0	52.6		9.0	38.6	69.8
Effective Green, g (s)	33.2	31.2			25.2		25.0	54.6		9.0	40.6	73.8
Actuated g/C Ratio	0.24	0.22			0.18		0.18	0.39		0.06	0.29	0.53
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0			2.0		2.0	2.0		2.0	2.0	3.0
Lane Grp Cap (vph)	711	262			315		229	1669		104	892	710
v/s Ratio Prot	0.20	0.07			c0.14		c0.17	0.34		0.07	c0.32	c0.19
v/s Ratio Perm												0.26
v/c Ratio	0.82	0.33			0.76		0.96	0.88		1.03	1.12	0.81
Uniform Delay, d1	50.6	45.6			54.5		57.0	39.7		65.5	49.7	27.4
Progression Factor	0.92	1.64			1.00		0.69	1.45		1.31	0.87	0.84
Incremental Delay, d2	7.2	0.7			8.9		43.9	6.2		91.1	67.0	6.3
Delay (s)	54.0	75.5			63.5		83.3	64.0		177.2	110.1	29.2
Level of Service	D	E			E		F	E		F	F	C
Approach Delay (s)		61.0			63.5			66.5			86.6	
Approach LOS		E			E			E			F	

Intersection Summary

HCM 2000 Control Delay	72.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	91.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

	↘	↗	↙
Lane Group	EBR	NET	SWT
Lane Group Flow (vph)	130	2013	1616
v/c Ratio	0.45	0.65	0.49
Control Delay	31.6	2.3	9.0
Queue Delay	0.2	0.3	2.6
Total Delay	31.8	2.6	11.6
Queue Length 50th (ft)	53	34	302
Queue Length 95th (ft)	122	74	m305
Internal Link Dist (ft)		238	380
Turn Bay Length (ft)			
Base Capacity (vph)	290	3095	3317
Starvation Cap Reductn	0	468	1532
Spillback Cap Reductn	11	15	838
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.47	0.77	0.91

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations			↱					↑↑↱			↑↑↑	
Traffic Volume (vph)	0	0	122	0	0	0	0	1692	261	0	1438	0
Future Volume (vph)	0	0	122	0	0	0	0	1692	261	0	1438	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	16	12	11	12	12	11	12
Total Lost time (s)			4.0					4.0			4.0	
Lane Util. Factor			1.00					0.91			0.91	
Frpb, ped/bikes			1.00					0.98			1.00	
Flpb, ped/bikes			1.00					1.00			1.00	
Frt			0.86					0.98			1.00	
Flt Protected			1.00					1.00			1.00	
Satd. Flow (prot)			1286					4069			4381	
Flt Permitted			1.00					1.00			1.00	
Satd. Flow (perm)			1286					4069			4381	
Peak-hour factor, PHF	0.94	0.94	0.94	0.92	0.92	0.92	0.97	0.97	0.97	0.89	0.89	0.89
Adj. Flow (vph)	0	0	130	0	0	0	0	1744	269	0	1616	0
RTOR Reduction (vph)	0	0	51	0	0	0	0	15	0	0	0	0
Lane Group Flow (vph)	0	0	79	0	0	0	0	1998	0	0	1616	0
Confl. Peds. (#/hr)									26			
Heavy Vehicles (%)	0%	0%	15%	0%	0%	0%	0%	6%	10%	0%	3%	0%
Turn Type			Prot					NA			NA	
Protected Phases			5					1			1	
Permitted Phases												
Actuated Green, G (s)			25.0					105.0			105.0	
Effective Green, g (s)			26.0					106.0			106.0	
Actuated g/C Ratio			0.19					0.76			0.76	
Clearance Time (s)			5.0					5.0			5.0	
Vehicle Extension (s)			2.0					2.0			2.0	
Lane Grp Cap (vph)			238					3080			3317	
v/s Ratio Prot			c0.06					c0.49			0.37	
v/s Ratio Perm												
v/c Ratio			0.33					0.65			0.49	
Uniform Delay, d1			49.5					8.1			6.5	
Progression Factor			1.00					0.22			1.36	
Incremental Delay, d2			0.3					0.5			0.0	
Delay (s)			49.7					2.3			8.9	
Level of Service			D					A			A	
Approach Delay (s)		49.7			0.0			2.3			8.9	
Approach LOS		D			A			A			A	

Intersection Summary

HCM 2000 Control Delay	6.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

3098: Tremont Street/Tremont St & Melnea Cass Boulevard

8/1/2016

	→	↘	↙	←	↑	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	238	293	858	200	1031	1128	721
v/c Ratio	0.98	0.75	1.00	0.47	1.19	0.73	1.57dl
Control Delay	111.3	35.2	79.4	45.8	122.7	9.5	150.8
Queue Delay	37.3	3.2	0.0	0.0	0.0	0.0	0.0
Total Delay	148.6	38.5	79.4	45.8	122.7	9.5	150.8
Queue Length 50th (ft)	229	109	403	151	~337	440	~422
Queue Length 95th (ft)	#357	184	#546	219	#484	439	#553
Internal Link Dist (ft)	203			68	380		136
Turn Bay Length (ft)			350				
Base Capacity (vph)	243	391	861	423	863	1554	594
Starvation Cap Reductn	28	41	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.11	0.84	1.00	0.47	1.19	0.73	1.21

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
dl Defacto Left Lane. Recode with 1 though lane as a left lane.

HCM Signalized Intersection Capacity Analysis
3098: Tremont Street/Tremont St & Melnea Cass Boulevard

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱	↰↰	↱			↰↑	↱		↰↱	
Traffic Volume (vph)	8	182	243	824	113	56	228	625	993	49	569	10
Future Volume (vph)	8	182	243	824	113	56	228	625	993	49	569	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	13	12	13	13	12	12	11	16	12	14	12
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00	0.97	1.00			0.95	1.00		0.95	
Frt		1.00	0.85	1.00	0.95			1.00	0.85		1.00	
Flt Protected		1.00	1.00	0.95	1.00			0.99	1.00		0.99	
Satd. Flow (prot)		1626	1398	3015	1482			2931	1554		3238	
Flt Permitted		1.00	1.00	0.95	1.00			0.54	1.00		0.53	
Satd. Flow (perm)		1626	1398	3015	1482			1600	1554		1731	
Peak-hour factor, PHF	0.38	0.84	0.83	0.96	0.86	0.81	0.82	0.83	0.88	0.54	0.93	0.55
Adj. Flow (vph)	21	217	293	858	131	69	278	753	1128	91	612	18
RTOR Reduction (vph)	0	0	182	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	238	111	858	200	0	0	1031	1128	0	720	0
Heavy Vehicles (%)	0%	9%	4%	8%	12%	15%	5%	6%	6%	20%	3%	36%
Turn Type	Split	NA	Perm	Split	NA		pm+pt	NA	Free	Perm	NA	
Protected Phases	5	5		6	6		7	1 7			1	
Permitted Phases			5				1 7		Free	1		
Actuated Green, G (s)		21.0	21.0	40.0	40.0			63.0	140.0		48.0	
Effective Green, g (s)		21.0	21.0	40.0	40.0			63.0	140.0		48.0	
Actuated g/C Ratio		0.15	0.15	0.29	0.29			0.45	1.00		0.34	
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0						2.0	
Lane Grp Cap (vph)		243	209	861	423			862	1554		593	
v/s Ratio Prot		c0.15		c0.28	0.13			c0.13				
v/s Ratio Perm			0.08					0.41	0.73		c0.42	
v/c Ratio		0.98	0.53	1.00	0.47			1.20	0.73		1.57dl	
Uniform Delay, d1		59.3	55.0	49.9	41.3			38.5	0.0		46.0	
Progression Factor		1.03	1.43	1.00	1.00			0.73	1.00		1.00	
Incremental Delay, d2		49.4	1.2	29.6	0.3			98.1	2.6		111.1	
Delay (s)		110.6	79.7	79.5	41.6			126.2	2.6		157.1	
Level of Service		F	E	E	D			F	A		F	
Approach Delay (s)		93.6			72.3			61.6			157.1	
Approach LOS		F			E			E			F	

Intersection Summary

HCM 2000 Control Delay	83.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.6%	ICU Level of Service	F
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group

4023: Tremont Street & Prentiss St

	↗	↖	↑	↓
Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	354	114	1412	1434
v/c Ratio	1.04	1.00	0.94	0.90
Control Delay	106.9	93.5	40.4	16.6
Queue Delay	0.0	0.0	0.0	5.5
Total Delay	106.9	93.5	40.4	22.1
Queue Length 50th (ft)	~322	108	294	144
Queue Length 95th (ft)	#476	m#117	m272	m126
Internal Link Dist (ft)	258		709	138
Turn Bay Length (ft)		150		
Base Capacity (vph)	341	114	1499	1587
Starvation Cap Reductn	0	0	0	119
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.04	1.00	0.94	0.98

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		↰	↑↑↑	↑↱	
Traffic Volume (vph)	153	148	107	1327	1292	84
Future Volume (vph)	153	148	107	1327	1292	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	13	12	10	11	11	12
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	0.91	0.95	
Frt	0.93		1.00	1.00	0.99	
Flt Protected	0.98		0.95	1.00	1.00	
Satd. Flow (prot)	1475		1458	4178	2671	
Flt Permitted	0.98		0.95	1.00	1.00	
Satd. Flow (perm)	1475		1458	4178	2671	
Peak-hour factor, PHF	0.85	0.85	0.94	0.94	0.96	0.96
Adj. Flow (vph)	180	174	114	1412	1346	88
RTOR Reduction (vph)	25	0	0	0	3	0
Lane Group Flow (vph)	329	0	114	1412	1431	0
Heavy Vehicles (%)	13%	5%	4%	8%	6%	11%
Parking (#/hr)					15	
Turn Type	Prot		Prot	NA	NA	
Protected Phases	10		1	6	2 9	
Permitted Phases						
Actuated Green, G (s)	29.0		10.0	49.3	81.0	
Effective Green, g (s)	30.0		11.0	50.3	83.0	
Actuated g/C Ratio	0.21		0.08	0.36	0.59	
Clearance Time (s)	5.0		5.0	5.0		
Vehicle Extension (s)	2.0		2.0	2.0		
Lane Grp Cap (vph)	316		114	1501	1583	
v/s Ratio Prot	c0.22		c0.08	0.34	c0.54	
v/s Ratio Perm						
v/c Ratio	1.04		1.00	0.94	0.90	
Uniform Delay, d1	55.0		64.5	43.4	25.0	
Progression Factor	1.00		1.09	0.88	0.74	
Incremental Delay, d2	61.6		25.3	1.6	2.0	
Delay (s)	116.6		95.8	39.7	20.5	
Level of Service	F		F	D	C	
Approach Delay (s)	116.6			43.9	20.5	
Approach LOS	F			D	C	

Intersection Summary

HCM 2000 Control Delay	41.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Queues
6: Tremont Street & Site Drive

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	257	222	1230	212	240	959
v/c Ratio	0.68	0.50	0.50	0.17	0.83	0.59
Control Delay	52.3	9.4	1.2	0.1	40.9	22.8
Queue Delay	0.1	0.0	0.6	1.4	0.0	0.0
Total Delay	52.4	9.4	1.8	1.6	40.9	22.8
Queue Length 50th (ft)	181	0	4	0	129	403
Queue Length 95th (ft)	273	65	m12	m0	m144	463
Internal Link Dist (ft)	281		152			637
Turn Bay Length (ft)				80	250	
Base Capacity (vph)	385	494	2478	1226	356	1628
Starvation Cap Reductn	0	0	776	828	0	0
Spillback Cap Reductn	3	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.45	0.72	0.53	0.67	0.59

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
6: Tremont Street & Site Drive

2021 Build SAT
8/1/2016

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↑↑↑	↱	↰	↑↑
Traffic Volume (vph)	236	204	1132	195	221	882
Future Volume (vph)	236	204	1132	195	221	882
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	12	12	11	12
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1711	1531	5085	1583	1711	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1711	1531	5085	1583	1711	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	257	222	1230	212	240	959
RTOR Reduction (vph)	0	184	0	47	0	0
Lane Group Flow (vph)	257	38	1230	165	240	959
Turn Type	Prot	Over	NA	pm+ov	Prot	NA
Protected Phases	9	5	6 10	9	5	2
Permitted Phases				6 10		
Actuated Green, G (s)	26.6	20.4	58.0	84.6	20.4	54.2
Effective Green, g (s)	26.6	20.4	58.0	84.6	20.4	54.2
Actuated g/C Ratio	0.22	0.17	0.48	0.70	0.17	0.45
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	2.0		3.0	2.0	3.0
Lane Grp Cap (vph)	379	260	2457	1181	290	1598
v/s Ratio Prot	c0.15	0.02	c0.24	0.03	c0.14	c0.27
v/s Ratio Perm				0.07		
v/c Ratio	0.68	0.15	0.50	0.14	0.83	0.60
Uniform Delay, d1	42.8	42.4	21.1	5.8	48.1	24.7
Progression Factor	1.00	1.00	0.04	0.00	0.54	0.84
Incremental Delay, d2	4.8	0.1	0.0	0.0	10.8	1.0
Delay (s)	47.5	42.5	0.9	0.0	36.7	21.8
Level of Service	D	D	A	A	D	C
Approach Delay (s)	45.2		0.7			24.8
Approach LOS	D		A			C

Intersection Summary

HCM 2000 Control Delay	16.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

192: Columbus Avenue/Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd

	→	←	↖	↖	↑	↘	↓
Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	586	405	314	112	945	190	937
v/c Ratio	1.06dl	1.02	0.64	0.63	0.77	1.33	0.84
Control Delay	83.2	98.3	11.3	67.4	47.1	225.6	49.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	83.2	98.3	11.3	67.4	47.1	225.6	49.6
Queue Length 50th (ft)	~223	~170	0	84	~356	~197	~363
Queue Length 95th (ft)	#352	#253	64	#157	#447	m#330	#458
Internal Link Dist (ft)	381	1188			1304		709
Turn Bay Length (ft)				205		205	
Base Capacity (vph)	580	398	490	177	1231	143	1121
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.01	1.02	0.64	0.63	0.77	1.33	0.84

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.
dl Defacto Left Lane. Recode with 1 though lane as a left lane.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations		↰↑↱			↰↑	↱		↰	↑↑↱			↰
Traffic Volume (vph)	219	239	93	65	280	267	1	103	812	67	13	167
Future Volume (vph)	219	239	93	65	280	267	1	103	812	67	13	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0		4.0	4.0			4.0
Lane Util. Factor		0.95			0.95	1.00		1.00	0.91			1.00
Frt		0.97			1.00	0.85		1.00	0.99			1.00
Flt Protected		0.98			0.99	1.00		0.95	1.00			0.95
Satd. Flow (prot)		2925			2945	1275		1519	4319			1227
Flt Permitted		0.57			0.73	1.00		0.95	1.00			0.95
Satd. Flow (perm)		1704			2175	1275		1519	4319			1227
Peak-hour factor, PHF	0.94	0.94	0.94	0.85	0.85	0.85	0.93	0.93	0.93	0.93	0.95	0.95
Adj. Flow (vph)	233	254	99	76	329	314	1	111	873	72	14	176
RTOR Reduction (vph)	0	0	0	0	0	256	0	0	0	0	0	0
Lane Group Flow (vph)	0	586	0	0	405	58	0	112	945	0	0	190
Heavy Vehicles (%)	9%	4%	5%	15%	8%	14%	0%	7%	7%	5%	0%	35%
Parking (#/hr)												
Turn Type	pm+pt	NA		Perm	NA	Perm	Prot	Prot	NA		Prot	Prot
Protected Phases	3	3 4			4		5	5	1		5	5
Permitted Phases	3 4			4		4						
Actuated Green, G (s)		28.0			19.0	19.0		12.0	30.6			12.0
Effective Green, g (s)		32.0			22.0	22.0		14.0	32.6			14.0
Actuated g/C Ratio		0.27			0.18	0.18		0.12	0.27			0.12
Clearance Time (s)					7.0	7.0		6.0	6.0			6.0
Vehicle Extension (s)					3.0	3.0		2.0	2.0			2.0
Lane Grp Cap (vph)		566			398	233		177	1173			143
v/s Ratio Prot		c0.09						0.07	0.22			c0.15
v/s Ratio Perm		0.18			c0.19	0.05						
v/c Ratio		1.06dl			1.02	0.25		0.63	0.81			1.33
Uniform Delay, d1		44.0			49.0	41.9		50.5	40.7			53.0
Progression Factor		1.22			1.00	1.00		1.00	1.00			1.24
Incremental Delay, d2		43.0			49.6	0.6		5.3	6.0			177.5
Delay (s)		96.8			98.6	42.5		55.9	46.7			243.4
Level of Service		F			F	D		E	D			F
Approach Delay (s)		96.8			74.1				47.7			
Approach LOS		F			E				D			

Intersection Summary

HCM 2000 Control Delay	73.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group

	↓	↙
Movement	SBT	SBR
Lane Configurations	↑↑↱	
Traffic Volume (vph)	635	256
Future Volume (vph)	635	256
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.0	
Lane Util. Factor	0.91	
Frt	0.96	
Flt Protected	1.00	
Satd. Flow (prot)	3935	
Flt Permitted	1.00	
Satd. Flow (perm)	3935	
Peak-hour factor, PHF	0.95	0.95
Adj. Flow (vph)	668	269
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	937	0
Heavy Vehicles (%)	9%	5%
Parking (#/hr)	10	
Turn Type	NA	
Protected Phases	1	
Permitted Phases		
Actuated Green, G (s)	30.6	
Effective Green, g (s)	32.6	
Actuated g/C Ratio	0.27	
Clearance Time (s)	6.0	
Vehicle Extension (s)	2.0	
Lane Grp Cap (vph)	1069	
v/s Ratio Prot	c0.24	
v/s Ratio Perm		
v/c Ratio	0.88	
Uniform Delay, d1	41.8	
Progression Factor	1.05	
Incremental Delay, d2	7.4	
Delay (s)	51.1	
Level of Service	D	
Approach Delay (s)	83.5	
Approach LOS	F	

Intersection Summary

611: Tremont Street & Ruggles St/Whittier St

Lane Group	EBL	EBT	WBT	NEL	NET	SWL	SWT	SWR
Lane Group Flow (vph)	385	227	163	193	1265	92	970	419
v/c Ratio	0.75	0.65	0.57	0.89	0.62	0.63	0.82	0.60
Control Delay	62.5	31.1	23.4	63.0	32.8	57.3	36.7	36.0
Queue Delay	0.0	8.9	0.4	0.0	0.0	0.0	1.0	0.0
Total Delay	62.5	39.9	23.8	63.0	32.8	57.3	37.7	36.0
Queue Length 50th (ft)	147	71	33	115	370	51	392	315
Queue Length 95th (ft)	199	150	77	#284	425	#154	#571	444
Internal Link Dist (ft)		324	271		637		238	
Turn Bay Length (ft)				280		200		
Base Capacity (vph)	534	354	415	226	2029	153	1183	702
Starvation Cap Reductn	0	93	0	0	0	0	64	2
Spillback Cap Reductn	0	0	55	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.87	0.45	0.85	0.62	0.60	0.87	0.60

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWU	SWL	SWT
Lane Configurations	↰↰	↱			✥		↰	↑↑↱			↰	↑↑
Traffic Volume (vph)	362	25	188	12	21	103	183	1170	31	14	72	902
Future Volume (vph)	362	25	188	12	21	103	183	1170	31	14	72	902
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	16	12	11	11	12	12	11	11
Total Lost time (s)	4.0	6.0			4.0		4.0	4.0			5.0	4.0
Lane Util. Factor	0.97	1.00			1.00		1.00	0.91			1.00	0.95
Frpb, ped/bikes	1.00	0.98			0.98		1.00	1.00			1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00			1.00	1.00
Frt	1.00	0.87			0.90		1.00	1.00			1.00	1.00
Flt Protected	0.95	1.00			1.00		0.95	1.00			0.95	1.00
Satd. Flow (prot)	2918	1127			1672		1236	4247			1570	2935
Flt Permitted	0.95	1.00			1.00		0.95	1.00			0.95	1.00
Satd. Flow (perm)	2918	1127			1672		1236	4247			1570	2935
Peak-hour factor, PHF	0.94	0.94	0.94	0.83	0.83	0.83	0.95	0.95	0.95	0.93	0.93	0.93
Adj. Flow (vph)	385	27	200	14	25	124	193	1232	33	15	77	970
RTOR Reduction (vph)	0	168	0	0	105	0	0	2	0	0	0	0
Lane Group Flow (vph)	385	59	0	0	58	0	193	1263	0	0	92	970
Confl. Peds. (#/hr)	7		6	6		7	37					
Heavy Vehicles (%)	8%	0%	28%	4%	10%	0%	27%	6%	0%	0%	0%	7%
Parking (#/hr)				5								
Turn Type	Split	NA		Split	NA		Prot	NA		Prot	Prot	NA
Protected Phases	3	3		4	4		1	6		5	5	2
Permitted Phases												
Actuated Green, G (s)	19.3	19.3			11.1		19.2	55.3			11.3	46.4
Effective Green, g (s)	21.3	19.3			13.1		21.2	57.3			11.3	48.4
Actuated g/C Ratio	0.18	0.16			0.11		0.18	0.48			0.09	0.40
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0			5.0	6.0
Vehicle Extension (s)	3.0	3.0			2.0		2.0	2.0			3.0	2.0
Lane Grp Cap (vph)	517	181			182		218	2027			147	1183
v/s Ratio Prot	c0.13	0.05			c0.03		c0.16	0.30			0.06	c0.33
v/s Ratio Perm												
v/c Ratio	0.74	0.33			0.32		0.89	0.62			0.63	0.82
Uniform Delay, d1	46.8	44.6			49.3		48.2	23.3			52.3	31.9
Progression Factor	1.15	2.41			1.00		0.55	1.28			0.75	0.91
Incremental Delay, d2	5.2	0.9			0.4		28.5	1.3			7.3	5.9
Delay (s)	58.9	108.2			49.7		54.8	31.2			46.7	34.9
Level of Service	E	F			D		D	C			D	C
Approach Delay (s)		77.2			49.7			34.3				34.7
Approach LOS		E			D			C				C

Intersection Summary

HCM 2000 Control Delay	42.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	81.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	SWR
Lane Configurations	↱
Traffic Volume (vph)	390
Future Volume (vph)	390
Ideal Flow (vphpl)	1900
Lane Width	11
Total Lost time (s)	4.0
Lane Util. Factor	1.00
Frpb, ped/bikes	0.91
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1196
Flt Permitted	1.00
Satd. Flow (perm)	1196
Peak-hour factor, PHF	0.93
Adj. Flow (vph)	419
RTOR Reduction (vph)	0
Lane Group Flow (vph)	419
Confl. Peds. (#/hr)	37
Heavy Vehicles (%)	7%
Parking (#/hr)	
Turn Type	pm+ov
Protected Phases	3
Permitted Phases	2
Actuated Green, G (s)	65.7
Effective Green, g (s)	69.7
Actuated g/C Ratio	0.58
Clearance Time (s)	6.0
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	734
v/s Ratio Prot	0.10
v/s Ratio Perm	0.25
v/c Ratio	0.57
Uniform Delay, d1	15.8
Progression Factor	1.94
Incremental Delay, d2	1.0
Delay (s)	31.5
Level of Service	C
Approach Delay (s)	
Approach LOS	

Intersection Summary

3082: Tremont Street & Renaissance Park/Ruggles St

Lane Group	EBR	NET	SWT
Lane Group Flow (vph)	66	1788	1400
v/c Ratio	0.19	0.61	0.47
Control Delay	7.0	6.7	8.1
Queue Delay	0.0	0.6	0.4
Total Delay	7.1	7.3	8.5
Queue Length 50th (ft)	0	136	254
Queue Length 95th (ft)	6	240	108
Internal Link Dist (ft)		238	380
Turn Bay Length (ft)			
Base Capacity (vph)	339	2954	2994
Starvation Cap Reductn	0	707	884
Spillback Cap Reductn	17	0	931
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.20	0.80	0.68

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations			↱					↑↑↱			↑↑↑	
Traffic Volume (vph)	0	0	43	0	0	0	0	1520	125	0	1330	0
Future Volume (vph)	0	0	43	0	0	0	0	1520	125	0	1330	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	16	12	11	12	12	11	12
Total Lost time (s)			4.0					4.0			4.0	
Lane Util. Factor			1.00					0.91			0.91	
Frpb, ped/bikes			1.00					1.00			1.00	
Flpb, ped/bikes			1.00					1.00			1.00	
Frt			0.86					0.99			1.00	
Flt Protected			1.00					1.00			1.00	
Satd. Flow (prot)			1275					4109			4178	
Flt Permitted			1.00					1.00			1.00	
Satd. Flow (perm)			1275					4109			4178	
Peak-hour factor, PHF	0.65	0.65	0.65	0.92	0.92	0.92	0.92	0.92	0.92	0.95	0.95	0.95
Adj. Flow (vph)	0	0	66	0	0	0	0	1652	136	0	1400	0
RTOR Reduction (vph)	0	0	52	0	0	0	0	8	0	0	0	0
Lane Group Flow (vph)	0	0	14	0	0	0	0	1780	0	0	1400	0
Confl. Peds. (#/hr)									7			
Heavy Vehicles (%)	0%	0%	16%	0%	0%	0%	0%	8%	10%	0%	8%	0%
Turn Type			Prot					NA			NA	
Protected Phases			5					1			1	
Permitted Phases												
Actuated Green, G (s)			25.0					85.0			85.0	
Effective Green, g (s)			26.0					86.0			86.0	
Actuated g/C Ratio			0.22					0.72			0.72	
Clearance Time (s)			5.0					5.0			5.0	
Vehicle Extension (s)			2.0					2.0			2.0	
Lane Grp Cap (vph)			276					2944			2994	
v/s Ratio Prot			c0.01					c0.43			0.34	
v/s Ratio Perm												
v/c Ratio			0.05					0.60			0.47	
Uniform Delay, d1			37.2					8.5			7.2	
Progression Factor			1.00					0.70			1.05	
Incremental Delay, d2			0.0					0.7			0.4	
Delay (s)			37.3					6.7			8.0	
Level of Service			D					A			A	
Approach Delay (s)		37.3			0.0			6.7			8.0	
Approach LOS		D			A			A			A	

Intersection Summary

HCM 2000 Control Delay	7.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	41.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

	→	↘	↙	←	↑	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	75	196	758	141	761	1013	568
v/c Ratio	0.48	0.70	0.86	0.32	0.79	0.66	0.55
Control Delay	60.3	25.6	50.0	34.1	29.2	8.6	30.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.3	25.6	50.0	34.1	29.2	8.6	30.4
Queue Length 50th (ft)	57	25	284	85	171	196	165
Queue Length 95th (ft)	91	76	333	124	#337	159	282
Internal Link Dist (ft)	215			623	380		183
Turn Bay Length (ft)			350				
Base Capacity (vph)	285	378	1055	517	966	1526	1030
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.52	0.72	0.27	0.79	0.66	0.55

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱	↰↰	↳			↰↑	↱		↰↑↱	
Traffic Volume (vph)	5	52	163	728	77	41	130	500	891	33	446	15
Future Volume (vph)	5	52	163	728	77	41	130	500	891	33	446	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	13	12	13	13	12	12	11	16	12	14	12
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00	0.97	1.00			0.95	1.00		0.95	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.98		1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt		1.00	0.85	1.00	0.95			1.00	0.85		0.99	
Flt Protected		0.99	1.00	0.95	1.00			0.99	1.00		0.99	
Satd. Flow (prot)		1631	1398	3015	1478			2938	1526		3217	
Flt Permitted		0.99	1.00	0.95	1.00			0.65	1.00		0.75	
Satd. Flow (perm)		1631	1398	3015	1478			1920	1526		2410	
Peak-hour factor, PHF	0.38	0.84	0.83	0.96	0.86	0.81	0.82	0.83	0.88	0.54	0.93	0.55
Adj. Flow (vph)	13	62	196	758	90	51	159	602	1012	61	480	27
RTOR Reduction (vph)	0	0	146	0	0	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	75	50	758	141	0	0	761	1013	0	566	0
Confl. Peds. (#/hr)									20			
Heavy Vehicles (%)	0%	9%	4%	8%	12%	15%	5%	6%	6%	20%	3%	36%
Turn Type	Split	NA	Perm	Split	NA		pm+pt	NA	Free	Perm	NA	
Protected Phases	5	5		6	6		7	1 7			1	
Permitted Phases			5				1 7		Free	1		
Actuated Green, G (s)		11.5	11.5	35.3	35.3			57.2	120.0		51.2	
Effective Green, g (s)		11.5	11.5	35.3	35.3			57.2	120.0		51.2	
Actuated g/C Ratio		0.10	0.10	0.29	0.29			0.48	1.00		0.43	
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0						2.0	
Lane Grp Cap (vph)		156	133	886	434			966	1526		1028	
v/s Ratio Prot		0.05		c0.25	0.10			0.04				
v/s Ratio Perm			0.04					c0.34	c0.66		0.23	
v/c Ratio		0.48	0.37	0.86	0.32			0.79	0.66		0.55	
Uniform Delay, d1		51.4	50.9	39.9	33.1			26.3	0.0		25.8	
Progression Factor		1.00	1.00	1.00	1.00			0.86	1.00		1.00	
Incremental Delay, d2		0.9	0.6	7.8	0.2			5.4	1.9		2.1	
Delay (s)		52.3	51.5	47.8	33.2			28.2	1.9		27.9	
Level of Service		D	D	D	C			C	A		C	
Approach Delay (s)		51.7			45.5			13.2			27.9	
Approach LOS		D			D			B			C	

Intersection Summary

HCM 2000 Control Delay	26.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

4023: Tremont Street & Prentiss St

	↗	↖	↑	↓
Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	88	80	1359	1288
v/c Ratio	0.56	0.56	0.91	0.70
Control Delay	60.0	66.7	40.3	7.9
Queue Delay	0.0	0.0	0.0	0.2
Total Delay	60.0	66.7	40.3	8.1
Queue Length 50th (ft)	58	62	260	120
Queue Length 95th (ft)	110	m81	m#462	87
Internal Link Dist (ft)	258		709	152
Turn Bay Length (ft)		150		
Base Capacity (vph)	163	164	1501	1827
Starvation Cap Reductn	0	0	0	94
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.54	0.49	0.91	0.74

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
4023: Tremont Street & Prentiss St

2021 Build SAT
8/1/2016

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱		↰	↑↑↑	↑↱	
Traffic Volume (vph)	58	18	74	1264	1059	49
Future Volume (vph)	58	18	74	1264	1059	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	11	11	12
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	0.91	0.95	
Frt	0.97		1.00	1.00	0.99	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1544		1518	4140	2603	
Flt Permitted	0.96		0.95	1.00	1.00	
Satd. Flow (perm)	1544		1518	4140	2603	
Peak-hour factor, PHF	0.87	0.87	0.93	0.93	0.86	0.86
Adj. Flow (vph)	67	21	80	1359	1231	57
RTOR Reduction (vph)	9	0	0	0	2	0
Lane Group Flow (vph)	79	0	80	1359	1286	0
Heavy Vehicles (%)	6%	9%	7%	9%	11%	8%
Parking (#/hr)					10	
Turn Type	Prot		Prot	NA	NA	
Protected Phases	10		1	6	2 9	
Permitted Phases						
Actuated Green, G (s)	10.5		8.7	42.5	80.8	
Effective Green, g (s)	11.5		9.7	43.5	82.8	
Actuated g/C Ratio	0.10		0.08	0.36	0.69	
Clearance Time (s)	5.0		5.0	5.0		
Vehicle Extension (s)	2.0		2.0	3.0		
Lane Grp Cap (vph)	147		122	1500	1796	
v/s Ratio Prot	c0.05		c0.05	c0.33	c0.49	
v/s Ratio Perm						
v/c Ratio	0.54		0.66	0.91	0.72	
Uniform Delay, d1	51.7		53.5	36.3	11.4	
Progression Factor	1.00		1.10	0.89	0.96	
Incremental Delay, d2	1.9		5.8	6.2	1.1	
Delay (s)	53.6		64.6	38.6	12.1	
Level of Service	D		E	D	B	
Approach Delay (s)	53.6			40.0	12.1	
Approach LOS	D			D	B	

Intersection Summary

HCM 2000 Control Delay	27.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

2017 Build Conditions – Malcolm X Concurrent Pedestrian Phase

Queues

9: Tremont Street & Site Dr

Lane Group	WBL	WBR	NET	NER	SWL	SWT
Lane Group Flow (vph)	41	54	1855	179	114	1020
v/c Ratio	0.26	0.27	0.51	0.19	0.67	0.78
Control Delay	64.7	17.1	0.6	1.5	41.3	61.5
Queue Delay	0.0	0.0	0.8	0.6	0.0	4.8
Total Delay	64.7	17.1	1.4	2.1	41.3	66.2
Queue Length 50th (ft)	36	0	2	3	88	507
Queue Length 95th (ft)	76	41	13	m11	m97	m550
Internal Link Dist (ft)	481		136			652
Turn Bay Length (ft)				100	250	
Base Capacity (vph)	155	272	3618	965	252	1314
Starvation Cap Reductn	0	0	1318	509	0	0
Spillback Cap Reductn	0	0	0	0	0	227
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.20	0.81	0.39	0.45	0.94

Intersection Summary

m   Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
9: Tremont Street & Site Dr

2021 Build AM
8/1/2016

Movement	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations	↰	↱	↑↑↑	↱	↰	↑↑
Traffic Volume (vph)	38	50	1707	165	105	938
Future Volume (vph)	38	50	1707	165	105	938
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1583	5085	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1583	5085	1583	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	54	1855	179	114	1020
RTOR Reduction (vph)	0	49	0	28	0	0
Lane Group Flow (vph)	41	5	1855	151	114	1020
Turn Type	Prot	Over	NA	custom	Prot	NA
Protected Phases	9	5	6 10	9	5	2
Permitted Phases				6		
Actuated Green, G (s)	12.3	13.4	99.3	82.9	13.4	52.0
Effective Green, g (s)	12.3	13.4	99.3	82.9	13.4	52.0
Actuated g/C Ratio	0.09	0.10	0.71	0.59	0.10	0.37
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	2.0		3.0	2.0	2.0
Lane Grp Cap (vph)	155	151	3606	937	169	1314
v/s Ratio Prot	c0.02	0.00	c0.36	0.01	c0.06	c0.29
v/s Ratio Perm				0.08		
v/c Ratio	0.26	0.03	0.51	0.16	0.67	0.78
Uniform Delay, d1	59.6	57.4	9.3	12.9	61.2	38.9
Progression Factor	1.00	1.00	0.03	0.29	0.49	1.50
Incremental Delay, d2	0.9	0.0	0.0	0.0	4.8	2.7
Delay (s)	60.5	57.5	0.3	3.8	34.5	60.9
Level of Service	E	E	A	A	C	E
Approach Delay (s)	58.8		0.6			58.2
Approach LOS	E		A			E

Intersection Summary

HCM 2000 Control Delay	22.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	23.0
Intersection Capacity Utilization	55.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

	→	←	↖	↰	↑	↘	↓
Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	749	491	359	177	1572	139	829
v/c Ratio	1.05	0.99	0.29	0.98	0.82	1.05	0.49
Control Delay	84.8	90.9	0.6	123.9	39.9	117.4	48.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	84.8	90.9	0.6	123.9	39.9	117.4	48.0
Queue Length 50th (ft)	~317	236	0	163	457	~137	289
Queue Length 95th (ft)	m#398	#357	0	#319	523	m#192	336
Internal Link Dist (ft)	381	1183			1304		709
Turn Bay Length (ft)				205		205	
Base Capacity (vph)	714	497	1232	180	1909	133	1675
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.05	0.99	0.29	0.98	0.82	1.05	0.49

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
2021 Build AM

192: Columbus Avenue /Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd
8/1/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	205	312	127	61	410	345	166	1409	69	4	127	610
Future Volume (vph)	205	312	127	61	410	345	166	1409	69	4	127	610
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor		0.95			0.95	1.00	1.00	0.91			1.00	0.91
Frt		0.97			1.00	0.85	1.00	0.99			1.00	0.97
Flt Protected		0.98			0.99	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)		2924			2954	1232	1577	4455			1170	3911
Flt Permitted		0.56			0.73	1.00	0.95	1.00			0.95	1.00
Satd. Flow (perm)		1666			2177	1232	1577	4455			1170	3911
Peak-hour factor, PHF	0.86	0.86	0.86	0.96	0.96	0.96	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	238	363	148	64	427	359	177	1499	73	4	135	649
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	749	0	0	491	359	177	1572	0	0	139	829
Heavy Vehicles (%)	8%	5%	6%	11%	9%	18%	3%	4%	5%	0%	40%	8%
Parking (#/hr)												20
Turn Type	pm+pt	NA		Perm	NA	Free	Prot	NA		Prot	Prot	NA
Protected Phases	3	3 4			4		5	1		5	5	1
Permitted Phases	3 4			4		Free						
Actuated Green, G (s)		43.0			29.0	140.0	14.0	58.0			14.0	58.0
Effective Green, g (s)		47.0			32.0	140.0	16.0	60.0			16.0	60.0
Actuated g/C Ratio		0.34			0.23	1.00	0.11	0.43			0.11	0.43
Clearance Time (s)					7.0		6.0	6.0			6.0	6.0
Vehicle Extension (s)					2.0		2.0	2.0			2.0	2.0
Lane Grp Cap (vph)		703			497	1232	180	1909			133	1676
v/s Ratio Prot		c0.12					0.11	c0.35			c0.12	0.21
v/s Ratio Perm		c0.24			0.23	0.29						
v/c Ratio		1.07			0.99	0.29	0.98	0.82			1.05	0.49
Uniform Delay, d1		46.5			53.8	0.0	61.9	35.3			62.0	29.0
Progression Factor		1.21			1.00	1.00	1.00	1.00			0.73	1.62
Incremental Delay, d2		43.5			36.8	0.6	61.7	4.2			72.2	0.6
Delay (s)		100.0			90.6	0.6	123.5	39.5			117.2	47.6
Level of Service		F			F	A	F	D			F	D
Approach Delay (s)		100.0			52.6			48.0				57.6
Approach LOS		F			D			D				E

Intersection Summary

HCM 2000 Control Delay	60.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	88.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	169
Future Volume (vph)	169
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.94
Adj. Flow (vph)	180
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Heavy Vehicles (%)	7%
Parking (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

611: Tremont Street & Ruggles St/Whittier St

Lane Group	EBL	EBT	WBT	NEL	NET	SWL	SWT	SWR
Lane Group Flow (vph)	626	175	201	240	1704	43	839	548
v/c Ratio	0.92	0.50	0.74	1.02	0.92	0.45	0.94	0.79
Control Delay	71.5	26.2	66.3	100.7	38.8	100.9	52.7	35.7
Queue Delay	16.9	0.0	2.8	28.6	0.0	0.0	26.1	0.0
Total Delay	88.4	26.2	69.2	129.4	38.8	100.9	78.9	35.7
Queue Length 50th (ft)	310	32	160	~212	594	40	426	439
Queue Length 95th (ft)	#389	151	171	#400	#771	72	#620	#640
Internal Link Dist (ft)		324	271		652		238	
Turn Bay Length (ft)				280		100		
Base Capacity (vph)	695	353	354	235	1849	113	895	697
Starvation Cap Reductn	77	0	0	0	0	0	98	0
Spillback Cap Reductn	17	0	75	45	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.01	0.50	0.72	1.26	0.92	0.38	1.05	0.79

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰↰	↱			✥		↰	↑↑↱		↰	↑↑	↱
Traffic Volume (vph)	551	15	139	42	45	54	221	1552	16	41	805	526
Future Volume (vph)	551	15	139	42	45	54	221	1552	16	41	805	526
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	16	12	11	11	12	11	11	11
Total Lost time (s)	4.0	6.0			4.0		4.0	4.0		5.0	4.0	4.0
Lane Util. Factor	0.97	1.00			1.00		1.00	0.91		1.00	0.95	1.00
Frpb, ped/bikes	1.00	0.98			0.99		1.00	1.00		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.86			0.95		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2865	1014			1638		1266	4227		1570	2935	1272
Flt Permitted	0.95	1.00			0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2865	1014			1638		1266	4227		1570	2935	1272
Peak-hour factor, PHF	0.88	0.88	0.88	0.70	0.70	0.70	0.92	0.92	0.92	0.96	0.96	0.96
Adj. Flow (vph)	626	17	158	60	64	77	240	1687	17	43	839	548
RTOR Reduction (vph)	0	123	0	0	17	0	0	1	0	0	0	0
Lane Group Flow (vph)	626	52	0	0	184	0	240	1703	0	43	839	548
Confl. Peds. (#/hr)	8		9	9		8	20					20
Heavy Vehicles (%)	10%	0%	42%	14%	0%	14%	24%	6%	67%	0%	7%	5%
Parking (#/hr)				15		0						
Turn Type	Split	NA		Split	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	3	3		4	4		1	6		5	2	3
Permitted Phases												2
Actuated Green, G (s)	31.4	31.4			19.8		24.0	58.3		7.5	40.8	72.2
Effective Green, g (s)	33.4	31.4			21.8		26.0	60.3		7.5	42.8	76.2
Actuated g/C Ratio	0.24	0.22			0.16		0.19	0.43		0.05	0.31	0.54
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0		5.0	6.0	6.0
Vehicle Extension (s)	2.0	2.0			2.0		2.0	2.0		3.0	2.0	2.0
Lane Grp Cap (vph)	683	227			255		235	1820		84	897	728
v/s Ratio Prot	c0.22	0.05			c0.11		c0.19	c0.40		0.03	0.29	0.18
v/s Ratio Perm												0.25
v/c Ratio	0.92	0.23			0.72		1.02	0.94		0.51	0.94	0.75
Uniform Delay, d1	51.9	44.4			56.2		57.0	38.0		64.5	47.3	24.6
Progression Factor	1.02	2.36			1.00		0.68	0.77		1.39	0.71	1.04
Incremental Delay, d2	16.2	0.2			8.3		60.7	9.6		4.8	17.0	3.7
Delay (s)	69.4	105.0			64.5		99.5	38.8		94.3	50.6	29.3
Level of Service	E	F			E		F	D		F	D	C
Approach Delay (s)		77.2			64.5			46.3			43.8	
Approach LOS		E			E			D			D	

Intersection Summary

HCM 2000 Control Delay	52.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	83.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

	↴	↗	↙
Lane Group	EBR	NET	SWT
Lane Group Flow (vph)	61	2235	1359
v/c Ratio	0.21	0.73	0.42
Control Delay	4.4	5.1	3.6
Queue Delay	0.0	0.7	2.4
Total Delay	4.4	5.8	6.1
Queue Length 50th (ft)	0	72	59
Queue Length 95th (ft)	0	92	m88
Internal Link Dist (ft)		238	380
Turn Bay Length (ft)			
Base Capacity (vph)	317	3075	3223
Starvation Cap Reductn	0	457	1687
Spillback Cap Reductn	13	95	612
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.20	0.85	0.88

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

3082: Tremont Street & Renaissance Park/Ruggles St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations			↱					↑↑↱			↑↑↑	
Traffic Volume (vph)	0	0	44	0	0	0	0	1900	268	0	1318	0
Future Volume (vph)	0	0	44	0	0	0	0	1900	268	0	1318	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	16	12	11	12	12	11	12
Total Lost time (s)			4.0					4.0			4.0	
Lane Util. Factor			1.00					0.91			0.91	
Frpb, ped/bikes			1.00					0.99			1.00	
Flpb, ped/bikes			1.00					1.00			1.00	
Frt			0.86					0.98			1.00	
Flt Protected			1.00					1.00			1.00	
Satd. Flow (prot)			1174					4048			4257	
Flt Permitted			1.00					1.00			1.00	
Satd. Flow (perm)			1174					4048			4257	
Peak-hour factor, PHF	0.72	0.72	0.72	0.92	0.92	0.92	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	0	61	0	0	0	0	1959	276	0	1359	0
RTOR Reduction (vph)	0	0	50	0	0	0	0	12	0	0	0	0
Lane Group Flow (vph)	0	0	11	0	0	0	0	2223	0	0	1359	0
Confl. Peds. (#/hr)									12			
Heavy Vehicles (%)	0%	0%	26%	0%	0%	0%	0%	7%	18%	0%	6%	0%
Turn Type			Prot					NA			NA	
Protected Phases			5					1			1	
Permitted Phases												
Actuated Green, G (s)			25.0					105.0			105.0	
Effective Green, g (s)			26.0					106.0			106.0	
Actuated g/C Ratio			0.19					0.76			0.76	
Clearance Time (s)			5.0					5.0			5.0	
Vehicle Extension (s)			2.0					2.0			2.0	
Lane Grp Cap (vph)			218					3064			3223	
v/s Ratio Prot			c0.01					c0.55			0.32	
v/s Ratio Perm												
v/c Ratio			0.05					0.73			0.42	
Uniform Delay, d1			46.9					9.2			6.1	
Progression Factor			1.00					0.49			0.59	
Incremental Delay, d2			0.0					0.6			0.0	
Delay (s)			46.9					5.1			3.6	
Level of Service			D					A			A	
Approach Delay (s)		46.9			0.0			5.1			3.6	
Approach LOS		D			A			A			A	

Intersection Summary

HCM 2000 Control Delay	5.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

3098: Tremont Street /Tremont St & Melnea Cass Boulevard

	→	↘	↙	←	↑	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	53	135	1003	313	1149	1145	478
v/c Ratio	0.41	0.57	1.16	0.72	0.99	0.75	1.30dl
Control Delay	57.6	21.6	130.9	55.7	35.3	9.5	68.9
Queue Delay	0.0	0.7	0.0	0.0	0.0	0.0	0.0
Total Delay	57.6	22.3	130.9	55.7	35.3	9.5	68.9
Queue Length 50th (ft)	39	23	~557	257	214	535	213
Queue Length 95th (ft)	m48	m38	#690	349	#443	732	#383
Internal Link Dist (ft)	197			732	380		216
Turn Bay Length (ft)			350				
Base Capacity (vph)	243	324	861	435	1164	1532	526
Starvation Cap Reductn	0	48	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.22	0.49	1.16	0.72	0.99	0.75	0.91

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.
dl Defacto Left Lane. Recode with 1 though lane as a left lane.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱	↰↰	↱			↰↑	↱		↰↱	
Traffic Volume (vph)	2	40	112	963	218	49	376	573	1008	33	354	20
Future Volume (vph)	2	40	112	963	218	49	376	573	1008	33	354	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	13	12	13	13	12	12	11	16	12	14	12
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00	0.97	1.00			0.95	1.00		0.95	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.99		1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt		1.00	0.85	1.00	0.97			1.00	0.85		0.99	
Flt Protected		1.00	1.00	0.95	1.00			0.98	1.00		0.99	
Satd. Flow (prot)		1626	1398	3015	1524			2916	1532		3163	
Flt Permitted		1.00	1.00	0.95	1.00			0.58	1.00		0.55	
Satd. Flow (perm)		1626	1398	3015	1524			1734	1532		1748	
Peak-hour factor, PHF	0.38	0.84	0.83	0.96	0.86	0.81	0.82	0.83	0.88	0.54	0.93	0.55
Adj. Flow (vph)	5	48	135	1003	253	60	459	690	1145	61	381	36
RTOR Reduction (vph)	0	0	124	0	0	0	0	0	0	0	4	0
Lane Group Flow (vph)	0	53	11	1003	313	0	0	1149	1145	0	474	0
Confl. Peds. (#/hr)									8			
Heavy Vehicles (%)	0%	9%	4%	8%	12%	15%	5%	6%	6%	20%	3%	36%
Turn Type	Split	NA	Perm	Split	NA		pm+pt	NA	Free	Perm	NA	
Protected Phases	5	5		6	6		7	1 7			1	
Permitted Phases			5				1 7		Free	1		
Actuated Green, G (s)		11.1	11.1	40.0	40.0			72.9	140.0		41.9	
Effective Green, g (s)		11.1	11.1	40.0	40.0			72.9	140.0		41.9	
Actuated g/C Ratio		0.08	0.08	0.29	0.29			0.52	1.00		0.30	
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0						2.0	
Lane Grp Cap (vph)		128	110	861	435			1164	1532		523	
v/s Ratio Prot		0.03		c0.33	0.21			c0.22				
v/s Ratio Perm			0.01					c0.30	c0.75		0.27	
v/c Ratio		0.41	0.10	1.16	0.72			0.99	0.75		1.30dl	
Uniform Delay, d1		61.4	59.8	50.0	45.0			33.1	0.0		47.2	
Progression Factor		0.84	1.57	1.00	1.00			0.47	1.00		1.00	
Incremental Delay, d2		0.6	0.1	86.8	4.7			20.5	2.7		21.9	
Delay (s)		52.2	94.2	136.8	49.7			36.0	2.7		69.0	
Level of Service		D	F	F	D			D	A		E	
Approach Delay (s)		82.4			116.1			19.3			69.0	
Approach LOS		F			F			B			E	

Intersection Summary

HCM 2000 Control Delay	57.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.6%	ICU Level of Service	E
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group

4023: Tremont Street & Prentiss St

	↗	↖	↑	↓
Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	198	290	1935	1005
v/c Ratio	0.73	0.84	0.90	0.86
Control Delay	69.3	64.3	28.6	17.9
Queue Delay	0.0	0.0	0.0	0.1
Total Delay	69.3	64.3	28.6	18.1
Queue Length 50th (ft)	166	198	641	137
Queue Length 95th (ft)	213	m#304	m#728	130
Internal Link Dist (ft)	258		709	136
Turn Bay Length (ft)		150		
Base Capacity (vph)	273	346	2157	1171
Starvation Cap Reductn	0	0	0	8
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.73	0.84	0.90	0.86

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis

2021 Build AM

4023: Tremont Street & Prentiss St

8/1/2016

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		↰	↑↑↑	↑↱	
Traffic Volume (vph)	125	28	258	1722	834	141
Future Volume (vph)	125	28	258	1722	834	141
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	13	12	10	11	11	12
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	0.91	0.95	
Frt	0.98		1.00	1.00	0.98	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1502		1472	4217	2457	
Flt Permitted	0.96		0.95	1.00	1.00	
Satd. Flow (perm)	1502		1472	4217	2457	
Peak-hour factor, PHF	0.77	0.77	0.89	0.89	0.97	0.97
Adj. Flow (vph)	162	36	290	1935	860	145
RTOR Reduction (vph)	6	0	0	0	9	0
Lane Group Flow (vph)	192	0	290	1935	996	0
Heavy Vehicles (%)	11%	7%	3%	7%	13%	10%
Parking (#/hr)					20	
Turn Type	Prot		Prot	NA	NA	
Protected Phases	10		1	6	2 9	
Permitted Phases						
Actuated Green, G (s)	23.7		32.0	70.6	64.3	
Effective Green, g (s)	24.7		33.0	71.6	66.3	
Actuated g/C Ratio	0.18		0.24	0.51	0.47	
Clearance Time (s)	5.0		5.0	5.0		
Vehicle Extension (s)	2.0		2.0	2.0		
Lane Grp Cap (vph)	264		346	2156	1163	
v/s Ratio Prot	c0.13		c0.20	c0.46	c0.41	
v/s Ratio Perm						
v/c Ratio	0.73		0.84	0.90	0.86	
Uniform Delay, d1	54.5		51.0	30.9	32.6	
Progression Factor	1.00		0.95	0.75	0.53	
Incremental Delay, d2	8.2		15.3	4.6	4.2	
Delay (s)	62.7		63.7	27.7	21.3	
Level of Service	E		E	C	C	
Approach Delay (s)	62.7			32.4	21.3	
Approach LOS	E			C	C	

Intersection Summary

HCM 2000 Control Delay	30.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Queues
7: Tremont Street & Site Dr

Lane Group	NWL	NWR	NET	NER	SWL	SWT
Lane Group Flow (vph)	166	178	1486	130	152	1332
v/c Ratio	0.60	0.55	0.55	0.11	0.83	1.05
Control Delay	63.2	14.5	1.4	0.1	58.4	68.6
Queue Delay	0.0	0.0	1.7	1.8	0.0	21.8
Total Delay	63.2	14.5	3.2	1.8	58.4	90.4
Queue Length 50th (ft)	141	0	15	0	102	~702
Queue Length 95th (ft)	222	72	m16	m0	m117	m#658
Internal Link Dist (ft)	432		138			650
Turn Bay Length (ft)				80	250	
Base Capacity (vph)	275	340	2722	1170	209	1274
Starvation Cap Reductn	0	0	1005	898	0	0
Spillback Cap Reductn	0	0	0	0	0	85
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.52	0.87	0.48	0.73	1.12

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations	↰	↱	↑↑↑	↱	↰	↑↑
Traffic Volume (vph)	153	164	1367	120	140	1225
Future Volume (vph)	153	164	1367	120	140	1225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	12	12	11	12
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1540	1378	4577	1425	1540	3185
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1540	1378	4577	1425	1540	3185
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	166	178	1486	130	152	1332
RTOR Reduction (vph)	0	157	0	21	0	0
Lane Group Flow (vph)	166	21	1486	109	152	1332
Turn Type	Prot	Over	NA	pm+ov	Prot	NA
Protected Phases	9	5	6 10	9	5	2
Permitted Phases				6 10		
Actuated Green, G (s)	25.0	16.7	83.3	108.3	16.7	56.0
Effective Green, g (s)	25.0	16.7	83.3	108.3	16.7	56.0
Actuated g/C Ratio	0.18	0.12	0.59	0.77	0.12	0.40
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	2.0		3.0	2.0	3.0
Lane Grp Cap (vph)	275	164	2723	1153	183	1274
v/s Ratio Prot	c0.11	0.02	c0.32	0.02	c0.10	c0.42
v/s Ratio Perm				0.06		
v/c Ratio	0.60	0.13	0.55	0.09	0.83	1.05
Uniform Delay, d1	52.9	55.1	17.0	3.9	60.3	42.0
Progression Factor	1.00	1.00	0.07	0.00	0.69	0.94
Incremental Delay, d2	3.7	0.1	0.0	0.0	12.5	30.1
Delay (s)	56.6	55.3	1.2	0.0	53.9	69.4
Level of Service	E	E	A	A	D	E
Approach Delay (s)	55.9		1.1			67.9
Approach LOS	E		A			E

Intersection Summary

HCM 2000 Control Delay	35.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

192: Columbus Avenue/Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd

	→	←	↖	↖	↑	↘	↓
Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	835	539	341	198	1146	208	1239
v/c Ratio	1.05	1.06	0.27	0.80	0.75	0.99	0.85
Control Delay	80.2	106.7	0.5	80.6	43.8	90.3	50.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	80.2	106.7	0.5	80.6	43.8	90.3	50.1
Queue Length 50th (ft)	~304	~283	0	176	335	182	335
Queue Length 95th (ft)	#516	#403	0	#278	369	m#226	m383
Internal Link Dist (ft)	381	1186			1304		709
Turn Bay Length (ft)				205		205	
Base Capacity (vph)	792	508	1275	247	1529	211	1464
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.05	1.06	0.27	0.80	0.75	0.99	0.85

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations		↰↱			↰↑	↱		↖	↑↑↱			↖
Traffic Volume (vph)	232	374	204	79	417	314	1	169	895	90	2	200
Future Volume (vph)	232	374	204	79	417	314	1	169	895	90	2	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	1.0		4.0	4.0			4.0
Lane Util. Factor		0.95			0.95	1.00		1.00	0.91			1.00
Frt		0.96			1.00	0.85		1.00	0.99			1.00
Flt Protected		0.99			0.99	1.00		0.95	1.00			0.95
Satd. Flow (prot)		2936			3065	1275		1577	4370			1345
Flt Permitted		0.56			0.66	1.00		0.95	1.00			0.95
Satd. Flow (perm)		1661			2032	1275		1577	4370			1345
Peak-hour factor, PHF	0.97	0.97	0.97	0.92	0.92	0.92	0.86	0.86	0.86	0.86	0.97	0.97
Adj. Flow (vph)	239	386	210	86	453	341	1	197	1041	105	2	206
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	835	0	0	539	341	0	198	1146	0	0	208
Heavy Vehicles (%)	5%	5%	5%	6%	5%	14%	0%	3%	5%	9%	0%	21%
Parking (#/hr)												
Turn Type	D.P+P	NA		Perm	NA	Free	Prot	Prot	NA		Prot	Prot
Protected Phases	3	3 4			4		5	5	1		5	5
Permitted Phases	4			4		Free						
Actuated Green, G (s)		48.0			32.0	140.0		20.0	47.0			20.0
Effective Green, g (s)		52.0			35.0	140.0		22.0	49.0			22.0
Actuated g/C Ratio		0.37			0.25	1.00		0.16	0.35			0.16
Clearance Time (s)					7.0			6.0	6.0			6.0
Vehicle Extension (s)					3.0			2.0	2.0			2.0
Lane Grp Cap (vph)		780			508	1275		247	1529			211
v/s Ratio Prot		c0.14						0.13	0.26			c0.15
v/s Ratio Perm		0.26			c0.27	0.27						
v/c Ratio		1.07			1.06	0.27		0.80	0.75			0.99
Uniform Delay, d1		44.0			52.5	0.0		56.9	40.1			58.8
Progression Factor		1.00			1.00	1.00		1.00	1.00			0.95
Incremental Delay, d2		48.8			57.1	0.5		16.0	3.4			34.2
Delay (s)		92.9			109.6	0.5		72.9	43.5			89.9
Level of Service		F			F	A		E	D			F
Approach Delay (s)		92.9			67.3				47.8			
Approach LOS		F			E				D			

Intersection Summary

HCM 2000 Control Delay	62.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	91.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

	↓	↙
Movement	SBT	SBR
Lane Configurations	↑↑↱	
Traffic Volume (vph)	1037	165
Future Volume (vph)	1037	165
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.0	
Lane Util. Factor	0.91	
Frt	0.98	
Flt Protected	1.00	
Satd. Flow (prot)	4186	
Flt Permitted	1.00	
Satd. Flow (perm)	4186	
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	1069	170
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	1239	0
Heavy Vehicles (%)	3%	2%
Parking (#/hr)	15	
Turn Type	NA	
Protected Phases	1	
Permitted Phases		
Actuated Green, G (s)	47.0	
Effective Green, g (s)	49.0	
Actuated g/C Ratio	0.35	
Clearance Time (s)	6.0	
Vehicle Extension (s)	2.0	
Lane Grp Cap (vph)	1465	
v/s Ratio Prot	c0.30	
v/s Ratio Perm		
v/c Ratio	0.85	
Uniform Delay, d1	42.0	
Progression Factor	1.12	
Incremental Delay, d2	2.5	
Delay (s)	49.7	
Level of Service	D	
Approach Delay (s)	55.4	
Approach LOS	E	

Intersection Summary

Lane Group	EBL	EBT	WBT	NEL	NET	SWL	SWT	SWR
Lane Group Flow (vph)	586	277	258	220	1476	107	998	577
v/c Ratio	0.83	0.61	0.77	0.96	0.86	1.16	1.11	0.86
Control Delay	52.9	16.5	63.7	81.6	51.9	206.2	97.5	39.2
Queue Delay	1.5	1.2	0.0	0.0	0.0	0.0	0.4	7.2
Total Delay	54.4	17.7	63.7	81.6	51.9	206.2	97.9	46.4
Queue Length 50th (ft)	274	109	195	207	520	~118	~592	519
Queue Length 95th (ft)	332	189	265	#369	#579	#248	#730	#716
Internal Link Dist (ft)		324	271		650		238	
Turn Bay Length (ft)				280		200		
Base Capacity (vph)	728	460	384	229	1708	92	896	682
Starvation Cap Reductn	45	59	0	0	0	0	62	0
Spillback Cap Reductn	0	0	1	0	0	0	0	75
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.69	0.67	0.96	0.86	1.16	1.20	0.95

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰↰	↱			✥		↰	↑↑↱		↰	↑↑	↱
Traffic Volume (vph)	516	25	219	73	42	99	196	1267	46	103	958	554
Future Volume (vph)	516	25	219	73	42	99	196	1267	46	103	958	554
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	16	12	11	11	12	12	11	11
Total Lost time (s)	4.0	6.0			4.0		4.0	4.0		6.0	4.0	4.0
Lane Util. Factor	0.97	1.00			1.00		1.00	0.91		1.00	0.95	1.00
Frpb, ped/bikes	1.00	0.97			0.99		1.00	1.00		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.87			0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3001	1176			1749		1287	4282		1624	3079	1277
Flt Permitted	0.95	1.00			0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3001	1176			1749		1287	4282		1624	3079	1277
Peak-hour factor, PHF	0.88	0.88	0.88	0.83	0.83	0.83	0.89	0.89	0.89	0.96	0.96	0.96
Adj. Flow (vph)	586	28	249	88	51	119	220	1424	52	107	998	577
RTOR Reduction (vph)	0	194	0	0	23	0	0	2	0	0	0	0
Lane Group Flow (vph)	586	83	0	0	235	0	220	1474	0	107	998	577
Confl. Peds. (#/hr)	13		16	16		13	23					23
Heavy Vehicles (%)	5%	0%	20%	2%	0%	0%	22%	5%	0%	0%	2%	4%
Parking (#/hr)				15		0						
Turn Type	Split	NA		Split	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	3	3		4	4		1	6		5	2	3
Permitted Phases												2
Actuated Green, G (s)	31.2	31.2			23.0		23.0	53.8		8.0	38.8	70.0
Effective Green, g (s)	33.2	31.2			25.0		25.0	55.8		8.0	40.8	74.0
Actuated g/C Ratio	0.24	0.22			0.18		0.18	0.40		0.06	0.29	0.53
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0			2.0		2.0	2.0		2.0	2.0	3.0
Lane Grp Cap (vph)	711	262			312		229	1706		92	897	711
v/s Ratio Prot	0.20	0.07			c0.13		c0.17	0.34		0.07	c0.32	c0.19
v/s Ratio Perm												0.26
v/c Ratio	0.82	0.32			0.75		0.96	0.86		1.16	1.11	0.81
Uniform Delay, d1	50.6	45.5			54.6		57.0	38.6		66.0	49.6	27.2
Progression Factor	0.85	1.37			1.00		0.59	1.18		1.29	0.65	0.93
Incremental Delay, d2	7.2	0.7			8.8		43.9	5.3		138.9	64.5	6.3
Delay (s)	50.0	63.0			63.4		77.3	50.9		224.1	96.5	31.6
Level of Service	D	E			E		E	D		F	F	C
Approach Delay (s)		54.2			63.4			54.3			82.4	
Approach LOS		D			E			D			F	

Intersection Summary

HCM 2000 Control Delay	65.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	91.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

3082: Tremont Street & Renaissance Park/Ruggles St

Lane Group	EBR	NET	SWT
Lane Group Flow (vph)	130	2013	1616
v/c Ratio	0.45	0.65	0.49
Control Delay	31.6	1.9	6.3
Queue Delay	0.1	0.4	1.3
Total Delay	31.8	2.3	7.6
Queue Length 50th (ft)	53	32	161
Queue Length 95th (ft)	122	35	m138
Internal Link Dist (ft)		238	380
Turn Bay Length (ft)			
Base Capacity (vph)	290	3095	3317
Starvation Cap Reductn	0	489	1389
Spillback Cap Reductn	9	264	679
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.46	0.77	0.84

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations			↱					↑↑↱			↑↑↑	
Traffic Volume (vph)	0	0	122	0	0	0	0	1692	261	0	1438	0
Future Volume (vph)	0	0	122	0	0	0	0	1692	261	0	1438	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	16	12	11	12	12	11	12
Total Lost time (s)			4.0					4.0			4.0	
Lane Util. Factor			1.00					0.91			0.91	
Frpb, ped/bikes			1.00					0.98			1.00	
Flpb, ped/bikes			1.00					1.00			1.00	
Frt			0.86					0.98			1.00	
Flt Protected			1.00					1.00			1.00	
Satd. Flow (prot)			1286					4069			4381	
Flt Permitted			1.00					1.00			1.00	
Satd. Flow (perm)			1286					4069			4381	
Peak-hour factor, PHF	0.94	0.94	0.94	0.92	0.92	0.92	0.97	0.97	0.97	0.89	0.89	0.89
Adj. Flow (vph)	0	0	130	0	0	0	0	1744	269	0	1616	0
RTOR Reduction (vph)	0	0	51	0	0	0	0	15	0	0	0	0
Lane Group Flow (vph)	0	0	79	0	0	0	0	1998	0	0	1616	0
Confl. Peds. (#/hr)									26			
Heavy Vehicles (%)	0%	0%	15%	0%	0%	0%	0%	6%	10%	0%	3%	0%
Turn Type			Prot					NA			NA	
Protected Phases			5					1			1	
Permitted Phases												
Actuated Green, G (s)			25.0					105.0			105.0	
Effective Green, g (s)			26.0					106.0			106.0	
Actuated g/C Ratio			0.19					0.76			0.76	
Clearance Time (s)			5.0					5.0			5.0	
Vehicle Extension (s)			2.0					2.0			2.0	
Lane Grp Cap (vph)			238					3080			3317	
v/s Ratio Prot			c0.06					c0.49			0.37	
v/s Ratio Perm												
v/c Ratio			0.33					0.65			0.49	
Uniform Delay, d1			49.5					8.1			6.5	
Progression Factor			1.00					0.17			0.94	
Incremental Delay, d2			0.3					0.6			0.0	
Delay (s)			49.7					1.9			6.2	
Level of Service			D					A			A	
Approach Delay (s)		49.7			0.0			1.9			6.2	
Approach LOS		D			A			A			A	

Intersection Summary

HCM 2000 Control Delay	5.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

	→	↘	↙	←	↑	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	238	293	859	200	1031	1128	721
v/c Ratio	0.98	0.75	1.00	0.47	1.19	0.73	1.57dl
Control Delay	102.7	26.3	79.7	45.8	124.9	9.7	150.8
Queue Delay	37.3	3.8	0.0	0.0	0.0	0.0	0.0
Total Delay	139.9	30.1	79.7	45.8	124.9	9.7	150.8
Queue Length 50th (ft)	220	65	404	151	~560	438	~422
Queue Length 95th (ft)	#359	107	#547	219	#611	504	#553
Internal Link Dist (ft)	203			68	380		136
Turn Bay Length (ft)			350				
Base Capacity (vph)	243	391	861	423	863	1554	594
Starvation Cap Reductn	27	45	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.10	0.85	1.00	0.47	1.19	0.73	1.21

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱	↰↰	↱			↰↑	↱		↰↱	
Traffic Volume (vph)	8	182	243	825	113	56	228	625	993	49	569	10
Future Volume (vph)	8	182	243	825	113	56	228	625	993	49	569	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	13	12	13	13	12	12	11	16	12	14	12
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00	0.97	1.00			0.95	1.00		0.95	
Frt		1.00	0.85	1.00	0.95			1.00	0.85		1.00	
Flt Protected		1.00	1.00	0.95	1.00			0.99	1.00		0.99	
Satd. Flow (prot)		1626	1398	3015	1482			2931	1554		3238	
Flt Permitted		1.00	1.00	0.95	1.00			0.54	1.00		0.53	
Satd. Flow (perm)		1626	1398	3015	1482			1600	1554		1731	
Peak-hour factor, PHF	0.38	0.84	0.83	0.96	0.86	0.81	0.82	0.83	0.88	0.54	0.93	0.55
Adj. Flow (vph)	21	217	293	859	131	69	278	753	1128	91	612	18
RTOR Reduction (vph)	0	0	182	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	238	111	859	200	0	0	1031	1128	0	720	0
Heavy Vehicles (%)	0%	9%	4%	8%	12%	15%	5%	6%	6%	20%	3%	36%
Turn Type	Split	NA	Perm	Split	NA		pm+pt	NA	Free	Perm	NA	
Protected Phases	5	5		6	6		7	1 7			1	
Permitted Phases			5				1 7		Free	1		
Actuated Green, G (s)		21.0	21.0	40.0	40.0			63.0	140.0		48.0	
Effective Green, g (s)		21.0	21.0	40.0	40.0			63.0	140.0		48.0	
Actuated g/C Ratio		0.15	0.15	0.29	0.29			0.45	1.00		0.34	
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0						2.0	
Lane Grp Cap (vph)		243	209	861	423			862	1554		593	
v/s Ratio Prot		c0.15		c0.28	0.13			c0.13				
v/s Ratio Perm			0.08					0.41	0.73		c0.42	
v/c Ratio		0.98	0.53	1.00	0.47			1.20	0.73		1.57dl	
Uniform Delay, d1		59.3	55.0	50.0	41.3			38.5	0.0		46.0	
Progression Factor		0.87	0.87	1.00	1.00			0.83	1.00		1.00	
Incremental Delay, d2		49.4	1.2	29.8	0.3			98.1	2.6		111.1	
Delay (s)		100.8	49.3	79.8	41.6			130.0	2.6		157.1	
Level of Service		F	D	E	D			F	A		F	
Approach Delay (s)		72.4			72.6			63.4			157.1	
Approach LOS		E			E			E			F	

Intersection Summary

HCM 2000 Control Delay	81.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.6%	ICU Level of Service	F
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group

	↗	↖	↑	↓
Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	354	114	1412	1434
v/c Ratio	1.04	1.00	0.94	0.90
Control Delay	106.9	150.2	34.4	16.5
Queue Delay	0.0	0.0	0.0	5.5
Total Delay	106.9	150.2	34.4	22.1
Queue Length 50th (ft)	~322	110	473	144
Queue Length 95th (ft)	#476	m#184	m#560	m126
Internal Link Dist (ft)	258		709	138
Turn Bay Length (ft)		150		
Base Capacity (vph)	341	114	1499	1587
Starvation Cap Reductn	0	0	0	119
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.04	1.00	0.94	0.98

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱		↰	↑↑↑	↑↱	
Traffic Volume (vph)	153	148	107	1327	1292	84
Future Volume (vph)	153	148	107	1327	1292	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	13	12	10	11	11	12
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	0.91	0.95	
Frt	0.93		1.00	1.00	0.99	
Flt Protected	0.98		0.95	1.00	1.00	
Satd. Flow (prot)	1475		1458	4178	2671	
Flt Permitted	0.98		0.95	1.00	1.00	
Satd. Flow (perm)	1475		1458	4178	2671	
Peak-hour factor, PHF	0.85	0.85	0.94	0.94	0.96	0.96
Adj. Flow (vph)	180	174	114	1412	1346	88
RTOR Reduction (vph)	25	0	0	0	3	0
Lane Group Flow (vph)	329	0	114	1412	1431	0
Heavy Vehicles (%)	13%	5%	4%	8%	6%	11%
Parking (#/hr)					15	
Turn Type	Prot		Prot	NA	NA	
Protected Phases	10		1	6	2 9	
Permitted Phases						
Actuated Green, G (s)	29.0		10.0	49.3	81.0	
Effective Green, g (s)	30.0		11.0	50.3	83.0	
Actuated g/C Ratio	0.21		0.08	0.36	0.59	
Clearance Time (s)	5.0		5.0	5.0		
Vehicle Extension (s)	2.0		2.0	2.0		
Lane Grp Cap (vph)	316		114	1501	1583	
v/s Ratio Prot	c0.22		c0.08	0.34	c0.54	
v/s Ratio Perm						
v/c Ratio	1.04		1.00	0.94	0.90	
Uniform Delay, d1	55.0		64.5	43.4	25.0	
Progression Factor	1.00		1.30	0.53	0.74	
Incremental Delay, d2	61.6		71.0	9.9	2.0	
Delay (s)	116.6		154.9	32.9	20.5	
Level of Service	F		F	C	C	
Approach Delay (s)	116.6			42.0	20.5	
Approach LOS	F			D	C	

Intersection Summary

HCM 2000 Control Delay	40.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	236	176	1228	202	227	959
v/c Ratio	0.62	0.44	0.49	0.16	0.81	0.64
Control Delay	49.9	9.5	1.2	0.1	44.0	28.7
Queue Delay	0.1	0.0	0.5	1.3	0.0	0.0
Total Delay	50.1	9.5	1.8	1.5	44.0	28.7
Queue Length 50th (ft)	164	0	4	0	124	407
Queue Length 95th (ft)	251	59	12	m0	m122	481
Internal Link Dist (ft)	281		152			637
Turn Bay Length (ft)				80	250	
Base Capacity (vph)	384	458	2511	1233	356	1503
Starvation Cap Reductn	0	0	776	837	0	0
Spillback Cap Reductn	6	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.62	0.38	0.71	0.51	0.64	0.64

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

	↙	↖	↑	↗	↘	↓
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↑↑↑	↱	↰	↑↑
Traffic Volume (vph)	217	162	1130	186	209	882
Future Volume (vph)	217	162	1130	186	209	882
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	12	12	11	12
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1711	1531	5085	1583	1711	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1711	1531	5085	1583	1711	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	236	176	1228	202	227	959
RTOR Reduction (vph)	0	147	0	44	0	0
Lane Group Flow (vph)	236	29	1228	158	227	959
Turn Type	Prot	Over	NA	pm+ov	Prot	NA
Protected Phases	9	5	6 10	9	5	2
Permitted Phases				6 10		
Actuated Green, G (s)	26.5	19.7	58.8	85.3	19.7	51.0
Effective Green, g (s)	26.5	19.7	58.8	85.3	19.7	51.0
Actuated g/C Ratio	0.22	0.16	0.49	0.71	0.16	0.42
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	2.0		3.0	2.0	3.0
Lane Grp Cap (vph)	377	251	2491	1191	280	1504
v/s Ratio Prot	c0.14	0.02	c0.24	0.03	c0.13	c0.27
v/s Ratio Perm				0.07		
v/c Ratio	0.63	0.12	0.49	0.13	0.81	0.64
Uniform Delay, d1	42.3	42.7	20.6	5.5	48.4	27.2
Progression Factor	1.00	1.00	0.04	0.00	0.61	0.97
Incremental Delay, d2	3.2	0.1	0.0	0.0	10.5	1.4
Delay (s)	45.5	42.8	0.9	0.0	39.8	27.8
Level of Service	D	D	A	A	D	C
Approach Delay (s)	44.3		0.7			30.1
Approach LOS	D		A			C

Intersection Summary

HCM 2000 Control Delay	18.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	57.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

192: Columbus Avenue/Tremont Street & Tremont St/Malcolm X/Malcolm X Blvd

	→	←	↖	↖	↑	↘	↓
Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	580	405	313	112	939	189	927
v/c Ratio	0.83	0.86	0.60	0.42	0.59	0.88	0.64
Control Delay	30.9	64.5	9.7	49.0	32.9	70.0	44.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.9	64.5	9.7	49.0	32.9	70.0	44.8
Queue Length 50th (ft)	111	160	0	77	216	135	231
Queue Length 95th (ft)	#204	#222	60	135	264	m#228	278
Internal Link Dist (ft)	381	1188			1304		709
Turn Bay Length (ft)				205		205	
Base Capacity (vph)	699	470	521	278	1581	224	1441
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.83	0.86	0.60	0.40	0.59	0.84	0.64

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations		↰↑↱			↰↑	↱		↰	↑↑↱			↰
Traffic Volume (vph)	213	239	93	65	280	266	1	103	806	67	13	166
Future Volume (vph)	213	239	93	65	280	266	1	103	806	67	13	166
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0		4.0	4.0			4.0
Lane Util. Factor		0.95			0.95	1.00		1.00	0.91			1.00
Frt		0.97			1.00	0.85		1.00	0.99			1.00
Flt Protected		0.98			0.99	1.00		0.95	1.00			0.95
Satd. Flow (prot)		2926			2945	1275		1519	4319			1227
Flt Permitted		0.59			0.73	1.00		0.95	1.00			0.95
Satd. Flow (perm)		1766			2171	1275		1519	4319			1227
Peak-hour factor, PHF	0.94	0.94	0.94	0.85	0.85	0.85	0.93	0.93	0.93	0.93	0.95	0.95
Adj. Flow (vph)	227	254	99	76	329	313	1	111	867	72	14	175
RTOR Reduction (vph)	0	0	0	0	0	245	0	0	0	0	0	0
Lane Group Flow (vph)	0	580	0	0	405	68	0	112	939	0	0	189
Heavy Vehicles (%)	9%	4%	5%	15%	8%	14%	0%	7%	7%	5%	0%	35%
Parking (#/hr)												
Turn Type	pm+pt	NA		Perm	NA	Perm	Prot	Prot	NA		Prot	Prot
Protected Phases	3	3 4			4		5	5	1		5	5
Permitted Phases	3 4			4		4						
Actuated Green, G (s)		33.9			22.9	22.9		19.1	42.0			19.1
Effective Green, g (s)		37.9			25.9	25.9		21.1	44.0			21.1
Actuated g/C Ratio		0.32			0.22	0.22		0.18	0.37			0.18
Clearance Time (s)					7.0	7.0		6.0	6.0			6.0
Vehicle Extension (s)					3.0	3.0		2.0	2.0			2.0
Lane Grp Cap (vph)		683			468	275		267	1583			215
v/s Ratio Prot		c0.09						0.07	0.22			c0.15
v/s Ratio Perm		0.18			c0.19	0.05						
v/c Ratio		0.85			0.87	0.25		0.42	0.59			0.88
Uniform Delay, d1		38.4			45.4	39.0		44.0	30.8			48.2
Progression Factor		0.64			1.00	1.00		1.00	1.00			0.87
Incremental Delay, d2		7.5			15.3	0.5		0.4	1.6			22.0
Delay (s)		32.1			60.7	39.4		44.4	32.4			64.0
Level of Service		C			E	D		D	C			E
Approach Delay (s)		32.1			51.4				33.7			
Approach LOS		C			D				C			

Intersection Summary

HCM 2000 Control Delay	41.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations	↑↑↱	
Traffic Volume (vph)	630	251
Future Volume (vph)	630	251
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.0	
Lane Util. Factor	0.91	
Frt	0.96	
Flt Protected	1.00	
Satd. Flow (prot)	3936	
Flt Permitted	1.00	
Satd. Flow (perm)	3936	
Peak-hour factor, PHF	0.95	0.95
Adj. Flow (vph)	663	264
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	927	0
Heavy Vehicles (%)	9%	5%
Parking (#/hr)	10	
Turn Type	NA	
Protected Phases	1	
Permitted Phases		
Actuated Green, G (s)	42.0	
Effective Green, g (s)	44.0	
Actuated g/C Ratio	0.37	
Clearance Time (s)	6.0	
Vehicle Extension (s)	2.0	
Lane Grp Cap (vph)	1443	
v/s Ratio Prot	c0.24	
v/s Ratio Perm		
v/c Ratio	0.64	
Uniform Delay, d1	31.5	
Progression Factor	1.35	
Incremental Delay, d2	1.5	
Delay (s)	44.1	
Level of Service	D	
Approach Delay (s)	47.4	
Approach LOS	D	

Intersection Summary

	↗	→	←	↰	↗	↳	↙	↙
Lane Group	EBL	EBT	WBT	NEL	NET	SWL	SWT	SWR
Lane Group Flow (vph)	385	222	138	200	1274	88	961	419
v/c Ratio	0.71	0.74	0.75	1.14	0.51	0.66	0.80	0.59
Control Delay	40.1	34.5	56.9	136.9	22.7	48.7	29.2	12.6
Queue Delay	0.0	0.0	0.0	0.0	0.1	0.0	0.8	0.0
Total Delay	40.1	34.5	56.9	136.9	22.8	48.7	30.0	12.6
Queue Length 50th (ft)	88	74	72	~176	359	29	272	22
Queue Length 95th (ft)	132	153	113	#342	421	#170	#576	419
Internal Link Dist (ft)		324	271		637		238	
Turn Bay Length (ft)				280		200		
Base Capacity (vph)	583	406	301	175	2482	133	1200	730
Starvation Cap Reductn	0	0	0	0	0	0	67	3
Spillback Cap Reductn	0	0	2	0	308	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.55	0.46	1.14	0.59	0.66	0.85	0.58

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWU	SWL	SWT
Lane Configurations	↰↰	↱			✥		↰	↑↑↱			↶	↑↑
Traffic Volume (vph)	362	24	184	12	20	83	190	1181	29	14	68	894
Future Volume (vph)	362	24	184	12	20	83	190	1181	29	14	68	894
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	16	12	11	11	12	12	11	11
Total Lost time (s)	4.0	6.0			4.0		4.0	4.0			6.0	4.0
Lane Util. Factor	0.97	1.00			1.00		1.00	0.91			1.00	0.95
Frpb, ped/bikes	1.00	0.98			0.98		1.00	1.00			1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00			1.00	1.00
Frt	1.00	0.87			0.90		1.00	1.00			1.00	1.00
Flt Protected	0.95	1.00			0.99		0.95	1.00			0.95	1.00
Satd. Flow (prot)	2918	1129			1676		1236	4248			1570	2935
Flt Permitted	0.95	1.00			0.66		0.95	1.00			0.21	1.00
Satd. Flow (perm)	2918	1129			1107		1236	4248			340	2935
Peak-hour factor, PHF	0.94	0.94	0.94	0.83	0.83	0.83	0.95	0.95	0.95	0.93	0.93	0.93
Adj. Flow (vph)	385	26	196	14	24	100	200	1243	31	15	73	961
RTOR Reduction (vph)	0	174	0	0	39	0	0	2	0	0	0	0
Lane Group Flow (vph)	385	48	0	0	99	0	200	1272	0	0	88	961
Confl. Peds. (#/hr)	7		6	6		7	37					
Heavy Vehicles (%)	8%	0%	28%	4%	10%	0%	27%	6%	0%	0%	0%	7%
Parking (#/hr)				5								
Turn Type	Prot	NA		Perm	NA		Prot	NA		Perm	Perm	NA
Protected Phases	3	4			4		1	6				2
Permitted Phases				4						2	2	
Actuated Green, G (s)	20.2	13.7			13.7		15.0	68.1			47.1	47.1
Effective Green, g (s)	22.2	13.7			15.7		17.0	70.1			47.1	49.1
Actuated g/C Ratio	0.18	0.11			0.13		0.14	0.58			0.39	0.41
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0			6.0	6.0
Vehicle Extension (s)	3.0	2.0			2.0		2.0	2.0			2.0	2.0
Lane Grp Cap (vph)	539	128			144		175	2481			133	1200
v/s Ratio Prot	c0.13	0.04					c0.16	0.30				c0.33
v/s Ratio Perm					c0.09						0.26	
v/c Ratio	0.71	0.38			0.69		1.14	0.51			0.66	0.80
Uniform Delay, d1	45.9	49.2			49.8		51.5	14.8			29.9	31.2
Progression Factor	0.72	2.26			1.00		0.49	1.35			0.68	0.69
Incremental Delay, d2	4.0	0.6			10.3		108.5	0.7			21.2	5.2
Delay (s)	37.2	112.0			60.1		133.8	20.7			41.5	26.6
Level of Service	D	F			E		F	C			D	C
Approach Delay (s)		64.5			60.1			36.0				22.6
Approach LOS		E			E			D				C

Intersection Summary

HCM 2000 Control Delay	36.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

	↙
Movement	SWR
Lane Configurations	↱
Traffic Volume (vph)	390
Future Volume (vph)	390
Ideal Flow (vphpl)	1900
Lane Width	11
Total Lost time (s)	4.0
Lane Util. Factor	1.00
Frpb, ped/bikes	0.91
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1197
Flt Permitted	1.00
Satd. Flow (perm)	1197
Peak-hour factor, PHF	0.93
Adj. Flow (vph)	419
RTOR Reduction (vph)	0
Lane Group Flow (vph)	419
Confl. Peds. (#/hr)	37
Heavy Vehicles (%)	7%
Parking (#/hr)	
Turn Type	pm+ov
Protected Phases	3
Permitted Phases	2
Actuated Green, G (s)	67.3
Effective Green, g (s)	71.3
Actuated g/C Ratio	0.59
Clearance Time (s)	6.0
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	751
v/s Ratio Prot	0.10
v/s Ratio Perm	0.25
v/c Ratio	0.56
Uniform Delay, d1	14.8
Progression Factor	0.59
Incremental Delay, d2	0.8
Delay (s)	9.5
Level of Service	A
Approach Delay (s)	
Approach LOS	

Intersection Summary

3082: Tremont Street & Renaissance Park/Ruggles St

Lane Group	EBR	NET	SWT
Lane Group Flow (vph)	66	1779	1386
v/c Ratio	0.19	0.60	0.46
Control Delay	6.6	9.8	3.8
Queue Delay	0.0	0.2	0.5
Total Delay	6.6	9.9	4.2
Queue Length 50th (ft)	0	396	46
Queue Length 95th (ft)	4	30	128
Internal Link Dist (ft)		238	380
Turn Bay Length (ft)			
Base Capacity (vph)	341	2954	2994
Starvation Cap Reductn	0	360	997
Spillback Cap Reductn	5	0	301
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.20	0.69	0.69

Intersection Summary

3082: Tremont Street & Renaissance Park/Ruggles St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations			↱					↑↑↱			↑↑↑	
Traffic Volume (vph)	0	0	43	0	0	0	0	1512	125	0	1317	0
Future Volume (vph)	0	0	43	0	0	0	0	1512	125	0	1317	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	16	12	11	12	12	11	12
Total Lost time (s)			4.0					4.0			4.0	
Lane Util. Factor			1.00					0.91			0.91	
Frpb, ped/bikes			1.00					1.00			1.00	
Flpb, ped/bikes			1.00					1.00			1.00	
Frt			0.86					0.99			1.00	
Flt Protected			1.00					1.00			1.00	
Satd. Flow (prot)			1275					4109			4178	
Flt Permitted			1.00					1.00			1.00	
Satd. Flow (perm)			1275					4109			4178	
Peak-hour factor, PHF	0.65	0.65	0.65	0.92	0.92	0.92	0.92	0.92	0.92	0.95	0.95	0.95
Adj. Flow (vph)	0	0	66	0	0	0	0	1643	136	0	1386	0
RTOR Reduction (vph)	0	0	52	0	0	0	0	8	0	0	0	0
Lane Group Flow (vph)	0	0	14	0	0	0	0	1771	0	0	1386	0
Confl. Peds. (#/hr)									7			
Heavy Vehicles (%)	0%	0%	16%	0%	0%	0%	0%	8%	10%	0%	8%	0%
Turn Type			Prot					NA			NA	
Protected Phases			5					1			1	
Permitted Phases												
Actuated Green, G (s)			25.0					85.0			85.0	
Effective Green, g (s)			26.0					86.0			86.0	
Actuated g/C Ratio			0.22					0.72			0.72	
Clearance Time (s)			5.0					5.0			5.0	
Vehicle Extension (s)			2.0					2.0			2.0	
Lane Grp Cap (vph)			276					2944			2994	
v/s Ratio Prot			c0.01					c0.43			0.33	
v/s Ratio Perm												
v/c Ratio			0.05					0.60			0.46	
Uniform Delay, d1			37.2					8.5			7.2	
Progression Factor			1.00					1.06			0.46	
Incremental Delay, d2			0.0					0.8			0.4	
Delay (s)			37.3					9.8			3.7	
Level of Service			D					A			A	
Approach Delay (s)		37.3			0.0			9.8			3.7	
Approach LOS		D			A			A			A	

Intersection Summary

HCM 2000 Control Delay	7.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Queues
3098: Tremont Street/Tremont St & Melnea Cass Boulevard

	→	↘	↙	←	↑	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	75	196	754	141	755	1010	559
v/c Ratio	0.48	0.70	0.85	0.33	0.78	0.66	0.54
Control Delay	60.3	24.9	50.0	34.2	25.5	9.4	30.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.3	24.9	50.0	34.2	25.5	9.4	30.1
Queue Length 50th (ft)	57	24	282	85	243	216	162
Queue Length 95th (ft)	91	75	331	124	#331	682	276
Internal Link Dist (ft)	215			623	380		183
Turn Bay Length (ft)			350				
Base Capacity (vph)	285	379	1055	517	972	1526	1035
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.52	0.71	0.27	0.78	0.66	0.54

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱	↰↰	↱			↰↑	↱		↰↱	
Traffic Volume (vph)	5	52	163	724	77	41	130	495	889	33	438	15
Future Volume (vph)	5	52	163	724	77	41	130	495	889	33	438	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	13	12	13	13	12	12	11	16	12	14	12
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00	0.97	1.00			0.95	1.00		0.95	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.98		1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt		1.00	0.85	1.00	0.95			1.00	0.85		0.99	
Flt Protected		0.99	1.00	0.95	1.00			0.99	1.00		0.99	
Satd. Flow (prot)		1631	1398	3015	1478			2938	1526		3215	
Flt Permitted		0.99	1.00	0.95	1.00			0.65	1.00		0.75	
Satd. Flow (perm)		1631	1398	3015	1478			1929	1526		2414	
Peak-hour factor, PHF	0.38	0.84	0.83	0.96	0.86	0.81	0.82	0.83	0.88	0.54	0.93	0.55
Adj. Flow (vph)	13	62	196	754	90	51	159	596	1010	61	471	27
RTOR Reduction (vph)	0	0	148	0	0	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	75	48	754	141	0	0	755	1010	0	557	0
Confl. Peds. (#/hr)									20			
Heavy Vehicles (%)	0%	9%	4%	8%	12%	15%	5%	6%	6%	20%	3%	36%
Turn Type	Split	NA	Perm	Split	NA		pm+pt	NA	Free	Perm	NA	
Protected Phases	5	5		6	6		7	1 7			1	
Permitted Phases			5				1 7		Free	1		
Actuated Green, G (s)		11.5	11.5	35.1	35.1			57.4	120.0		51.4	
Effective Green, g (s)		11.5	11.5	35.1	35.1			57.4	120.0		51.4	
Actuated g/C Ratio		0.10	0.10	0.29	0.29			0.48	1.00		0.43	
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	
Vehicle Extension (s)		2.0	2.0	2.0	2.0						2.0	
Lane Grp Cap (vph)		156	133	881	432			973	1526		1033	
v/s Ratio Prot		0.05		c0.25	0.10			0.04				
v/s Ratio Perm			0.03					c0.33	c0.66		0.23	
v/c Ratio		0.48	0.36	0.86	0.33			0.78	0.66		0.54	
Uniform Delay, d1		51.4	50.8	40.1	33.2			26.0	0.0		25.5	
Progression Factor		1.00	1.00	1.00	1.00			0.73	1.00		1.00	
Incremental Delay, d2		0.9	0.6	7.9	0.2			5.1	1.9		2.0	
Delay (s)		52.3	51.4	48.0	33.4			24.0	1.9		27.5	
Level of Service		D	D	D	C			C	A		C	
Approach Delay (s)		51.6			45.7			11.4			27.5	
Approach LOS		D			D			B			C	

Intersection Summary

HCM 2000 Control Delay	25.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

	↗	↖	↑	↓
Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	88	80	1346	1278
v/c Ratio	0.56	0.49	0.88	0.74
Control Delay	60.0	75.9	31.9	8.7
Queue Delay	0.0	0.0	0.0	0.3
Total Delay	60.0	75.9	31.9	9.0
Queue Length 50th (ft)	58	65	376	125
Queue Length 95th (ft)	110	m105	#520	88
Internal Link Dist (ft)	258		709	152
Turn Bay Length (ft)		150		
Base Capacity (vph)	163	164	1527	1735
Starvation Cap Reductn	0	0	0	93
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.54	0.49	0.88	0.78

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱		↰	↑↑↑	↑↱	
Traffic Volume (vph)	58	18	74	1252	1050	49
Future Volume (vph)	58	18	74	1252	1050	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	13	12	12	11	11	12
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	0.91	0.95	
Frt	0.97		1.00	1.00	0.99	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1544		1518	4140	2603	
Flt Permitted	0.96		0.95	1.00	1.00	
Satd. Flow (perm)	1544		1518	4140	2603	
Peak-hour factor, PHF	0.87	0.87	0.93	0.93	0.86	0.86
Adj. Flow (vph)	67	21	80	1346	1221	57
RTOR Reduction (vph)	9	0	0	0	2	0
Lane Group Flow (vph)	79	0	80	1346	1276	0
Heavy Vehicles (%)	6%	9%	7%	9%	11%	8%
Parking (#/hr)					10	
Turn Type	Prot		Prot	NA	NA	
Protected Phases	10		1	6	2 9	
Permitted Phases						
Actuated Green, G (s)	10.5		12.0	43.3	77.5	
Effective Green, g (s)	11.5		13.0	44.3	79.5	
Actuated g/C Ratio	0.10		0.11	0.37	0.66	
Clearance Time (s)	5.0		5.0	5.0		
Vehicle Extension (s)	2.0		2.0	3.0		
Lane Grp Cap (vph)	147		164	1528	1724	
v/s Ratio Prot	c0.05		c0.05	c0.33	c0.49	
v/s Ratio Perm						
v/c Ratio	0.54		0.49	0.88	0.74	
Uniform Delay, d1	51.7		50.4	35.4	13.4	
Progression Factor	1.00		1.33	0.66	0.92	
Incremental Delay, d2	1.9		7.9	6.1	1.4	
Delay (s)	53.6		74.7	29.5	13.7	
Level of Service	D		E	C	B	
Approach Delay (s)	53.6			32.0	13.7	
Approach LOS	D			C	B	

Intersection Summary

HCM 2000 Control Delay	24.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	57.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

2017 Build Conditions – Whittier Street One-Way Analysis

Queues

9: Tremont Street & Site Dr

Lane Group	WBL	WBR	NET	NER	SWL	SWT
Lane Group Flow (vph)	41	54	1827	208	145	1020
v/c Ratio	0.33	0.29	0.55	0.23	0.80	0.75
Control Delay	74.5	18.4	0.7	1.6	84.7	41.6
Queue Delay	0.0	0.0	0.6	0.8	0.0	0.3
Total Delay	74.5	18.4	1.4	2.4	84.7	41.9
Queue Length 50th (ft)	39	0	2	7	96	450
Queue Length 95th (ft)	82	44	13	m18	143	538
Internal Link Dist (ft)	481		136			652
Turn Bay Length (ft)				100	250	
Base Capacity (vph)	124	233	3331	905	235	1353
Starvation Cap Reductn	0	0	1001	444	0	0
Spillback Cap Reductn	0	0	0	0	0	62
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.23	0.78	0.45	0.62	0.79

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
9: Tremont Street & Site Dr

2021 Build AM
8/2/2016

	↙	↰	↗	↗	↳	↙
Movement	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations	↰	↱	↑↑↑	↱	↰	↑↑
Traffic Volume (vph)	38	50	1681	191	133	938
Future Volume (vph)	38	50	1681	191	133	938
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	10	12
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1593	1425	4577	1425	1486	3185
Flt Permitted	0.95	1.00	1.00	1.00	0.17	1.00
Satd. Flow (perm)	1593	1425	4577	1425	261	3185
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	54	1827	208	145	1020
RTOR Reduction (vph)	0	49	0	26	0	0
Lane Group Flow (vph)	41	5	1827	182	145	1020
Turn Type	Prot	Over	NA	custom	custom	NA
Protected Phases	9	5	6 10	9	5	2
Permitted Phases				6	10	
Actuated Green, G (s)	12.0	14.6	111.4	94.4	38.6	65.0
Effective Green, g (s)	12.0	14.6	111.4	94.4	38.6	65.0
Actuated g/C Ratio	0.08	0.10	0.73	0.62	0.25	0.42
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	2.0		3.0	2.0	2.0
Lane Grp Cap (vph)	124	135	3332	879	182	1353
v/s Ratio Prot	c0.03	0.00	c0.40	0.02	c0.08	c0.32
v/s Ratio Perm				0.11	c0.12	
v/c Ratio	0.33	0.04	0.55	0.21	0.80	0.75
Uniform Delay, d1	66.7	62.8	9.4	12.9	55.0	37.2
Progression Factor	1.00	1.00	0.04	0.27	1.00	1.00
Incremental Delay, d2	1.6	0.0	0.1	0.1	19.8	3.9
Delay (s)	68.3	62.9	0.4	3.6	74.8	41.2
Level of Service	E	E	A	A	E	D
Approach Delay (s)	65.2		0.7			45.4
Approach LOS	E		A			D

Intersection Summary

HCM 2000 Control Delay	18.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	153.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	60.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

7: Tremont Street & Site Dr

Lane Group	NWL	NWR	NET	NER	SWL	SWT
Lane Group Flow (vph)	166	178	1409	208	217	1333
v/c Ratio	0.55	0.53	0.54	0.18	1.08	1.02
Control Delay	63.3	14.0	2.1	0.1	146.3	74.7
Queue Delay	0.0	0.0	1.2	2.4	0.0	29.6
Total Delay	63.3	14.0	3.3	2.6	146.3	104.3
Queue Length 50th (ft)	151	0	19	0	~241	~742
Queue Length 95th (ft)	233	76	m20	m0	#417	#961
Internal Link Dist (ft)	432		138			650
Turn Bay Length (ft)				80	250	
Base Capacity (vph)	301	334	2632	1168	201	1303
Starvation Cap Reductn	0	0	920	831	0	0
Spillback Cap Reductn	0	0	0	0	0	102
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.53	0.82	0.62	1.08	1.11

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations	↰	↱	↑↑↑	↱	↰	↑↑
Traffic Volume (vph)	153	164	1296	191	200	1226
Future Volume (vph)	153	164	1296	191	200	1226
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	12	12	11	12
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1540	1378	4577	1425	1540	3185
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1540	1378	4577	1425	1540	3185
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	166	178	1409	208	217	1333
RTOR Reduction (vph)	0	155	0	26	0	0
Lane Group Flow (vph)	166	23	1409	182	217	1333
Turn Type	Prot	Over	NA	pm+ov	Prot	NA
Protected Phases	9	5	6 10	9	5	2
Permitted Phases				6 10		
Actuated Green, G (s)	30.0	20.0	88.0	118.0	20.0	62.6
Effective Green, g (s)	30.0	20.0	88.0	118.0	20.0	62.6
Actuated g/C Ratio	0.20	0.13	0.58	0.77	0.13	0.41
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	2.0		3.0	2.0	2.0
Lane Grp Cap (vph)	301	180	2632	1145	201	1303
v/s Ratio Prot	c0.11	0.02	c0.31	0.03	c0.14	c0.42
v/s Ratio Perm				0.10		
v/c Ratio	0.55	0.13	0.54	0.16	1.08	1.02
Uniform Delay, d1	55.4	58.8	19.9	4.6	66.5	45.2
Progression Factor	1.00	1.00	0.09	0.00	1.00	1.00
Incremental Delay, d2	2.2	0.1	0.0	0.0	86.3	30.9
Delay (s)	57.6	58.9	1.8	0.0	152.8	76.1
Level of Service	E	E	A	A	F	E
Approach Delay (s)	58.3		1.6			86.9
Approach LOS	E		A			F

Intersection Summary

HCM 2000 Control Delay	44.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	153.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	62.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Queues

6: Tremont Street & Site Drive

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	236	176	1171	260	327	961
v/c Ratio	0.57	0.50	0.44	0.20	1.47	0.88
Control Delay	58.7	13.0	0.7	0.2	276.6	61.1
Queue Delay	5.2	0.0	0.4	1.7	0.0	10.7
Total Delay	63.9	13.0	1.2	1.9	276.6	71.8
Queue Length 50th (ft)	209	0	4	0	~446	482
Queue Length 95th (ft)	324	74	4	m0	#646	573
Internal Link Dist (ft)	281		152			637
Turn Bay Length (ft)				80	250	
Base Capacity (vph)	414	353	2924	1306	223	1087
Starvation Cap Reductn	0	0	1105	869	0	0
Spillback Cap Reductn	120	0	0	0	0	119
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.80	0.50	0.64	0.59	1.47	0.99

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
6: Tremont Street & Site Drive

2021 Build SAT
8/2/2016

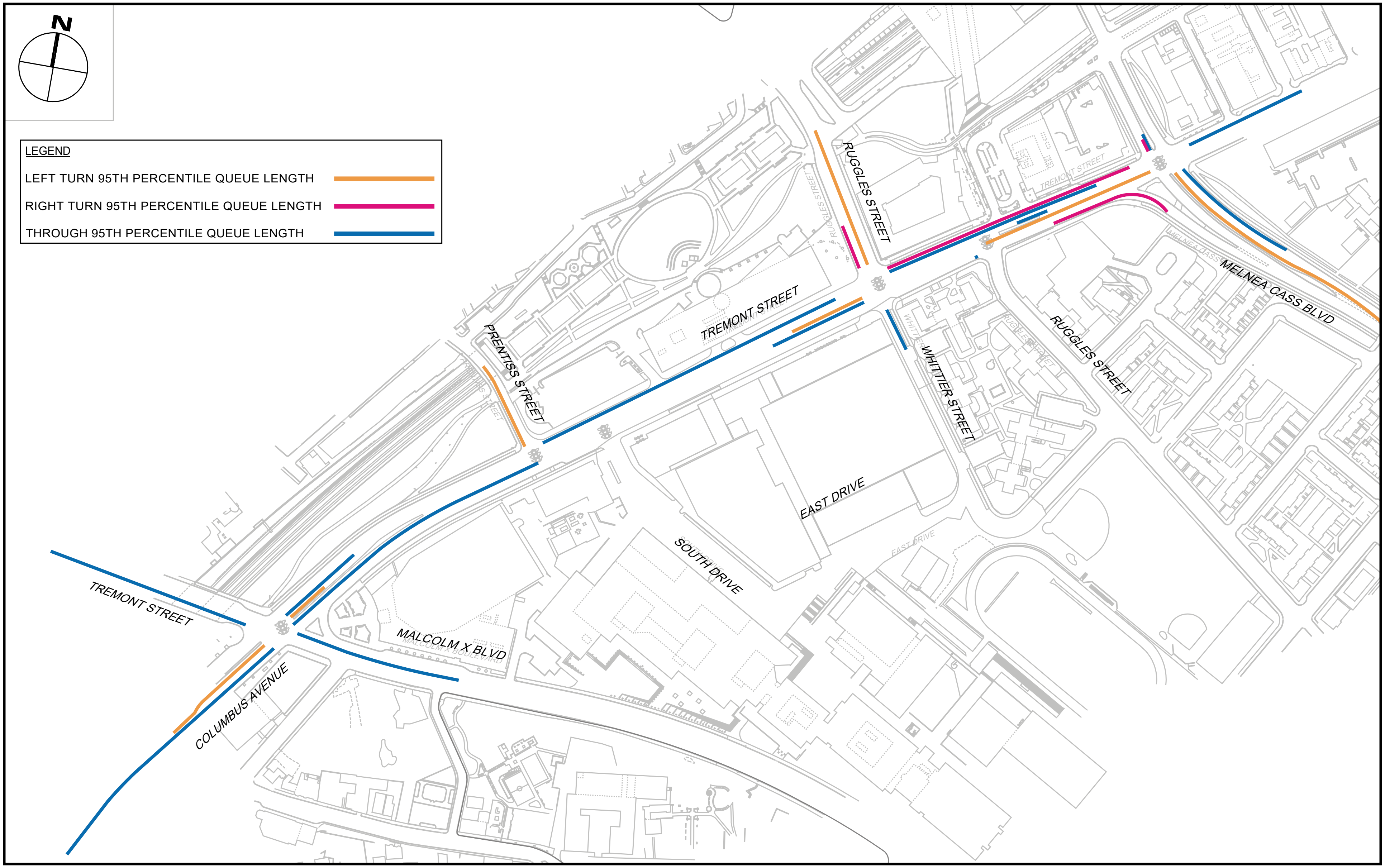
	↙	↖	↑	↗	↘	↓
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↑↑↑	↱	↰	↑↑
Traffic Volume (vph)	217	162	1077	239	301	884
Future Volume (vph)	217	162	1077	239	301	884
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	12	12	11	12
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1711	1531	5085	1583	1711	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1711	1531	5085	1583	1711	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	236	176	1171	260	327	961
RTOR Reduction (vph)	0	153	0	40	0	0
Lane Group Flow (vph)	236	23	1171	220	327	961
Turn Type	Prot	Over	NA	pm+ov	Prot	NA
Protected Phases	9	5	6 10	9	5	2
Permitted Phases				6 10		
Actuated Green, G (s)	37.1	20.0	80.9	118.0	20.0	47.0
Effective Green, g (s)	37.1	20.0	80.9	118.0	20.0	47.0
Actuated g/C Ratio	0.24	0.13	0.53	0.77	0.13	0.31
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	2.0		3.0	2.0	3.0
Lane Grp Cap (vph)	414	200	2688	1272	223	1087
v/s Ratio Prot	c0.14	0.02	c0.23	0.04	c0.19	c0.27
v/s Ratio Perm				0.10		
v/c Ratio	0.57	0.12	0.44	0.17	1.47	0.88
Uniform Delay, d1	50.9	58.7	22.1	4.6	66.5	50.4
Progression Factor	1.00	1.00	0.02	0.00	1.00	1.00
Incremental Delay, d2	1.9	0.1	0.0	0.0	232.7	10.5
Delay (s)	52.8	58.8	0.5	0.0	299.2	60.9
Level of Service	D	E	A	A	F	E
Approach Delay (s)	55.4		0.4			121.4
Approach LOS	E		A			F

Intersection Summary

HCM 2000 Control Delay	57.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	153.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Appendix H: Queue Length Figures

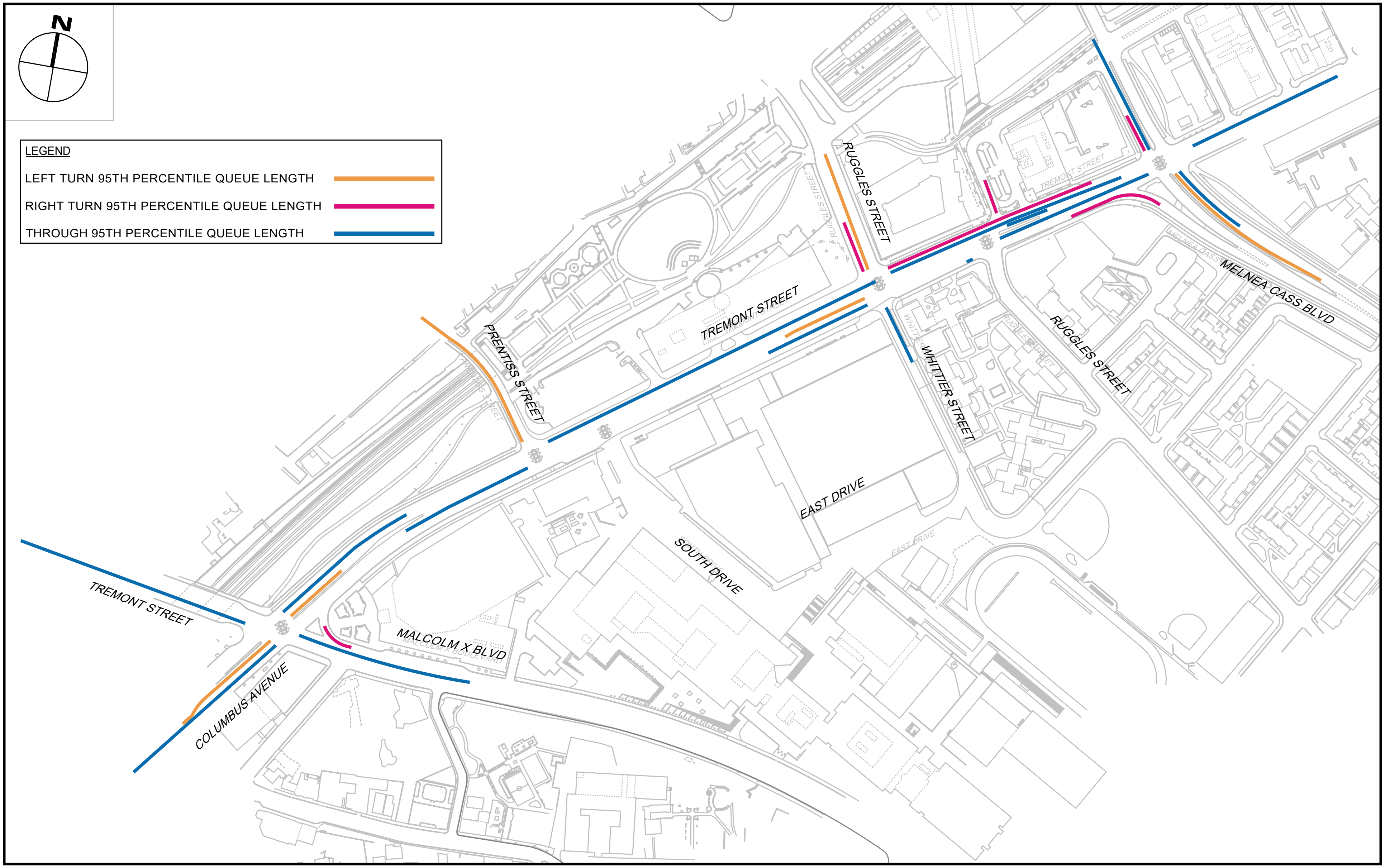


2016 Existing Condition Weekday Morning Peak Hour Queue Lengths
Tremont Crossing
Boston, MA

DPIR, August 2016

SCALE: 1" = 350'
0 175' 350'

BSC GROUP



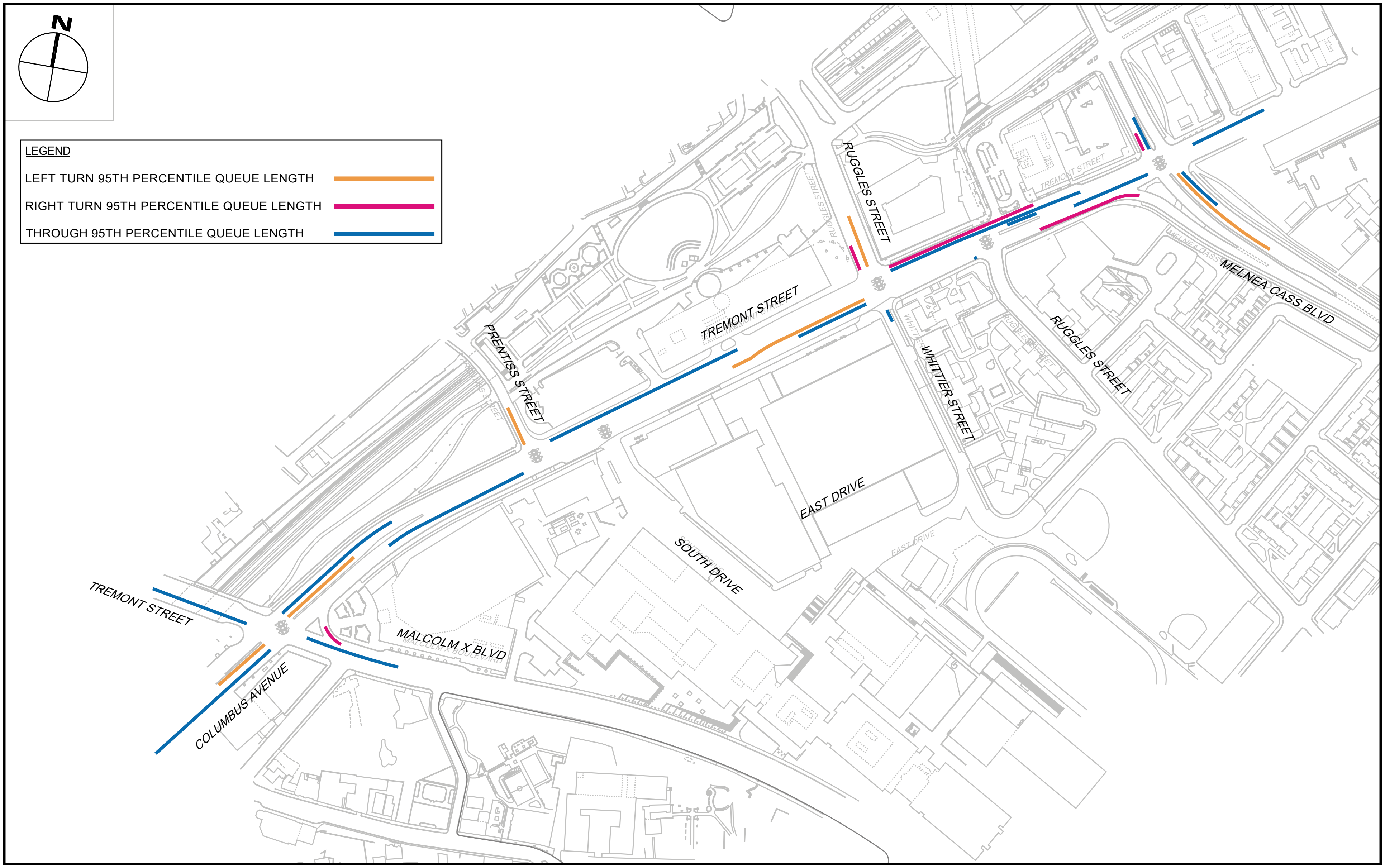
2016 Existing Condition Weekday Evening Peak Hour Queue Lengths
Tremont Crossing
Boston, MA

DPIR, August 2016

SCALE: 1" = 350'

0 175' 350'

BSC GROUP

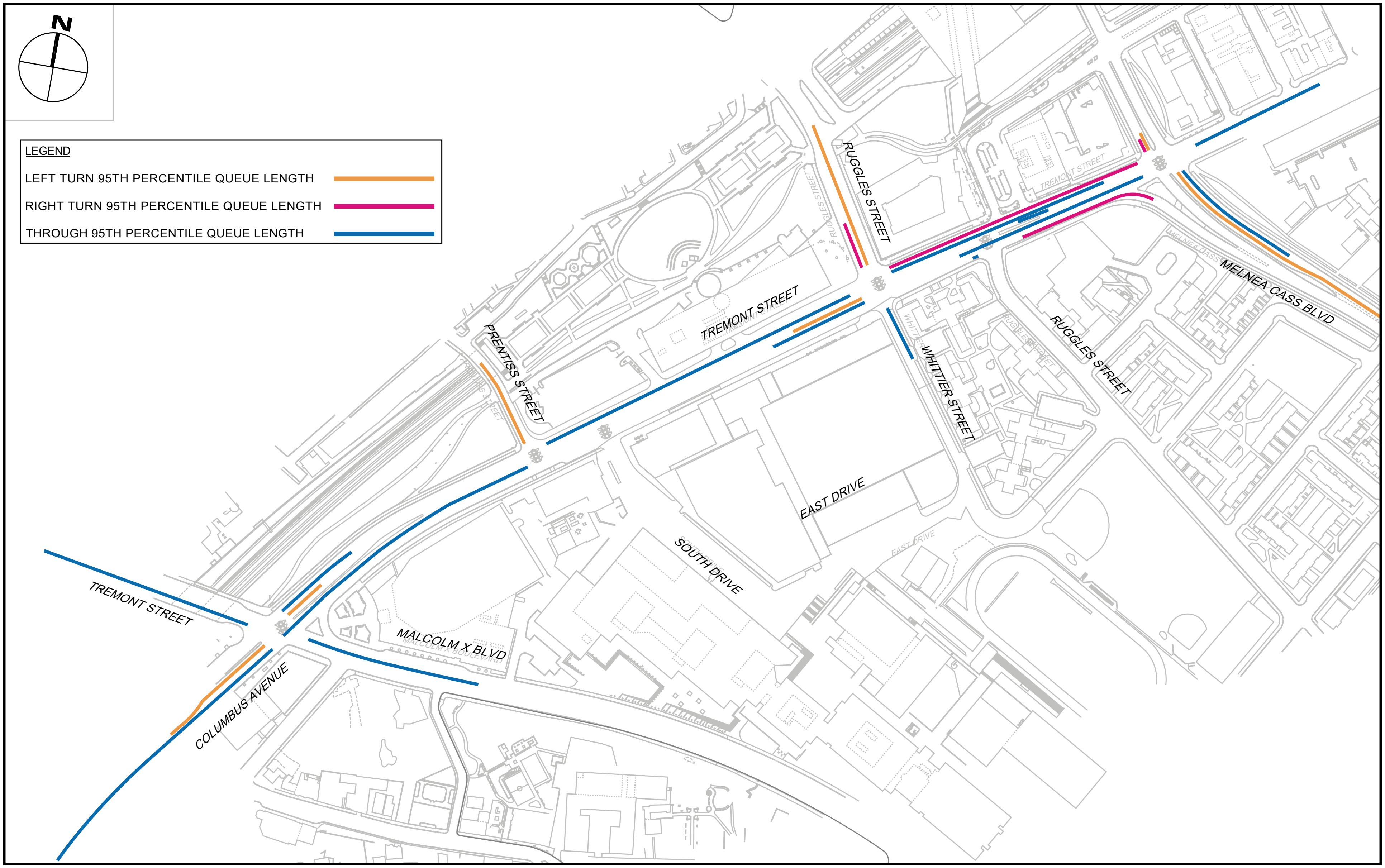


2016 Existing Condition Saturday Midday Peak Hour Queue Lengths
Tremont Crossing
Boston, MA

DPIR, August 2016

SCALE: 1" = 350'
0 175' 350'

BSC GROUP

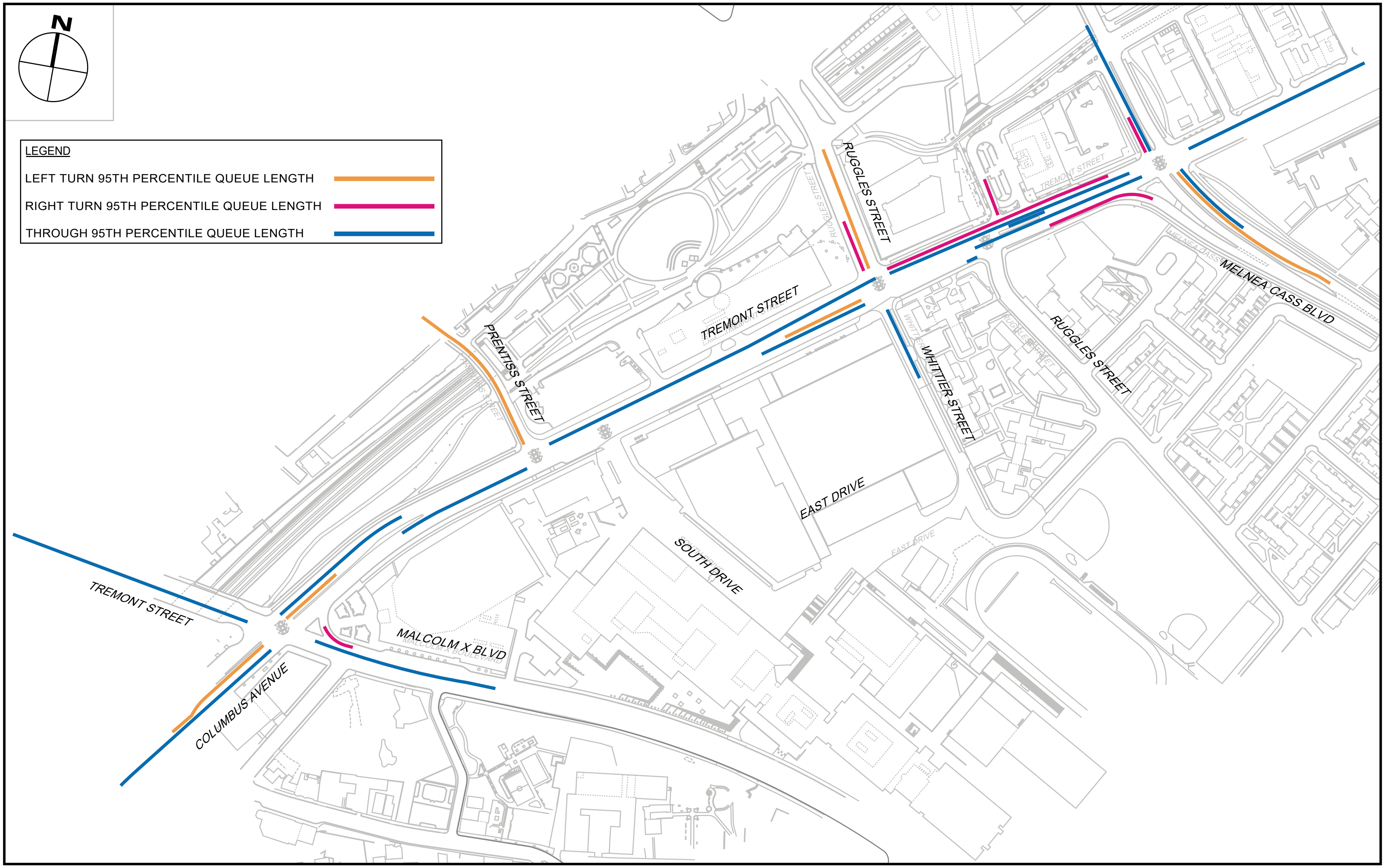


2021 No Build Condition Weekday Morning Peak Hour Queue Lengths
Tremont Crossing
Boston, MA

DPIR, August 2016

SCALE: 1" = 350'
0 175' 350'

BSC GROUP



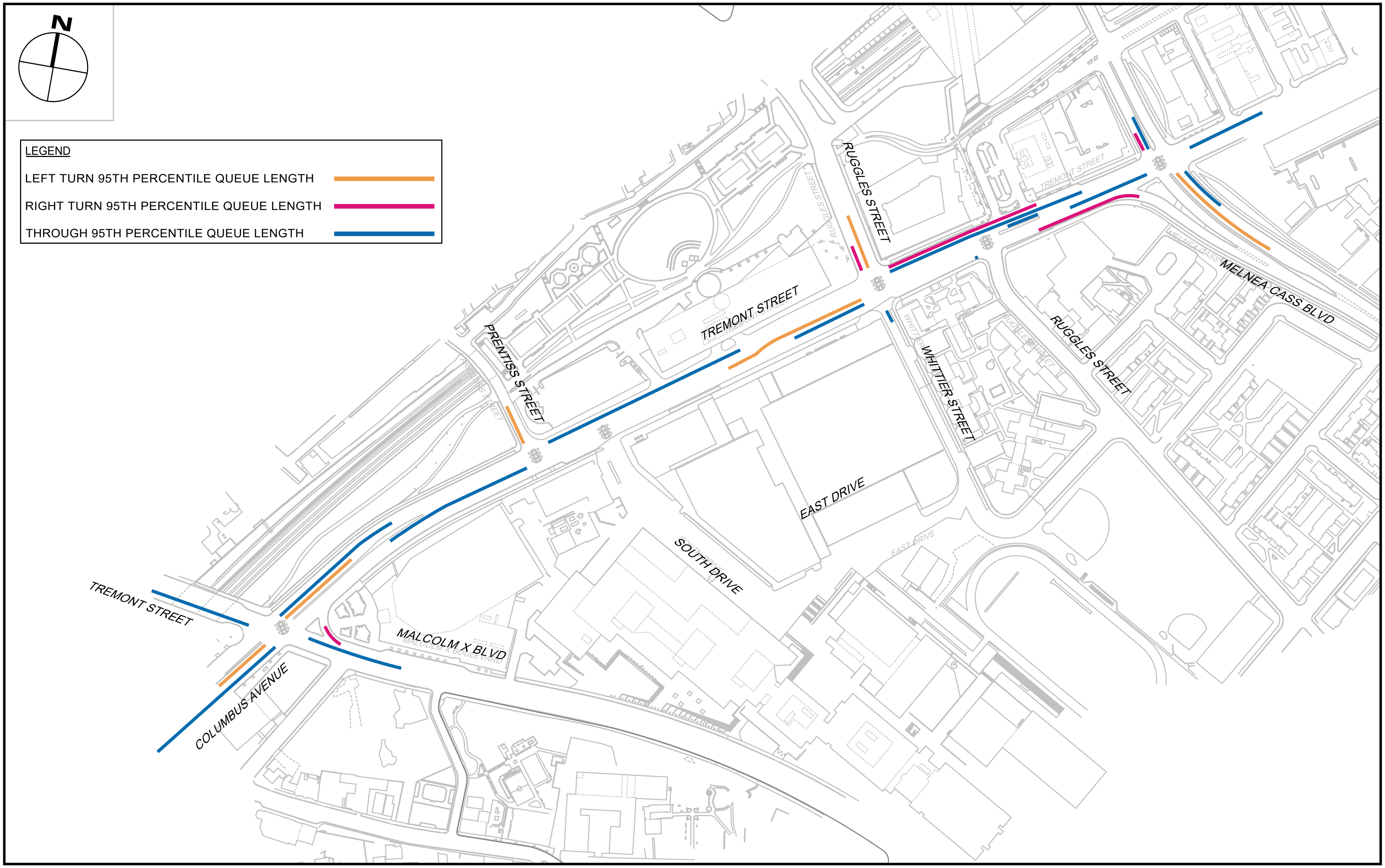
2021 No Build Condition Weekday Evening Peak Hour Queue Lengths
Tremont Crossing
Boston, MA

DPIR, August 2016

SCALE: 1" = 350'

0 175' 350'

BSC GROUP

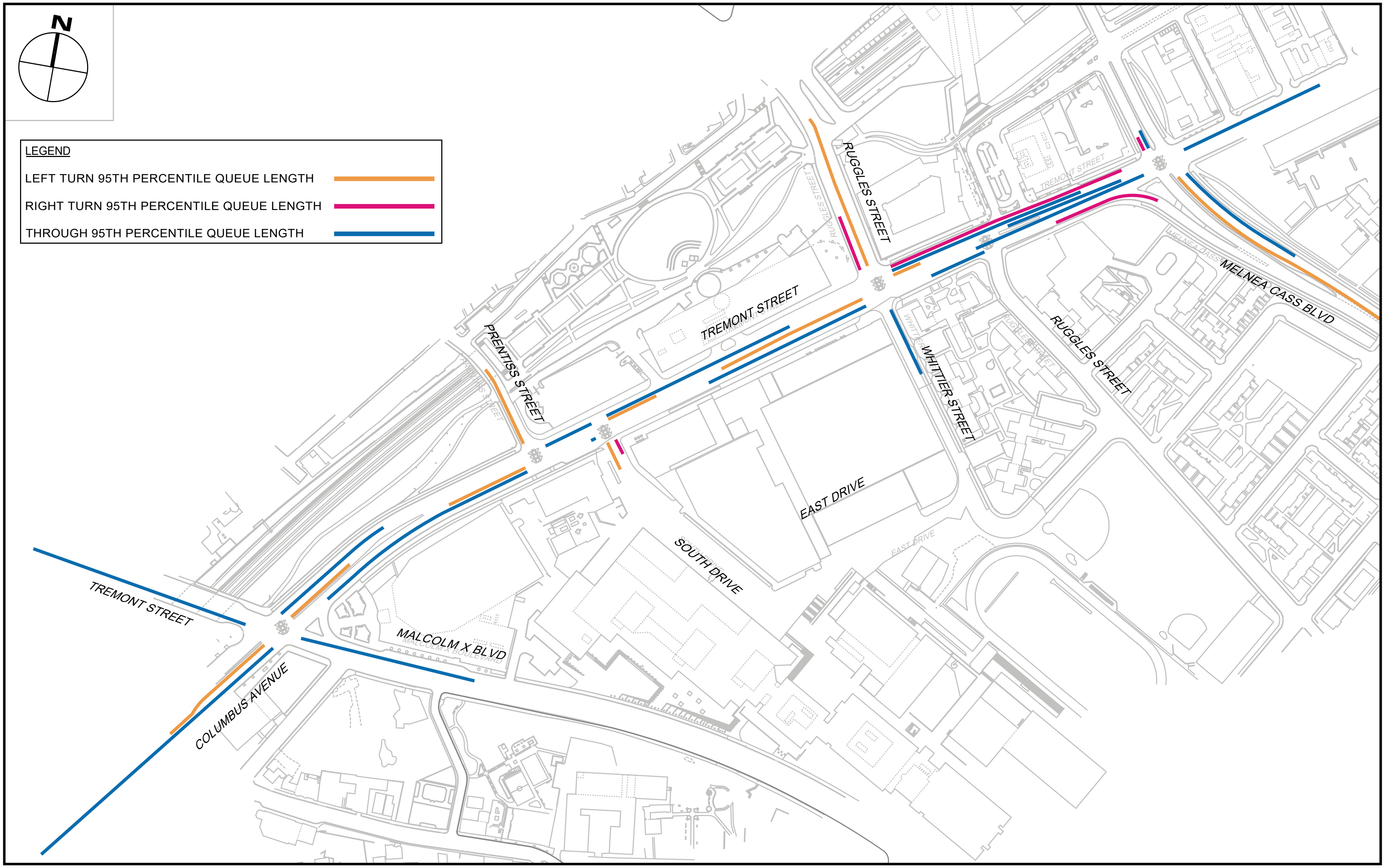


2021 No Build Condition Saturday Midday Peak Hour Queue Lengths
Tremont Crossing
Boston, MA

SCALE: 1" = 350'
0 175' 350'

DPIR, August 2016

BSC GROUP



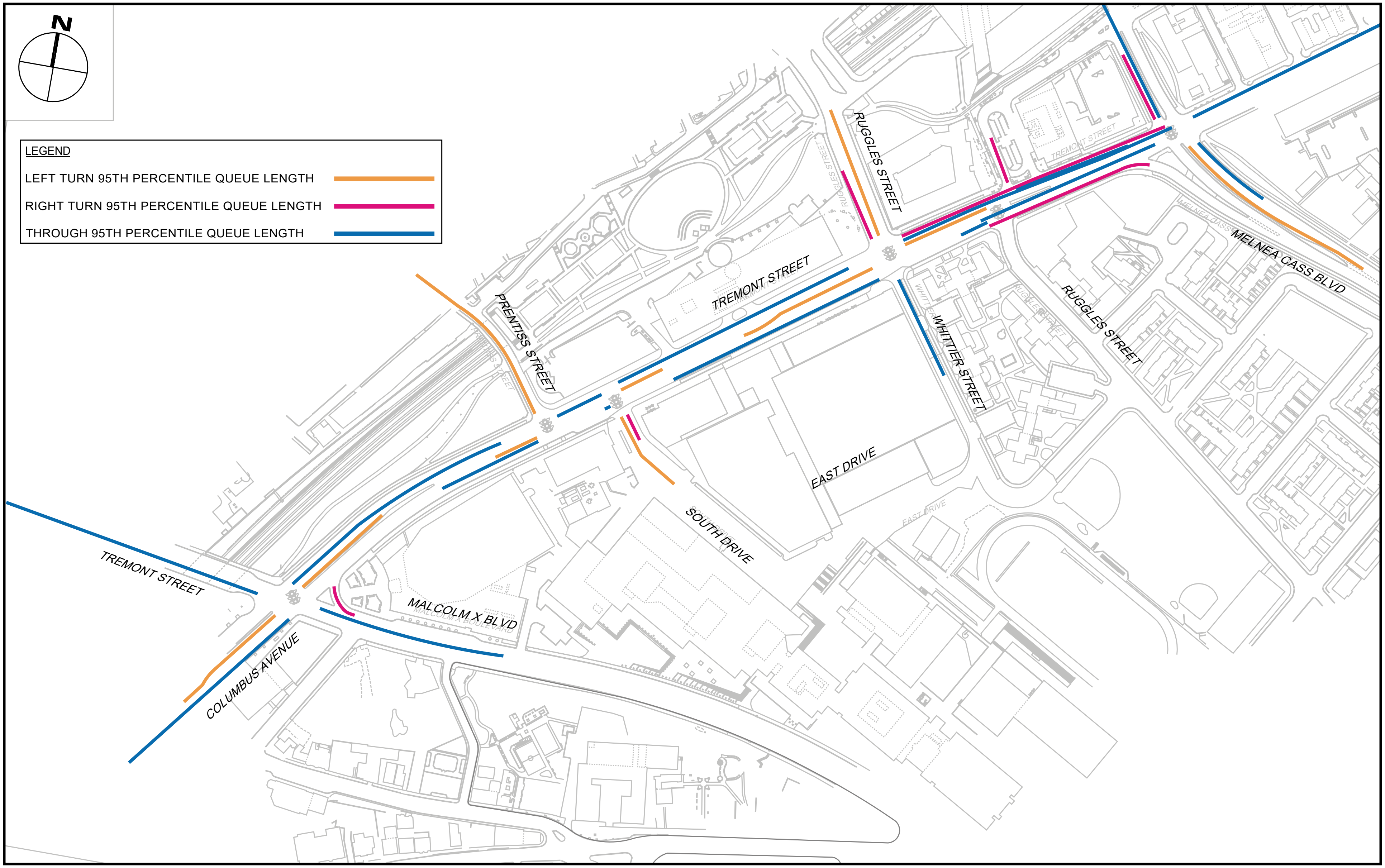
2021 Build Condition Weekday Morning Peak Hour Queue Lengths
Tremont Crossing
Boston, MA

DPIR, August 2016

SCALE: 1" = 350'

0 175' 350'

BSC GROUP

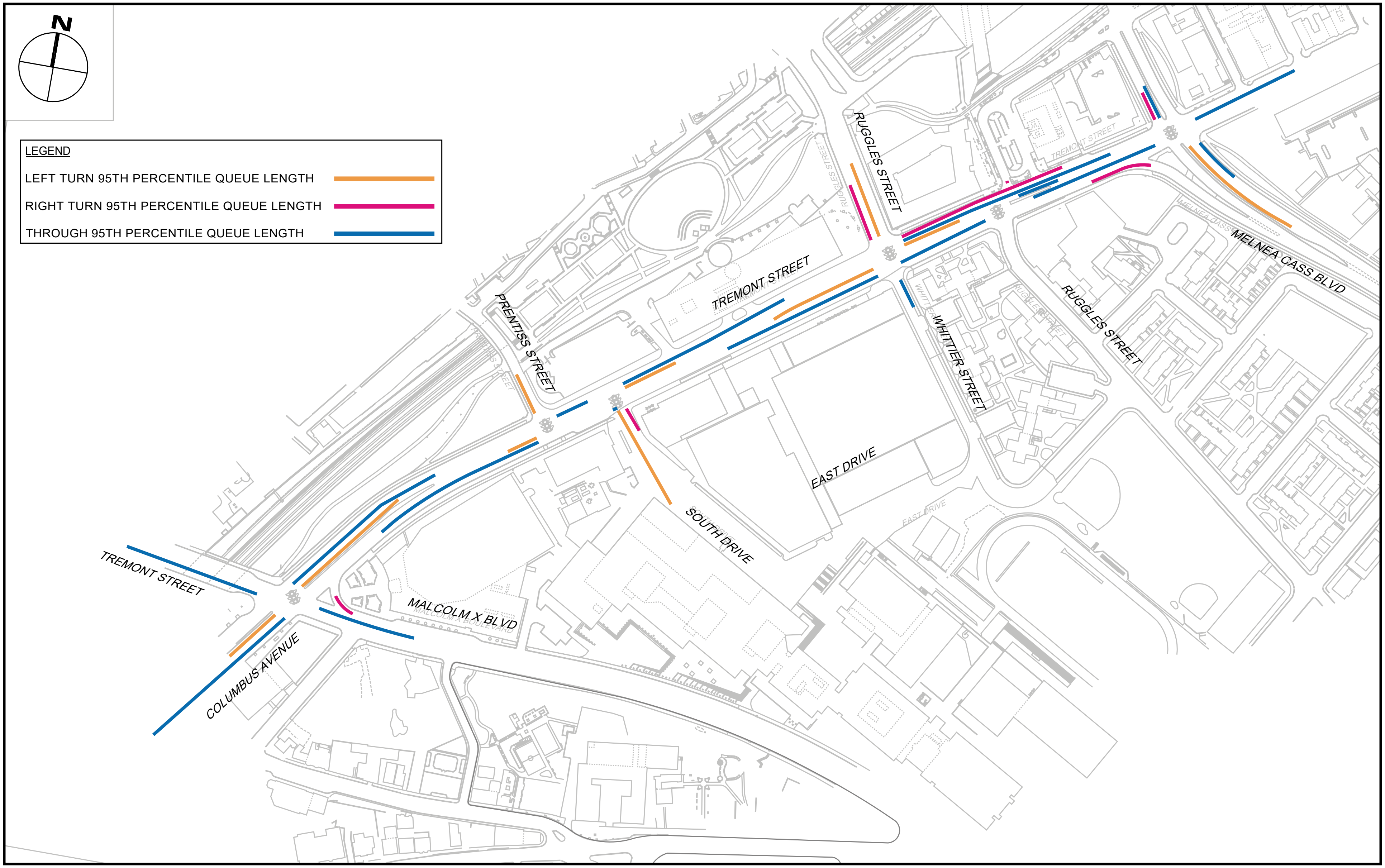


2021 Build Condition Weekday Evening Peak Hour Queue Lengths
Tremont Crossing
Boston, MA

DPIR, August 2016

SCALE: 1" = 350'
0 175' 350'

BSC GROUP



2021 Build Condition Saturday Midday Peak Hour Queue Lengths
Tremont Crossing
Boston, MA

DPIR, August 2016

SCALE: 1" = 350'
0 175' 350'

BSC GROUP

Appendix I: Proposed Improvement Plans

Figure App 2-I-1: Tremont St. Dimensions @ Whittier St.

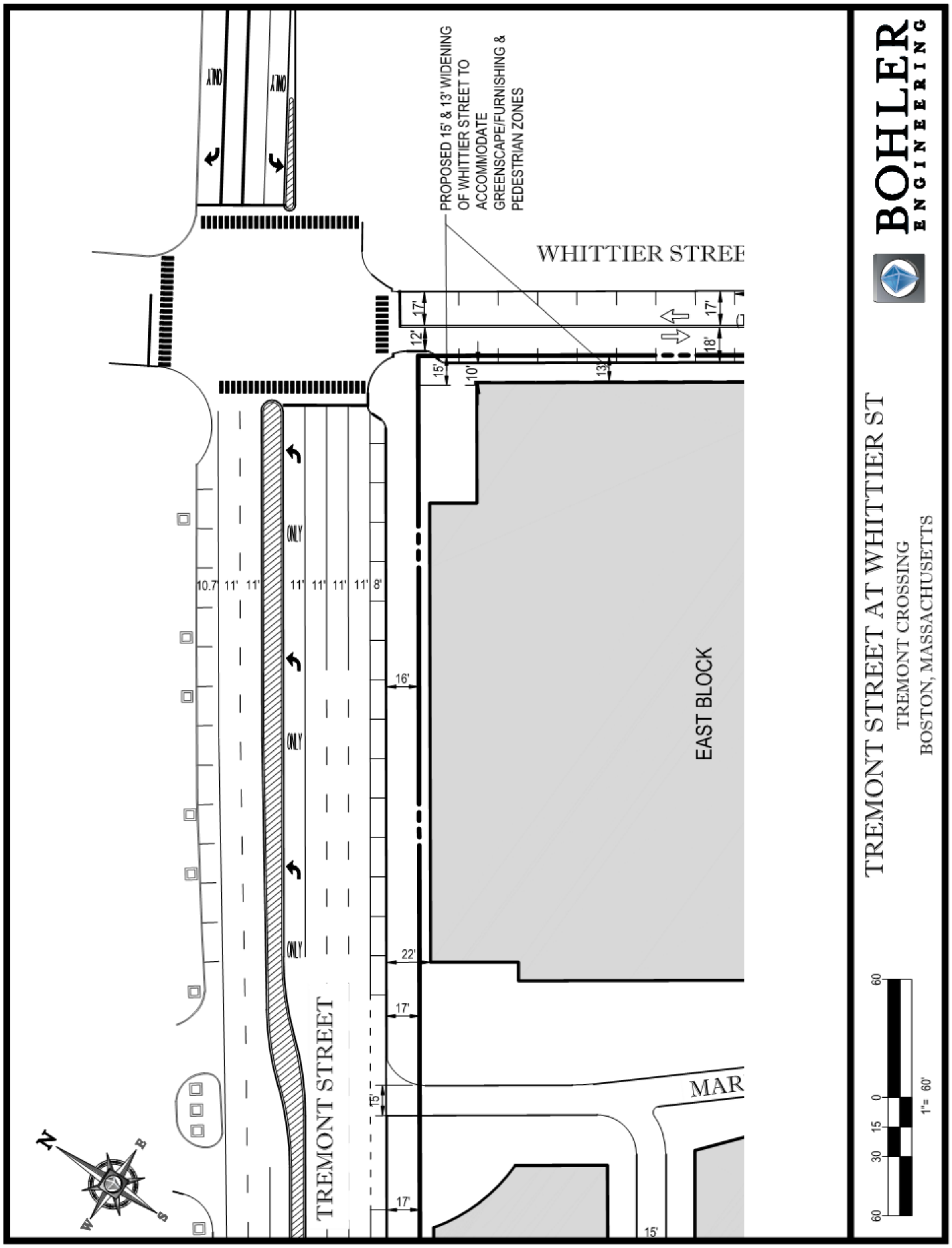


Figure App 2-I-2: Tremont St. Dimensions @ South Dr.

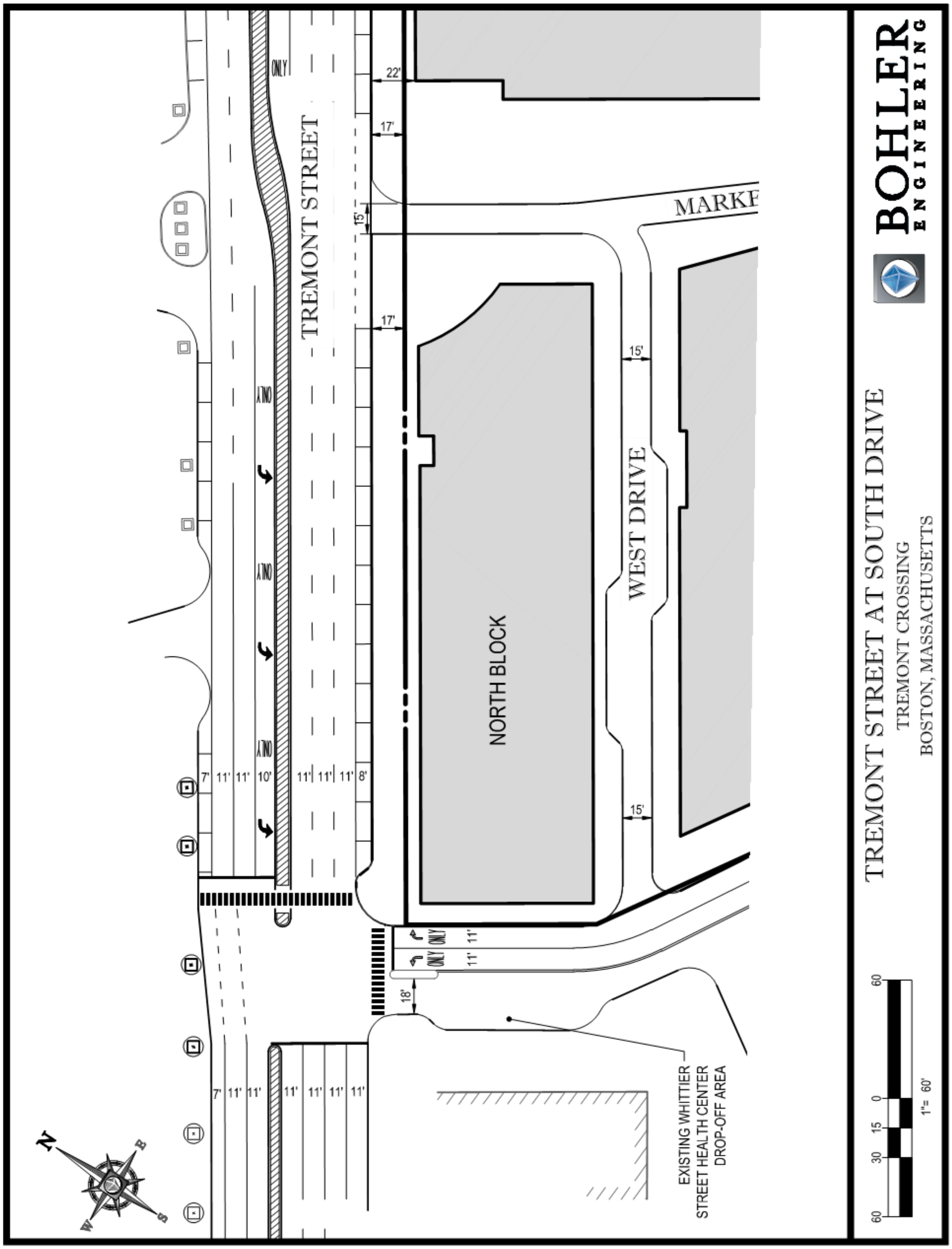


Figure App 2-I-3: South Dr. Dimensions

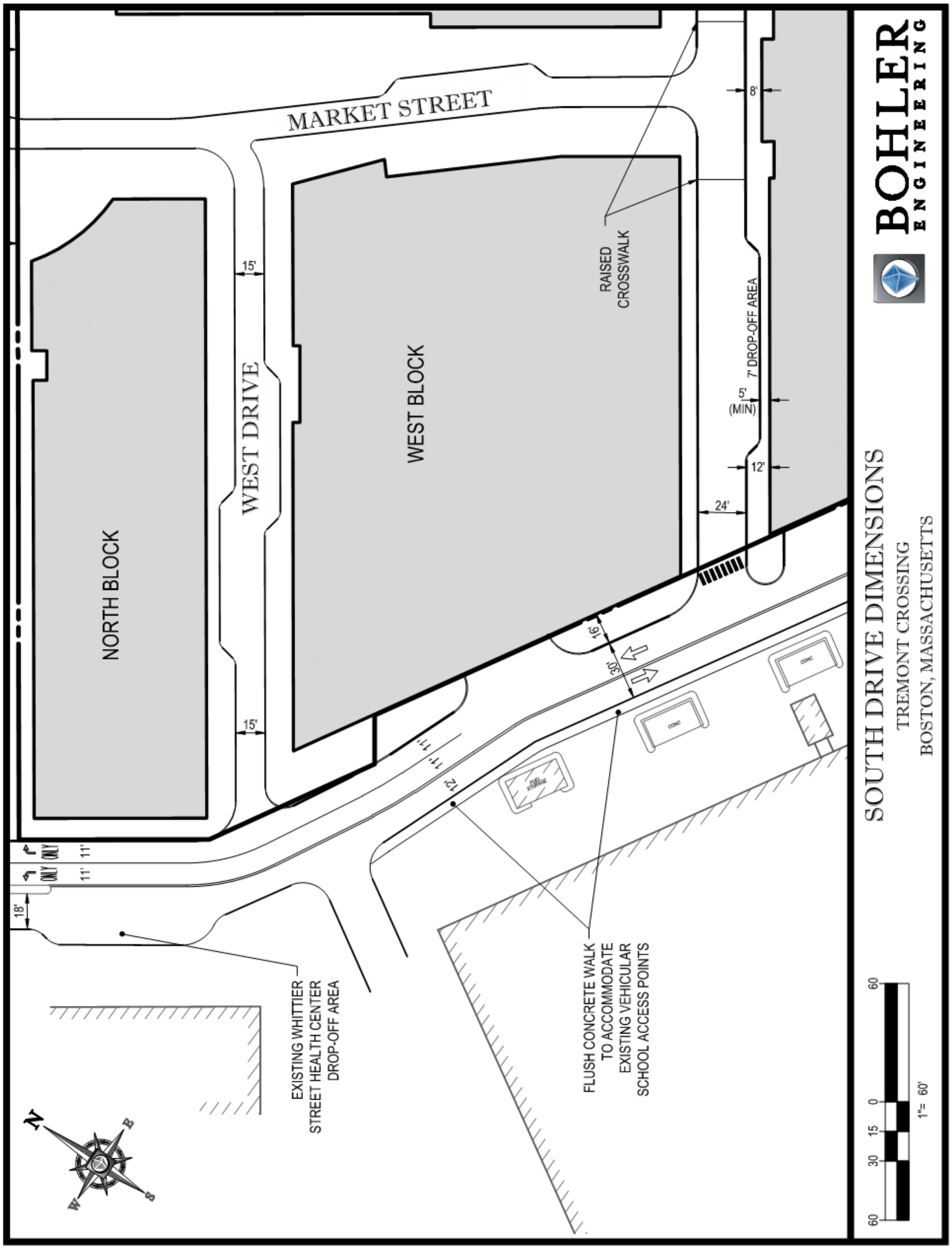


Figure App 2-I-4: East Dr. Dimensions

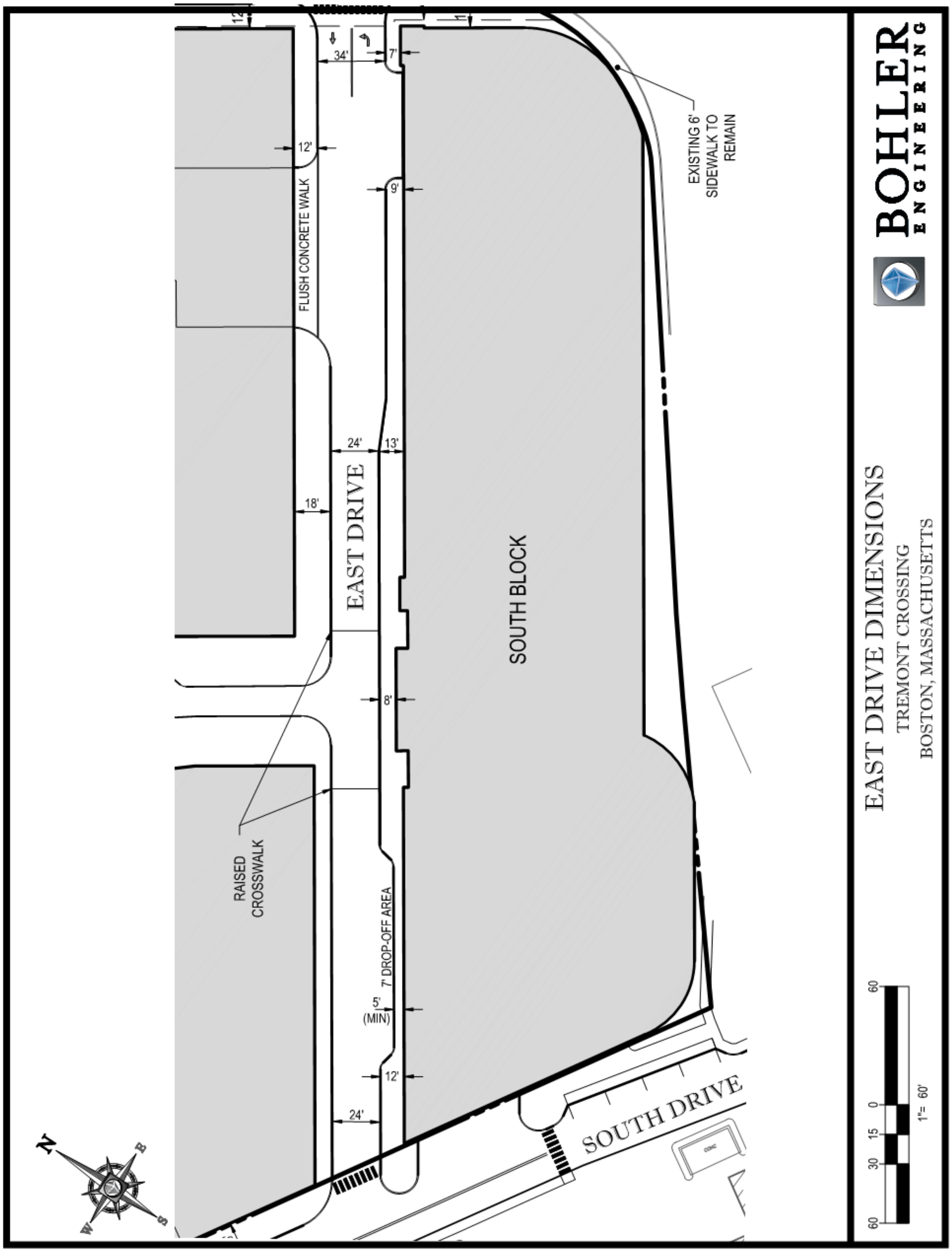
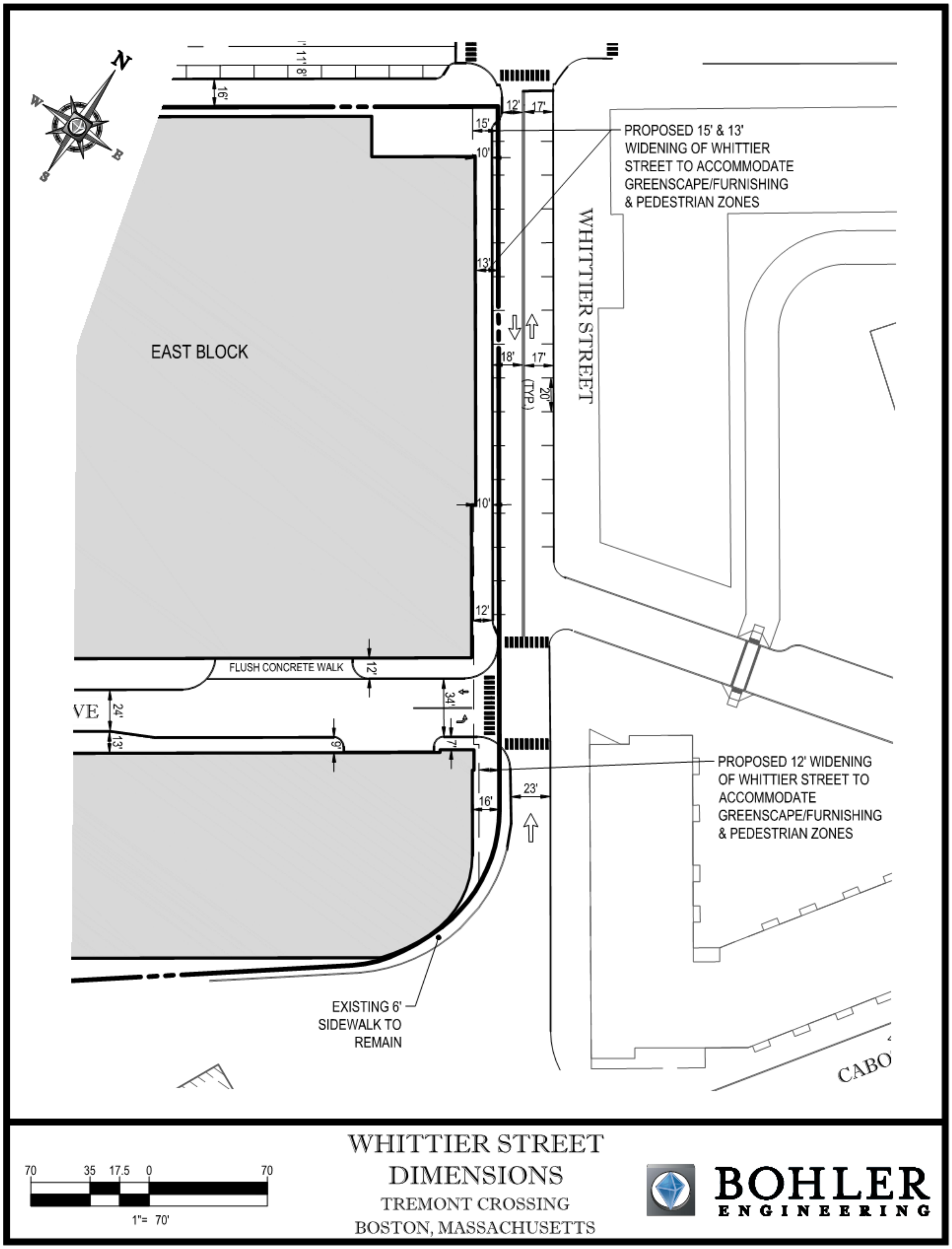


Figure App 2-I-5: Whittier St. Dimensions



PROPOSED 15' & 13' WIDENING OF WHITTIER STREET TO ACCOMMODATE GREENSCAPE/FURNISHING & PEDESTRIAN ZONES

PROPOSED 12' WIDENING OF WHITTIER STREET TO ACCOMMODATE GREENSCAPE/FURNISHING & PEDESTRIAN ZONES

EXISTING 6' SIDEWALK TO REMAIN

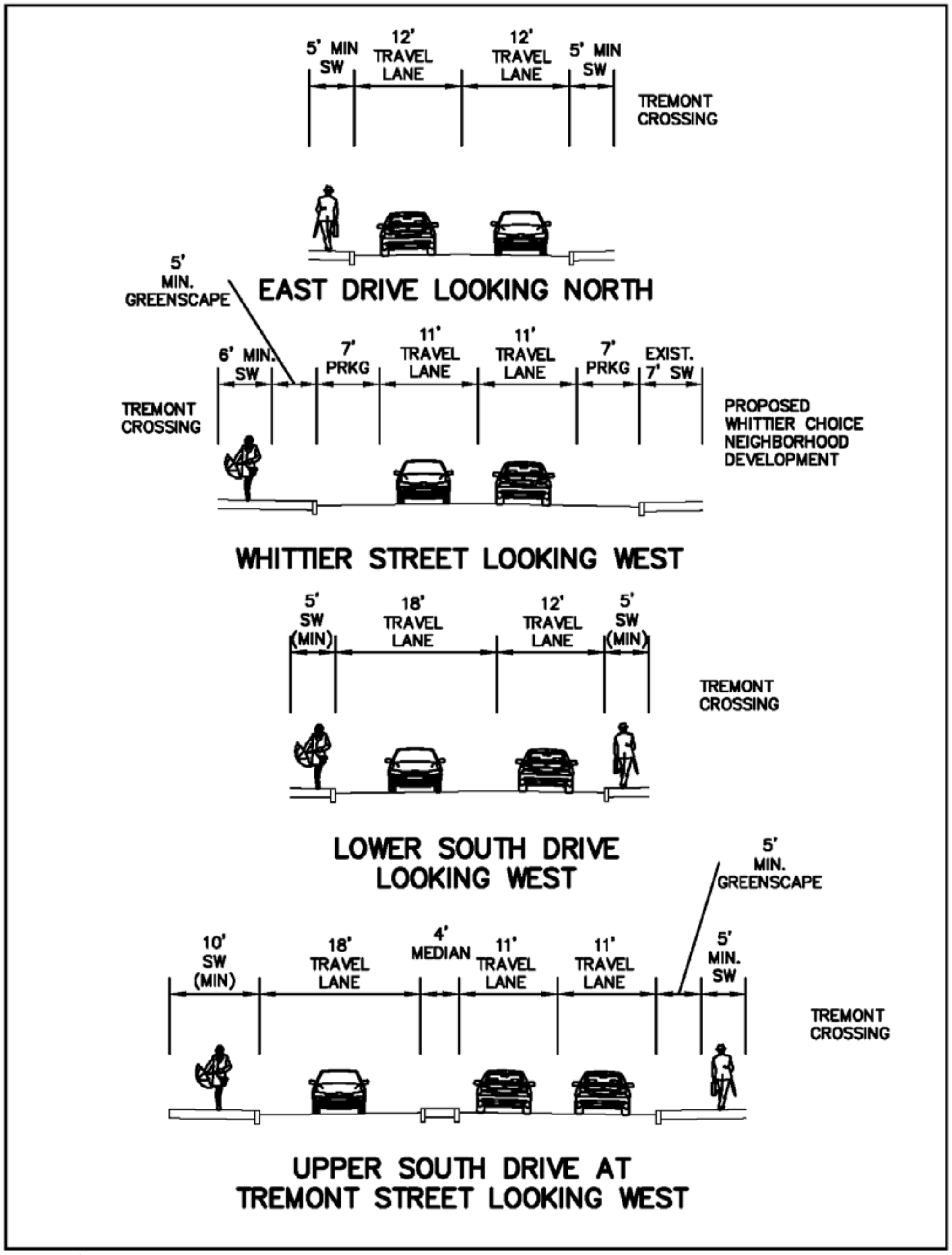
WHITTIER STREET DIMENSIONS

TREMONT CROSSING

BOSTON, MASSACHUSETTS

BOHLER ENGINEERING

Figure App 2-I-6: Proposed Roadway Cross Sections



Proposed Cross Sections
Tremont Crossing
Boston, Massachusetts

Not to Scale

BSC GROUP

Figure App 2-I-7: Large Truck Turning Template - Entering

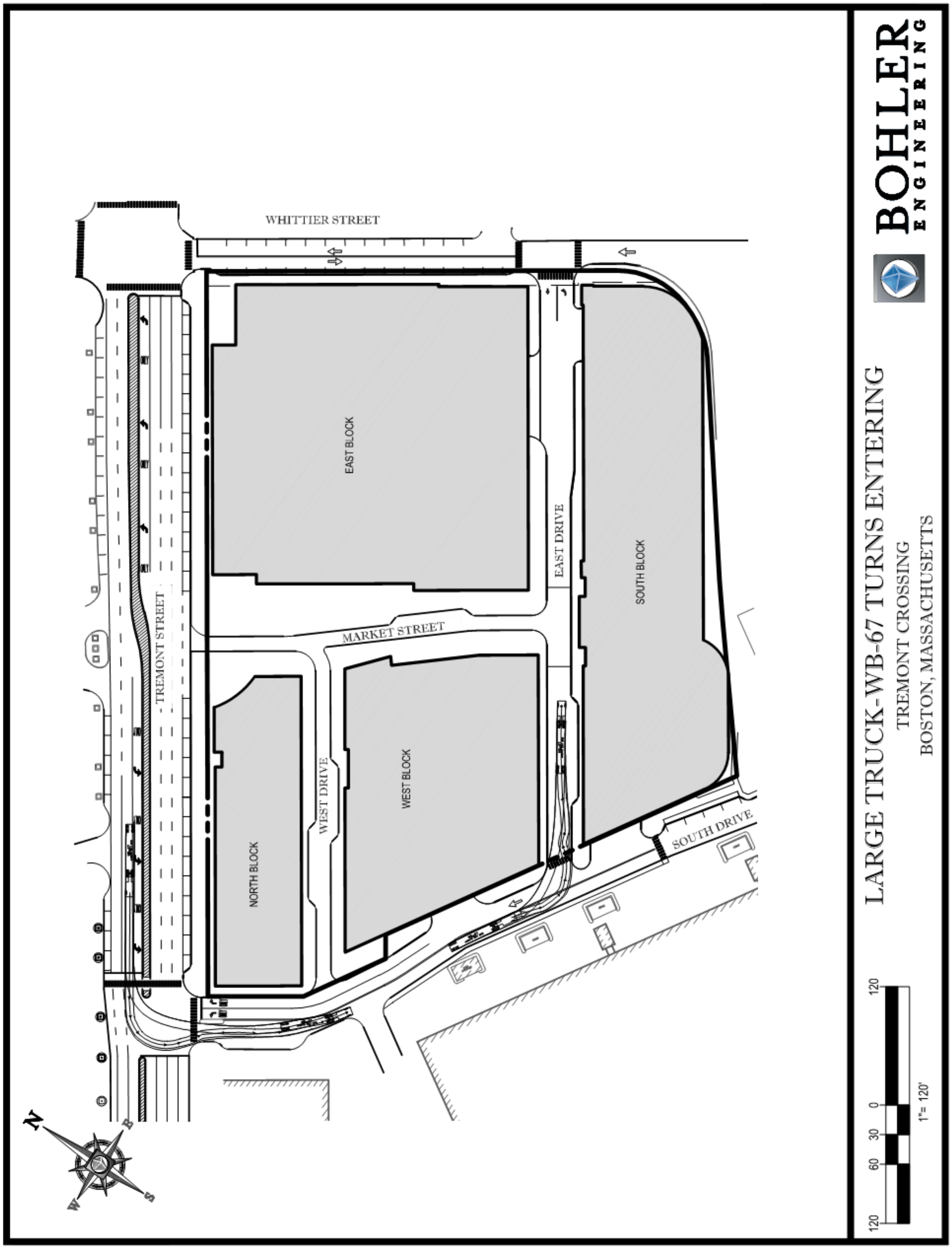


Figure App 2-I-8:Large Truck Turning Template - Existing

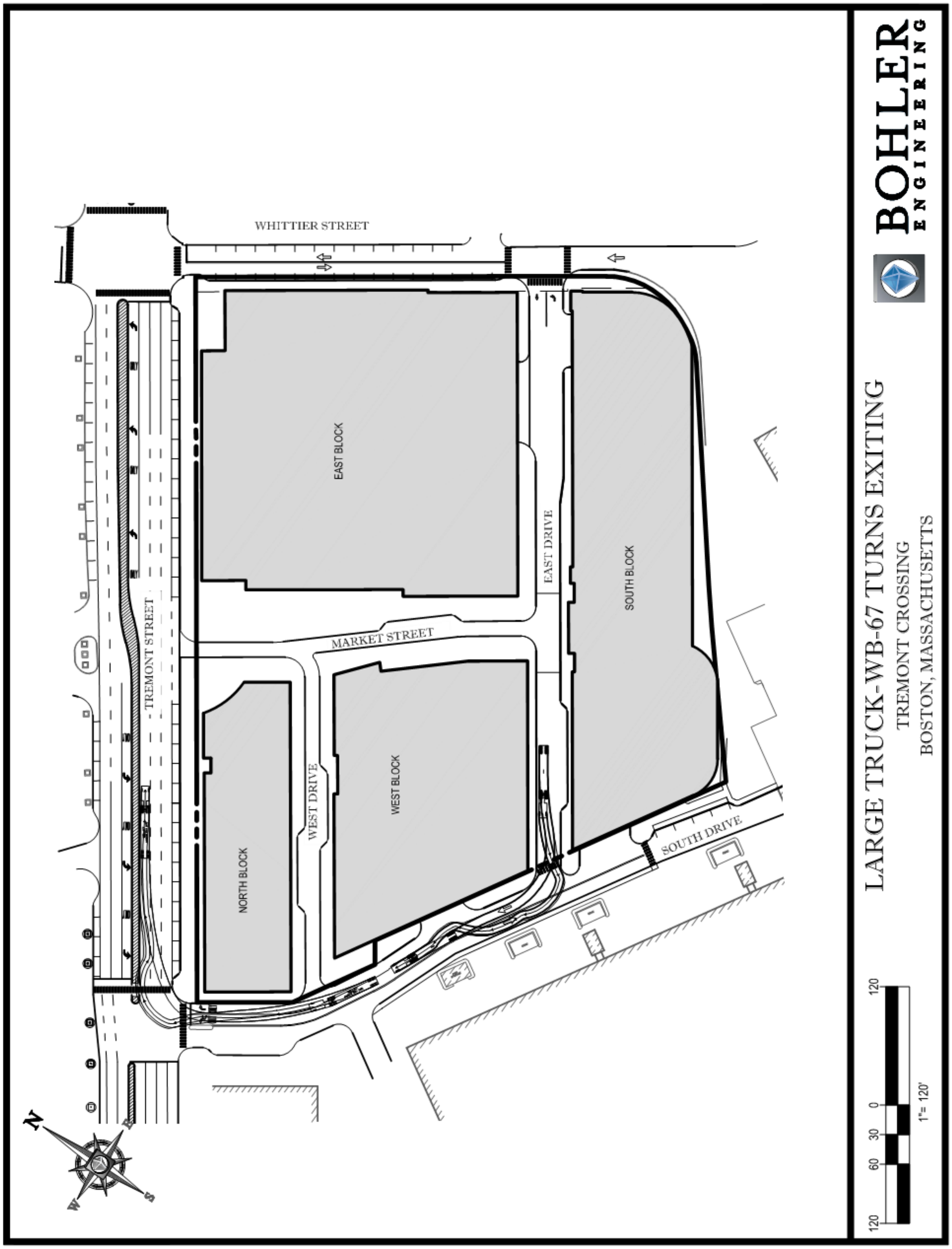


Figure App 2-I-9: Large Truck Turning Template - Loading

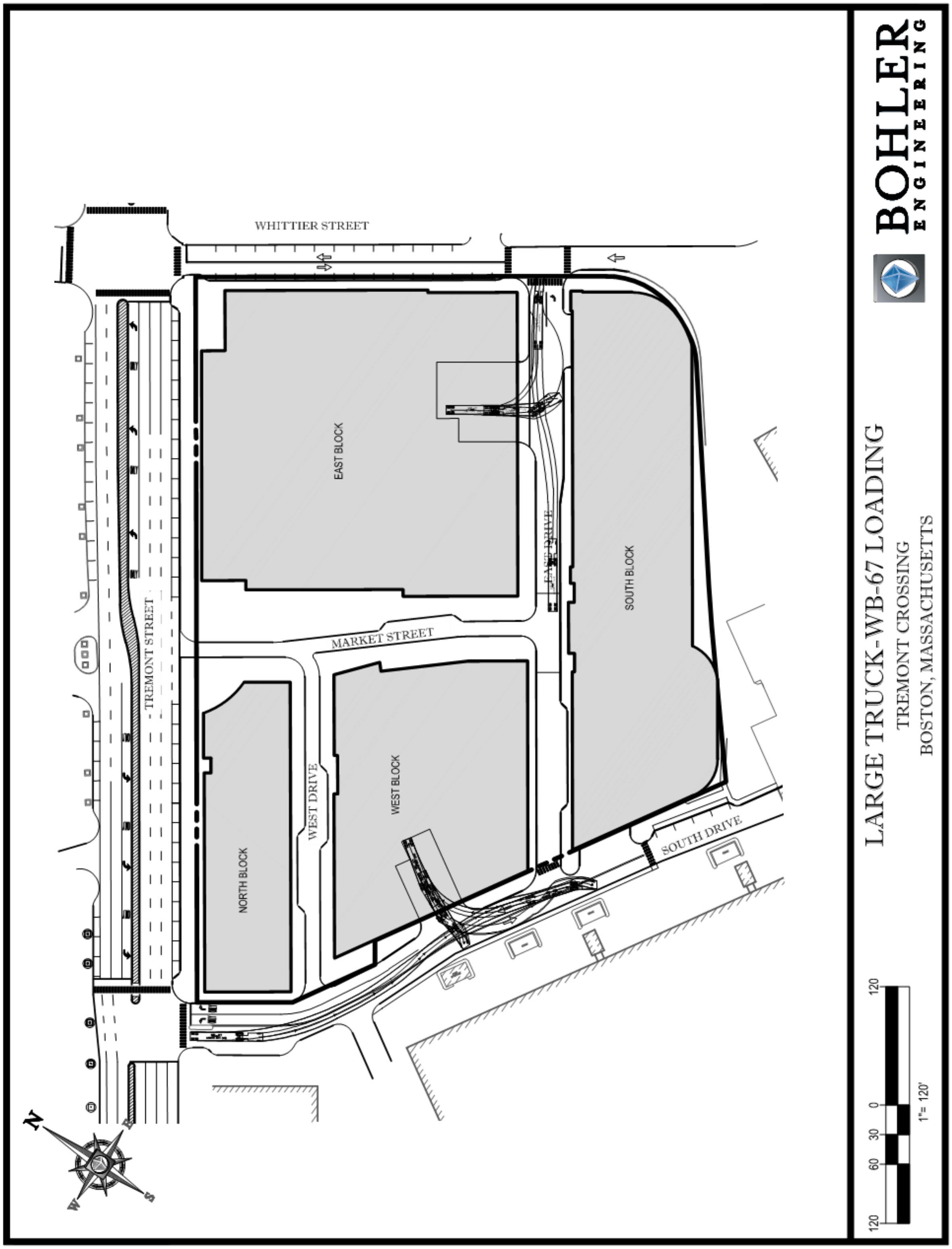
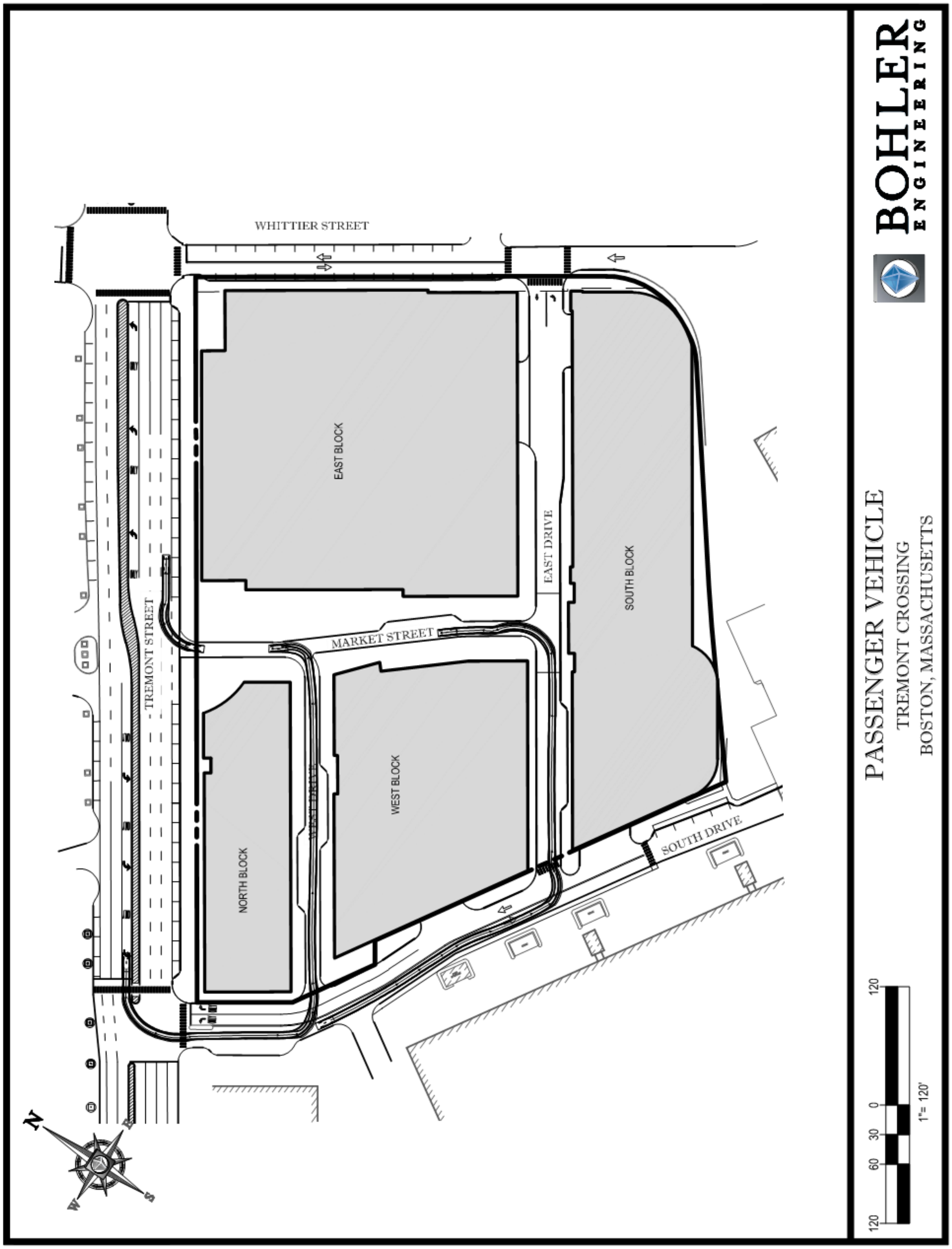


Figure App 2-I-10: Passenger Vehicle Turning Template - Market St.



APPENDIX 3

WIND ANALYSIS

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Tremont Crossing
Boston, Massachusetts

Draft Report

Pedestrian Wind Study
RWDI # 1601270
August 5, 2016

SUBMITTED TO

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Appendix A: Drawing List for Model Construction

1. INTRODUCTION

A pedestrian wind study was conducted on the proposed Tremont Crossing development located in Boston, Massachusetts. The objective of the study was to assess the effect of the proposed development on local conditions in pedestrian areas around the study site and provide recommendations for minimizing adverse effects.

The study involved wind simulations on a 1:300 scale model of the proposed building and surroundings. These simulations were then conducted in RWDI’s boundary-layer wind tunnel at Guelph, Ontario, for the purpose of quantifying local wind speed conditions and comparing to appropriate criteria for gauging wind comfort in pedestrian areas. A list of the drawings used for the construction of the model can be found in Appendix A. The criteria recommended by the Boston Redevelopment Authority (BRA) were used in this study. The present report describes the methods and presents the results of the wind tunnel simulations.

2. OVERVIEW

Major buildings, especially those that protrude above their surroundings, often cause increased local wind speeds at the pedestrian level. Typically, wind speeds increase with elevation above the ground surface, and taller buildings intercept these faster winds and deflect them down to the pedestrian level. The funneling of wind through gaps between buildings and the acceleration of wind around corners of buildings may also cause increases in wind speed. Conversely, if a building is surrounded by others of equivalent height, it may be protected from the prevailing upper-level winds, resulting in no significant changes to the local pedestrian-level wind environment. The most effective way to assess potential pedestrian-level wind impacts around a proposed new building is to conduct scale model tests in a wind tunnel.

The consideration of wind in planning outdoor activity areas is important since high winds in an area tend to deter pedestrian use. For example, winds should be light or relatively light in areas where people would be sitting, such as outdoor cafes or playgrounds. For bus stops and other locations where people would be standing, somewhat higher winds can be tolerated. For frequently used sidewalks, where people are primarily walking, stronger winds are acceptable. For infrequently used areas, the wind comfort criteria can be relaxed even further. The actual effects of wind can range from pedestrian inconvenience, due to the blowing of dust and other loose material in a moderate breeze, to severe difficulty with walking due to the wind forces on the pedestrian.

3. METHODOLOGY

Information concerning the site and surroundings was derived from: site photographs; information on surrounding buildings and terrain; site plans and elevations of the proposed development provided by the design team. The following configurations were simulated:

No Build Configuration:	includes all existing and approved surrounding buildings, including Whittier Choice Phase 1;

Build Configuration:	includes the proposed Tremont Crossing and all existing and approved surroundings; and,
Full Build Configuration:	includes the proposed Tremont Crossing, the future Whittier Choice Phase 2 and all existing and approved surroundings.

As shown in Figures 1a through 1c, the wind tunnel model included the proposed development and all relevant surrounding buildings and topography within a 1200 ft radius of the study site. The mean speed profile and turbulence of the natural wind approaching the modelled area were also simulated in RWDI's boundary layer wind tunnel. The scale model was equipped with 138 specially designed wind speed sensors that were connected to the wind tunnel's data acquisition system to record the mean and fluctuating components of wind speed at a full-scale height of 5 feet above grade in pedestrian areas throughout the study site. Wind speeds were measured for 36 wind directions, in 10 degree increments, starting from true north. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the reference wind speed in the free stream above the model. The results were then combined with long-term meteorological data, recorded during the years 1990 to 2015 at Boston's Logan International Airport, in order to predict full scale wind conditions. The analysis was performed separately for each of the four seasons and for the entire year.

Figure 2 presents "wind roses", summarizing the seasonal and annual wind climates in the Boston area, based on the data from Logan Airport. Although the prevailing wind directions change throughout the year from season to season, winds from the easterly, southwesterly and west-northwesterly directions tend to be the most frequent throughout the year. Strong winds (speeds greater than 20 mph, shown by the red bands in the wind rose diagrams of Figure 2) are most frequent during the winter (13.1% of the time). Strong winter winds are most frequently from the southwest and west through northwest. On an annual basis (the last wind rose in Figure 2) the most common wind directions are those between south-southwest and northwest. Winds from the east and east-southeast are also relatively common. In the case of strong winds, winds from the southwesterly and west-northwesterly direction are most common, with winds from the northeasterly directions also being relatively frequent.

This study involved state-of-the-art measurement and analysis techniques to predict wind conditions at the study site. Nevertheless, some uncertainty remains in predicting wind comfort, and this must be kept in mind. For example, the sensation of comfort among individuals can be quite variable. Variations in age, individual health, clothing, and other human factors can change a particular response of an individual. The comfort limits used in this report represent an average for the total population. Also, unforeseen changes in the project area, such as the construction or removal of buildings, can affect the conditions experienced at the site. Finally, the prediction of wind speeds is necessarily a statistical procedure. The wind speeds reported are for the frequency of occurrence stated (one percent of the time). Higher wind speeds will occur but on a less frequent basis.

4. PEDESTRIAN WIND COMFORT CRITERIA

The BRA has adopted two standards for assessing the relative wind comfort of pedestrians. First, the BRA wind design guidance criterion states that an effective gust velocity (hourly mean wind speed +1.5 times the root-mean-square wind speed) of 31 mph should not be exceeded more than one percent of the time. The second set of criteria used by the BRA to determine the acceptability of specific locations is based on the work of Melbourne[1]. This set of criteria is used to determine the relative level of pedestrian wind comfort for activities such as sitting, standing, or walking. The criteria are expressed in terms of benchmarks for the 1-hour mean wind speed exceeded 1% of the time (i.e., the 99-percentile mean wind speed). They are as follows:

BRA Mean Wind Criteria*

Dangerous	> 27 mph
Uncomfortable for Walking	> 19 and ≤ 27 mph
Comfortable for Walking	> 15 and ≤ 19 mph
Comfortable for Standing	> 12 and ≤ 15 mph
Comfortable for Sitting	< 12 mph

* Applicable to the hourly mean wind speed exceeded one percent of the time.

The wind climate found in a typical downtown location in Boston is generally comfortable for the pedestrian use of sidewalks and thoroughfares and meets the BRA effective gust velocity criterion of 31 mph. However, without any mitigation measures, this wind climate is likely to be frequently uncomfortable for more passive activities such as sitting.

5. TEST RESULTS

Table 1 presents the mean and effective gust wind speeds for each season, as well as those on an annual basis. Tables 2a and 2b presents the change in mean wind speed categories from the No Build to Build conditions and from No Build to Full Build conditions, respectively. Figures 3a through 4c graphically depict the mean and gust wind conditions from Table 1 at each wind measurement location based on the annual winds only. Figures 5a and 5b are graphical representations of the mean speed category changes presented in Tables 2a and 2b, respectively. Typically the summer and fall winds tend to be more comfortable than the annual winds, while the winter and spring winds are less comfortable than the annual winds. The following discussion of pedestrian wind comfort is based on the annual winds for each configuration tested, except where noted below in the text.

---

[1] Melbourne, W.H., 1978, "Criteria for Environmental Wind Conditions", Journal of Industrial Aerodynamics, 3 (1978) 241 - 249.

5.1 Mean Speed Criterion

A mean speed categorization of walking is considered appropriate for sidewalks. Lower wind speeds conducive to standing are preferred at building entrances. Wind conditions comfortable for sitting are desired around patios during the summer when the areas would be in use.

5.1.1 No Build Configuration

On an annual basis, wind conditions are generally comfortable for walking or better at the project site (Figure 3a). A number of areas are subject to accelerated winds and are categorized as Uncomfortable (Locations 8, 13, 59, 61, 79, 82, 83, 117, 123, 130, 132 and 133 in Figure 3a). There is one location at the intersection of Ruggler Street and Tremont Street that has been identified as Dangerous.

It is noted that certain locations (6, 12, 16, 62, 63, 71, 84, 106, 115, 131 and 138) meet the walking criterion on an annual basis but they are expected to be Uncomfortable during the winter season (see Table 1). Similarly, in addition to location 80, locations 13, 59, 79, 84, 117, 123 and 132 are identified as Dangerous during the winter season.

5.1.2 Build Configuration

The construction of the proposed development is expected to offer sheltering in certain areas around the northwest corner of the proposed development. However, there are a number of locations (1, 33, 36, 39, 42, 45, 46, 50, 53, 55, 56, 70, 71, 72, 74, 79 and 84) that are expected to become Uncomfortable once the proposed development is in place. When compared to the Build configuration, two new locations (73 and 75) are expected to be classified as Dangerous.

As mentioned before, winter conditions tend to be windier than the annual conditions. Thus, certain locations (19, 22, 26, 29, 40, 46, 52, 54, 59, 61, 67, 78, 98 and 123) that meet the walking criterion on an annual basis are expected to be Uncomfortable during the winter season. Similarly, in addition to the annual Dangerous locations mentioned above, locations 1, 38, 39, 53, 56, 71, 83, 84, 117 and 132 are identified as Dangerous during the winter season.

5.1.3 Full Build Configuration

Overall, the wind conditions for the Full Building configuration are very similar to those observed for the Build configuration. In fact, the construction of the Whittier Choice Phase 2 improves the Dangerous wind condition observed at locations 75 and 80 for the Build configuration.

5.2 Effective Gust Criterion

The No Build configuration is expected to have one exceedance (location 80) of the Effective Gust Criterion. However, the criterion is expected to be exceeded at eight additional locations (36, 45, 55, 70 and 72 to 75) for the Build configuration. For the Full Build configuration, the Effective Gust Criterion is exceeded at 3 additional locations (56, 76 and 84).

6. RECOMMENDATIONS

Based on the results and our understanding of which areas are considered critical, it is recommended that the following mitigation measures be incorporated into the design of the project.

Based on discussions with the design team, we understand that the recommendations advanced herein are in the process of being incorporated into the project, so that the unacceptable wind conditions reported here are likely to be mitigated in the final design.

The exact nature and configuration of mitigation can be confirmed through additional quantitative (wind tunnel) tests.

6.1 East Block

The large 3-story podium, setbacks and tapering of the tower and the overhang along Tremont Street are all positive wind control features that should be retained and enhanced in the final design. One of the most effective measures to reduce the wind activity at the northeast corner of the East Block is to setback the tower further from Whittier Street as shown in Image 1. If this is not feasible, the following wind control measures can be considered and photo examples are provided in Images 2 to 5.

- Locate main entrances away from the northeast building corner;
- Enhance the landscaping design at this corner to include coniferous species and hardscape such as trellises, canopies, screens and street art; and
- Recess Tremont Street entrances from the building façade and install wind screens on the west side of these entrances.

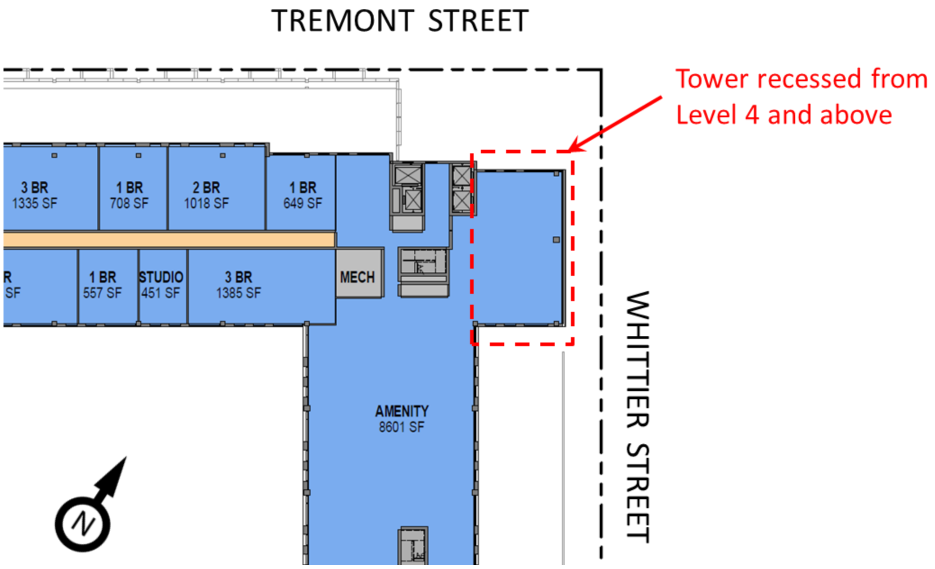


Image 1 – Proposed Tower Recession from Whittier Street

Image 2 – Examples of Trellises and Canopies

Image 3 – Examples of Wind Screens and Artwork

Image 4 – Examples of Landscape

Image 5 – Examples of Recessed Entrances

6.2 West Block

The following recommendations are given to improve the conditions around the West Block:

- If a main entrance has to be placed at the northeast corner of the West block, it should be located on the east side of the corner on the concaved facade to reduce the direct exposure to the westerly and northwesterly winds. Additional wind control measures in the form of landscaping, wind screens and canopies will also be beneficial; and

- All entrances along the north and west facades should be recessed, or wind screens should be installed on each side of the entrances.

6.3 Central Plaza

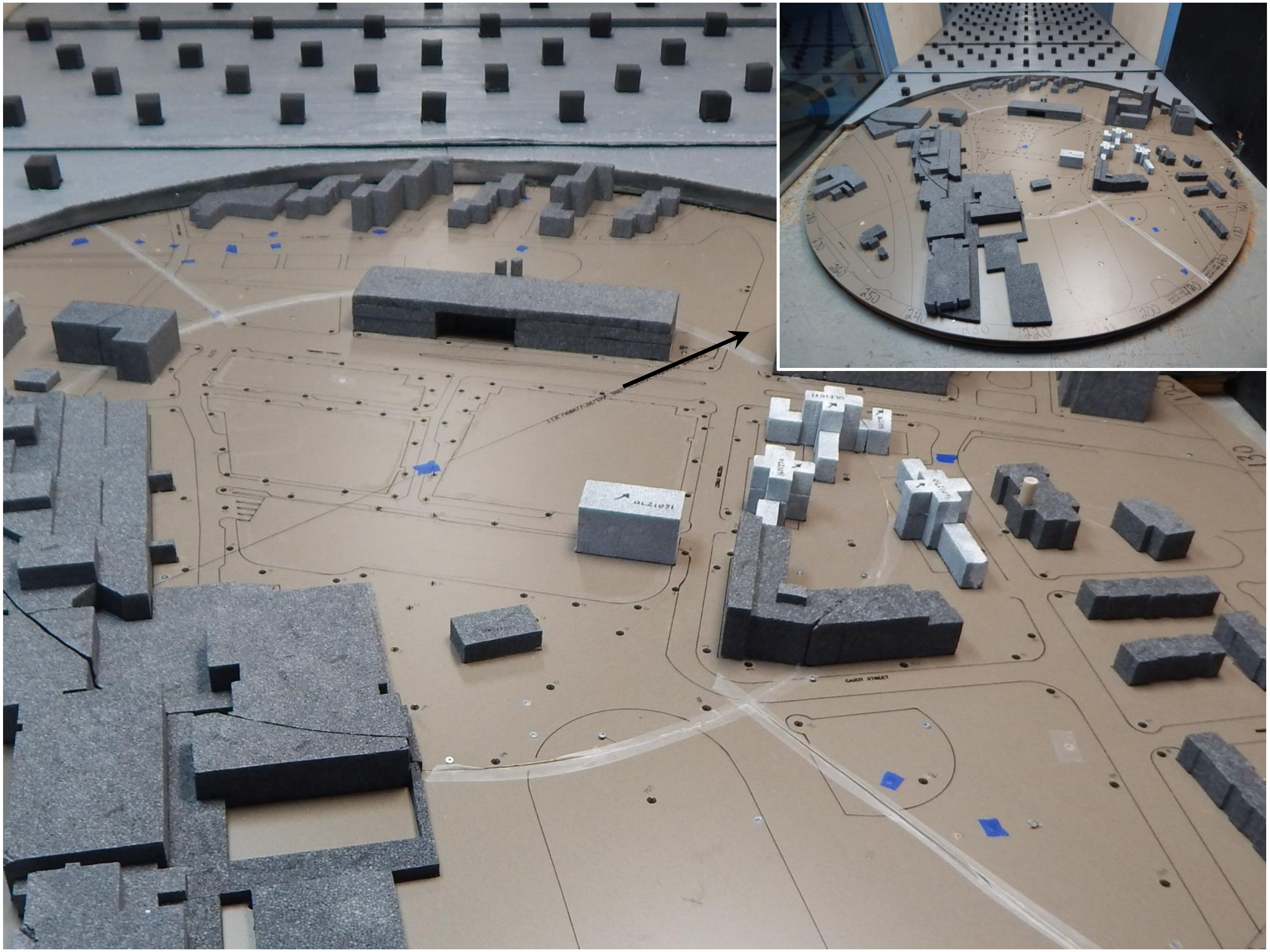
The landscape proposed along the Central Plaza (Image 6) should be complemented with canopies above main entrances and perhaps supplementary wind screens

Image 6 – Proposed landscape along the Central Plaza

7. APPLICABILITY OF RESULTS

The results presented in this report pertain to the model of the proposed Tremont Crossing development constructed using the architectural design drawings listed in Appendix A. Should there be any design changes that deviate from this list of drawings, the results presented may change. Therefore, if changes in the design are made, it is recommended that RWDI be contacted and requested to review their potential effects on wind conditions.

FIGURES



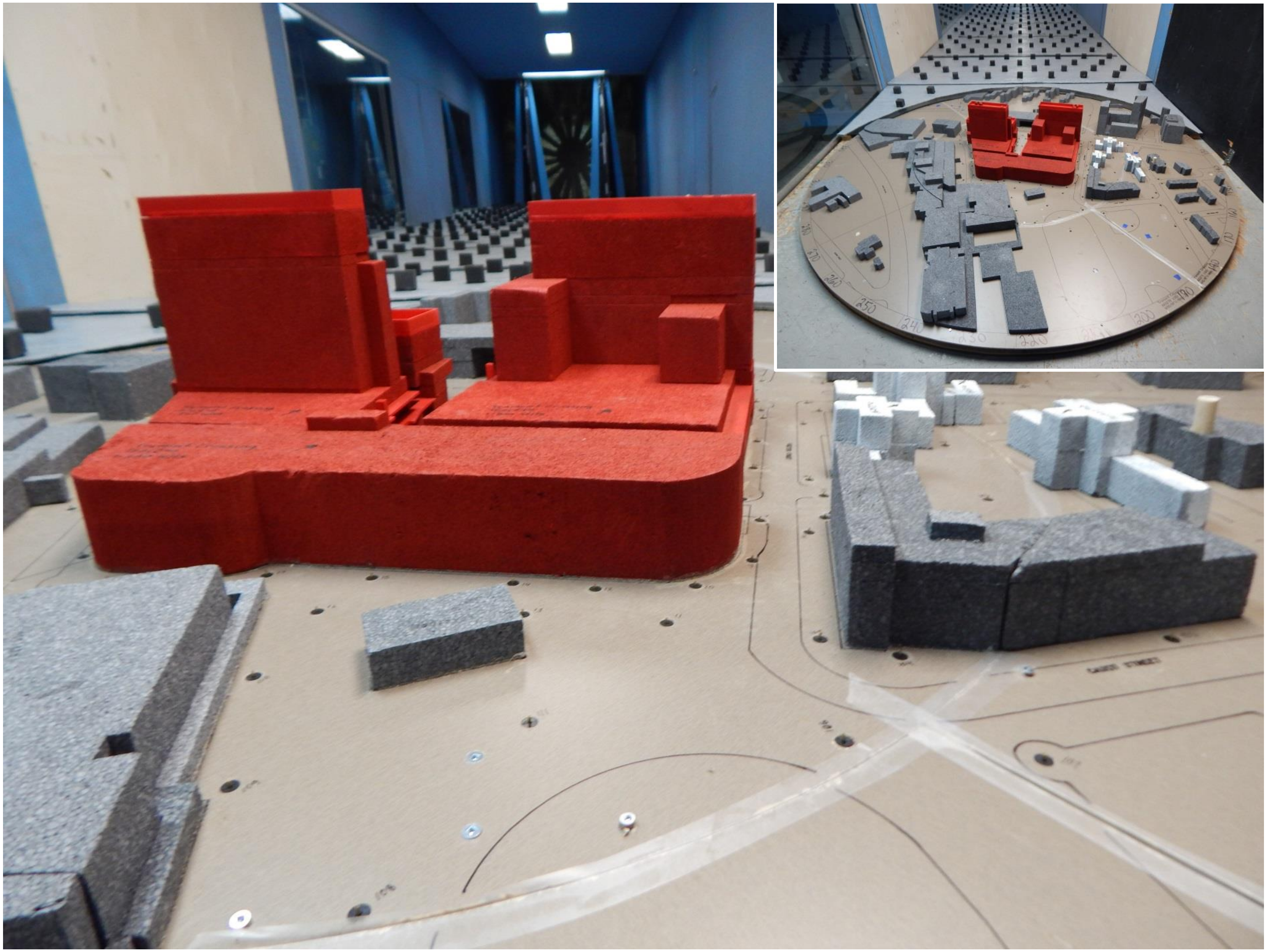
Wind Tunnel Study Model
No Build Configuration

Tremont Crossing – Boston, Massachusetts

Project #1601270

Figure No. 1a

Date: August 5, 2016



Wind Tunnel Study Model

Build Configuration

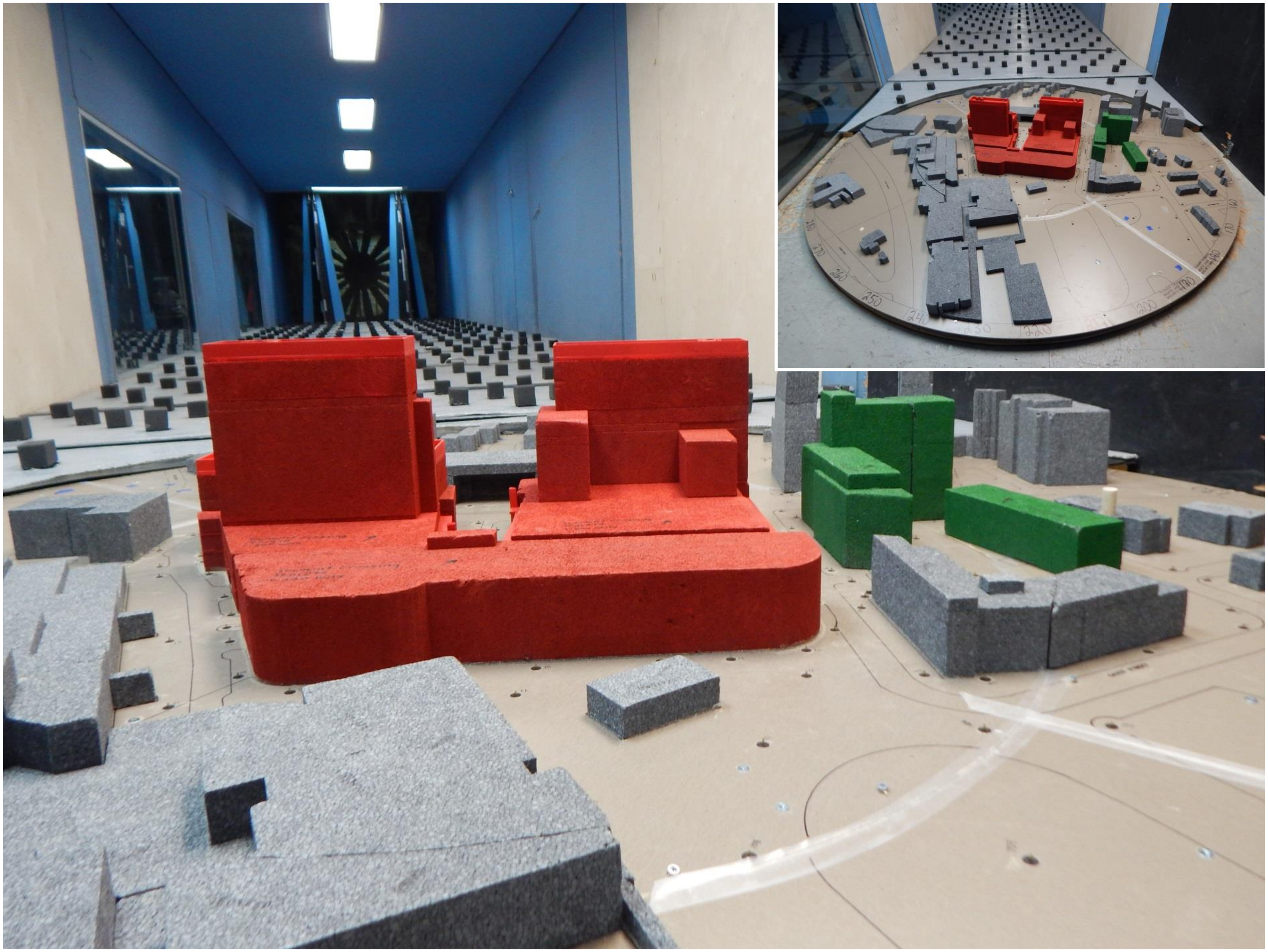
Tremont Crossing – Boston, Massachusetts

Project #1601270

Figure No. 1b

Date: August 5, 2016

RWDI



Wind Tunnel Study Model

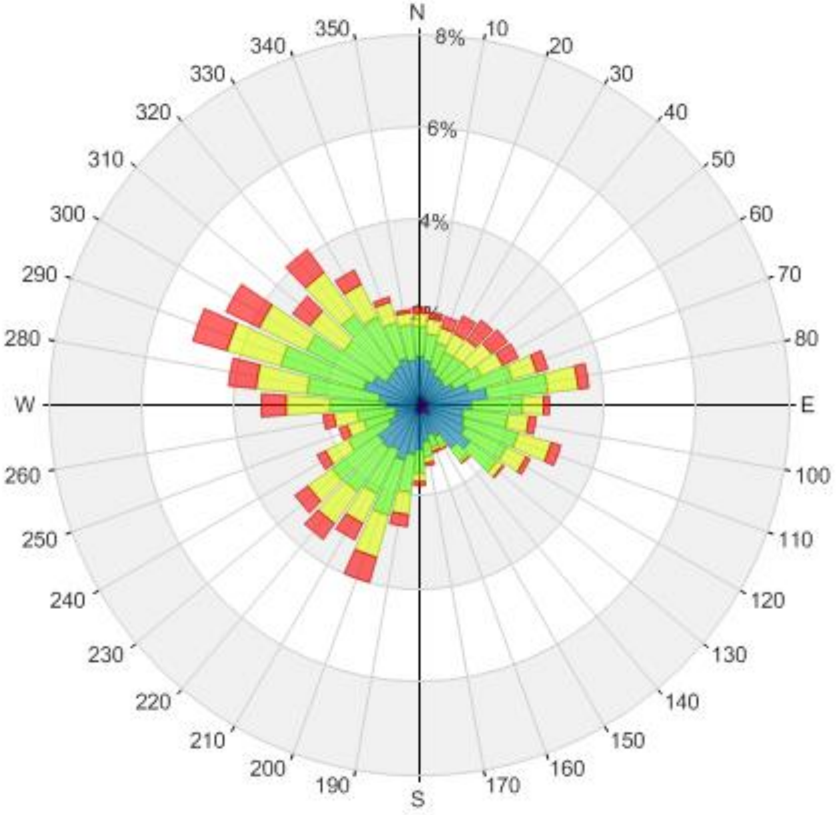
Full Build Configuration

Tremont Crossing – Boston, Massachusetts

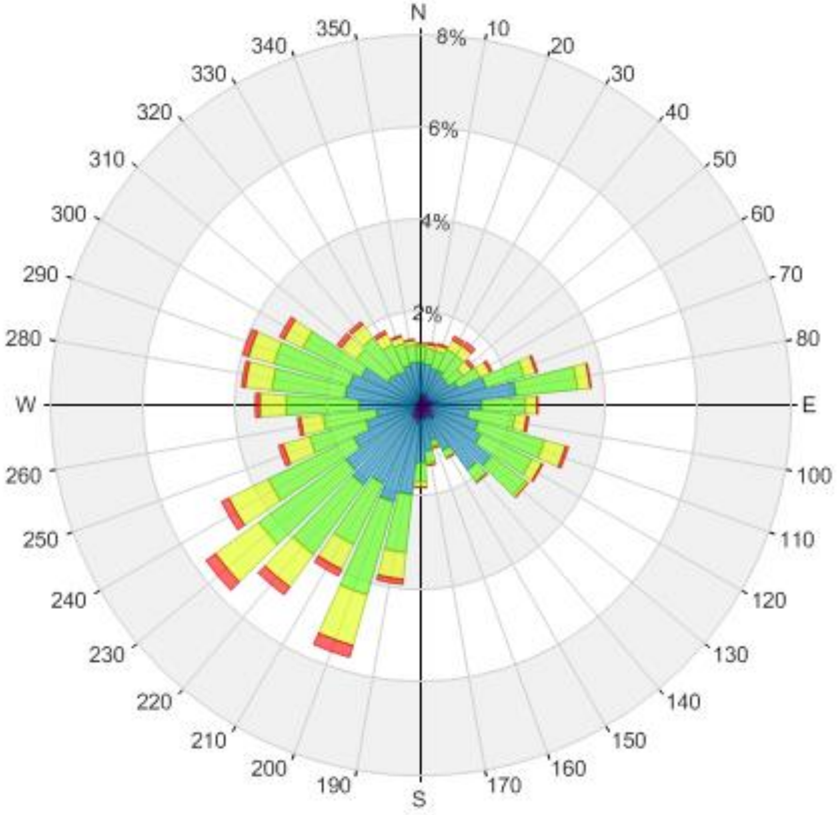
Project #1601270

Figure No. 1c

Date: August 5, 2016



Spring
(March - May)



Summer
(June - August)

	Wind Speed (mph)	Probability (%)	
		Spring	Summer
	Calm	2.3	2.6
🟪	1-5	6.2	8.5
🟦	6-10	28.2	37.9
🟩	11-15	32.9	35.2
🟨	16-20	19.9	13.0
🟥	>20	10.5	2.7

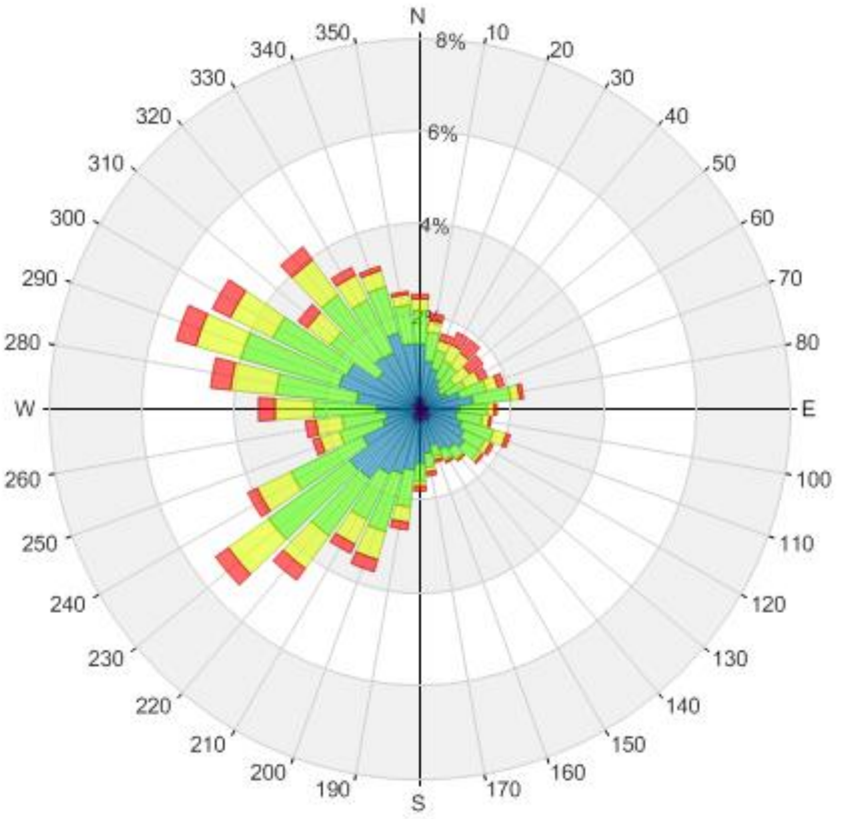
Directional Distribution (%) of Winds (Blowing From)
Boston Logan International Airport (1990 - 2015)

Tremont Crossing – Boston, MA

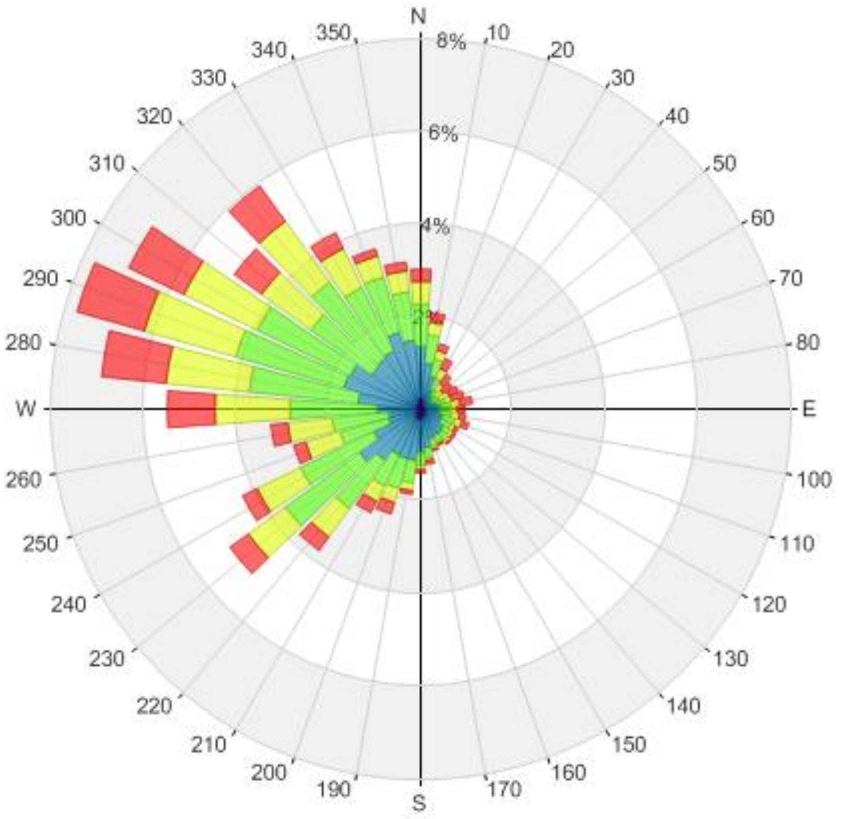
Project #1601270

Figure No. 2

Date: August 05, 2016



Fall
(September - November)



Winter
(December - February)

	Wind Speed (mph)	Probability (%)	
		Fall	**Winter**
	Calm	2.8	2.2
🟪	1-5	7.8	6.0
🟦	6-10	33.9	27.2
🟩	11-15	33.0	31.0
🟨	16-20	15.6	20.4
🟥	>20	7.0	13.1

Directional Distribution (%) of Winds (Blowing From)

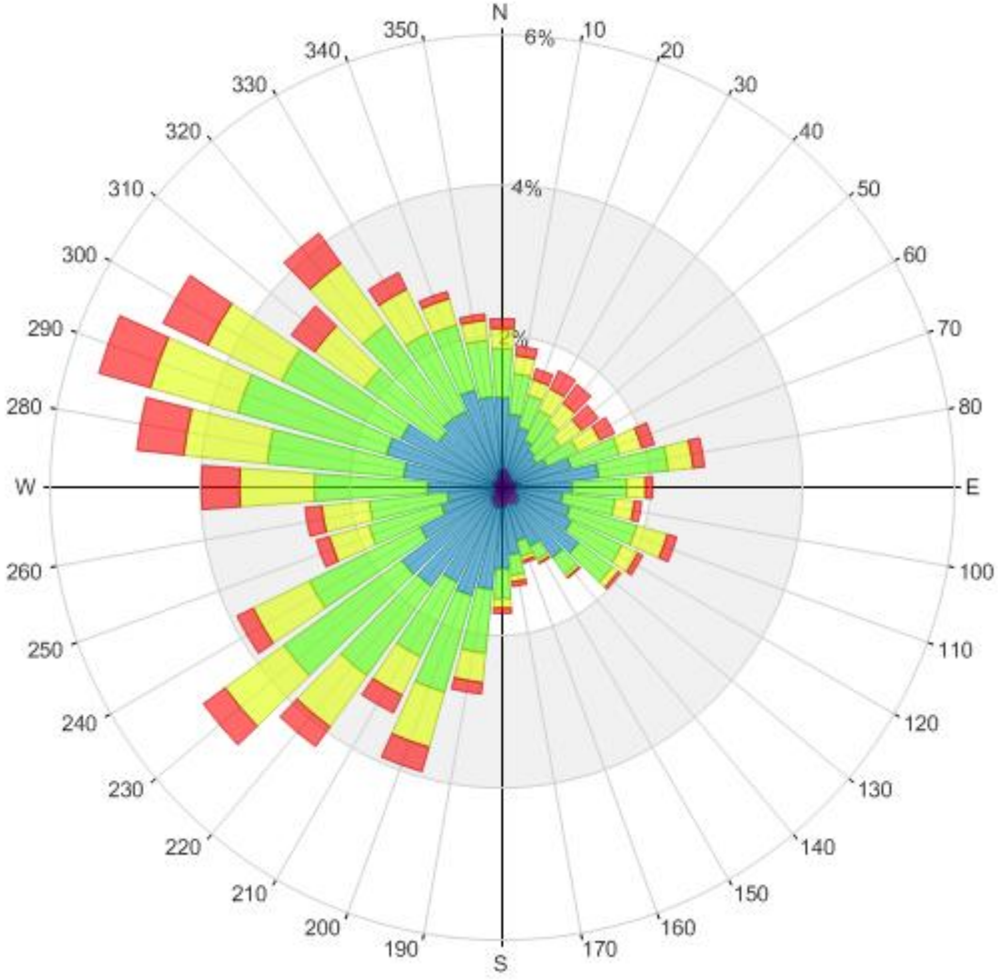
Boston Logan International Airport (1990 - 2015)

Figure No. 2

Tremont Crossing – Boston, MA

Project #1601270

Date: August 05, 2016



Annual Winds

	Wind Speed (mph)	Probability (%)
	Calm	2.5
🟪	1-5	7.1
🟦	6-10	31.8
🟩	11-15	33.0
🟨	16-20	17.2
🟥	>20	8.3

Directional Distribution (%) of Winds (Blowing From)

Boston Logan International Airport (1990 - 2015)

Tremont Crossing – Boston, MA

Project #1601270

Figure No. 2

Date: August 05, 2016

RWDI

Pedestrian Wind Conditions - Mean Speed - No Build

Annual

Tremont Crossing - Boston, MA

True North

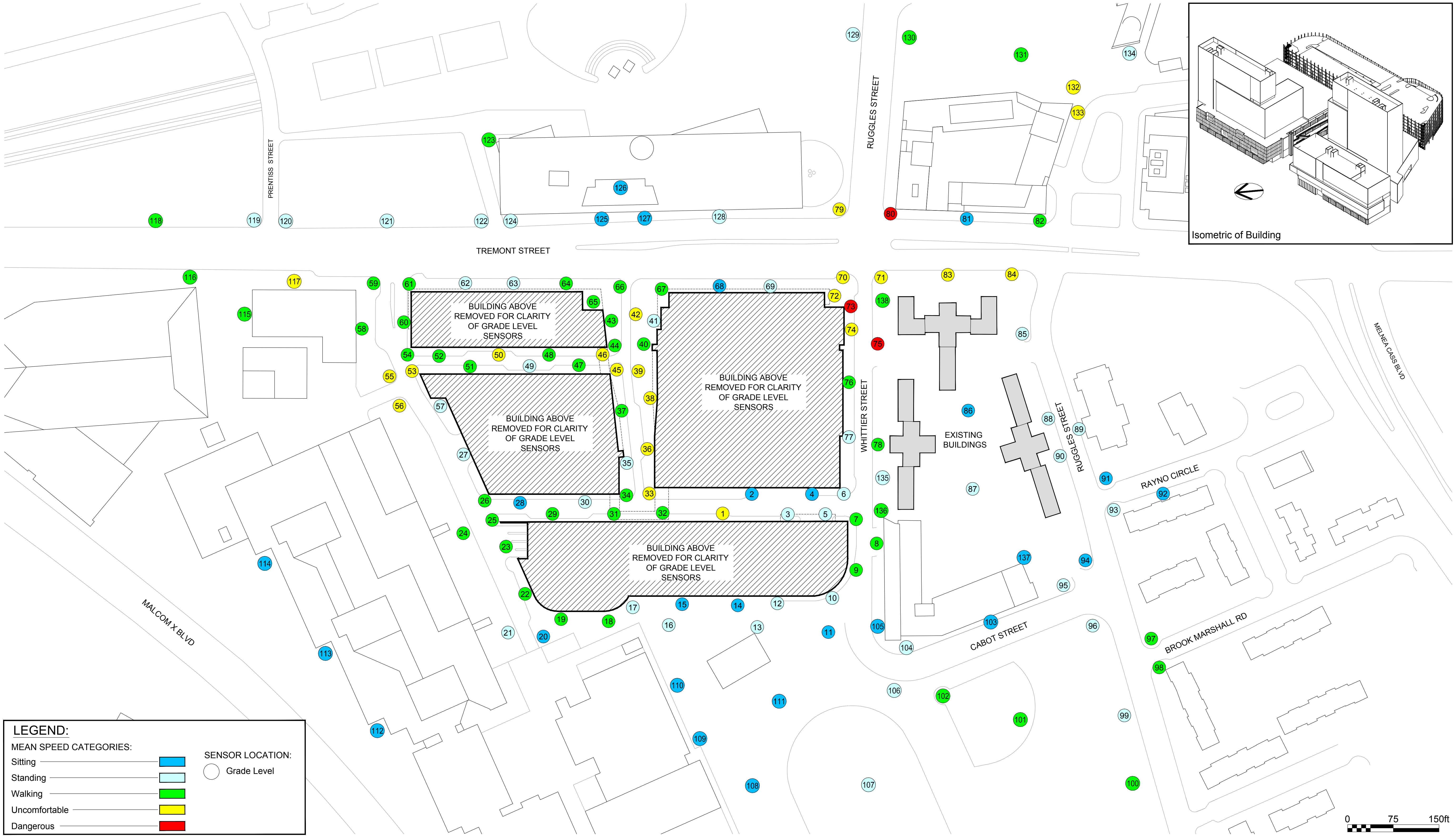
Project #1601270

Drawn by: JMS

Figure: 3a

Approx. Scale: 1"=150'

Date Revised: Aug 4, 2016



LEGEND:

MEAN SPEED CATEGORIES:

Sitting	🟦
Standing	🟦
Walking	🟩
Uncomfortable	🟨
Dangerous	🟥

SENSOR LOCATION:

○ Grade Level

Pedestrian Wind Conditions - Mean Speed -Build
Annual

Tremont Crossing - Boston, MA

True North

Project #1601270

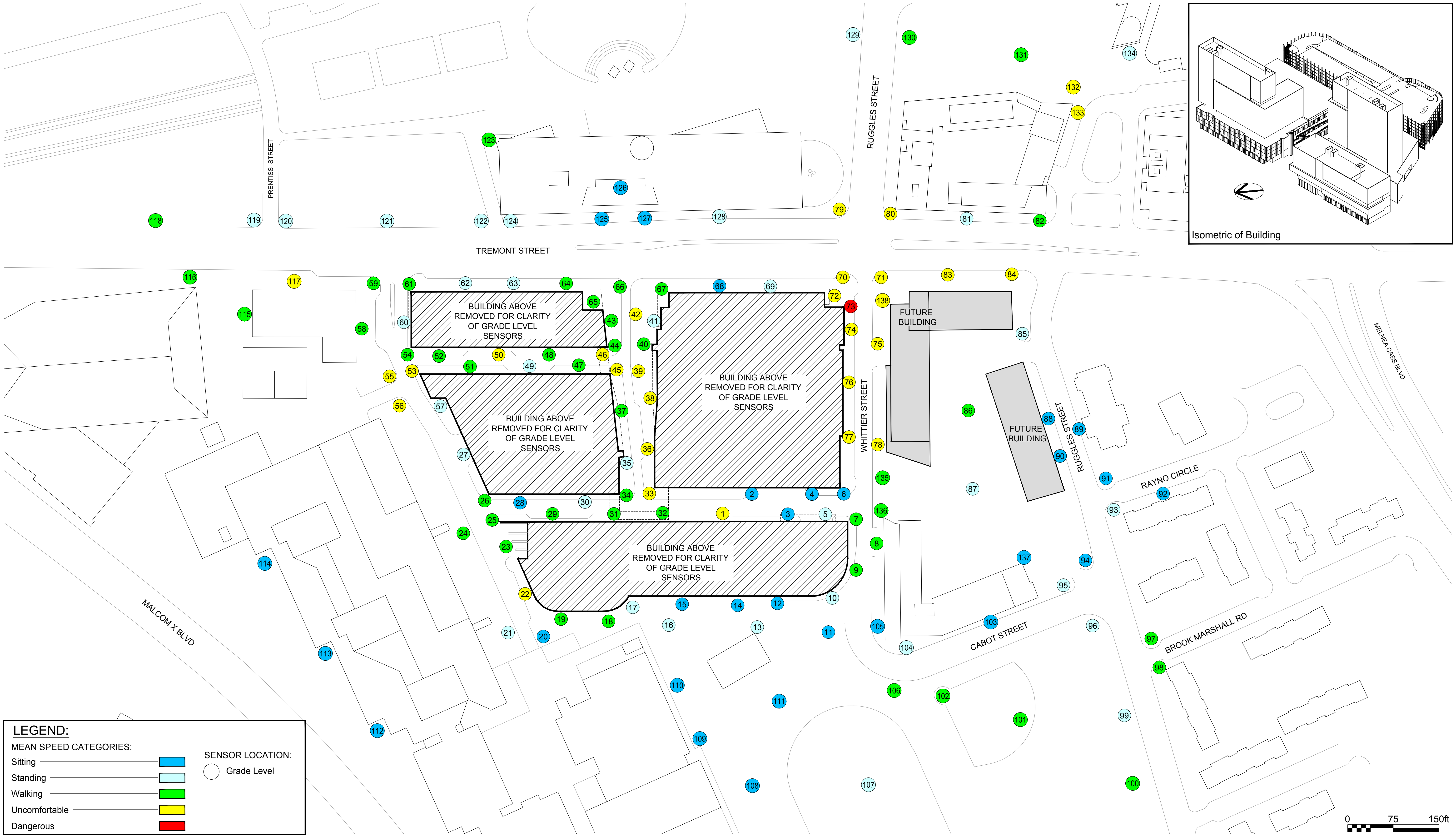
Drawn by: JMS

Figure: 3b

Approx. Scale: 1"=150'

Date Revised: Aug 4, 2016

RWDI



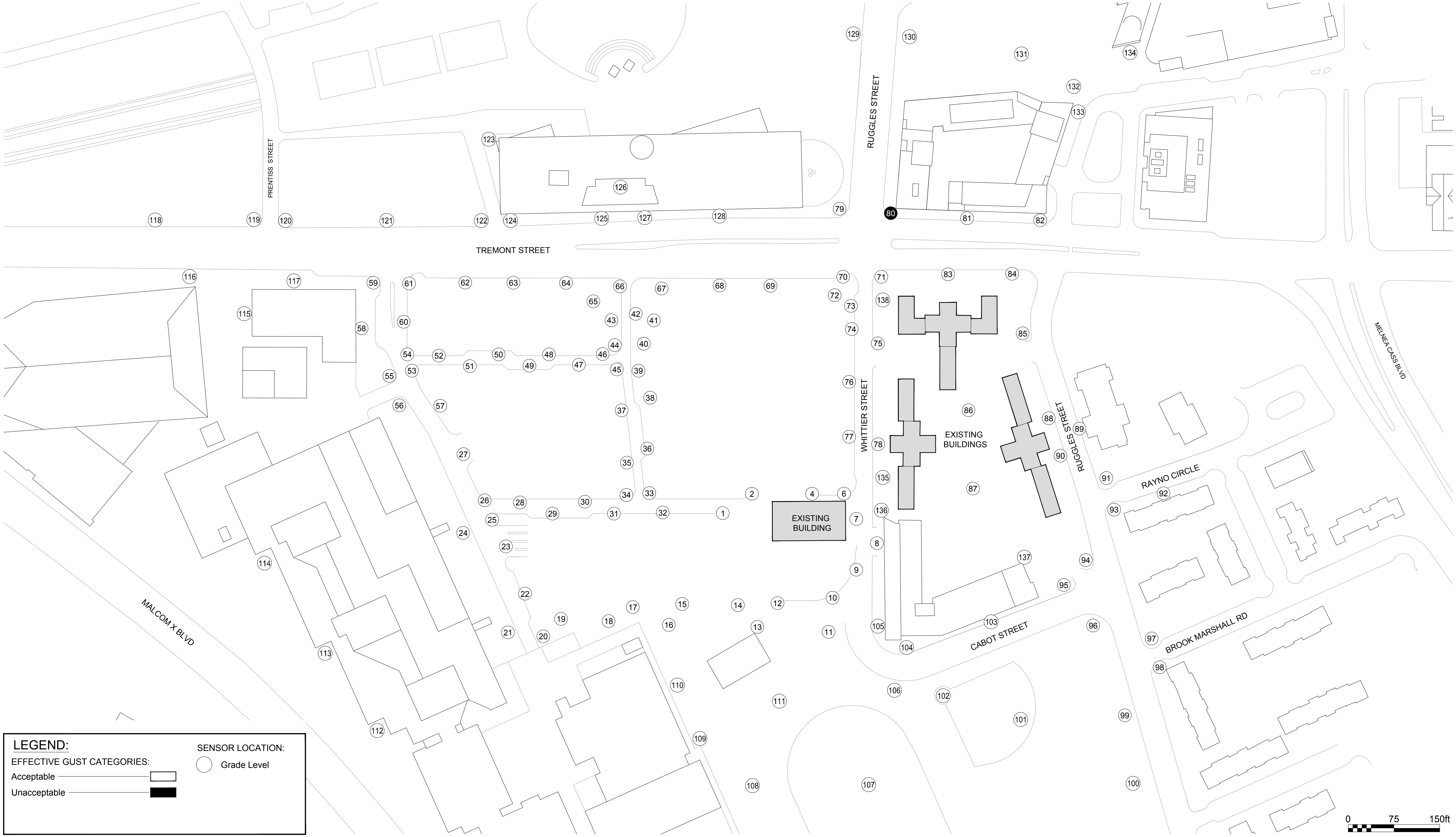
Pedestrian Wind Conditions - Mean Speed - Full Build
Annual

Tremont Crossing - Boston, MA

True North

Project #1601270

Drawn by: JMS
Figure: 3c
Approx. Scale: 1"=150'
Date Revised: Aug 4, 2016



Pedestrian Wind Conditions - Effective Gust - No Build

Annual

Tremont Crossing - Boston, MA

Project #1601270

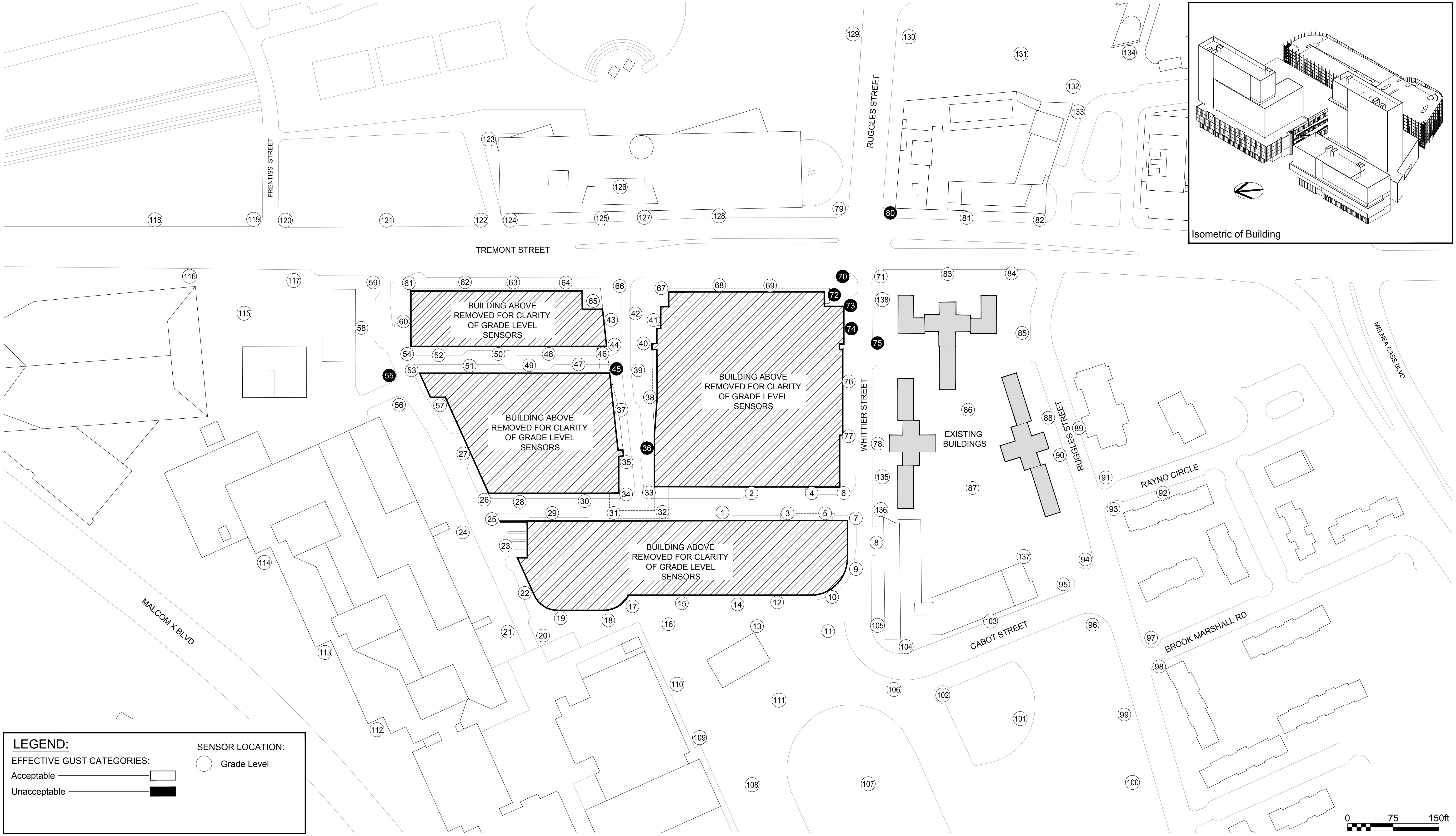
True North

Drawn by: JMS

Figure: 4a

Approx. Scale: 1"=150'

Date Revised: Aug 4, 2016



Pedestrian Wind Conditions - Effective Gust - Build
Annual

Tremont Crossing - Boston, MA

Project #1601270

True North ↗

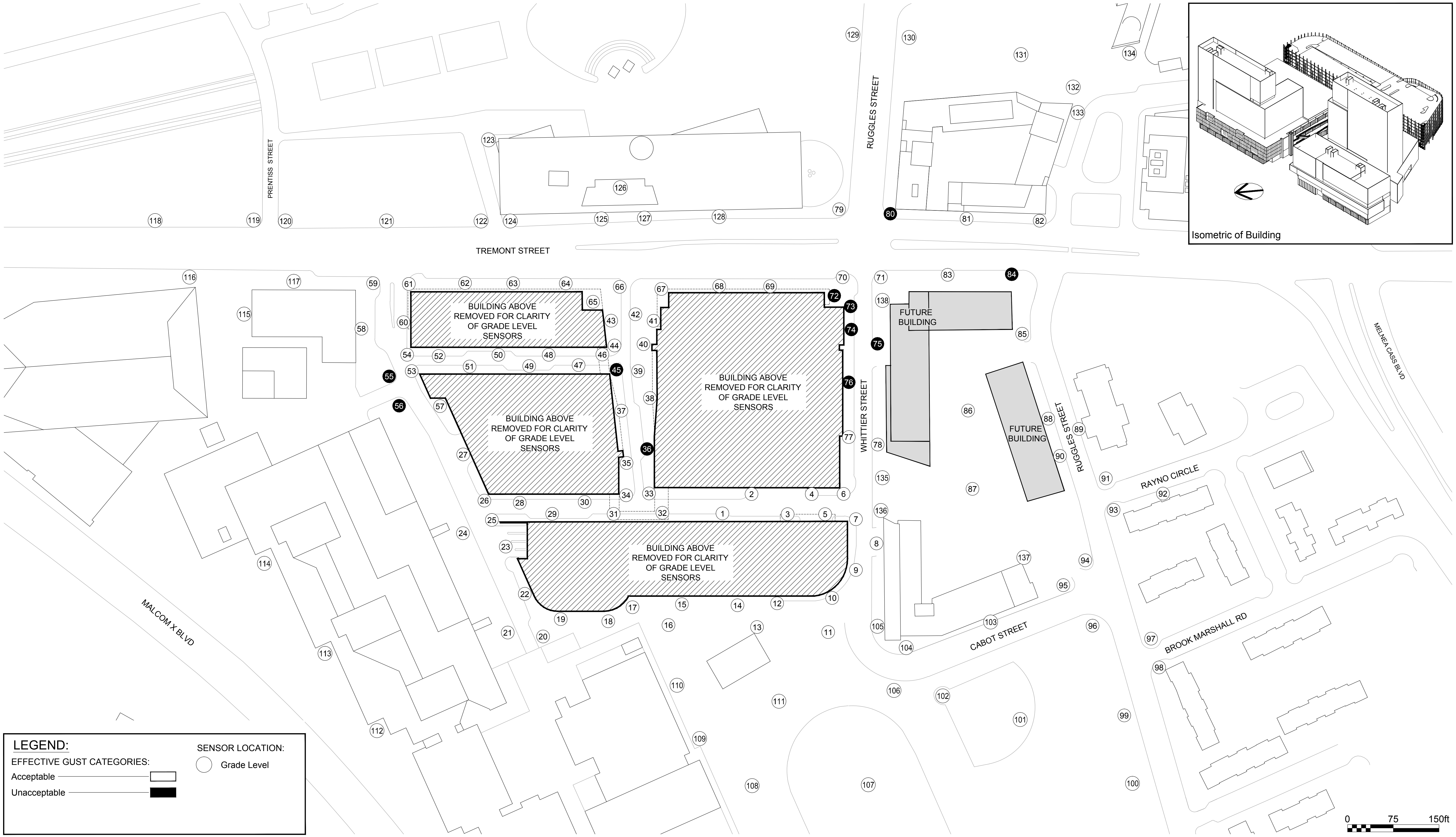
Drawn by: JMS

Figure: 4b

Approx. Scale: 1"=150'

Date Revised: Aug 4, 2016

RWDI



LEGEND:

EFFECTIVE GUST CATEGORIES:

Acceptable ☐

Unacceptable ■

SENSOR LOCATION:

○ Grade Level

Pedestrian Wind Conditions - Effective Gust - Full Build

Annual

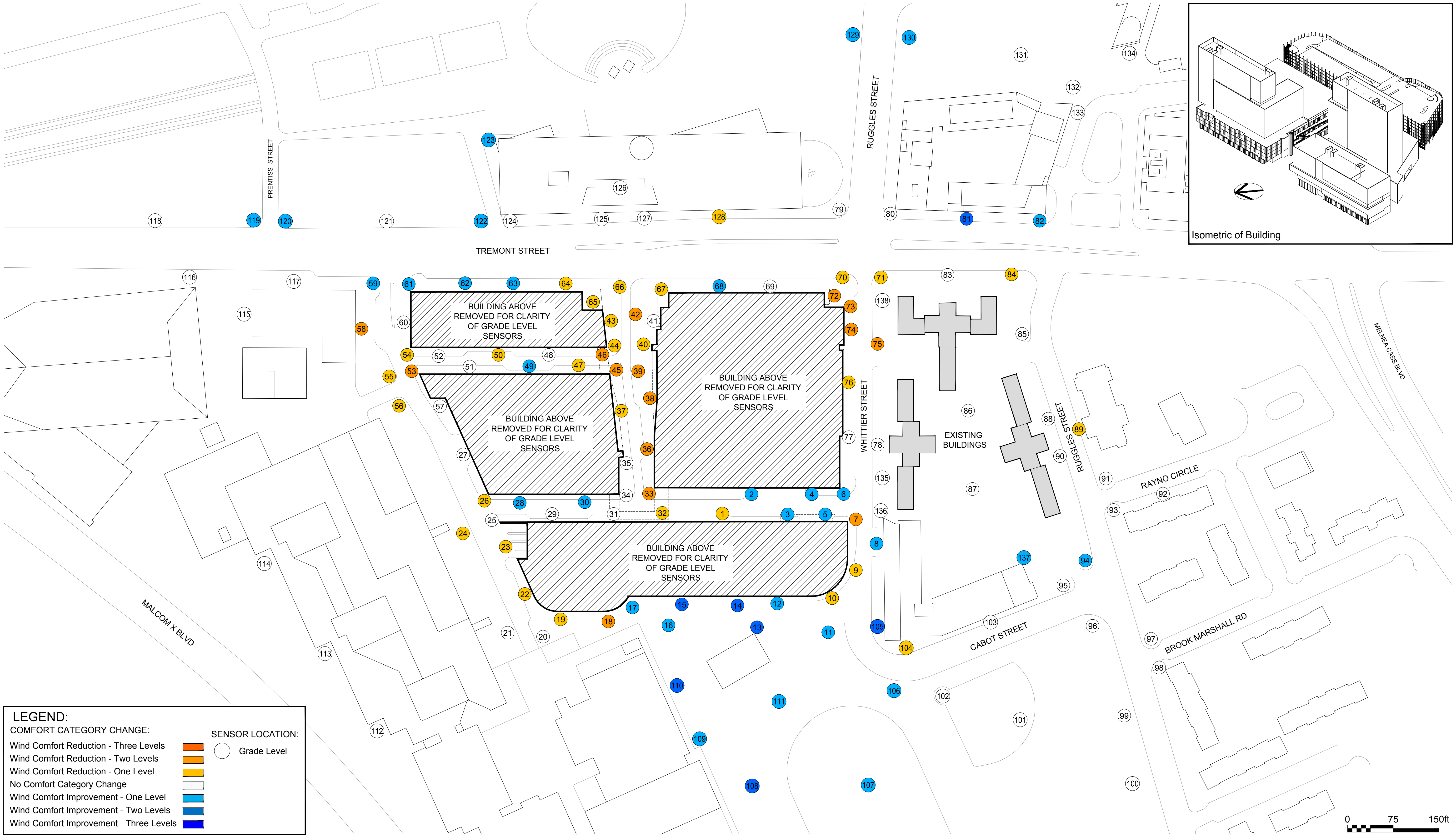
Tremont Crossing - Boston, MA

Project #1601270

True North

Drawn by: JMS	Figure: 4c
Approx. Scale:	1"=150'
Date Revised:	Aug 4, 2016

RWDI



LEGEND:

COMFORT CATEGORY CHANGE:

Wind Comfort Reduction - Three Levels	🟥
Wind Comfort Reduction - Two Levels	🟧
Wind Comfort Reduction - One Level	🟨
No Comfort Category Change	⬜
Wind Comfort Improvement - One Level	🟦
Wind Comfort Improvement - Two Levels	🟦
Wind Comfort Improvement - Three Levels	🟦

SENSOR LOCATION:

○ Grade Level

Pedestrian Wind Conditions - Category Change - No Build to Build
Annual

Tremont Crossing - Boston, MA

True North

Project #1601270

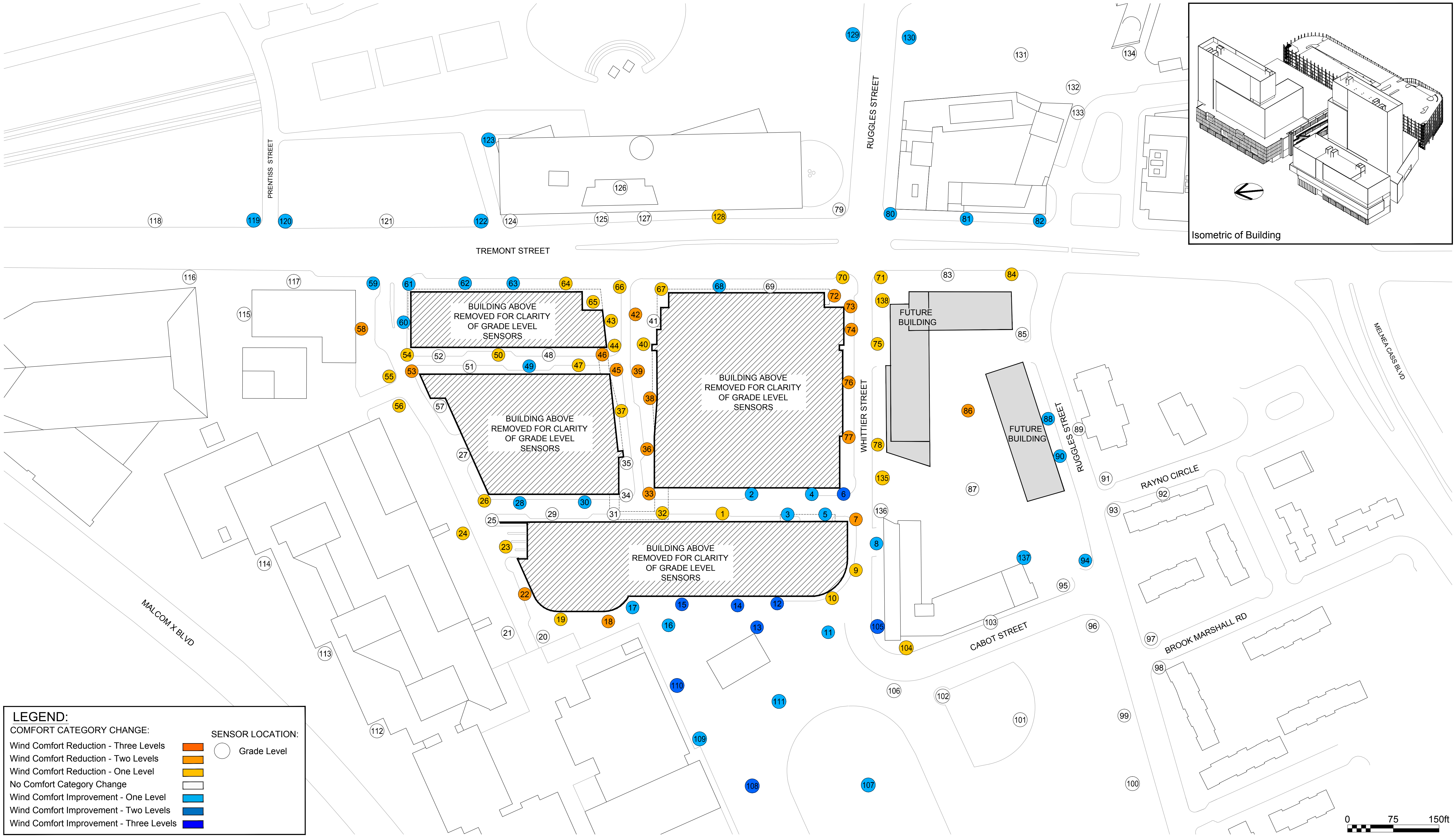
Drawn by: JMS

Figure: 5a

Approx. Scale: 1"=150'

Date Revised: Aug 5, 2016

RWDI



LEGEND:

COMFORT CATEGORY CHANGE:

Wind Comfort Reduction - Three Levels	🟥
Wind Comfort Reduction - Two Levels	🟧
Wind Comfort Reduction - One Level	🟨
No Comfort Category Change	⬜
Wind Comfort Improvement - One Level	🟦
Wind Comfort Improvement - Two Levels	🟦
Wind Comfort Improvement - Three Levels	🟦

SENSOR LOCATION:

○ Grade Level

Pedestrian Wind Conditions - Category Change - No Build To Full Build
Annual

Tremont Crossing - Boston, MA

True North

Project #1601270

Drawn by: JMS	Figure: 5b
Approx. Scale:	1"=150'
Date Revised:	Aug 5, 2016

RWDI

TABLES

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
1	A	Spring	16		Walking	23		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	21	31%	Uncomfortable	29	26%	Acceptable
		Summer	16	33%	Walking	22	29%	Acceptable
		Fall	19	27%	Walking	27	29%	Acceptable
		Winter	23	35%	Uncomfortable	32	28%	Unacceptable
		Annual	20	25%	Uncomfortable	29	26%	Acceptable
	C	Spring	21	31%	Uncomfortable	29	26%	Acceptable
		Summer	16	33%	Walking	22	29%	Acceptable
		Fall	19	27%	Walking	27	29%	Acceptable
		Winter	23	35%	Uncomfortable	32	28%	Unacceptable
		Annual	21	31%	Uncomfortable	29	26%	Acceptable
2	A	Spring	14		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	10	-29%	Sitting	16	-20%	Acceptable
		Summer	8	-20%	Sitting	13	-13%	Acceptable
		Fall	10	-23%	Sitting	15	-21%	Acceptable
		Winter	12	-20%	Sitting	19	-14%	Acceptable
		Annual	10	-23%	Sitting	16	-20%	Acceptable
	C	Spring	9	-36%	Sitting	15	-25%	Acceptable
		Summer	7	-30%	Sitting	11	-27%	Acceptable
		Fall	8	-38%	Sitting	14	-26%	Acceptable
		Winter	10	-33%	Sitting	17	-23%	Acceptable
		Annual	9	-31%	Sitting	15	-25%	Acceptable
3	A	Spring	--		N/A	--		N/A
		Summer	--		N/A	--		N/A
		Fall	--		N/A	--		N/A
		Winter	--		N/A	--		N/A
		Annual	--		N/A	--		N/A
	B	Spring	13	-46%	Standing	21	-28%	Acceptable
		Summer	10	-47%	Sitting	16	-27%	Acceptable
		Fall	12	-48%	Sitting	19	-30%	Acceptable
		Winter	15	-42%	Standing	23	-23%	Acceptable
		Annual	13	-46%	Standing	21	-25%	Acceptable
	C	Spring	11	-54%	Sitting	18	-38%	Acceptable
		Summer	8	-58%	Sitting	13	-41%	Acceptable
		Fall	10	-57%	Sitting	16	-41%	Acceptable
		Winter	12	-54%	Sitting	19	-37%	Acceptable
		Annual	11	-54%	Sitting	17	-39%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

CONSULTING ENGINEERS
& SCIENTISTS

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
4	A	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	10	-23%	Sitting	16	-20%	Acceptable
		Summer	8	-20%	Sitting	12	-20%	Acceptable
		Fall	9	-25%	Sitting	15	-17%	Acceptable
		Winter	11	-21%	Sitting	17	-23%	Acceptable
		Annual	10	-23%	Sitting	15	-25%	Acceptable
	C	Spring	9	-31%	Sitting	15	-25%	Acceptable
		Summer	7	-30%	Sitting	11	-27%	Acceptable
		Fall	8	-33%	Sitting	14	-22%	Acceptable
		Winter	9	-36%	Sitting	15	-32%	Acceptable
		Annual	8	-38%	Sitting	14	-30%	Acceptable
5	A	Spring	--		N/A	--		N/A
		Summer	--		N/A	--		N/A
		Fall	--		N/A	--		N/A
		Winter	--		N/A	--		N/A
		Annual	--		N/A	--		N/A
	B	Spring	17	183%	Walking	25	178%	Acceptable
		Summer	12	140%	Sitting	18	157%	Acceptable
		Fall	14	133%	Standing	22	144%	Acceptable
		Winter	15	150%	Standing	24	140%	Acceptable
		Annual	15	150%	Standing	23	156%	Acceptable
	C	Spring	14	133%	Standing	23	156%	Acceptable
		Summer	11	120%	Sitting	18	157%	Acceptable
		Fall	13	117%	Standing	21	133%	Acceptable
		Winter	14	133%	Standing	25	150%	Acceptable
		Annual	13	117%	Standing	23	156%	Acceptable
6	A	Spring	18		Walking	26		Acceptable
		Summer	13		Standing	20		Acceptable
		Fall	17		Walking	24		Acceptable
		Winter	20		Uncomfortable	29		Acceptable
		Annual	18		Walking	26		Acceptable
	B	Spring	16	-11%	Walking	24		Acceptable
		Summer	11	-15%	Sitting	17	-15%	Acceptable
		Fall	14	-18%	Standing	21	-12%	Acceptable
		Winter	14	-30%	Standing	22	-24%	Acceptable
		Annual	14	-22%	Standing	21	-19%	Acceptable
	C	Spring	13	-28%	Standing	20	-23%	Acceptable
		Summer	10	-23%	Sitting	15	-25%	Acceptable
		Fall	12	-29%	Sitting	18	-25%	Acceptable
		Winter	13	-35%	Standing	21	-28%	Acceptable
		Annual	12	-33%	Sitting	19	-27%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
7	A	Spring	12		Sitting	20		Acceptable
		Summer	9		Sitting	15		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	13		Standing	21		Acceptable
		Annual	12		Sitting	19		Acceptable
	B	Spring	17	42%	Walking	25	25%	Acceptable
		Summer	13	44%	Standing	18	20%	Acceptable
		Fall	15	36%	Standing	22	22%	Acceptable
		Winter	17	31%	Walking	24	14%	Acceptable
		Annual	16	33%	Walking	23	21%	Acceptable
	C	Spring	17	42%	Walking	25	25%	Acceptable
		Summer	13	44%	Standing	19	27%	Acceptable
		Fall	16	45%	Walking	23	28%	Acceptable
		Winter	18	38%	Walking	27	29%	Acceptable
		Annual	16	33%	Walking	25	32%	Acceptable
8	A	Spring	20		Uncomfortable	28		Acceptable
		Summer	15		Standing	22		Acceptable
		Fall	19		Walking	26		Acceptable
		Winter	23		Uncomfortable	31		Acceptable
		Annual	20		Uncomfortable	28		Acceptable
	B	Spring	17	-15%	Walking	25	-11%	Acceptable
		Summer	14		Standing	20		Acceptable
		Fall	16	-16%	Walking	23	-12%	Acceptable
		Winter	17	-26%	Walking	25	-19%	Acceptable
		Annual	16	-20%	Walking	23	-18%	Acceptable
	C	Spring	17	-15%	Walking	26		Acceptable
		Summer	14		Standing	20		Acceptable
		Fall	16	-16%	Walking	24		Acceptable
		Winter	19	-17%	Walking	28		Acceptable
		Annual	17	-15%	Walking	25	-11%	Acceptable
9	A	Spring	13		Standing	21		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15		Standing	24		Acceptable
		Annual	13		Standing	21		Acceptable
	B	Spring	18	38%	Walking	26	24%	Acceptable
		Summer	14	40%	Standing	19	19%	Acceptable
		Fall	17	31%	Walking	23	15%	Acceptable
		Winter	19	27%	Walking	26		Acceptable
		Annual	17	31%	Walking	24	14%	Acceptable
	C	Spring	17	31%	Walking	25	19%	Acceptable
		Summer	13	30%	Standing	19	19%	Acceptable
		Fall	15	15%	Standing	23	15%	Acceptable
		Winter	17	13%	Walking	26		Acceptable
		Annual	16	23%	Walking	24	14%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
10	A	Spring	12		Sitting	19		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	13		Standing	22		Acceptable
		Annual	12		Sitting	19		Acceptable
	B	Spring	14	17%	Standing	21	11%	Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	13	18%	Standing	20	11%	Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	C	Spring	13		Standing	20		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	13	18%	Standing	20	11%	Acceptable
		Winter	13		Standing	21		Acceptable
		Annual	13		Standing	20		Acceptable
11	A	Spring	16		Walking	22		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	11	-31%	Sitting	18	-18%	Acceptable
		Summer	9	-31%	Sitting	14	-22%	Acceptable
		Fall	10	-33%	Sitting	17	-19%	Acceptable
		Winter	11	-35%	Sitting	18	-25%	Acceptable
		Annual	11	-27%	Sitting	17	-23%	Acceptable
	C	Spring	11	-31%	Sitting	18	-18%	Acceptable
		Summer	9	-31%	Sitting	14	-22%	Acceptable
		Fall	10	-33%	Sitting	17	-19%	Acceptable
		Winter	11	-35%	Sitting	18	-25%	Acceptable
		Annual	10	-33%	Sitting	17	-23%	Acceptable
12	A	Spring	19		Walking	27		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	18		Walking	25		Acceptable
		Winter	21		Uncomfortable	30		Acceptable
		Annual	19		Walking	27		Acceptable
	B	Spring	13	-32%	Standing	19	-30%	Acceptable
		Summer	11	-27%	Sitting	16	-24%	Acceptable
		Fall	12	-33%	Sitting	18	-28%	Acceptable
		Winter	13	-38%	Standing	20	-33%	Acceptable
		Annual	13	-32%	Standing	18	-33%	Acceptable
	C	Spring	12	-37%	Sitting	18	-33%	Acceptable
		Summer	11	-27%	Sitting	16	-24%	Acceptable
		Fall	12	-33%	Sitting	18	-28%	Acceptable
		Winter	13	-38%	Standing	19	-37%	Acceptable
		Annual	12	-37%	Sitting	18	-33%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
13	A	Spring	22		Uncomfortable	29		Acceptable
		Summer	17		Walking	22		Acceptable
		Fall	21		Uncomfortable	27		Acceptable
		Winter	24		Uncomfortable	32		Unacceptable
		Annual	22		Uncomfortable	29		Acceptable
	B	Spring	15	-32%	Standing	22	-24%	Acceptable
		Summer	12	-29%	Sitting	18	-18%	Acceptable
		Fall	14	-33%	Standing	21	-22%	Acceptable
		Winter	16	-33%	Walking	23	-28%	Acceptable
		Annual	14	-36%	Standing	22	-24%	Acceptable
	C	Spring	15	-32%	Standing	22	-24%	Acceptable
		Summer	12	-29%	Sitting	18	-18%	Acceptable
		Fall	14	-33%	Standing	21	-22%	Acceptable
		Winter	16	-33%	Walking	23	-28%	Acceptable
		Annual	14	-36%	Standing	21	-28%	Acceptable
14	A	Spring	17		Walking	24		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	19		Walking	26		Acceptable
		Annual	17		Walking	24		Acceptable
	B	Spring	12	-29%	Sitting	18	-25%	Acceptable
		Summer	10	-23%	Sitting	15	-17%	Acceptable
		Fall	11	-31%	Sitting	17	-23%	Acceptable
		Winter	13	-32%	Standing	19	-27%	Acceptable
		Annual	12	-29%	Sitting	18	-25%	Acceptable
	C	Spring	11	-35%	Sitting	17	-29%	Acceptable
		Summer	10	-23%	Sitting	14	-22%	Acceptable
		Fall	11	-31%	Sitting	16	-27%	Acceptable
		Winter	12	-37%	Sitting	18	-31%	Acceptable
		Annual	11	-35%	Sitting	17	-29%	Acceptable
15	A	Spring	16		Walking	23		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	12	-25%	Sitting	18	-22%	Acceptable
		Summer	10	-23%	Sitting	15	-17%	Acceptable
		Fall	12	-25%	Sitting	18	-18%	Acceptable
		Winter	13	-28%	Standing	20	-20%	Acceptable
		Annual	12	-25%	Sitting	18	-22%	Acceptable
	C	Spring	12	-25%	Sitting	18	-22%	Acceptable
		Summer	10	-23%	Sitting	15	-17%	Acceptable
		Fall	12	-25%	Sitting	18	-18%	Acceptable
		Winter	13	-28%	Standing	20	-20%	Acceptable
		Annual	12	-25%	Sitting	18	-22%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
16	A	Spring	18		Walking	24		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	17		Walking	23		Acceptable
		Winter	20		Uncomfortable	27		Acceptable
		Annual	18		Walking	24		Acceptable
	B	Spring	13	-28%	Standing	20	-17%	Acceptable
		Summer	11	-21%	Sitting	16	-16%	Acceptable
		Fall	13	-24%	Standing	19	-17%	Acceptable
		Winter	14	-30%	Standing	21	-22%	Acceptable
		Annual	13	-28%	Standing	19	-21%	Acceptable
	C	Spring	13	-28%	Standing	20	-17%	Acceptable
		Summer	11	-21%	Sitting	16	-16%	Acceptable
		Fall	13	-24%	Standing	19	-17%	Acceptable
		Winter	14	-30%	Standing	21	-22%	Acceptable
		Annual	13	-28%	Standing	19	-21%	Acceptable
17	A	Spring	16		Walking	23		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	16		Walking	22		Acceptable
	B	Spring	13	-19%	Standing	18	-22%	Acceptable
		Summer	11		Sitting	15	-12%	Acceptable
		Fall	12	-20%	Sitting	18	-14%	Acceptable
		Winter	14	-18%	Standing	20	-17%	Acceptable
		Annual	13	-19%	Standing	18	-18%	Acceptable
	C	Spring	13	-19%	Standing	19	-17%	Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	12	-20%	Sitting	18	-14%	Acceptable
		Winter	14	-18%	Standing	20	-17%	Acceptable
		Annual	13	-19%	Standing	18	-18%	Acceptable
18	A	Spring	13		Standing	19		Acceptable
		Summer	10		Sitting	14		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	13		Standing	20		Acceptable
		Annual	12		Sitting	18		Acceptable
	B	Spring	18	38%	Walking	24	26%	Acceptable
		Summer	14	40%	Standing	20	43%	Acceptable
		Fall	16	33%	Walking	23	28%	Acceptable
		Winter	18	38%	Walking	25	25%	Acceptable
		Annual	17	42%	Walking	23	28%	Acceptable
	C	Spring	18	38%	Walking	25	32%	Acceptable
		Summer	14	40%	Standing	20	43%	Acceptable
		Fall	17	42%	Walking	23	28%	Acceptable
		Winter	19	46%	Walking	26	30%	Acceptable
		Annual	17	42%	Walking	24	33%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
19	A	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	19		Acceptable
	B	Spring	19	46%	Walking	26	30%	Acceptable
		Summer	15	50%	Standing	21	40%	Acceptable
		Fall	18	50%	Walking	25	39%	Acceptable
		Winter	20	43%	Uncomfortable	28	33%	Acceptable
		Annual	19	46%	Walking	26	37%	Acceptable
	C	Spring	19	46%	Walking	27	35%	Acceptable
		Summer	15	50%	Standing	21	40%	Acceptable
		Fall	18	50%	Walking	25	39%	Acceptable
		Winter	20	43%	Uncomfortable	28	33%	Acceptable
		Annual	19	46%	Walking	26	37%	Acceptable
20	A	Spring	9		Sitting	14		Acceptable
		Summer	7		Sitting	10		Acceptable
		Fall	8		Sitting	13		Acceptable
		Winter	10		Sitting	15		Acceptable
		Annual	9		Sitting	13		Acceptable
	B	Spring	12	33%	Sitting	18	29%	Acceptable
		Summer	10	43%	Sitting	14	40%	Acceptable
		Fall	12	50%	Sitting	17	31%	Acceptable
		Winter	13	30%	Standing	19	27%	Acceptable
		Annual	12	33%	Sitting	18	38%	Acceptable
	C	Spring	13	44%	Standing	18	29%	Acceptable
		Summer	10	43%	Sitting	15	50%	Acceptable
		Fall	12	50%	Sitting	18	38%	Acceptable
		Winter	13	30%	Standing	20	33%	Acceptable
		Annual	12	33%	Sitting	18	38%	Acceptable
21	A	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	19		Acceptable
	B	Spring	15	15%	Standing	22		Acceptable
		Summer	12	20%	Sitting	18	20%	Acceptable
		Fall	14	17%	Standing	21	17%	Acceptable
		Winter	16	14%	Walking	23		Acceptable
		Annual	15	15%	Standing	21	11%	Acceptable
	C	Spring	15	15%	Standing	23	15%	Acceptable
		Summer	13	30%	Standing	18	20%	Acceptable
		Fall	15	25%	Standing	21	17%	Acceptable
		Winter	16	14%	Walking	23		Acceptable
		Annual	15	15%	Standing	22	16%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
22	A	Spring	14		Standing	20		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	20		Acceptable
	B	Spring	19	36%	Walking	26	30%	Acceptable
		Summer	17	55%	Walking	23	44%	Acceptable
		Fall	19	46%	Walking	26	37%	Acceptable
		Winter	21	40%	Uncomfortable	28	27%	Acceptable
		Annual	19	36%	Walking	26	30%	Acceptable
	C	Spring	20	43%	Uncomfortable	27	35%	Acceptable
		Summer	17	55%	Walking	23	44%	Acceptable
		Fall	19	46%	Walking	26	37%	Acceptable
		Winter	21	40%	Uncomfortable	29	32%	Acceptable
		Annual	20	43%	Uncomfortable	27	35%	Acceptable
23	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	16	14%	Walking	23		Acceptable
		Summer	14	27%	Standing	20	25%	Acceptable
		Fall	16	14%	Walking	22		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	16	14%	Walking	23		Acceptable
	C	Spring	16	14%	Walking	24	14%	Acceptable
		Summer	14	27%	Standing	20	25%	Acceptable
		Fall	16	14%	Walking	23	15%	Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	16	14%	Walking	23		Acceptable
24	A	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	15		Standing	23		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	17	31%	Walking	24	20%	Acceptable
		Summer	14	40%	Standing	20	25%	Acceptable
		Fall	16	23%	Walking	23	21%	Acceptable
		Winter	19	27%	Walking	27	17%	Acceptable
		Annual	17	31%	Walking	24	20%	Acceptable
	C	Spring	17	31%	Walking	25	25%	Acceptable
		Summer	14	40%	Standing	20	25%	Acceptable
		Fall	16	23%	Walking	23	21%	Acceptable
		Winter	19	27%	Walking	27	17%	Acceptable
		Annual	17	31%	Walking	25	25%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

<u>Effective Gust Criteria</u>

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
25	A	Spring	16		Walking	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	16		Walking	22		Acceptable
	B	Spring	17		Walking	25	14%	Acceptable
		Summer	14	17%	Standing	21	24%	Acceptable
		Fall	16		Walking	24	14%	Acceptable
		Winter	18		Walking	27		Acceptable
		Annual	17		Walking	25	14%	Acceptable
	C	Spring	17		Walking	25	14%	Acceptable
		Summer	15	25%	Standing	21	24%	Acceptable
		Fall	17	13%	Walking	24	14%	Acceptable
		Winter	18		Walking	27		Acceptable
		Annual	17		Walking	25	14%	Acceptable
26	A	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	19	27%	Walking	26	18%	Acceptable
		Summer	17	42%	Walking	23	35%	Acceptable
		Fall	18	20%	Walking	26	24%	Acceptable
		Winter	20	18%	Uncomfortable	28	12%	Acceptable
		Annual	19	27%	Walking	26	18%	Acceptable
	C	Spring	19	27%	Walking	26	18%	Acceptable
		Summer	16	33%	Walking	23	35%	Acceptable
		Fall	18	20%	Walking	26	24%	Acceptable
		Winter	20	18%	Uncomfortable	28	12%	Acceptable
		Annual	19	27%	Walking	26	18%	Acceptable
27	A	Spring	15		Standing	22		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	15		Standing	22		Acceptable
		Summer	13	18%	Standing	19	12%	Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	C	Spring	15		Standing	22		Acceptable
		Summer	13	18%	Standing	19	12%	Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
28	A	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	11	-27%	Sitting	17	-23%	Acceptable
		Summer	9	-25%	Sitting	14	-18%	Acceptable
		Fall	11	-27%	Sitting	16	-24%	Acceptable
		Winter	12	-29%	Sitting	19	-24%	Acceptable
		Annual	11	-27%	Sitting	17	-23%	Acceptable
	C	Spring	11	-27%	Sitting	17	-23%	Acceptable
		Summer	9	-25%	Sitting	14	-18%	Acceptable
		Fall	10	-33%	Sitting	16	-24%	Acceptable
		Winter	12	-29%	Sitting	18	-28%	Acceptable
		Annual	10	-33%	Sitting	17	-23%	Acceptable
29	A	Spring	16		Walking	23		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	19	19%	Walking	28	22%	Acceptable
		Summer	16	33%	Walking	22	22%	Acceptable
		Fall	18	20%	Walking	26	18%	Acceptable
		Winter	21	17%	Uncomfortable	30	20%	Acceptable
		Annual	19	19%	Walking	27	17%	Acceptable
	C	Spring	19	19%	Walking	28	22%	Acceptable
		Summer	16	33%	Walking	22	22%	Acceptable
		Fall	18	20%	Walking	26	18%	Acceptable
		Winter	22	22%	Uncomfortable	30	20%	Acceptable
		Annual	19	19%	Walking	28	22%	Acceptable
30	A	Spring	16		Walking	23		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	13	-19%	Standing	19	-17%	Acceptable
		Summer	10	-17%	Sitting	15	-17%	Acceptable
		Fall	12	-20%	Sitting	18	-18%	Acceptable
		Winter	14	-18%	Standing	21	-16%	Acceptable
		Annual	13	-19%	Standing	19	-17%	Acceptable
	C	Spring	13	-19%	Standing	19	-17%	Acceptable
		Summer	10	-17%	Sitting	15	-17%	Acceptable
		Fall	12	-20%	Sitting	18	-18%	Acceptable
		Winter	14	-18%	Standing	21	-16%	Acceptable
		Annual	13	-19%	Standing	19	-17%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
31	A	Spring	16		Walking	23		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	18	12%	Walking	26	13%	Acceptable
		Summer	14	17%	Standing	20	11%	Acceptable
		Fall	17	13%	Walking	24		Acceptable
		Winter	20	18%	Uncomfortable	29	16%	Acceptable
		Annual	18	12%	Walking	26	13%	Acceptable
	C	Spring	18	12%	Walking	26	13%	Acceptable
		Summer	14	17%	Standing	20	11%	Acceptable
		Fall	17	13%	Walking	25	14%	Acceptable
		Winter	20	18%	Uncomfortable	29	16%	Acceptable
		Annual	18	12%	Walking	26	13%	Acceptable
32	A	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	18	20%	Walking	26	18%	Acceptable
		Summer	14	17%	Standing	20	18%	Acceptable
		Fall	17	21%	Walking	24	14%	Acceptable
		Winter	20	18%	Uncomfortable	29	21%	Acceptable
		Annual	18	20%	Walking	26	18%	Acceptable
	C	Spring	18	20%	Walking	26	18%	Acceptable
		Summer	14	17%	Standing	20	18%	Acceptable
		Fall	17	21%	Walking	25	19%	Acceptable
		Winter	20	18%	Uncomfortable	29	21%	Acceptable
		Annual	18	20%	Walking	26	18%	Acceptable
33	A	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	20	33%	Uncomfortable	27	23%	Acceptable
		Summer	15	25%	Standing	21	24%	Acceptable
		Fall	19	27%	Walking	26	24%	Acceptable
		Winter	22	29%	Uncomfortable	30	25%	Acceptable
		Annual	20	33%	Uncomfortable	27	23%	Acceptable
	C	Spring	20	33%	Uncomfortable	27	23%	Acceptable
		Summer	16	33%	Walking	21	24%	Acceptable
		Fall	19	27%	Walking	26	24%	Acceptable
		Winter	23	35%	Uncomfortable	30	25%	Acceptable
		Annual	20	33%	Uncomfortable	27	23%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

<u>Effective Gust Criteria</u>

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
34	A	Spring	16		Walking	22		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	16		Walking	22		Acceptable
	B	Spring	18	12%	Walking	26	18%	Acceptable
		Summer	14	17%	Standing	20	11%	Acceptable
		Fall	17	13%	Walking	24	14%	Acceptable
		Winter	20	18%	Uncomfortable	29	21%	Acceptable
		Annual	18	12%	Walking	26	18%	Acceptable
	C	Spring	18	12%	Walking	26	18%	Acceptable
		Summer	14	17%	Standing	20	11%	Acceptable
		Fall	17	13%	Walking	24	14%	Acceptable
		Winter	20	18%	Uncomfortable	29	21%	Acceptable
		Annual	18	12%	Walking	26	18%	Acceptable
35	A	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	15		Standing	24		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	14		Standing	22		Acceptable
		Winter	17		Walking	26		Acceptable
		Annual	15		Standing	24		Acceptable
	C	Spring	15		Standing	24		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	14		Standing	22		Acceptable
		Winter	17		Walking	27	12%	Acceptable
		Annual	15		Standing	24		Acceptable
36	A	Spring	13		Standing	20		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	25	92%	Uncomfortable	32	60%	Unacceptable
		Summer	19	73%	Walking	25	56%	Acceptable
		Fall	23	77%	Uncomfortable	30	58%	Acceptable
		Winter	27	93%	Uncomfortable	36	71%	Unacceptable
		Annual	25	92%	Uncomfortable	32	60%	Unacceptable
	C	Spring	25	92%	Uncomfortable	32	60%	Unacceptable
		Summer	19	73%	Walking	25	56%	Acceptable
		Fall	23	77%	Uncomfortable	30	58%	Acceptable
		Winter	28	100%	Dangerous	36	71%	Unacceptable
		Annual	25	92%	Uncomfortable	32	60%	Unacceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
37	A	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	17	13%	Walking	25	14%	Acceptable
		Summer	12		Sitting	19	12%	Acceptable
		Fall	16	14%	Walking	23		Acceptable
		Winter	18		Walking	27	12%	Acceptable
		Annual	16		Walking	24		Acceptable
	C	Spring	17	13%	Walking	25	14%	Acceptable
		Summer	13		Standing	19	12%	Acceptable
		Fall	16	14%	Walking	23		Acceptable
		Winter	18		Walking	27	12%	Acceptable
		Annual	16		Walking	25	14%	Acceptable
38	A	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	21		Acceptable
	B	Spring	22	47%	Uncomfortable	29	32%	Acceptable
		Summer	17	42%	Walking	23	35%	Acceptable
		Fall	20	43%	Uncomfortable	27	29%	Acceptable
		Winter	24	50%	Uncomfortable	32	33%	Unacceptable
		Annual	22	47%	Uncomfortable	29	38%	Acceptable
	C	Spring	22	47%	Uncomfortable	29	32%	Acceptable
		Summer	17	42%	Walking	23	35%	Acceptable
		Fall	20	43%	Uncomfortable	28	33%	Acceptable
		Winter	24	50%	Uncomfortable	32	33%	Unacceptable
		Annual	22	47%	Uncomfortable	29	38%	Acceptable
39	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15		Standing	23		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	23	64%	Uncomfortable	30	43%	Acceptable
		Summer	17	55%	Walking	23	44%	Acceptable
		Fall	22	69%	Uncomfortable	29	45%	Acceptable
		Winter	24	60%	Uncomfortable	32	39%	Unacceptable
		Annual	22	57%	Uncomfortable	30	43%	Acceptable
	C	Spring	22	57%	Uncomfortable	30	43%	Acceptable
		Summer	17	55%	Walking	23	44%	Acceptable
		Fall	22	69%	Uncomfortable	29	45%	Acceptable
		Winter	24	60%	Uncomfortable	32	39%	Unacceptable
		Annual	22	57%	Uncomfortable	30	43%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

<u>Effective Gust Criteria</u>

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
40	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	21		Acceptable
	B	Spring	19	36%	Walking	27	29%	Acceptable
		Summer	16	45%	Walking	21	31%	Acceptable
		Fall	19	46%	Walking	26	30%	Acceptable
		Winter	20	43%	Uncomfortable	28	27%	Acceptable
		Annual	19	46%	Walking	26	24%	Acceptable
	C	Spring	19	36%	Walking	26	24%	Acceptable
		Summer	15	36%	Standing	21	31%	Acceptable
		Fall	18	38%	Walking	26	30%	Acceptable
		Winter	20	43%	Uncomfortable	28	27%	Acceptable
		Annual	18	38%	Walking	26	24%	Acceptable
41	A	Spring	13		Standing	20		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	14		Standing	22		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15		Standing	23		Acceptable
		Annual	13		Standing	21		Acceptable
	C	Spring	13		Standing	21		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	14		Standing	23		Acceptable
		Annual	13		Standing	21		Acceptable
42	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	21	50%	Uncomfortable	28	33%	Acceptable
		Summer	16	45%	Walking	22	38%	Acceptable
		Fall	20	54%	Uncomfortable	27	42%	Acceptable
		Winter	22	57%	Uncomfortable	31	41%	Acceptable
		Annual	20	54%	Uncomfortable	28	40%	Acceptable
	C	Spring	20	43%	Uncomfortable	29	38%	Acceptable
		Summer	16	45%	Walking	23	44%	Acceptable
		Fall	20	54%	Uncomfortable	28	47%	Acceptable
		Winter	22	57%	Uncomfortable	31	41%	Acceptable
		Annual	20	54%	Uncomfortable	28	40%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
43	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	20		Acceptable
	B	Spring	18	29%	Walking	25	19%	Acceptable
		Summer	15	36%	Standing	20	18%	Acceptable
		Fall	17	31%	Walking	24	20%	Acceptable
		Winter	18	20%	Walking	27	23%	Acceptable
		Annual	17	21%	Walking	25	25%	Acceptable
	C	Spring	18	29%	Walking	25	19%	Acceptable
		Summer	15	36%	Standing	20	18%	Acceptable
		Fall	17	31%	Walking	24	20%	Acceptable
		Winter	18	20%	Walking	27	23%	Acceptable
		Annual	17	21%	Walking	25	25%	Acceptable
44	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	18	29%	Walking	25	19%	Acceptable
		Summer	13	18%	Standing	19	19%	Acceptable
		Fall	17	31%	Walking	24	20%	Acceptable
		Winter	18	20%	Walking	26	18%	Acceptable
		Annual	17	21%	Walking	24	14%	Acceptable
	C	Spring	18	29%	Walking	25	19%	Acceptable
		Summer	13	18%	Standing	19	19%	Acceptable
		Fall	17	31%	Walking	24	20%	Acceptable
		Winter	18	20%	Walking	25	14%	Acceptable
		Annual	17	21%	Walking	24	14%	Acceptable
45	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	26	86%	Uncomfortable	33	57%	Unacceptable
		Summer	20	82%	Uncomfortable	26	53%	Acceptable
		Fall	24	71%	Uncomfortable	31	55%	Acceptable
		Winter	28	75%	Dangerous	36	57%	Unacceptable
		Annual	26	86%	Uncomfortable	33	57%	Unacceptable
	C	Spring	27	93%	Uncomfortable	34	62%	Unacceptable
		Summer	20	82%	Uncomfortable	26	53%	Acceptable
		Fall	25	79%	Uncomfortable	32	60%	Unacceptable
		Winter	29	81%	Dangerous	37	61%	Unacceptable
		Annual	27	93%	Uncomfortable	34	62%	Unacceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
46	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	20	43%	Uncomfortable	28	33%	Acceptable
		Summer	15	36%	Standing	22	38%	Acceptable
		Fall	19	46%	Walking	27	35%	Acceptable
		Winter	22	47%	Uncomfortable	31	41%	Acceptable
		Annual	20	43%	Uncomfortable	28	33%	Acceptable
	C	Spring	20	43%	Uncomfortable	28	33%	Acceptable
		Summer	16	45%	Walking	22	38%	Acceptable
		Fall	19	46%	Walking	27	35%	Acceptable
		Winter	22	47%	Uncomfortable	31	41%	Acceptable
		Annual	20	43%	Uncomfortable	28	33%	Acceptable
47	A	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	16		Walking	23		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	C	Spring	17	13%	Walking	23		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	19	12%	Walking	25		Acceptable
		Annual	17	13%	Walking	23		Acceptable
48	A	Spring	16		Walking	23		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	20	25%	Uncomfortable	27	17%	Acceptable
		Summer	17	42%	Walking	23	35%	Acceptable
		Fall	19	27%	Walking	26	24%	Acceptable
		Winter	21	24%	Uncomfortable	28	12%	Acceptable
		Annual	19	19%	Walking	26	13%	Acceptable
	C	Spring	20	25%	Uncomfortable	27	17%	Acceptable
		Summer	17	42%	Walking	23	35%	Acceptable
		Fall	19	27%	Walking	26	24%	Acceptable
		Winter	20	18%	Uncomfortable	28	12%	Acceptable
		Annual	19	19%	Walking	26	13%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
49	A	Spring	16		Walking	24		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	18		Walking	26		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	16		Walking	22		Acceptable
		Summer	14	17%	Standing	19		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	16	-11%	Walking	22	-15%	Acceptable
		Annual	15		Standing	21		Acceptable
	C	Spring	16		Walking	22		Acceptable
		Summer	14	17%	Standing	19		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	15	-17%	Standing	22	-15%	Acceptable
		Annual	15		Standing	21		Acceptable
50	A	Spring	17		Walking	24		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	16		Walking	23		Acceptable
		Winter	19		Walking	27		Acceptable
		Annual	17		Walking	24		Acceptable
	B	Spring	21	24%	Uncomfortable	29	21%	Acceptable
		Summer	18	38%	Walking	24	33%	Acceptable
		Fall	20	25%	Uncomfortable	27	17%	Acceptable
		Winter	21	11%	Uncomfortable	29		Acceptable
		Annual	20	18%	Uncomfortable	27	12%	Acceptable
	C	Spring	21	24%	Uncomfortable	28	17%	Acceptable
		Summer	18	38%	Walking	24	33%	Acceptable
		Fall	20	25%	Uncomfortable	27	17%	Acceptable
		Winter	21	11%	Uncomfortable	28		Acceptable
		Annual	20	18%	Uncomfortable	27	12%	Acceptable
51	A	Spring	16		Walking	23		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	18	12%	Walking	24		Acceptable
		Summer	14	17%	Standing	19	12%	Acceptable
		Fall	17	13%	Walking	23		Acceptable
		Winter	19	12%	Walking	26		Acceptable
		Annual	18	12%	Walking	24		Acceptable
	C	Spring	18	12%	Walking	24		Acceptable
		Summer	14	17%	Standing	19	12%	Acceptable
		Fall	17	13%	Walking	23		Acceptable
		Winter	19	12%	Walking	26		Acceptable
		Annual	18	12%	Walking	24		Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

<u>Effective Gust Criteria</u>

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
52	A	Spring	16		Walking	23		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	17		Walking	26		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	19	19%	Walking	26	13%	Acceptable
		Summer	15	25%	Standing	20	11%	Acceptable
		Fall	18	20%	Walking	24	14%	Acceptable
		Winter	21	24%	Uncomfortable	28		Acceptable
		Annual	19	19%	Walking	26	13%	Acceptable
	C	Spring	19	19%	Walking	26	13%	Acceptable
		Summer	15	25%	Standing	20	11%	Acceptable
		Fall	18	20%	Walking	24	14%	Acceptable
		Winter	21	24%	Uncomfortable	28		Acceptable
		Annual	19	19%	Walking	26	13%	Acceptable
53	A	Spring	13		Standing	21		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	24	85%	Uncomfortable	31	48%	Acceptable
		Summer	18	80%	Walking	24	50%	Acceptable
		Fall	22	69%	Uncomfortable	29	53%	Acceptable
		Winter	26	86%	Uncomfortable	34	55%	Unacceptable
		Annual	24	85%	Uncomfortable	31	55%	Acceptable
	C	Spring	24	85%	Uncomfortable	31	48%	Acceptable
		Summer	19	90%	Walking	24	50%	Acceptable
		Fall	22	69%	Uncomfortable	29	53%	Acceptable
		Winter	26	86%	Uncomfortable	34	55%	Unacceptable
		Annual	24	85%	Uncomfortable	31	55%	Acceptable
54	A	Spring	13		Standing	21		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	19	46%	Walking	27	29%	Acceptable
		Summer	15	50%	Standing	21	31%	Acceptable
		Fall	18	38%	Walking	25	32%	Acceptable
		Winter	20	43%	Uncomfortable	29	32%	Acceptable
		Annual	19	46%	Walking	26	30%	Acceptable
	C	Spring	19	46%	Walking	27	29%	Acceptable
		Summer	15	50%	Standing	21	31%	Acceptable
		Fall	18	38%	Walking	25	32%	Acceptable
		Winter	21	50%	Uncomfortable	29	32%	Acceptable
		Annual	19	46%	Walking	27	35%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
55	A	Spring	16		Walking	24		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	23		Acceptable
		Winter	18		Walking	26		Acceptable
		Annual	16		Walking	24		Acceptable
	B	Spring	24	50%	Uncomfortable	33	38%	Unacceptable
		Summer	19	58%	Walking	26	44%	Acceptable
		Fall	23	53%	Uncomfortable	31	35%	Acceptable
		Winter	27	50%	Uncomfortable	36	38%	Unacceptable
		Annual	24	50%	Uncomfortable	33	38%	Unacceptable
	C	Spring	25	56%	Uncomfortable	33	38%	Unacceptable
		Summer	19	58%	Walking	26	44%	Acceptable
		Fall	23	53%	Uncomfortable	31	35%	Acceptable
		Winter	27	50%	Uncomfortable	36	38%	Unacceptable
		Annual	24	50%	Uncomfortable	33	38%	Unacceptable
56	A	Spring	16		Walking	25		Acceptable
		Summer	12		Sitting	19		Acceptable
		Fall	15		Standing	24		Acceptable
		Winter	18		Walking	28		Acceptable
		Annual	16		Walking	25		Acceptable
	B	Spring	23	44%	Uncomfortable	32	28%	Unacceptable
		Summer	18	50%	Walking	25	32%	Acceptable
		Fall	22	47%	Uncomfortable	30	25%	Acceptable
		Winter	25	39%	Uncomfortable	34	21%	Unacceptable
		Annual	23	44%	Uncomfortable	31	24%	Acceptable
	C	Spring	23	44%	Uncomfortable	32	28%	Unacceptable
		Summer	18	50%	Walking	25	32%	Acceptable
		Fall	22	47%	Uncomfortable	30	25%	Acceptable
		Winter	25	39%	Uncomfortable	35	25%	Unacceptable
		Annual	23	44%	Uncomfortable	32	28%	Unacceptable
57	A	Spring	15		Standing	22		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	14		Standing	22		Acceptable
	B	Spring	14		Standing	23		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	13		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	14		Standing	22		Acceptable
	C	Spring	14		Standing	22		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	13		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	14		Standing	22		Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
58	A	Spring	11		Sitting	17		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	10		Sitting	16		Acceptable
		Winter	11		Sitting	18		Acceptable
		Annual	11		Sitting	17		Acceptable
	B	Spring	17	55%	Walking	26	53%	Acceptable
		Summer	14	56%	Standing	20	43%	Acceptable
		Fall	16	60%	Walking	24	50%	Acceptable
		Winter	18	64%	Walking	27	50%	Acceptable
		Annual	16	45%	Walking	25	47%	Acceptable
	C	Spring	17	55%	Walking	26	53%	Acceptable
		Summer	14	56%	Standing	21	50%	Acceptable
		Fall	16	60%	Walking	24	50%	Acceptable
		Winter	18	64%	Walking	27	50%	Acceptable
		Annual	17	55%	Walking	25	47%	Acceptable
59	A	Spring	23		Uncomfortable	30		Acceptable
		Summer	17		Walking	23		Acceptable
		Fall	21		Uncomfortable	29		Acceptable
		Winter	25		Uncomfortable	34		Unacceptable
		Annual	23		Uncomfortable	30		Acceptable
	B	Spring	19	-17%	Walking	27		Acceptable
		Summer	15	-12%	Standing	22		Acceptable
		Fall	18	-14%	Walking	26	-10%	Acceptable
		Winter	21	-16%	Uncomfortable	29	-15%	Acceptable
		Annual	19	-17%	Walking	27		Acceptable
	C	Spring	19	-17%	Walking	27		Acceptable
		Summer	15	-12%	Standing	22		Acceptable
		Fall	18	-14%	Walking	26	-10%	Acceptable
		Winter	20	-20%	Uncomfortable	29	-15%	Acceptable
		Annual	19	-17%	Walking	27		Acceptable
60	A	Spring	16		Walking	24		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	18		Walking	26		Acceptable
		Annual	16		Walking	24		Acceptable
	B	Spring	15		Standing	23		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	23		Acceptable
		Winter	18		Walking	26		Acceptable
		Annual	16		Walking	24		Acceptable
	C	Spring	15		Standing	24		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	23		Acceptable
		Winter	17		Walking	26		Acceptable
		Annual	15		Standing	24		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
61	A	Spring	20		Uncomfortable	26		Acceptable
		Summer	15		Standing	20		Acceptable
		Fall	19		Walking	25		Acceptable
		Winter	22		Uncomfortable	29		Acceptable
		Annual	20		Uncomfortable	26		Acceptable
	B	Spring	20		Uncomfortable	28		Acceptable
		Summer	17	13%	Walking	24	20%	Acceptable
		Fall	18		Walking	27		Acceptable
		Winter	20		Uncomfortable	29		Acceptable
		Annual	19		Walking	27		Acceptable
	C	Spring	20		Uncomfortable	28		Acceptable
		Summer	17	13%	Walking	24	20%	Acceptable
		Fall	18		Walking	27		Acceptable
		Winter	20		Uncomfortable	29		Acceptable
		Annual	19		Walking	27		Acceptable
62	A	Spring	19		Walking	25		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	18		Walking	24		Acceptable
		Winter	21		Uncomfortable	28		Acceptable
		Annual	19		Walking	25		Acceptable
	B	Spring	14	-26%	Standing	21	-16%	Acceptable
		Summer	11	-21%	Sitting	16	-16%	Acceptable
		Fall	12	-33%	Sitting	19	-21%	Acceptable
		Winter	14	-33%	Standing	22	-21%	Acceptable
		Annual	13	-32%	Standing	20	-20%	Acceptable
	C	Spring	13	-32%	Standing	21	-16%	Acceptable
		Summer	11	-21%	Sitting	16	-16%	Acceptable
		Fall	12	-33%	Sitting	19	-21%	Acceptable
		Winter	14	-33%	Standing	22	-21%	Acceptable
		Annual	13	-32%	Standing	20	-20%	Acceptable
63	A	Spring	18		Walking	26		Acceptable
		Summer	14		Standing	20		Acceptable
		Fall	18		Walking	24		Acceptable
		Winter	20		Uncomfortable	28		Acceptable
		Annual	18		Walking	26		Acceptable
	B	Spring	15	-17%	Standing	23	-12%	Acceptable
		Summer	12	-14%	Sitting	18		Acceptable
		Fall	14	-22%	Standing	22		Acceptable
		Winter	17	-15%	Walking	25	-11%	Acceptable
		Annual	15	-17%	Standing	23	-12%	Acceptable
	C	Spring	15	-17%	Standing	23	-12%	Acceptable
		Summer	12	-14%	Sitting	18		Acceptable
		Fall	14	-22%	Standing	22		Acceptable
		Winter	16	-20%	Walking	25	-11%	Acceptable
		Annual	15	-17%	Standing	23	-12%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
64	A	Spring	15		Standing	22		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	17	13%	Walking	26	18%	Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	16	14%	Walking	24	14%	Acceptable
		Winter	19	19%	Walking	28	22%	Acceptable
		Annual	17	13%	Walking	25	14%	Acceptable
	C	Spring	17	13%	Walking	25	14%	Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	16	14%	Walking	23		Acceptable
		Winter	19	19%	Walking	28	22%	Acceptable
		Annual	17	13%	Walking	25	14%	Acceptable
65	A	Spring	14		Standing	21		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	16	14%	Walking	25	19%	Acceptable
		Summer	12		Sitting	19	12%	Acceptable
		Fall	15		Standing	24	20%	Acceptable
		Winter	18	20%	Walking	28	27%	Acceptable
		Annual	16	14%	Walking	25	19%	Acceptable
	C	Spring	16	14%	Walking	25	19%	Acceptable
		Summer	13		Standing	19	12%	Acceptable
		Fall	15		Standing	24	20%	Acceptable
		Winter	18	20%	Walking	28	27%	Acceptable
		Annual	16	14%	Walking	25	19%	Acceptable
66	A	Spring	14		Standing	21		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	18	29%	Walking	26	24%	Acceptable
		Summer	14	17%	Standing	21	24%	Acceptable
		Fall	17	31%	Walking	25	25%	Acceptable
		Winter	19	27%	Walking	29	32%	Acceptable
		Annual	18	29%	Walking	26	24%	Acceptable
	C	Spring	18	29%	Walking	27	29%	Acceptable
		Summer	14	17%	Standing	21	24%	Acceptable
		Fall	17	31%	Walking	26	30%	Acceptable
		Winter	19	27%	Walking	29	32%	Acceptable
		Annual	18	29%	Walking	27	29%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
67	A	Spring	13		Standing	20		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	19	46%	Walking	28	40%	Acceptable
		Summer	15	36%	Standing	22	38%	Acceptable
		Fall	18	38%	Walking	26	37%	Acceptable
		Winter	21	50%	Uncomfortable	30	43%	Acceptable
		Annual	19	46%	Walking	27	35%	Acceptable
	C	Spring	19	46%	Walking	28	40%	Acceptable
		Summer	15	36%	Standing	22	38%	Acceptable
		Fall	18	38%	Walking	26	37%	Acceptable
		Winter	21	50%	Uncomfortable	30	43%	Acceptable
		Annual	19	46%	Walking	28	40%	Acceptable
68	A	Spring	13		Standing	19		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	13		Standing	21		Acceptable
		Annual	13		Standing	19		Acceptable
	B	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	12		Sitting	20		Acceptable
	C	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	13		Standing	21		Acceptable
		Annual	12		Sitting	20		Acceptable
69	A	Spring	13		Standing	20		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	19		Acceptable
	B	Spring	13		Standing	21		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	14		Standing	23		Acceptable
		Annual	13		Standing	21	11%	Acceptable
	C	Spring	13		Standing	21		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

<u>Effective Gust Criteria</u>

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
70	A	Spring	18		Walking	27		Acceptable
		Summer	13		Standing	20		Acceptable
		Fall	16		Walking	25		Acceptable
		Winter	19		Walking	29		Acceptable
		Annual	17		Walking	26		Acceptable
	B	Spring	24	33%	Uncomfortable	32	19%	Unacceptable
		Summer	19	46%	Walking	24	20%	Acceptable
		Fall	23	44%	Uncomfortable	30	20%	Acceptable
		Winter	27	42%	Uncomfortable	35	21%	Unacceptable
		Annual	24	41%	Uncomfortable	32	23%	Unacceptable
	C	Spring	22	22%	Uncomfortable	30	11%	Acceptable
		Summer	17	31%	Walking	23	15%	Acceptable
		Fall	21	31%	Uncomfortable	29	16%	Acceptable
		Winter	24	26%	Uncomfortable	33	14%	Unacceptable
		Annual	22	29%	Uncomfortable	30	15%	Acceptable
71	A	Spring	19		Walking	29		Acceptable
		Summer	15		Standing	22		Acceptable
		Fall	18		Walking	27		Acceptable
		Winter	21		Uncomfortable	31		Acceptable
		Annual	19		Walking	28		Acceptable
	B	Spring	23	21%	Uncomfortable	31		Acceptable
		Summer	19	27%	Walking	26	18%	Acceptable
		Fall	22	22%	Uncomfortable	30	11%	Acceptable
		Winter	25	19%	Uncomfortable	34		Unacceptable
		Annual	23	21%	Uncomfortable	31	11%	Acceptable
	C	Spring	20		Uncomfortable	30		Acceptable
		Summer	16		Walking	24		Acceptable
		Fall	19		Walking	29		Acceptable
		Winter	21		Uncomfortable	32		Unacceptable
		Annual	20		Uncomfortable	29		Acceptable
72	A	Spring	15		Standing	24		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	14		Standing	22		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	15		Standing	23		Acceptable
	B	Spring	25	67%	Uncomfortable	35	46%	Unacceptable
		Summer	19	58%	Walking	26	44%	Acceptable
		Fall	24	71%	Uncomfortable	33	50%	Unacceptable
		Winter	28	65%	Dangerous	39	56%	Unacceptable
		Annual	25	67%	Uncomfortable	35	52%	Unacceptable
	C	Spring	24	60%	Uncomfortable	34	42%	Unacceptable
		Summer	18	50%	Walking	26	44%	Acceptable
		Fall	23	64%	Uncomfortable	32	45%	Unacceptable
		Winter	27	59%	Uncomfortable	38	52%	Unacceptable
		Annual	24	60%	Uncomfortable	34	48%	Unacceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
73	A	Spring	17		Walking	25		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	15		Standing	23		Acceptable
		Winter	18		Walking	28		Acceptable
		Annual	16		Walking	25		Acceptable
	B	Spring	28	65%	Dangerous	38	52%	Unacceptable
		Summer	21	62%	Uncomfortable	29	53%	Acceptable
		Fall	26	73%	Uncomfortable	36	57%	Unacceptable
		Winter	31	72%	Dangerous	42	50%	Unacceptable
		Annual	28	75%	Dangerous	38	52%	Unacceptable
	C	Spring	29	71%	Dangerous	37	48%	Unacceptable
		Summer	22	69%	Uncomfortable	29	53%	Acceptable
		Fall	27	80%	Uncomfortable	35	52%	Unacceptable
		Winter	32	78%	Dangerous	42	50%	Unacceptable
		Annual	28	75%	Dangerous	37	48%	Unacceptable
74	A	Spring	15		Standing	24		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	17		Walking	26		Acceptable
		Annual	15		Standing	23		Acceptable
	B	Spring	23	53%	Uncomfortable	33	38%	Unacceptable
		Summer	18	50%	Walking	26	44%	Acceptable
		Fall	21	40%	Uncomfortable	31	41%	Acceptable
		Winter	25	47%	Uncomfortable	36	38%	Unacceptable
		Annual	22	47%	Uncomfortable	33	43%	Unacceptable
	C	Spring	27	80%	Uncomfortable	39	62%	Unacceptable
		Summer	21	75%	Uncomfortable	29	61%	Acceptable
		Fall	25	67%	Uncomfortable	36	64%	Unacceptable
		Winter	30	76%	Dangerous	43	65%	Unacceptable
		Annual	27	80%	Uncomfortable	38	65%	Unacceptable
75	A	Spring	17		Walking	25		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	16		Walking	24		Acceptable
		Winter	19		Walking	28		Acceptable
		Annual	17		Walking	25		Acceptable
	B	Spring	29	71%	Dangerous	37	48%	Unacceptable
		Summer	22	69%	Uncomfortable	28	47%	Acceptable
		Fall	27	69%	Uncomfortable	35	46%	Unacceptable
		Winter	32	68%	Dangerous	41	46%	Unacceptable
		Annual	29	71%	Dangerous	37	48%	Unacceptable
	C	Spring	27	59%	Uncomfortable	35	40%	Unacceptable
		Summer	21	62%	Uncomfortable	27	42%	Acceptable
		Fall	26	62%	Uncomfortable	32	33%	Unacceptable
		Winter	30	58%	Dangerous	38	36%	Unacceptable
		Annual	27	59%	Uncomfortable	34	36%	Unacceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
76	A	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	17	31%	Walking	26	30%	Acceptable
		Summer	13	30%	Standing	20	25%	Acceptable
		Fall	16	33%	Walking	25	32%	Acceptable
		Winter	19	36%	Walking	29	32%	Acceptable
		Annual	17	31%	Walking	26	30%	Acceptable
	C	Spring	25	92%	Uncomfortable	34	70%	Unacceptable
		Summer	19	90%	Walking	26	62%	Acceptable
		Fall	23	92%	Uncomfortable	31	63%	Acceptable
		Winter	27	93%	Uncomfortable	37	68%	Unacceptable
		Annual	24	85%	Uncomfortable	34	70%	Unacceptable
77	A	Spring	13		Standing	19		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	19		Acceptable
	B	Spring	16	23%	Walking	26	37%	Acceptable
		Summer	12	20%	Sitting	18	20%	Acceptable
		Fall	15	25%	Standing	22	22%	Acceptable
		Winter	16	14%	Walking	25	19%	Acceptable
		Annual	15	15%	Standing	23	21%	Acceptable
	C	Spring	20	54%	Uncomfortable	29	53%	Acceptable
		Summer	15	50%	Standing	22	47%	Acceptable
		Fall	18	50%	Walking	26	44%	Acceptable
		Winter	22	57%	Uncomfortable	31	48%	Acceptable
		Annual	20	54%	Uncomfortable	28	47%	Acceptable
78	A	Spring	16		Walking	24		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	18		Walking	27		Acceptable
		Annual	16		Walking	24		Acceptable
	B	Spring	20	25%	Uncomfortable	30	25%	Acceptable
		Summer	15	25%	Standing	22	22%	Acceptable
		Fall	18	20%	Walking	27	23%	Acceptable
		Winter	21	17%	Uncomfortable	31	15%	Acceptable
		Annual	19	19%	Walking	29	21%	Acceptable
	C	Spring	20	25%	Uncomfortable	29	21%	Acceptable
		Summer	15	25%	Standing	23	28%	Acceptable
		Fall	19	27%	Walking	28	27%	Acceptable
		Winter	23	28%	Uncomfortable	33	22%	Unacceptable
		Annual	20	25%	Uncomfortable	29	21%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
79	A	Spring	21		Uncomfortable	30		Acceptable
		Summer	17		Walking	25		Acceptable
		Fall	20		Uncomfortable	29		Acceptable
		Winter	23		Uncomfortable	33		Unacceptable
		Annual	21		Uncomfortable	30		Acceptable
	B	Spring	21		Uncomfortable	29		Acceptable
		Summer	19	12%	Walking	26		Acceptable
		Fall	21		Uncomfortable	29		Acceptable
		Winter	23		Uncomfortable	31		Acceptable
		Annual	21		Uncomfortable	29		Acceptable
	C	Spring	20		Uncomfortable	28		Acceptable
		Summer	18		Walking	26		Acceptable
		Fall	20		Uncomfortable	28		Acceptable
		Winter	21		Uncomfortable	30		Acceptable
		Annual	20		Uncomfortable	28		Acceptable
80	A	Spring	28		Dangerous	36		Unacceptable
		Summer	22		Uncomfortable	29		Acceptable
		Fall	26		Uncomfortable	34		Unacceptable
		Winter	31		Dangerous	41		Unacceptable
		Annual	28		Dangerous	36		Unacceptable
	B	Spring	29		Dangerous	37		Unacceptable
		Summer	23		Uncomfortable	29		Acceptable
		Fall	28		Dangerous	35		Unacceptable
		Winter	33		Dangerous	41		Unacceptable
		Annual	29		Dangerous	37		Unacceptable
	C	Spring	27		Uncomfortable	35		Unacceptable
		Summer	22		Uncomfortable	28		Acceptable
		Fall	26		Uncomfortable	33		Unacceptable
		Winter	30		Dangerous	39		Unacceptable
		Annual	27		Uncomfortable	35		Unacceptable
81	A	Spring	16		Walking	23		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	16		Walking	23		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	12	-25%	Sitting	19	-17%	Acceptable
		Summer	10	-33%	Sitting	16	-24%	Acceptable
		Fall	11	-31%	Sitting	18	-22%	Acceptable
		Winter	12	-29%	Sitting	20	-20%	Acceptable
		Annual	11	-31%	Sitting	19	-17%	Acceptable
	C	Spring	16		Walking	22		Acceptable
		Summer	13	-13%	Standing	18	-14%	Acceptable
		Fall	14	-12%	Standing	21		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	15		Standing	21		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
82	A	Spring	22		Uncomfortable	30		Acceptable
		Summer	16		Walking	22		Acceptable
		Fall	20		Uncomfortable	27		Acceptable
		Winter	21		Uncomfortable	29		Acceptable
		Annual	20		Uncomfortable	28		Acceptable
	B	Spring	19	-14%	Walking	29		Acceptable
		Summer	13	-19%	Standing	20		Acceptable
		Fall	17	-15%	Walking	25		Acceptable
		Winter	18	-14%	Walking	27		Acceptable
		Annual	17	-15%	Walking	26		Acceptable
	C	Spring	20		Uncomfortable	30		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	18		Walking	27		Acceptable
		Winter	21		Uncomfortable	30		Acceptable
		Annual	19		Walking	28		Acceptable
83	A	Spring	20		Uncomfortable	29		Acceptable
		Summer	16		Walking	23		Acceptable
		Fall	19		Walking	27		Acceptable
		Winter	22		Uncomfortable	31		Acceptable
		Annual	20		Uncomfortable	28		Acceptable
	B	Spring	22		Uncomfortable	30		Acceptable
		Summer	17		Walking	24		Acceptable
		Fall	21	11%	Uncomfortable	28		Acceptable
		Winter	25	14%	Uncomfortable	32		Unacceptable
		Annual	22		Uncomfortable	29		Acceptable
	C	Spring	21		Uncomfortable	30		Acceptable
		Summer	17		Walking	23		Acceptable
		Fall	20		Uncomfortable	28		Acceptable
		Winter	24		Uncomfortable	32		Unacceptable
		Annual	21		Uncomfortable	29		Acceptable
84	A	Spring	20		Uncomfortable	30		Acceptable
		Summer	16		Walking	24		Acceptable
		Fall	18		Walking	28		Acceptable
		Winter	21		Uncomfortable	32		Unacceptable
		Annual	19		Walking	29		Acceptable
	B	Spring	20		Uncomfortable	31		Acceptable
		Summer	16		Walking	25		Acceptable
		Fall	19		Walking	29		Acceptable
		Winter	22		Uncomfortable	34		Unacceptable
		Annual	20		Uncomfortable	31		Acceptable
	C	Spring	25	25%	Uncomfortable	34	13%	Unacceptable
		Summer	19	19%	Walking	26		Acceptable
		Fall	23	28%	Uncomfortable	31	11%	Acceptable
		Winter	27	29%	Uncomfortable	37	16%	Unacceptable
		Annual	25	32%	Uncomfortable	33	14%	Unacceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
85	A	Spring	16		Walking	25		Acceptable
		Summer	11		Sitting	18		Acceptable
		Fall	14		Standing	22		Acceptable
		Winter	15		Standing	24		Acceptable
		Annual	14		Standing	23		Acceptable
	B	Spring	16		Walking	26		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	23		Acceptable
		Winter	17	13%	Walking	26		Acceptable
		Annual	15		Standing	24		Acceptable
	C	Spring	16		Walking	25		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	23		Acceptable
		Winter	16		Walking	25		Acceptable
		Annual	15		Standing	23		Acceptable
86	A	Spring	12		Sitting	18		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	11		Sitting	17		Acceptable
		Winter	12		Sitting	19		Acceptable
		Annual	11		Sitting	18		Acceptable
	B	Spring	12		Sitting	18		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	11		Sitting	17		Acceptable
		Winter	12		Sitting	19		Acceptable
		Annual	11		Sitting	18		Acceptable
	C	Spring	18	50%	Walking	27	50%	Acceptable
		Summer	13	44%	Standing	19	36%	Acceptable
		Fall	16	45%	Walking	24	41%	Acceptable
		Winter	18	50%	Walking	27	42%	Acceptable
		Annual	17	55%	Walking	25	39%	Acceptable
87	A	Spring	14		Standing	22		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	15		Standing	23		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	C	Spring	15		Standing	25	14%	Acceptable
		Summer	11		Sitting	18	12%	Acceptable
		Fall	13		Standing	23	15%	Acceptable
		Winter	15		Standing	24		Acceptable
		Annual	14		Standing	23		Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
88	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	15		Standing	23		Acceptable
		Summer	13	18%	Standing	19		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	C	Spring	11		Sitting	18		Acceptable
		Summer	8	-27%	Sitting	13	-24%	Acceptable
		Fall	10		Sitting	16		Acceptable
		Winter	11		Sitting	19		Acceptable
		Annual	10		Sitting	17		Acceptable
89	A	Spring	12		Sitting	19		Acceptable
		Summer	9		Sitting	15		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	13		Standing	20		Acceptable
		Annual	12		Sitting	19		Acceptable
	B	Spring	13		Standing	20		Acceptable
		Summer	10	11%	Sitting	17	13%	Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	13		Standing	21		Acceptable
		Annual	13		Standing	20		Acceptable
	C	Spring	10	-17%	Sitting	16	-16%	Acceptable
		Summer	8	-11%	Sitting	12	-20%	Acceptable
		Fall	10		Sitting	16	-11%	Acceptable
		Winter	11	-15%	Sitting	17	-15%	Acceptable
		Annual	10	-17%	Sitting	16	-16%	Acceptable
90	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	15		Standing	23		Acceptable
		Summer	13	18%	Standing	19	12%	Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	C	Spring	11	-21%	Sitting	18	-14%	Acceptable
		Summer	8	-27%	Sitting	13	-24%	Acceptable
		Fall	10	-23%	Sitting	16	-20%	Acceptable
		Winter	11	-27%	Sitting	19	-14%	Acceptable
		Annual	10	-29%	Sitting	17	-19%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
91	A	Spring	12		Sitting	19		Acceptable
		Summer	9		Sitting	15		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	12		Sitting	20		Acceptable
		Annual	11		Sitting	18		Acceptable
	B	Spring	12		Sitting	19		Acceptable
		Summer	10	11%	Sitting	15		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	12		Sitting	20		Acceptable
		Annual	11		Sitting	18		Acceptable
	C	Spring	13		Standing	19		Acceptable
		Summer	11	22%	Sitting	16		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	13		Standing	19		Acceptable
		Annual	12		Sitting	18		Acceptable
92	A	Spring	12		Sitting	19		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	11		Sitting	17		Acceptable
		Winter	12		Sitting	20		Acceptable
		Annual	11		Sitting	18		Acceptable
	B	Spring	12		Sitting	19		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	10		Sitting	17		Acceptable
		Winter	11		Sitting	19		Acceptable
		Annual	11		Sitting	17		Acceptable
	C	Spring	12		Sitting	18		Acceptable
		Summer	8	-11%	Sitting	13		Acceptable
		Fall	10		Sitting	16		Acceptable
		Winter	11		Sitting	18		Acceptable
		Annual	10		Sitting	17		Acceptable
93	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	20		Acceptable
	C	Spring	15		Standing	21		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	20		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
94	A	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	19		Acceptable
	B	Spring	13		Standing	19		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	13		Standing	20		Acceptable
		Annual	12		Sitting	19		Acceptable
	C	Spring	13		Standing	19		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	13		Standing	20		Acceptable
		Annual	12		Sitting	18		Acceptable
95	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	20		Acceptable
	B	Spring	14		Standing	20		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	19		Acceptable
	C	Spring	15		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	15		Standing	21		Acceptable
		Annual	14		Standing	20		Acceptable
96	A	Spring	14		Standing	21		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	20		Acceptable
	B	Spring	15		Standing	21		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	21		Acceptable
	C	Spring	15		Standing	21		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	21		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
97	A	Spring	18		Walking	24		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	18		Walking	25		Acceptable
		Summer	15		Standing	20		Acceptable
		Fall	17		Walking	23		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	17		Walking	24		Acceptable
	C	Spring	18		Walking	25		Acceptable
		Summer	15		Standing	20		Acceptable
		Fall	17		Walking	23		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	17		Walking	24		Acceptable
98	A	Spring	18		Walking	25		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	17		Walking	24		Acceptable
		Winter	18		Walking	26		Acceptable
		Annual	17		Walking	24		Acceptable
	B	Spring	19		Walking	27		Acceptable
		Summer	16		Walking	22		Acceptable
		Fall	18		Walking	25		Acceptable
		Winter	20	11%	Uncomfortable	28		Acceptable
		Annual	19	12%	Walking	26		Acceptable
	C	Spring	19		Walking	27		Acceptable
		Summer	16		Walking	22		Acceptable
		Fall	18		Walking	25		Acceptable
		Winter	20	11%	Uncomfortable	28		Acceptable
		Annual	18		Walking	26		Acceptable
99	A	Spring	14		Standing	21		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	16	14%	Walking	23		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	17	13%	Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	C	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	15		Standing	21		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
100	A	Spring	17		Walking	24		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	17		Walking	25		Acceptable
		Summer	14		Standing	20		Acceptable
		Fall	17		Walking	23		Acceptable
		Winter	18		Walking	26		Acceptable
		Annual	17		Walking	24		Acceptable
	C	Spring	17		Walking	24		Acceptable
		Summer	14		Standing	20		Acceptable
		Fall	16		Walking	23		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
101	A	Spring	17		Walking	24		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	16		Walking	22		Acceptable
	B	Spring	17		Walking	24		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	C	Spring	18		Walking	24		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	16		Walking	23		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
102	A	Spring	17		Walking	24		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	16		Walking	22		Acceptable
	B	Spring	17		Walking	23		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	16		Walking	22		Acceptable
	C	Spring	17		Walking	24		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	16		Walking	22		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
103	A	Spring	12		Sitting	18		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	11		Sitting	17		Acceptable
		Winter	11		Sitting	18		Acceptable
		Annual	11		Sitting	17		Acceptable
	B	Spring	12		Sitting	18		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	11		Sitting	17		Acceptable
		Winter	12		Sitting	18		Acceptable
		Annual	11		Sitting	17		Acceptable
	C	Spring	12		Sitting	18		Acceptable
		Summer	10		Sitting	14		Acceptable
		Fall	11		Sitting	17		Acceptable
		Winter	12		Sitting	18		Acceptable
		Annual	11		Sitting	17		Acceptable
104	A	Spring	13		Standing	19		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	17		Acceptable
		Winter	13		Standing	19		Acceptable
		Annual	12		Sitting	18		Acceptable
	B	Spring	13		Standing	20		Acceptable
		Summer	12	20%	Sitting	17	13%	Acceptable
		Fall	13		Standing	19	12%	Acceptable
		Winter	14		Standing	21	11%	Acceptable
		Annual	13		Standing	19		Acceptable
	C	Spring	14		Standing	20		Acceptable
		Summer	12	20%	Sitting	18	20%	Acceptable
		Fall	13		Standing	20	18%	Acceptable
		Winter	14		Standing	21	11%	Acceptable
		Annual	13		Standing	20	11%	Acceptable
105	A	Spring	18		Walking	26		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	17		Walking	24		Acceptable
		Winter	19		Walking	28		Acceptable
		Annual	18		Walking	26		Acceptable
	B	Spring	11	-39%	Sitting	17	-35%	Acceptable
		Summer	10	-33%	Sitting	15	-29%	Acceptable
		Fall	11	-35%	Sitting	17	-29%	Acceptable
		Winter	11	-42%	Sitting	18	-36%	Acceptable
		Annual	11	-39%	Sitting	17	-35%	Acceptable
	C	Spring	12	-33%	Sitting	20	-23%	Acceptable
		Summer	10	-33%	Sitting	16	-24%	Acceptable
		Fall	12	-29%	Sitting	19	-21%	Acceptable
		Winter	14	-26%	Standing	22	-21%	Acceptable
		Annual	12	-33%	Sitting	20	-23%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
106	A	Spring	19		Walking	27		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	18		Walking	25		Acceptable
		Winter	21		Uncomfortable	29		Acceptable
		Annual	19		Walking	27		Acceptable
	B	Spring	16	-16%	Walking	23	-15%	Acceptable
		Summer	13	-13%	Standing	18	-14%	Acceptable
		Fall	15	-17%	Standing	21	-16%	Acceptable
		Winter	16	-24%	Walking	23	-21%	Acceptable
		Annual	15	-21%	Standing	22	-19%	Acceptable
	C	Spring	17	-11%	Walking	24	-11%	Acceptable
		Summer	13	-13%	Standing	19		Acceptable
		Fall	15	-17%	Standing	22	-12%	Acceptable
		Winter	17	-19%	Walking	24	-17%	Acceptable
		Annual	16	-16%	Walking	22	-19%	Acceptable
107	A	Spring	18		Walking	24		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	16		Walking	23		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	17		Walking	23		Acceptable
	B	Spring	16	-11%	Walking	23		Acceptable
		Summer	12		Sitting	16	-11%	Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	16	-11%	Walking	23		Acceptable
		Annual	15	-12%	Standing	21		Acceptable
	C	Spring	17		Walking	23		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	16	-11%	Walking	23		Acceptable
		Annual	15	-12%	Standing	22		Acceptable
108	A	Spring	17		Walking	24		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	16		Walking	23		Acceptable
		Winter	19		Walking	26		Acceptable
		Annual	17		Walking	24		Acceptable
	B	Spring	9	-47%	Sitting	14	-42%	Acceptable
		Summer	7	-50%	Sitting	11	-42%	Acceptable
		Fall	8	-50%	Sitting	13	-43%	Acceptable
		Winter	9	-53%	Sitting	15	-42%	Acceptable
		Annual	9	-47%	Sitting	14	-42%	Acceptable
	C	Spring	13	-24%	Standing	19	-21%	Acceptable
		Summer	9	-36%	Sitting	14	-26%	Acceptable
		Fall	11	-31%	Sitting	17	-26%	Acceptable
		Winter	13	-32%	Standing	19	-27%	Acceptable
		Annual	12	-29%	Sitting	18	-25%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
109	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	11	-21%	Sitting	18	-14%	Acceptable
		Summer	8	-27%	Sitting	13	-19%	Acceptable
		Fall	10	-29%	Sitting	16	-20%	Acceptable
		Winter	11	-31%	Sitting	18	-22%	Acceptable
		Annual	10	-29%	Sitting	17	-19%	Acceptable
	C	Spring	12	-14%	Sitting	18	-14%	Acceptable
		Summer	8	-27%	Sitting	13	-19%	Acceptable
		Fall	10	-29%	Sitting	16	-20%	Acceptable
		Winter	11	-31%	Sitting	18	-22%	Acceptable
		Annual	10	-29%	Sitting	17	-19%	Acceptable
110	A	Spring	16		Walking	23		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	13	-19%	Standing	20	-13%	Acceptable
		Summer	9	-31%	Sitting	14	-22%	Acceptable
		Fall	11	-27%	Sitting	18	-18%	Acceptable
		Winter	12	-33%	Sitting	19	-24%	Acceptable
		Annual	12	-25%	Sitting	18	-22%	Acceptable
	C	Spring	13	-19%	Standing	21		Acceptable
		Summer	9	-31%	Sitting	14	-22%	Acceptable
		Fall	12	-20%	Sitting	18	-18%	Acceptable
		Winter	12	-33%	Sitting	19	-24%	Acceptable
		Annual	12	-25%	Sitting	18	-22%	Acceptable
111	A	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	19		Acceptable
	B	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	13		Standing	20		Acceptable
		Annual	12		Sitting	19		Acceptable
	C	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	13		Standing	20		Acceptable
		Annual	12		Sitting	19		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

<u>Effective Gust Criteria</u>

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
112	A	Spring	11		Sitting	17		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	11		Sitting	17		Acceptable
		Winter	12		Sitting	18		Acceptable
		Annual	11		Sitting	17		Acceptable
	B	Spring	11		Sitting	17		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	11		Sitting	17		Acceptable
		Winter	12		Sitting	18		Acceptable
		Annual	11		Sitting	17		Acceptable
	C	Spring	11		Sitting	17		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	11		Sitting	17		Acceptable
		Winter	11		Sitting	18		Acceptable
		Annual	11		Sitting	17		Acceptable
113	A	Spring	11		Sitting	18		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	10		Sitting	17		Acceptable
		Winter	11		Sitting	18		Acceptable
		Annual	11		Sitting	17		Acceptable
	B	Spring	11		Sitting	17		Acceptable
		Summer	9		Sitting	15		Acceptable
		Fall	10		Sitting	17		Acceptable
		Winter	12		Sitting	18		Acceptable
		Annual	11		Sitting	17		Acceptable
	C	Spring	11		Sitting	18		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	11		Sitting	17		Acceptable
		Winter	12		Sitting	19		Acceptable
		Annual	11		Sitting	17		Acceptable
114	A	Spring	9		Sitting	13		Acceptable
		Summer	7		Sitting	11		Acceptable
		Fall	8		Sitting	13		Acceptable
		Winter	9		Sitting	14		Acceptable
		Annual	8		Sitting	13		Acceptable
	B	Spring	9		Sitting	13		Acceptable
		Summer	7		Sitting	11		Acceptable
		Fall	9	12%	Sitting	13		Acceptable
		Winter	10	11%	Sitting	15		Acceptable
		Annual	9	12%	Sitting	13		Acceptable
	C	Spring	9		Sitting	14		Acceptable
		Summer	7		Sitting	11		Acceptable
		Fall	9	12%	Sitting	13		Acceptable
		Winter	10	11%	Sitting	15		Acceptable
		Annual	9	12%	Sitting	14		Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
115	A	Spring	19		Walking	26		Acceptable
		Summer	14		Standing	20		Acceptable
		Fall	18		Walking	24		Acceptable
		Winter	21		Uncomfortable	29		Acceptable
		Annual	19		Walking	26		Acceptable
	B	Spring	17	-11%	Walking	24		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	16	-11%	Walking	23		Acceptable
		Winter	19		Walking	28		Acceptable
		Annual	17	-11%	Walking	24		Acceptable
	C	Spring	17	-11%	Walking	24		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	16	-11%	Walking	23		Acceptable
		Winter	19		Walking	27		Acceptable
		Annual	17	-11%	Walking	24		Acceptable
116	A	Spring	18		Walking	26		Acceptable
		Summer	14		Standing	20		Acceptable
		Fall	17		Walking	24		Acceptable
		Winter	19		Walking	28		Acceptable
		Annual	18		Walking	25		Acceptable
	B	Spring	16	-11%	Walking	25		Acceptable
		Summer	12	-14%	Sitting	19		Acceptable
		Fall	15	-12%	Standing	23		Acceptable
		Winter	18		Walking	27		Acceptable
		Annual	16	-11%	Walking	24		Acceptable
	C	Spring	16	-11%	Walking	25		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	15	-12%	Standing	23		Acceptable
		Winter	18		Walking	27		Acceptable
		Annual	16	-11%	Walking	24		Acceptable
117	A	Spring	22		Uncomfortable	29		Acceptable
		Summer	17		Walking	22		Acceptable
		Fall	21		Uncomfortable	27		Acceptable
		Winter	25		Uncomfortable	32		Unacceptable
		Annual	22		Uncomfortable	29		Acceptable
	B	Spring	24		Uncomfortable	31		Acceptable
		Summer	19	12%	Walking	24		Acceptable
		Fall	23		Uncomfortable	29		Acceptable
		Winter	28	12%	Dangerous	34		Unacceptable
		Annual	24		Uncomfortable	31		Acceptable
	C	Spring	24		Uncomfortable	31		Acceptable
		Summer	19	12%	Walking	24		Acceptable
		Fall	23		Uncomfortable	29		Acceptable
		Winter	28	12%	Dangerous	34		Unacceptable
		Annual	24		Uncomfortable	31		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
118	A	Spring	17		Walking	23		Acceptable
		Summer	14		Standing	18		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	18		Walking	24		Acceptable
		Annual	17		Walking	22		Acceptable
	B	Spring	17		Walking	23		Acceptable
		Summer	14		Standing	18		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	18		Walking	24		Acceptable
		Annual	17		Walking	22		Acceptable
	C	Spring	17		Walking	23		Acceptable
		Summer	14		Standing	18		Acceptable
		Fall	17		Walking	22		Acceptable
		Winter	18		Walking	24		Acceptable
		Annual	17		Walking	22		Acceptable
119	A	Spring	17		Walking	23		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	16		Walking	22		Acceptable
	B	Spring	16		Walking	22		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	14	-12%	Standing	21		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	15		Standing	21		Acceptable
	C	Spring	16		Walking	22		Acceptable
		Summer	12	-14%	Sitting	18		Acceptable
		Fall	14	-12%	Standing	20		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	15		Standing	21		Acceptable
120	A	Spring	17		Walking	23		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	16		Walking	22		Acceptable
	B	Spring	15	-12%	Standing	22		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	15	-12%	Standing	22		Acceptable
		Annual	14	-12%	Standing	20		Acceptable
	C	Spring	15	-12%	Standing	21		Acceptable
		Summer	12	-14%	Sitting	17	-11%	Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	15	-12%	Standing	22		Acceptable
		Annual	14	-12%	Standing	20		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
121	A	Spring	14		Standing	20		Acceptable
		Summer	11		Sitting	15		Acceptable
		Fall	14		Standing	19		Acceptable
		Winter	16		Walking	22		Acceptable
		Annual	14		Standing	20		Acceptable
	B	Spring	16	14%	Walking	23	15%	Acceptable
		Summer	14	27%	Standing	19	27%	Acceptable
		Fall	15		Standing	22	16%	Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	C	Spring	16	14%	Walking	23	15%	Acceptable
		Summer	14	27%	Standing	19	27%	Acceptable
		Fall	15		Standing	22	16%	Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
122	A	Spring	18		Walking	25		Acceptable
		Summer	14		Standing	20		Acceptable
		Fall	17		Walking	25		Acceptable
		Winter	20		Uncomfortable	28		Acceptable
		Annual	18		Walking	25		Acceptable
	B	Spring	15	-17%	Standing	22	-12%	Acceptable
		Summer	11	-21%	Sitting	17	-15%	Acceptable
		Fall	14	-18%	Standing	20	-20%	Acceptable
		Winter	15	-25%	Standing	23	-18%	Acceptable
		Annual	14	-22%	Standing	21	-16%	Acceptable
	C	Spring	15	-17%	Standing	22	-12%	Acceptable
		Summer	11	-21%	Sitting	17	-15%	Acceptable
		Fall	13	-24%	Standing	20	-20%	Acceptable
		Winter	15	-25%	Standing	22	-21%	Acceptable
		Annual	14	-22%	Standing	21	-16%	Acceptable
123	A	Spring	21		Uncomfortable	30		Acceptable
		Summer	18		Walking	25		Acceptable
		Fall	20		Uncomfortable	28		Acceptable
		Winter	23		Uncomfortable	32		Unacceptable
		Annual	21		Uncomfortable	29		Acceptable
	B	Spring	19		Walking	28		Acceptable
		Summer	18		Walking	25		Acceptable
		Fall	19		Walking	27		Acceptable
		Winter	20	-13%	Uncomfortable	28	-12%	Acceptable
		Annual	19		Walking	27		Acceptable
	C	Spring	19		Walking	27		Acceptable
		Summer	17		Walking	25		Acceptable
		Fall	19		Walking	26		Acceptable
		Winter	20	-13%	Uncomfortable	28	-12%	Acceptable
		Annual	19		Walking	27		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

<u>Effective Gust Criteria</u>

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
124	A	Spring	15		Standing	23		Acceptable
		Summer	13		Standing	20		Acceptable
		Fall	14		Standing	22		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	15		Standing	23		Acceptable
		Summer	13		Standing	20		Acceptable
		Fall	14		Standing	22		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	C	Spring	15		Standing	23		Acceptable
		Summer	12		Sitting	19		Acceptable
		Fall	14		Standing	22		Acceptable
		Winter	15		Standing	23		Acceptable
		Annual	14		Standing	22		Acceptable
125	A	Spring	9		Sitting	15		Acceptable
		Summer	7		Sitting	12		Acceptable
		Fall	8		Sitting	14		Acceptable
		Winter	9		Sitting	15		Acceptable
		Annual	8		Sitting	14		Acceptable
	B	Spring	10	11%	Sitting	16		Acceptable
		Summer	7		Sitting	12		Acceptable
		Fall	9	12%	Sitting	15		Acceptable
		Winter	10	11%	Sitting	16		Acceptable
		Annual	9	12%	Sitting	15		Acceptable
	C	Spring	10	11%	Sitting	16		Acceptable
		Summer	7		Sitting	12		Acceptable
		Fall	9	12%	Sitting	15		Acceptable
		Winter	10	11%	Sitting	16		Acceptable
		Annual	9	12%	Sitting	15		Acceptable
126	A	Spring	7		Sitting	10		Acceptable
		Summer	6		Sitting	9		Acceptable
		Fall	6		Sitting	10		Acceptable
		Winter	7		Sitting	11		Acceptable
		Annual	6		Sitting	10		Acceptable
	B	Spring	7		Sitting	11		Acceptable
		Summer	6		Sitting	9		Acceptable
		Fall	7	17%	Sitting	11		Acceptable
		Winter	8	14%	Sitting	12		Acceptable
		Annual	7	17%	Sitting	11		Acceptable
	C	Spring	7		Sitting	11		Acceptable
		Summer	5	-17%	Sitting	9		Acceptable
		Fall	7	17%	Sitting	11		Acceptable
		Winter	7		Sitting	12		Acceptable
		Annual	7	17%	Sitting	11		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
127	A	Spring	9		Sitting	15		Acceptable
		Summer	8		Sitting	12		Acceptable
		Fall	9		Sitting	15		Acceptable
		Winter	10		Sitting	16		Acceptable
		Annual	9		Sitting	15		Acceptable
	B	Spring	12	33%	Sitting	19	27%	Acceptable
		Summer	10	25%	Sitting	15	25%	Acceptable
		Fall	11	22%	Sitting	18	20%	Acceptable
		Winter	13	30%	Standing	20	25%	Acceptable
		Annual	12	33%	Sitting	18	20%	Acceptable
	C	Spring	12	33%	Sitting	19	27%	Acceptable
		Summer	10	25%	Sitting	15	25%	Acceptable
		Fall	11	22%	Sitting	17	13%	Acceptable
		Winter	12	20%	Sitting	20	25%	Acceptable
		Annual	12	33%	Sitting	18	20%	Acceptable
128	A	Spring	10		Sitting	17		Acceptable
		Summer	8		Sitting	13		Acceptable
		Fall	9		Sitting	15		Acceptable
		Winter	11		Sitting	17		Acceptable
		Annual	10		Sitting	16		Acceptable
	B	Spring	16	60%	Walking	24	41%	Acceptable
		Summer	13	62%	Standing	19	46%	Acceptable
		Fall	14	56%	Standing	21	40%	Acceptable
		Winter	16	45%	Walking	24	41%	Acceptable
		Annual	15	50%	Standing	22	38%	Acceptable
	C	Spring	14	40%	Standing	22	29%	Acceptable
		Summer	12	50%	Sitting	18	38%	Acceptable
		Fall	12	33%	Sitting	20	33%	Acceptable
		Winter	13	18%	Standing	21	24%	Acceptable
		Annual	13	30%	Standing	21	31%	Acceptable
129	A	Spring	17		Walking	24		Acceptable
		Summer	14		Standing	20		Acceptable
		Fall	16		Walking	23		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	16		Walking	23		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	15		Standing	22		Acceptable
	C	Spring	16		Walking	23		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	15		Standing	22		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
130	A	Spring	22		Uncomfortable	30		Acceptable
		Summer	19		Walking	26		Acceptable
		Fall	21		Uncomfortable	29		Acceptable
		Winter	22		Uncomfortable	31		Acceptable
		Annual	21		Uncomfortable	29		Acceptable
	B	Spring	18	-18%	Walking	26	-13%	Acceptable
		Summer	16	-16%	Walking	22	-15%	Acceptable
		Fall	17	-19%	Walking	25	-14%	Acceptable
		Winter	19	-14%	Walking	27	-13%	Acceptable
		Annual	17	-19%	Walking	25	-14%	Acceptable
	C	Spring	18	-18%	Walking	26	-13%	Acceptable
		Summer	16	-16%	Walking	23	-12%	Acceptable
		Fall	18	-14%	Walking	25	-14%	Acceptable
		Winter	19	-14%	Walking	27	-13%	Acceptable
		Annual	18	-14%	Walking	25	-14%	Acceptable
131	A	Spring	18		Walking	28		Acceptable
		Summer	14		Standing	22		Acceptable
		Fall	17		Walking	26		Acceptable
		Winter	20		Uncomfortable	30		Acceptable
		Annual	18		Walking	28		Acceptable
	B	Spring	18		Walking	27		Acceptable
		Summer	14		Standing	22		Acceptable
		Fall	17		Walking	26		Acceptable
		Winter	19		Walking	30		Acceptable
		Annual	18		Walking	27		Acceptable
	C	Spring	18		Walking	28		Acceptable
		Summer	14		Standing	22		Acceptable
		Fall	17		Walking	26		Acceptable
		Winter	20		Uncomfortable	30		Acceptable
		Annual	18		Walking	27		Acceptable
132	A	Spring	22		Uncomfortable	31		Acceptable
		Summer	17		Walking	24		Acceptable
		Fall	20		Uncomfortable	29		Acceptable
		Winter	24		Uncomfortable	34		Unacceptable
		Annual	22		Uncomfortable	30		Acceptable
	B	Spring	23		Uncomfortable	32		Unacceptable
		Summer	18		Walking	25		Acceptable
		Fall	21		Uncomfortable	29		Acceptable
		Winter	25		Uncomfortable	34		Unacceptable
		Annual	23		Uncomfortable	31		Acceptable
	C	Spring	23		Uncomfortable	32		Unacceptable
		Summer	18		Walking	25		Acceptable
		Fall	21		Uncomfortable	29		Acceptable
		Winter	25		Uncomfortable	34		Unacceptable
		Annual	22		Uncomfortable	31		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations

A - No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
133	A	Spring	21		Uncomfortable	29		Acceptable
		Summer	16		Walking	21		Acceptable
		Fall	19		Walking	26		Acceptable
		Winter	22		Uncomfortable	30		Acceptable
		Annual	20		Uncomfortable	27		Acceptable
	B	Spring	21		Uncomfortable	28		Acceptable
		Summer	16		Walking	21		Acceptable
		Fall	19		Walking	26		Acceptable
		Winter	22		Uncomfortable	29		Acceptable
		Annual	20		Uncomfortable	27		Acceptable
	C	Spring	21		Uncomfortable	28		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	19		Walking	25		Acceptable
		Winter	21		Uncomfortable	29		Acceptable
		Annual	20		Uncomfortable	26		Acceptable
134	A	Spring	14		Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	21		Acceptable
	C	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
135	A	Spring	13		Standing	21		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15		Standing	23		Acceptable
		Annual	13		Standing	21		Acceptable
	B	Spring	14		Standing	22		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	C	Spring	17	31%	Walking	26	24%	Acceptable
		Summer	13	30%	Standing	20	25%	Acceptable
		Fall	16	23%	Walking	24	20%	Acceptable
		Winter	20	33%	Uncomfortable	29	26%	Acceptable
		Annual	17	31%	Walking	26	24%	Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

<u>Effective Gust Criteria</u>

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
136	A	Spring	17		Walking	25		Acceptable
		Summer	14		Standing	20		Acceptable
		Fall	16		Walking	24		Acceptable
		Winter	18		Walking	26		Acceptable
		Annual	17		Walking	24		Acceptable
	B	Spring	17		Walking	24		Acceptable
		Summer	14		Standing	21		Acceptable
		Fall	16		Walking	23		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	C	Spring	18		Walking	26		Acceptable
		Summer	16	14%	Walking	22		Acceptable
		Fall	18	12%	Walking	25		Acceptable
		Winter	19		Walking	27		Acceptable
		Annual	18		Walking	25		Acceptable
137	A	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	11	-15%	Sitting	18		Acceptable
		Summer	9		Sitting	14	-12%	Acceptable
		Fall	10	-17%	Sitting	17	-11%	Acceptable
		Winter	12	-14%	Sitting	19	-14%	Acceptable
		Annual	11	-15%	Sitting	18		Acceptable
	C	Spring	12		Sitting	19		Acceptable
		Summer	9		Sitting	15		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	13		Standing	21		Acceptable
		Annual	12		Sitting	19		Acceptable
138	A	Spring	18		Walking	28		Acceptable
		Summer	14		Standing	21		Acceptable
		Fall	17		Walking	26		Acceptable
		Winter	20		Uncomfortable	31		Acceptable
		Annual	18		Walking	28		Acceptable
	B	Spring	18		Walking	26		Acceptable
		Summer	16	14%	Walking	24	14%	Acceptable
		Fall	18		Walking	26		Acceptable
		Winter	19		Walking	28		Acceptable
		Annual	18		Walking	26		Acceptable
	C	Spring	21	17%	Uncomfortable	31	11%	Acceptable
		Summer	16	14%	Walking	24	14%	Acceptable
		Fall	19	12%	Walking	29	12%	Acceptable
		Winter	21		Uncomfortable	32		Unacceptable
		Annual	20	11%	Uncomfortable	30		Acceptable

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) % Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>

A - No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

<u>Effective Gust Criteria</u>

Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 2A: Mean Speed Category Change (No Build to Build) – Annual Winds at Grade Level

Location	BRA Comfort Category		Change in Comfort Category
	BRA Comfort Category	BRA Comfort Category	
1	Walking	Uncomfortable	Increases 1 Category
2	Standing	Sitting	Decreases 1 Category
3	Standing	Standing	Decreases 1 Category
4	Standing	Sitting	Decreases 1 Category
5	Standing	Standing	Decreases 1 Category
6	Walking	Standing	Decreases 1 Category
7	Sitting	Walking	Increases 2 Categories
8	Uncomfortable	Walking	Decreases 1 Category
9	Standing	Walking	Increases 1 Category
10	Sitting	Standing	Increases 1 Category
11	Standing	Sitting	Decreases 1 Category
12	Walking	Standing	Decreases 1 Category
13	Uncomfortable	Standing	Decreases 2 Categories
14	Walking	Sitting	Decreases 2 Categories
15	Walking	Sitting	Decreases 2 Categories
16	Walking	Standing	Decreases 1 Category
17	Walking	Standing	Decreases 1 Category
18	Sitting	Walking	Increases 2 Categories
19	Standing	Walking	Increases 1 Category
20	Sitting	Sitting	No Change
21	Standing	Standing	No Change
22	Standing	Walking	Increases 1 Category
23	Standing	Walking	Increases 1 Category
24	Standing	Walking	Increases 1 Category
25	Walking	Walking	No Change
26	Standing	Walking	Increases 1 Category
27	Standing	Standing	No Change

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) Category Change is based on comparison with Configuration A

Configurations

A – No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Table 2A: Mean Speed Category Change (No Build to Build) – Annual Winds at Grade Level

Location	BRA Comfort Category		Change in Comfort Category
	BRA Comfort Category	BRA Comfort Category	
28	Standing	Sitting	Decreases 1 Category
29	Walking	Walking	No Change
30	Walking	Standing	Decreases 1 Category
31	Walking	Walking	No Change
32	Standing	Walking	Increases 1 Category
33	Standing	Uncomfortable	Increases 2 Categories
34	Walking	Walking	No Change
35	Standing	Standing	No Change
36	Standing	Uncomfortable	Increases 2 Categories
37	Standing	Walking	Increases 1 Category
38	Standing	Uncomfortable	Increases 2 Categories
39	Standing	Uncomfortable	Increases 2 Categories
40	Standing	Walking	Increases 1 Category
41	Standing	Standing	No Change
42	Standing	Uncomfortable	Increases 2 Categories
43	Standing	Walking	Increases 1 Category
44	Standing	Walking	Increases 1 Category
45	Standing	Uncomfortable	Increases 2 Categories
46	Standing	Uncomfortable	Increases 2 Categories
47	Standing	Walking	Increases 1 Category
48	Walking	Walking	No Change
49	Walking	Standing	Decreases 1 Category
50	Walking	Uncomfortable	Increases 1 Category
51	Walking	Walking	No Change
52	Walking	Walking	No Change
53	Standing	Uncomfortable	Increases 2 Categories
54	Standing	Walking	Increases 1 Category

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) Category Change is based on comparison with Configuration A

Configurations

A – No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Table 2A: Mean Speed Category Change (No Build to Build) – Annual Winds at Grade Level

Location	BRA Comfort Category		Change in Comfort Category
	BRA Comfort Category	BRA Comfort Category	
55	Walking	Uncomfortable	Increases 1 Category
56	Walking	Uncomfortable	Increases 1 Category
57	Standing	Standing	No Change
58	Sitting	Walking	Increases 2 Categories
59	Uncomfortable	Walking	Decreases 1 Category
60	Walking	Walking	No Change
61	Uncomfortable	Walking	Decreases 1 Category
62	Walking	Standing	Decreases 1 Category
63	Walking	Standing	Decreases 1 Category
64	Standing	Walking	Increases 1 Category
65	Standing	Walking	Increases 1 Category
66	Standing	Walking	Increases 1 Category
67	Standing	Walking	Increases 1 Category
68	Standing	Sitting	Decreases 1 Category
69	Standing	Standing	No Change
70	Walking	Uncomfortable	Increases 1 Category
71	Walking	Uncomfortable	Increases 1 Category
72	Standing	Uncomfortable	Increases 2 Categories
73	Walking	Dangerous	Increases 2 Categories
74	Standing	Uncomfortable	Increases 2 Categories
75	Walking	Dangerous	Increases 2 Categories
76	Standing	Walking	Increases 1 Category
77	Standing	Standing	No Change
78	Walking	Walking	No Change
79	Uncomfortable	Uncomfortable	No Change
80	Dangerous	Dangerous	No Change
81	Walking	Sitting	Decreases 2 Categories

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) Category Change is based on comparison with Configuration A

Configurations

A – No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Table 2A: Mean Speed Category Change (No Build to Build) – Annual Winds at Grade Level

Location	BRA Comfort Category		Change in Comfort Category
	BRA Comfort Category	BRA Comfort Category	
82	Uncomfortable	Walking	Decreases 1 Category
83	Uncomfortable	Uncomfortable	No Change
84	Walking	Uncomfortable	Increases 1 Category
85	Standing	Standing	No Change
86	Sitting	Sitting	No Change
87	Standing	Standing	No Change
88	Standing	Standing	No Change
89	Sitting	Standing	Increases 1 Category
90	Standing	Standing	No Change
91	Sitting	Sitting	No Change
92	Sitting	Sitting	No Change
93	Standing	Standing	No Change
94	Standing	Sitting	Decreases 1 Category
95	Standing	Standing	No Change
96	Standing	Standing	No Change
97	Walking	Walking	No Change
98	Walking	Walking	No Change
99	Standing	Standing	No Change
100	Walking	Walking	No Change
101	Walking	Walking	No Change
102	Walking	Walking	No Change
103	Sitting	Sitting	No Change
104	Sitting	Standing	Increases 1 Category
105	Walking	Sitting	Decreases 2 Categories
106	Walking	Standing	Decreases 1 Category
107	Walking	Standing	Decreases 1 Category
108	Walking	Sitting	Decreases 2 Categories

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) Category Change is based on comparison with Configuration A

Configurations

A – No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Table 2A: Mean Speed Category Change (No Build to Build) – Annual Winds at Grade Level

Location	BRA Comfort Category		Change in Comfort Category
	BRA Comfort Category	BRA Comfort Category	
109	Standing	Sitting	Decreases 1 Category
110	Walking	Sitting	Decreases 2 Categories
111	Standing	Sitting	Decreases 1 Category
112	Sitting	Sitting	No Change
113	Sitting	Sitting	No Change
114	Sitting	Sitting	No Change
115	Walking	Walking	No Change
116	Walking	Walking	No Change
117	Uncomfortable	Uncomfortable	No Change
118	Walking	Walking	No Change
119	Walking	Standing	Decreases 1 Category
120	Walking	Standing	Decreases 1 Category
121	Standing	Standing	No Change
122	Walking	Standing	Decreases 1 Category
123	Uncomfortable	Walking	Decreases 1 Category
124	Standing	Standing	No Change
125	Sitting	Sitting	No Change
126	Sitting	Sitting	No Change
127	Sitting	Sitting	No Change
128	Sitting	Standing	Increases 1 Category
129	Walking	Standing	Decreases 1 Category
130	Uncomfortable	Walking	Decreases 1 Category
131	Walking	Walking	No Change
132	Uncomfortable	Uncomfortable	No Change
133	Uncomfortable	Uncomfortable	No Change
134	Standing	Standing	No Change
135	Standing	Standing	No Change

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) Category Change is based on comparison with Configuration A

Configurations

A – No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Table 2A: Mean Speed Category Change (No Build to Build) – Annual Winds at Grade Level

Location	BRA Comfort Category		Change in Comfort Category
	BRA Comfort Category	BRA Comfort Category	
136	Walking	Walking	No Change
137	Standing	Sitting	Decreases 1 Category
138	Walking	Walking	No Change

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) Category Change is based on comparison with Configuration A

Configurations

A – No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Table 2B: Mean Speed Category Change (No Build to Full Build) – Annual Winds at Grade Level

Location	BRA Comfort Category		Change in Comfort Category
	No Build	Full Build	
1	Walking	Uncomfortable	Increases 1 Category
2	Standing	Sitting	Decreases 1 Category
3	Standing	Sitting	Decreases 1 Category
4	Standing	Sitting	Decreases 1 Category
5	Standing	Standing	Decreases 1 Category
6	Walking	Sitting	Decreases 2 Categories
7	Sitting	Walking	Increases 2 Categories
8	Uncomfortable	Walking	Decreases 1 Category
9	Standing	Walking	Increases 1 Category
10	Sitting	Standing	Increases 1 Category
11	Standing	Sitting	Decreases 1 Category
12	Walking	Sitting	Decreases 2 Categories
13	Uncomfortable	Standing	Decreases 2 Categories
14	Walking	Sitting	Decreases 2 Categories
15	Walking	Sitting	Decreases 2 Categories
16	Walking	Standing	Decreases 1 Category
17	Walking	Standing	Decreases 1 Category
18	Sitting	Walking	Increases 2 Categories
19	Standing	Walking	Increases 1 Category
20	Sitting	Sitting	No Change
21	Standing	Standing	No Change
22	Standing	Uncomfortable	Increases 2 Categories
23	Standing	Walking	Increases 1 Category
24	Standing	Walking	Increases 1 Category
25	Walking	Walking	No Change
26	Standing	Walking	Increases 1 Category
27	Standing	Standing	No Change

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) Category Change is based on comparison with Configuration A

Configurations

A – No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Table 2B: Mean Speed Category Change (No Build to Full Build) – Annual Winds at Grade Level

Location	BRA Comfort Category		Change in Comfort Category
	No Build	Full Build	
28	Standing	Sitting	Decreases 1 Category
29	Walking	Walking	No Change
30	Walking	Standing	Decreases 1 Category
31	Walking	Walking	No Change
32	Standing	Walking	Increases 1 Category
33	Standing	Uncomfortable	Increases 2 Categories
34	Walking	Walking	No Change
35	Standing	Standing	No Change
36	Standing	Uncomfortable	Increases 2 Categories
37	Standing	Walking	Increases 1 Category
38	Standing	Uncomfortable	Increases 2 Categories
39	Standing	Uncomfortable	Increases 2 Categories
40	Standing	Walking	Increases 1 Category
41	Standing	Standing	No Change
42	Standing	Uncomfortable	Increases 2 Categories
43	Standing	Walking	Increases 1 Category
44	Standing	Walking	Increases 1 Category
45	Standing	Uncomfortable	Increases 2 Categories
46	Standing	Uncomfortable	Increases 2 Categories
47	Standing	Walking	Increases 1 Category
48	Walking	Walking	No Change
49	Walking	Standing	Decreases 1 Category
50	Walking	Uncomfortable	Increases 1 Category
51	Walking	Walking	No Change
52	Walking	Walking	No Change
53	Standing	Uncomfortable	Increases 2 Categories
54	Standing	Walking	Increases 1 Category

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) Category Change is based on comparison with Configuration A

Configurations

A – No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Table 2B: Mean Speed Category Change (No Build to Full Build) – Annual Winds at Grade Level

Location	BRA Comfort Category		Change in Comfort Category
	No Build	Full Build	
55	Walking	Uncomfortable	Increases 1 Category
56	Walking	Uncomfortable	Increases 1 Category
57	Standing	Standing	No Change
58	Sitting	Walking	Increases 2 Categories
59	Uncomfortable	Walking	Decreases 1 Category
60	Walking	Standing	Decreases 1 Category
61	Uncomfortable	Walking	Decreases 1 Category
62	Walking	Standing	Decreases 1 Category
63	Walking	Standing	Decreases 1 Category
64	Standing	Walking	Increases 1 Category
65	Standing	Walking	Increases 1 Category
66	Standing	Walking	Increases 1 Category
67	Standing	Walking	Increases 1 Category
68	Standing	Sitting	Decreases 1 Category
69	Standing	Standing	No Change
70	Walking	Uncomfortable	Increases 1 Category
71	Walking	Uncomfortable	Increases 1 Category
72	Standing	Uncomfortable	Increases 2 Categories
73	Walking	Dangerous	Increases 2 Categories
74	Standing	Uncomfortable	Increases 2 Categories
75	Walking	Uncomfortable	Increases 1 Category
76	Standing	Uncomfortable	Increases 2 Categories
77	Standing	Uncomfortable	Increases 2 Categories
78	Walking	Uncomfortable	Increases 1 Category
79	Uncomfortable	Uncomfortable	No Change
80	Dangerous	Uncomfortable	Decreases 1 Category
81	Walking	Standing	Decreases 1 Category

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) Category Change is based on comparison with Configuration A

Configurations

A – No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Table 2B: Mean Speed Category Change (No Build to Full Build) – Annual Winds at Grade Level

Location	BRA Comfort Category		Change in Comfort Category
	No Build	Full Build	
82	Uncomfortable	Walking	Decreases 1 Category
83	Uncomfortable	Uncomfortable	No Change
84	Walking	Uncomfortable	Increases 1 Category
85	Standing	Standing	No Change
86	Sitting	Walking	Increases 2 Categories
87	Standing	Standing	No Change
88	Standing	Sitting	Decreases 1 Category
89	Sitting	Sitting	No Change
90	Standing	Sitting	Decreases 1 Category
91	Sitting	Sitting	No Change
92	Sitting	Sitting	No Change
93	Standing	Standing	No Change
94	Standing	Sitting	Decreases 1 Category
95	Standing	Standing	No Change
96	Standing	Standing	No Change
97	Walking	Walking	No Change
98	Walking	Walking	No Change
99	Standing	Standing	No Change
100	Walking	Walking	No Change
101	Walking	Walking	No Change
102	Walking	Walking	No Change
103	Sitting	Sitting	No Change
104	Sitting	Standing	Increases 1 Category
105	Walking	Sitting	Decreases 2 Categories
106	Walking	Walking	No Change
107	Walking	Standing	Decreases 1 Category
108	Walking	Sitting	Decreases 2 Categories

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) Category Change is based on comparison with Configuration A

<u>Configurations</u>

A – No Build
B – Build
C – Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Table 2B: Mean Speed Category Change (No Build to Full Build) – Annual Winds at Grade Level

Location	BRA Comfort Category		Change in Comfort Category
	No Build	Full Build	
109	Standing	Sitting	Decreases 1 Category
110	Walking	Sitting	Decreases 2 Categories
111	Standing	Sitting	Decreases 1 Category
112	Sitting	Sitting	No Change
113	Sitting	Sitting	No Change
114	Sitting	Sitting	No Change
115	Walking	Walking	No Change
116	Walking	Walking	No Change
117	Uncomfortable	Uncomfortable	No Change
118	Walking	Walking	No Change
119	Walking	Standing	Decreases 1 Category
120	Walking	Standing	Decreases 1 Category
121	Standing	Standing	No Change
122	Walking	Standing	Decreases 1 Category
123	Uncomfortable	Walking	Decreases 1 Category
124	Standing	Standing	No Change
125	Sitting	Sitting	No Change
126	Sitting	Sitting	No Change
127	Sitting	Sitting	No Change
128	Sitting	Standing	Increases 1 Category
129	Walking	Standing	Decreases 1 Category
130	Uncomfortable	Walking	Decreases 1 Category
131	Walking	Walking	No Change
132	Uncomfortable	Uncomfortable	No Change
133	Uncomfortable	Uncomfortable	No Change
134	Standing	Standing	No Change
135	Standing	Walking	Increases 1 Category

Notes:
1) Wind speeds are for a 1% probability of exceedance; and,
2) Category Change is based on comparison with Configuration A

Configurations

A – No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Table 2B: Mean Speed Category Change (No Build to Full Build) – Annual Winds at Grade Level

Location	BRA Comfort Category		Change in Comfort Category
	No Build	Full Build	
136	Walking	Walking	No Change
137	Standing	Sitting	Decreases 1 Category
138	Walking	Uncomfortable	Increases 1 Category

Notes: 1) Wind speeds are for a 1% probability of exceedance; and,
2) Category Change is based on comparison with Configuration A

Configurations

A – No Build
B – Build
C – Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

APPENDIX A

APPENDIX A: DRAWING LIST FOR MODEL CONSTRUCTION

The drawings and information listed below were received from Feldco Development Corp. and were used to construct the scale model of the proposed Tremont Crossing development. Should there be any design changes that deviate from this list of drawings, the results may change. Therefore, if changes in the design are made, it is recommended that RWDI be contacted and requested to review their potential effects on wind conditions.

File Name	File Type	Date Received (dd/mm/yyyy)
2016-07-01_Tremont Crossing Model	RVT	01/07/2016

APPENDIX 4

PRELIMINARY FOUNDATION RECOMMENDATIONS

GEI Consultants

Consulting
Engineers and
Scientists

August 3, 2016
Project 1609300

Mr. Jeffrey Feldman
Feldco Development Corp.
222 Newbury Street, 4th Floor
Boston, MA 02116

Dear Mr. Feldman:

Re: Preliminary Foundation Recommendations
Tremont Crossing
Boston, Massachusetts

This letter report presents the results of our preliminary subsurface explorations and geotechnical foundation design recommendations for the proposed Tremont Crossing Development Project in the Roxbury section of Boston, Massachusetts. These recommendations are based on our understanding of the proposed development discussed during the July 19, 2016 conference call with the project team. This report addresses the potential foundation options for each building of the proposed development and is not intended to serve as the final geotechnical report to support the detailed design of the proposed structures. Additional explorations will be required to support the final design and construction.

We executed the following scope of work:

- Performed ten soil borings, and installed three groundwater observation wells.
- Performed three days of pressuremeter testing in three of the boreholes.
- Performed nine grain size analyses on granular soil samples and five moisture content analyses on fine-grained soil samples collected from the borings.
- Prepared this letter report presenting the results of our subsurface explorations and preliminary foundation design recommendations.

Our work was authorized by our Standard Professional Services Agreement dated June 23, 2016, signed by Mr. Barry Feldman of Feldco Development.

Site Description

The site is located in the Roxbury section of Boston, Massachusetts and is bounded by Tremont Street to the north, Whittier Street to the east, Downing Street to the south, Madison Park Technical Vocational High School to the southwest, and the Whittier Street Health Center to the west, as shown in Figs. 1 and 2. For the purposes of this report and as shown on Fig. 2, we have identified Tremont Street as the north side of the project site.

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GEI Consultants, Inc.
400 Unicorn Park Drive, Woburn, MA 01801
781.721.4000 fax: 781.721.4073

Currently, the western half of the site serves as a parking area for the current Whittier Street Health Center, the Madison Park Technical Vocational High School, and the Boston Police Headquarters. The northeast portion of the site was recently cleared of trees and brush and is vacant. The former Whittier Health Center is a brick building surrounded by asphalt paving that occupies the southeast portion of the site. Between Vernon Street and the former Whittier Health Center, there is a portion of the site that remains partly wooded.

The site generally slopes from El. 19 on the west side to El. 16 on the east side. Tremont Street slopes from about El. 27 near the northwest corner of the site to about El. 18 near the northeast corner of the site. The area bounded by Tremont Street, Hampshire Street, Whittier Street, and Vernon Street is slightly higher in elevation than the remainder of the site and has been filled to about El. 23 or El. 24.

Elevations in this letter are referenced to Boston City Base Datum which is 5.65 feet below the North Geodetic Vertical Datum of 1929 (NGVD 1929). El. 0.0 BCB = El. -5.65 NGVD 1929.

Project Background

In 2013, we performed two preliminary geotechnical borings on the northwest and northeast corners of the site (B101 and B102, respectively) as shown in Fig. 2.

Our 2013 investigation also included a preliminary evaluation of possible foundation types for each proposed building. However, to better evaluate foundation options for each building, and to assist Turner in refining their project pricing, we performed this phase of borings to gather more information related to the following:

- Thickness and extent of the fill.
- Thickness and extent of the organic soil.
- Depth to a suitable foundation bearing layer such as the glacial outwash sand, glacial till and bedrock.

The proposed development is divided into four distinct areas referred to by the project team as the North, West, East, and South Blocks as shown in Fig. 2. The North Block will consist of a museum with office space above. The East and West Blocks will consist of three stories of retail each with mid-rise residential towers approximately 20-stories tall. A six-story parking garage will occupy most of the South Block.

Exploration Program

New England Boring Contractors of Derry, New Hampshire drilled ten borings (B201 through B210) between June 28, 2016 and July 19, 2016. Borings were drilled using a track-mounted Mobile B-53 ATV drill rig or truck-mounted Mobile B-53 drill rig depending on the accessibility of each borehole. The borings were advanced using wash-rotary techniques with driven casing and drilling mud. The boring locations are shown in Fig. 2. A GEI field engineer observed the drilling and logged the samples.

Standard Penetration Tests (SPTs) were performed and split spoon samples were generally collected at five foot intervals. All SPTs were performed using a safety hammer with a rope and cathead. Recovered split-spoon soil samples were placed in jars and sent to our laboratory for verification of field classification. Individual sample descriptions are provided in the boring logs in Appendix A.

Rock core samples were collected using an NX-size, double-tube core barrel with a diamond bit yielding 2-inch-diameter rock core samples. Core runs were a maximum of 5 feet long. Sample descriptions are provided in the boring logs in Appendix A.

Pressuremeter Testing

In addition to the SPTs and soil sampling, GEI performed a program of specialized field testing. A series of pressuremeter tests were performed to provide supplemental information to evaluate the allowable soil bearing pressures for foundation design and to estimate foundation settlements.

The pressuremeter test consists of lowering an inflatable probe into the borehole to the desired test depth. The probe is expanded against the soils forming the walls of the borehole, and the pressure required to expand the probe and the corresponding volume changes are recorded incrementally. In effect, an in-situ stress-strain load test is performed in the soil. The results of the pressuremeter test can be related empirically to both allowable bearing capacity and settlement estimates. The results of the pressuremeter tests are included in Appendix B and are further discussed below.

Laboratory Testing

We performed nine grain size analyses on granular soil samples and five moisture content analyses on fine-grained soil samples collected from the borings to verify field descriptions. The results of the grain size analyses are presented in Appendix C. The moisture content data is provided on the boring logs in Appendix A.

Subsurface Conditions

The soil layers encountered in the recently completed borings as well as B101 and B102 completed in 2013 by GEI are described below, in order of increasing depth. Layer thicknesses and top of rock elevations are summarized in Table 1. Subsurface conditions are known only at the boring locations. Conditions between borings may differ significantly from those described below.

> Asphalt/Concrete – In B204 and B210, a 6-inch-thick layer of asphalt was encountered at the ground surface. In B206, a 6-inch-thick concrete sidewalk was encountered at the ground surface.
>
> Fill – A 3- to 17.5-foot-thick layer of miscellaneous fill was encountered in all of the borings. The fill generally consisted of silty sand with varying amounts of gravel to widely graded gravel with varying amounts of silt, sand, and clay. However, in some locations, the fill consisted of clay or sandy clay. Brick, concrete, and asphalt fragments were also common throughout the fill. The SPT N-values ranged from 7 to over 100 blows per foot (bpf) indicating loose to very dense soil.
>
> Organic Soil – A 5- to 10-foot-thick layer of organic soil was encountered beneath the fill in the South Block borings and most East Block borings. The organics ranged from low plasticity black organic silt with layers of peat to brown or dark gray peat. The SPT N-values ranged from 0 (weight of hammer) to 9 bpf, indicating a very soft to medium stiff soil.
>
> Glacial Outwash – A layer of glacial outwash consisting of sand and gravel was encountered in all of the borings. The layer thickness varied from 25 to 65 feet in the most recent borings. Up to 71.5 feet of glacial outwash was encountered in B102. The glacial outwash tended to be thinner on the southwest portion of the site and thicker in the northeast portion of the site. The glacial outwash generally consisted of widely graded to narrowly graded sand with silt

and gravel. The silt and gravel content varied across the site. The silt content was generally less than 10 percent by weight though occasional silty sand zones were encountered. SPT N-values ranged from 10 to 80 bpf indicating a medium dense to very dense soil layer.

In B210, there was a 10-foot-thick layer of sandy clay and clayey sand within the glacial outwash from a depth of 40.3 to 50.3 feet. The SPT N-values in this zone varied from 14 to 28 bpf.

Glacial Till – Glacial till was encountered below the glacial outwash and above the bedrock in all of the borings except B102. This layer varied from 5- to 21.5-feet thick. The glacial till generally consisted of light gray clayey sand and gravel and sandy clay with gravel to silty sand with gravel. Some of the glacial till samples predominantly consisted of gravel. The SPT N-values ranged from 25 to over 100 blows per foot indicating a medium dense to very dense soil.

Weathered Bedrock / Bedrock – Highly weathered to slightly weathered Roxbury Conglomerate was encountered below the glacial till. The Roxbury Conglomerate is a sedimentary rock with clasts (rounded to subrounded gravel to boulder size rocks) set in a finer-grained (sand and silt size particles) sedimentary matrix. In most of the borings, the upper 5 to 15 feet of bedrock was moderately to highly weathered. The weathering appeared to affect the sand matrix more than the clasts resulting in recoveries of rounded to subrounded gravel missing the sand and silt matrix that was washed away due to the coring process. Typically, the degree of weathering decreased with depth which resulted in better recoveries with depth. Recoveries and Rock Quality Designations (RQDs) ranged from 17% to 100% and from 0% to 69%, respectively.

Water Levels

Observation wells were installed in B203(OW), B205(OW), B210(OW). The installation logs for the observation wells are presented in Appendix A. We measured groundwater levels in the three observation wells and in B102(OW) while we were onsite. The measured groundwater varied from El. 6.2 to El. 7.6 which is approximately 9 to 15 feet below the existing ground surface. The water level data through August 1, 2016 are presented in Table 2. Groundwater levels may be different at other times and locations.

Preliminary Evaluation of Foundation Types

Based on our discussions with you and our review of the latest site plan provided to us by Cambridge Seven Associates, we understand that the proposed development includes the following components as shown on Fig. 2:

- A museum space with several floors of office space occupying the North Block.
- A residential tower (approx. 20 stories) occupying the northern portion of the West Block surrounded by three levels of retail space.
- A 6-level precast concrete parking structure occupying the South Block.
- A U-shaped residential tower (approx. 20 stories) occupying the north portion of the East Block surrounded by three stories of retail space.

Foundation loads are not available at this time. However, based on preliminary loads from Odeh Engineers prepared for the purpose of a feasibility level review, we understand that the interior column loads for the retail space are expected to be in the range of 450 kips to 1,400 kips. The interior column loading for the towers and garage are expected to range from 1,400 kips to 2,800 kips.

Information on allowable total and differential settlements for the proposed buildings was not available at the time of this report, and it may be necessary to modify our foundation recommendations once that information is available.

North Block

We recommend supporting the proposed North Block building either on spread footings or a mat foundation bearing in the undisturbed glacial outwash (sand and gravel) layer below the fill. If the fill layer is removed from within the North Block, there may be an opportunity to incorporate one level of below grade space.

Based on our evaluation of the pressuremeter test results, we recommend designing the North Block foundations using a net allowable bearing pressure of 5 tons per square foot (tsf) for spread footings and 3 tsf for a mat foundation. This is expected to result in less than 1 inch of settlement and less than ½ inch of differential settlement between columns for spread footings.

West Block

We recommend supporting the residential tower occupying the north portion of the West Block on spread footings or a mat foundation bearing in the undisturbed glacial outwash (sand and gravel) layer. For budgeting purposes, we recommend assuming the spread footings or a mat foundation can be designed for a net allowable bearing pressure of 2 tsf. This is expected to result in less than 1 inch of settlement and less than ½ inch of differential settlement between columns. This recommendation is based on SPT N-values measured in B203 ranging from 13 to 21 in the upper 15 feet of the glacial outwash. We recommend performing additional pressuremeter testing during final design to evaluate whether higher net allowable bearing pressures can be justified.

We recommend isolating the retail space from the residential tower to accommodate differential settlement between the structures. We recommend supporting the 3-story retail space on spread footings bearing in the undisturbed glacial outwash (sand and gravel) layer. Based on our evaluation of the pressuremeter test results, we recommend designing the retail space foundations using a net allowable bearing pressure of 5 tons per square foot.

Based on B206 performed just south of the West Block, there is a potential for organic soils to be present along the south side of the West Block. The extent of the organic soils should be further defined during the final subsurface exploration program. If organic soils are encountered and if it is not practical to remove them or to construct spread footings below the organics, the West Block retail space could be supported on footings on improved ground. The selected ground improvement should be appropriate for soft soil conditions, i.e. not susceptible to bulging where they pass through organic soils. It is generally possible to achieve allowable bearing pressures of 2 tsf and total and differential settlements of 1 and ½ inch, respectively. Potential ground improvement alternatives are discussed in more detail below.

Based on the boring data collected to date, we expect most of the ground floor slab will be able to be designed as a conventional soil-supported slab-on-grade. However, if organic soils are encountered, ground improvement may be required to improve the performance of the ground floor slab-on-grade.

South Block

Due to the presence of soft compressible soils below the fill, we recommend supporting the proposed South Block parking garage on deep foundations extending down to the glacial outwash, glacial till, or bedrock. We recommend considering the following deep foundation options:

Recommended Deep Foundation Alternative for South Block	**Approx. Length (feet)**	**Est. Allowable Vertical Capacity per Element (tons)**	**Bearing Layer - Tip**
48-inch-diameter auger cast pile	55 to 80	800 to 1,000	Glacial Till / Rock
36-inch-dia. auger cast pile	55 to 80	450 to 550	Glacial Till / Rock
Driven steel pipe or H-piles, or precast concrete piles	55 to 80	120 to 200	Bedrock
Pressure injected footings	25 to 35	100 to 120	Glacial Outwash
Rock-socketed drilled shafts	70 to 100	>1,500	Bedrock

East Block

Due to the presence of soft compressible soils (organics) below the fill, we recommend supporting the residential tower occupying the north portion of the East Block on deep foundation elements extending down to the glacial outwash, glacial till, or bedrock. We recommend considering the following deep foundation options:

Recommended Deep Foundation Alternative for East Block	**Approx. Length (feet)**	**Est. Allowable Vertical Capacity per Element (tons)**	**Bearing Layer - Tip**
Driven steel pipe or H-piles, or precast concrete piles	100 to 110	120 to 200	Bedrock
Pressure injected footings	30 to 35	120 to 140	Sand and Gravel
Rock-socketed drilled shafts	115 to 130	>1,500	Bedrock

Due to the presence of the relatively thick fill and organic soil layers encountered in the borings, we recommend supporting the 3-story retail space occupying the East Block on deep foundation elements or on spread footings with ground improvement. We recommend isolating the retail space from the residential tower to accommodate differential settlements between the structures.

Due to the presence of compressible soils, the ground floor slab should be a structural slab that can span between foundation elements. Alternatively, the ground floor slab could be constructed as a slab-on-grade with ground improvement.

Ground Improvement

Based on our evaluation of the most recent boring data, it is our opinion that ground improvement is a viable alternative for the 3-story retail areas and may be competitive with higher capacity deep foundation alternatives.

The ground improvement systems are typically designed and installed by specialty contractors using proprietary methods under a performance specification that sets criteria for allowable bearing pressure and settlement. The criteria are used by the structural engineer to design the footings. Proprietary methods that can be considered include controlled modulus columns (CMCs), rammed aggregate piers (RAPs), or grouted aggregate inclusions. Some methods are more suited to soil profiles with soft compressible soils. For example, the RAPs may be susceptible to bulging where they extend through the compressible soil layers. For this site, appropriate design criteria for the ground improvement would be an allowable bearing pressure of 2 tsf, and a maximum allowable settlement of 1 inch with ½ inch of differential settlement between columns.

Seismic Design

Based on the subsurface conditions observed in our borings, we recommend using Site Class D for seismic design, in accordance with Section 1613.5.2 of the Building Code. Corresponding design values for the city of Boston (per Massachusetts amendments to Chapter 16 of the IBC) are:

$S_S = 0.29$
$S_1 = 0.068$
$S_{DS}= 0.303$
$S_{D1} = 0.109$

The soils below the foundation levels for each building are not susceptible to liquefaction based on the criteria in Section 1806.4 of the Building Code (Massachusetts Amendments to the IBC).

Based on Section 1613.5.2 of the Building Code, soil profiles with greater than 10 feet of peat may be classified as Site Class F. Though not observed in any of our geotechnical borings, other areas of the site may have more than 10 feet of organic soil. Per the Building Code, these areas will require a site-specific seismic analysis if the fundamental period of the proposed structures exceeds 0.5 seconds.

Future Work

We recommend that GEI be engaged during final design and construction to:

- Perform the final phase of geotechnical borings.
- Develop and execute a soil characterization program for the soils that will be displaced by the construction.
- Prepare final design and construction environmental and geotechnical recommendations.
- Prepare specifications related to the geotechnical and environmental aspects of the design.
- Observe and document the installation of the deep foundations, subgrade preparation, and management of excess soils.

Limitations

This letter was prepared for the use of Feldco Development, Corp., exclusively. Our recommendations are based on the project information provided to us at the time of this report and may require modification if there are any changes in the nature, design, or location of the proposed structure. We cannot accept responsibility for designs based on our recommendations unless we are engaged to review the final plans and specifications to determine whether any changes in the project affect the validity of our recommendations and whether our recommendations have been properly implemented in the design.

It was not part of our scope to perform a detailed site history. Therefore, we have not explored for or researched the locations of buried utilities or other structures in the area of the proposed construction.

The recommendations in this report are based in part on the data obtained from the subsurface explorations. The nature and extent of variations between explorations may not become evident until construction. If variations from the anticipated conditions are encountered, it may be necessary to revise the recommendations in this report. We, therefore, recommend that GEI be engaged to make site visits during construction to: a) check that the subsurface conditions exposed during construction are in general conformance with our design assumptions and b) ascertain that, in general, the work is being performed in compliance with the contract documents.

Our professional services for this project have been performed in accordance with generally accepted engineering practices; no warranty, express or implied, is made.

We appreciate the opportunity to work with you on this project. Please call Mike Yako at 781-721-4043 or James Christensen at 781-721-4126 if you have any questions.

Sincerely,

GEI CONSULTANTS, INC.

Michael Yako, P.E.
Vice President

James Christensen, P.E.
Project Manager

MAY/JLC:rr

Enclosures:
- Table 1 – Geotechnical Boring Data
- Table 2 – Groundwater Data
- Figure 1 – Site Location Map
- Figure 2 – Boring Location Plan
- Appendix A – GEI Boring Logs and Observation Well Logs
- Appendix B – Pressuremeter Test Data
- Appendix C – Laboratory Test Data

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Tables

Table 1. Geotechnical Boring Data
Tremont Crossing
Boston, Massachusetts

Boring Number	Approximate Ground Surface Elevation (feet)	Boring Depth (feet)	Fill Thickness (feet)	Organic Soil Thickness (feet)	Glacial Outwash Thickness (feet)	Glacial Till Thickness (feet)	Elevation Top of Weathered Bedrock (feet)	Elevation Top of Medium Hard Bedrock (feet)
B101	19.6	79	3	NE	50.3	15.5	-49.4	NE
B102(OW)	17.5	94	7.5	10	71.5	NE	NE	NE
B201	22	85	7.5	NE	55	11	-51.5	NE
B202	23	109	17.5	10	62.5	7.5	-74.5	-81
B203(OW)	22.5	70.2	8.5	NE	35	21.5	-42.5	-43.4
B204	19.5	69	8.5	NE	42.3	12.3	-43.5	NE
B205(OW)	22.5	109	16	6.9	64.5	10	-75	-81.5
B206	19	64	13.5	5	26.9	8.1	-34.5	-40
B207	16	85.1	11.5	NE	41	17.5	-54	NE
B208	17	84	8	9.5	56	5.5	NE	-62
B209A	17	68.5	12.5	5	25	15	-40.5	-46.5
B210(OW)	17	79	8.5	10	44.8	10.8	NE	-57

General Notes:

1. Ground surface elevations based on survey plan provided by BSC Group July 2013.

2. All elevations are referenced to Boston City Base datum, which is 5.65 feet below NGVD 1929;
EL. 0.0 BCB = EL. -5.65 NGVD 1929

3. NE = Not encountered.

4. B209 is not included in the table because it was abandoned due to an obstruction at a depth of 8 ft.

5. A 5-ft.-thick clay layer was encountered between fill and organic soil in B102. B102 was terminated in the glacial outwash layer.

6. In B210, a 10-ft-thick sandy clay / clayey sand layer was encountered within the glacial outwash,

Table 2. Groundwater Data
Tremont Crossing
Boston, Massachusetts

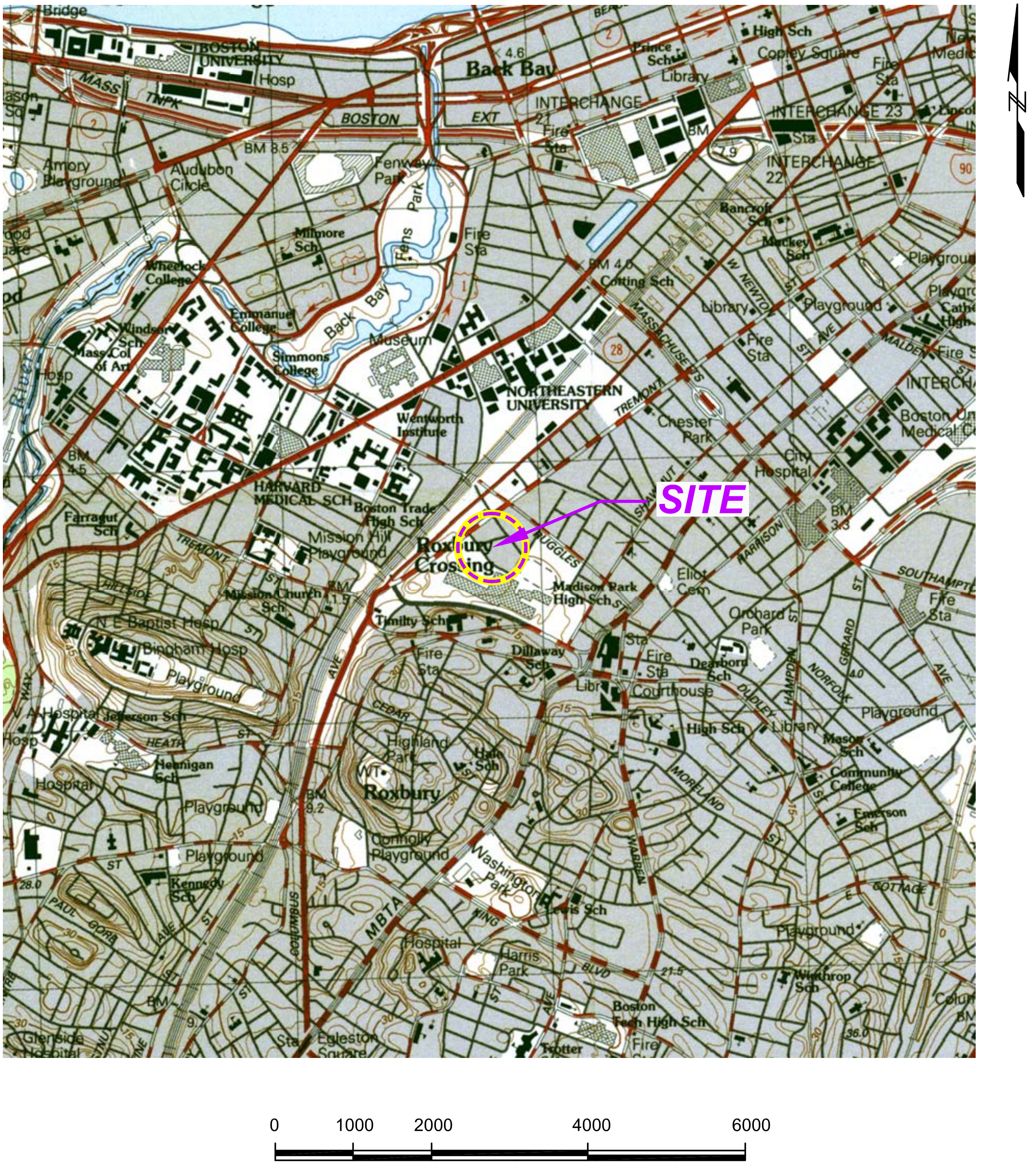
Boring Number	Approximate Ground Surface Elevation (feet)	Installation Date	Date of Reading and Elevation of Water (ft)									
			8/14/2013	7/7/2016	7/8/2016	7/11/2016	7/12/2016	7/13/2016	7/14/2016	7/15/2016	7/28/2016	8/1/2016
B102(OW)	17.5	7/27/2013	6.9	--	--	--	--	--	--	--	--	6.4
B203(OW)	22.5	7/11/2016	--	--	--	--	6.2	6.2	6.2	6.2	6.2	7.3
B205(OW)	22.5	7/13/2016	--	--	--	--	--	7.5	7.5	7.5	--	7.3
B210(OW)	17	7/6/2016	--	7.6	7.6	7.6	7.5	7.6	7.6	7.6	7.5	7.4

General Notes:

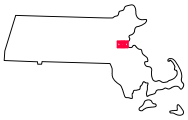
1. Ground surface elevations based on survey plan provided by BSC Group July 2013.

2. All elevations are referenced to Boston City Base datum, which is 5.65 feet below NGVD 1929;
EL. 0.0 BCB = EL. -5.65 NGVD 1929

Figures



This Image provided by MassGIS is from U.S.G.S.
Topographic 7.5 X 15 Minute Series
Boston South, MA Quadrangle, 1987.
Datum is National Geodetic Vertical Datum (NGVD).
Contour Interval is 3 Meters.



MASSACHUSETTS
QUADRANGLE LOCATION

Tremont Crossing
Roxbury, Massachusetts

Feldco Development Corp.
Cambridge, Massachusetts

GEI Consultants

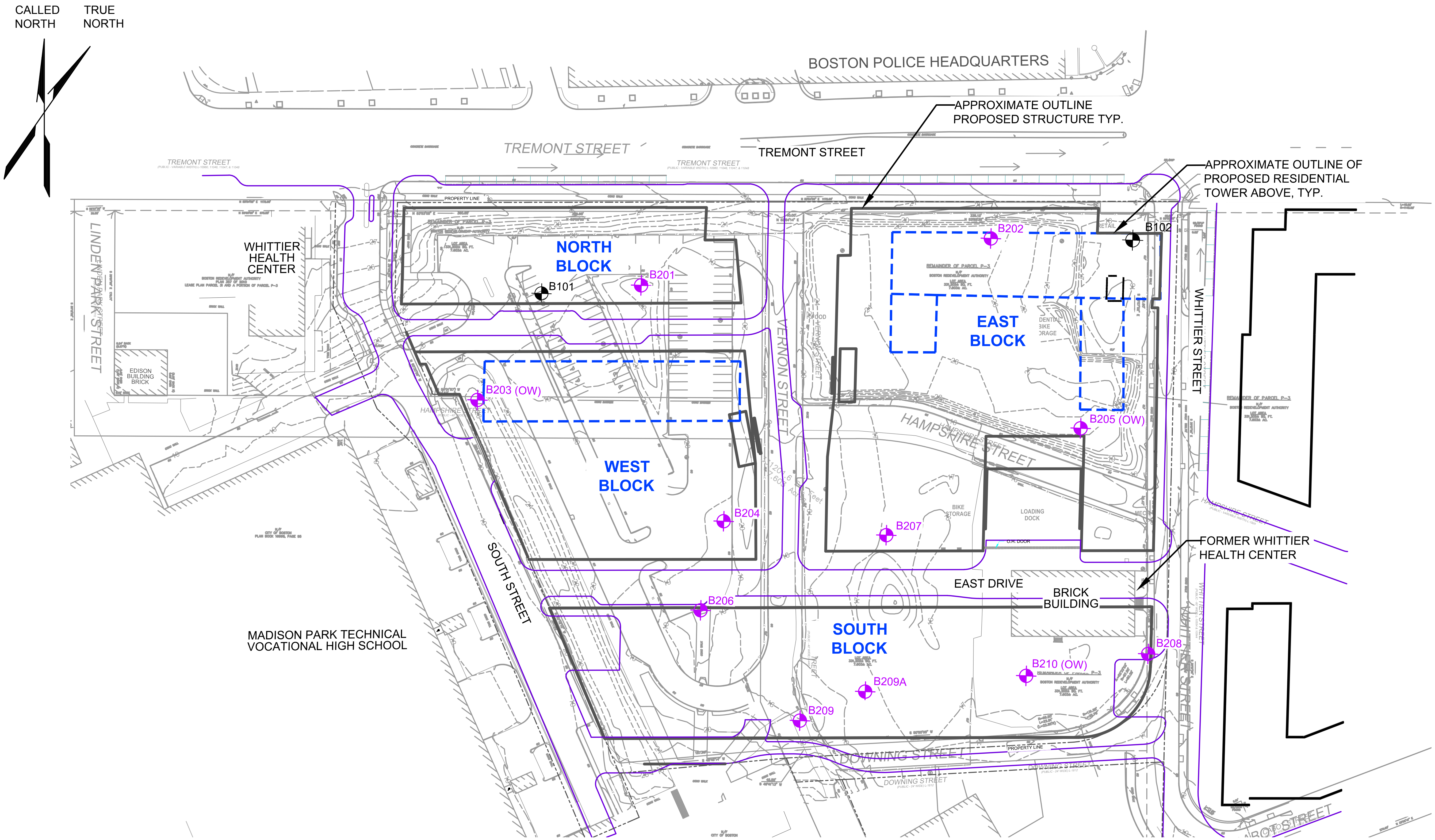
SITE LOCATION MAP

Project 160930-0

August 2016

Fig. 1

B:\Working\FELDCO\1609300 Tremont Crossing\00_CAD\Figures\Fig. 1 - Site Location Map



0 100 200

SCALE, FEET

LEGEND:

B101 BORING, GEI 2013

B201 BORING, GEI 2016

NOTE:

1. PRELIMINARY BASE PLAN PREPARED BY BSC GROUP AND TRANSMITTED TO GEI ON JULY 12, 2013.
2. ELEVATIONS REFERENCE BOSTON CITY BASE DATUM WHICH IS 5.65 FT BELOW NGVD 1929. EL. 0.0 BCB = EL. -5.65 NGVD 1929.

Tremont Crossing Roxbury, Massachusetts	GEI Consultants	BORING LOCATION PLAN
Feldco Development Corp. Cambridge, Massachusetts	Project 160930-0	August 2016 Fig. 2

B:\Working\FELDCO\1609300 Tremont Crossing\00_CAD\Figures\Fig # - Exploration Locations Plan

Appendix A

2016 GEI Boring Logs and Observation Well Logs

2013 GEI Boring Logs and Observation Well Logs

BORING INFORMATION

LOCATION: See boring location plan

GROUND SURFACE EL. (ft): 22

DATE START/END: 6/30/2016 - 7/5/2016

VERTICAL DATUM: Boston City Base

DRILLING COMPANY: New England Boring

TOTAL DEPTH (ft): 85.0

DRILLER NAME: B. Cross

LOGGED BY: J. Scully/D. McVeety

RIG TYPE: Mobile B-53 ATV

BORING

B201

PAGE 1 of 3

DRILLING INFORMATION

HAMMER TYPE: Safety Hammer - rope and cathead

CASING I.D./O.D.: 4 inch / 4.5 inch

CORE BARREL TYPE: NX

AUGER I.D./O.D.: NA / NA

DRILL ROD O.D.: NM

CORE BARREL I.D./O.D. NA / NA

DRILLING METHOD: Mud Rotary Wash

WATER LEVEL DEPTHS (ft): ∇ 14.1 7/5/2016 8:00 am

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
	1	S1	0 to 2	24/9	5-35-29-40		FILL	S1: SILTY SAND (SM) ~75% fine to coarse sand, ~15% non-plastic fines, ~10% gravel up to 1/2 inch, brown. Brick fragments. FILL.
20	2 3							
	4 5	S2	4 to 6	24/12	20-34-29-20			S2: SILTY SAND WITH GRAVEL (SM) ~55% fine to coarse sand, ~25% non-plastic fines, ~20% gravel up to 1/4 inch, gray. Brick fragments. FILL.
	6 7 8							
	9 10	S3	9 to 11	24/6	9-11-12-17		SAND AND GRAVEL	S3: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM): 77.5% fine to coarse sand, 15.4% fine gravel up to 1/4 inch, 7.1% non-plastic fines.
10	11 12 13							
	14 15	S4	14 to 16	24/6	27-32-14-13	Added drilling mud. Pressuremeter test.		S4:NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) 58.8% fine to coarse sand, 33.4% mostly fine gravel up to 3/4 inch, 7.8% non-plastic fines, brown.
	16 17 18							
	19 20	S5	19 to 21	24/10	24-21-18-22	Pressuremeter test.		S5: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM) 73.9% mostly medium to fine sand, 17.7% gravel up to 1/2 inch, 8.4% non-plastic fines, brown.
0	21 22 23							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts

GEI PROJECT NUMBER: 1609300

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
	25	S6	24 to 26	24/12	13-11-14-15		SAND AND GRAVEL	S6: WIDELY GRADED SAND WITH GRAVEL (SW) ~85% fine to coarse sand, ~15% fine gravel up to 1/4 inch, brown.
	26							
	27							
	28							
	29							
	30	S7	29 to 31	24/7	24-23-35-30	Pressuremeter test.		S7: WIDELY GRADED SAND WITH GRAVEL (SW) ~75% fine to coarse sand, ~20% gravel up to 1/4 inch, ~5% non-plastic fines, brown.
	31							
-10	32							
	33							
	34							
	35	S8	34 to 36	24/12	15-12-15-17			S8: SILTY SAND (SM) ~70% fine sand, ~30% non-plastic fines, olive-brown. Pockets of low plasticity fines.
	36							
	37							
	38							
	39							
	40	S9	39 to 41	24/10	16-32-35-27			S9: WIDELY GRADED SAND WITH GRAVEL (SW) ~80% fine to coarse sand, ~15% gravel up to 1/4 inch, ~5% non-plastic fines, brown.
	41							
-20	42							
	43							
	44							
	45	S10	44 to 46	24/6	22-18-18-19			S10: NARROWLY GRADED SAND WITH SILT (SP-SM) 91.5% mostly fine sand, 8.1% non-plastic fines, 0.4% fine gravel up to 3/8", brown.
	46							
	47							
	48							
	49							
	50	S11	49 to 51	24/10	20-19-20-18			S11: Similar to S10.
	51							
-30	52							
	53							
	54							
	55	S12	54 to 56	24/12	22-32-31-26	Pressuremeter test.		S12: WIDELY GRADED SAND WITH GRAVEL (SW) ~80% fine to coarse sand, ~15% gravel up to 1/4 inch, ~5% non-plastic fines, brown.

NOTES:

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 22 **DATE START/END:** 6/30/2016 - 7/5/2016
VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

BORING B201

PAGE 3 of 3

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	56						SAND AND GRAVEL	
	57							
	58							
	59	S13	59 to 61	24/9	17-16-18-17			S13: NARROWLY GRADED SAND WITH SILT (SP-SM) ~90% fine sand, ~10% non-plastic fines, gray.
	60							
	61							
-40	62							
	63						TILL	
	64	S14	64 to 66	24/7	24-26-23-12			S14: CLAYEY SAND WITH GRAVEL (SC) ~50% fine to coarse sand, ~30% low plasticity fines, ~20% gravel up to 1/2 inch, gray. TILL.
	65							
	66							
	67							
	68							
	69	S12	69 to 71	24/2	28-27-30-37			S15: Similar to S14. TILL.
	70							
	71							
-50	72							
	73					Casing at 73.5 feet.	WEATHERED BEDROCK	
	74							
	75	C1	74.5 to 79.5	60/12	0	Weathered bedrock. Coring Advancement (min./ft.): 3-5-4-5-4 Sand matrix appears to have been washed away.		C1: Pieces of gravel. Highly weathered rock.
	76							
	77							
	78							
	79							
	80	C2	80 to 85	60/12	0	Coring Advancement (min./ft.): 8-5.5-4.5-4.5-5.5 Sand matrix appears to have been washed away.		C2: (0-3"): Fine sand (3-12"): Pieces of subrounded-subangular gravel 1/2-3/4 inch. Possible clasts of Roxbury Conglomerate.
	81							
-60	82							
	83							
	84							
	85							Bottom of boring at 85 ft. Borehole tremie grouted and topped with cuttings.
	86							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

BORING INFORMATION

LOCATION: See boring location plan

GROUND SURFACE EL. (ft): 23 **DATE START/END:** 7/13/2016 - 7/15/2016

VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

TOTAL DEPTH (ft): 109.0 **DRILLER NAME:** B. Cross

LOGGED BY: K. Gleichauf **RIG TYPE:** Mobile B-53 ATV

BORING

B202

PAGE 1 of 4

DRILLING INFORMATION

HAMMER TYPE: Safety Hammer - rope and cathead **CASING I.D./O.D.:** 4 inch / 4.5 inch **CORE BARREL TYPE:** NX

AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.** NA / NA

DRILLING METHOD: Mud Rotary Wash

WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer

S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger

Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter

NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
	1	S1	0 to 1.8	21/14	8-25-34-100/3"		FILL	S1: SILTY SAND WITH GRAVEL (SM) ~55% fine to coarse sand, ~30% non-plastic fines, ~15% fine gravel, gray. FILL.
	2							
20	3							
	4	S2	4 to 6	24/0	16-23-16-25			S2: SILTY SAND WITH GRAVEL (SM) ~40% fine to coarse sand, ~30% non-plastic fines, ~30% fine to coarse gravel, gray/brown. Brick Fragments. FILL.
	5							
	6							
	7							
	8							
	9	S3	9 to 11	24/8	13-12-11-6	Petroleum-like odor.		S3: SILTY SAND WITH GRAVEL (SM) similar to S2. Low plasticity fines. FILL.
	10							
	11							
	12							
10	13							
	14	S4	14 to 16	24/3	7-13-8-6	Slight Petroleum-like odor.		S4: SILTY SAND WITH GRAVEL (SM) ~70% fine to coarse sand, ~15% non-plastic fines, ~15% fine gravel, brown/gray. Brick fragments. FILL.
	15							
	16							
	17							
	18						ORGANICS	
	19	S5	19 to 21	24/13	2-1/18"	WC = 210.7%		S5: PEAT (PT) Dark brown/gray, fibrous, organic odor.
	20							
	21							
	22							
0	23							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts

GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 23 **DATE START/END:** 7/13/2016 - 7/15/2016
VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

BORING B202

PAGE 2 of 4

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S6	24 to 26	24/24	WOR/6"-WOH/18"	WC = 171.4%	ORGANICS	S6: PEAT (PT) Dark brown/gray, fibrous, organic odor.
	26							
	27							
	28						SAND AND GRAVEL	
	29	S7	29 to 31	24/7	42-24-24-20			S7: WIDELY GRADED SAND WITH SILT (SW-SM) ~90% fine to coarse sand, ~10% non-plastic fines, gray.
	30							
	31							
	32							
-10	33							
	34	S8	34 to 36	24/5	30-27-22-21			S8: WIDELY GRADED SAND WITH GRAVEL (SW) ~70% fine to coarse sand, ~25% fine to coarse gravel up to 1", ~5% nonplastic fines, dark brown.
	35							
	36							
	37							
	38							
	39	S9	39 to 41	24/5	14-29-30-29			S9: NARROWLY GRADED SAND WITH GRAVEL (SW) ~60% medium to coarse sand, ~30% fine to coarse gravel up to 1.5", ~5% non-plastic fines, brown.
	40							
	41							
	42							
-20	43							
	44	S10	44 to 46	24/5	17-17-12-10			S10: WIDELY GRADED GRAVEL WITH SAND (GW) ~80% fine to coarse gravel up to 1.25", ~15% fine to coarse sand, ~5% non-plastic fines, brown.
	45							
	46							
	47							
	48					Rig chatter.		
	49	S11	49 to 51	24/0	19-19-21-14			S11: NARROWLY GRADED SAND WITH GRAVEL (SP) ~50% medium to coarse sand, ~45% fine gravel, ~5% nonplastic fines, brown.
	50					No recovery; redrive with 3 in. SS.		
	51							
	52							
-30	53							
	54	S12	54 to 56	24/13	14-17-15-15			S12: WIDELY GRADED SAND (SW) ~85% fine to coarse sand, ~10% fine gravel up to 1/2", ~5% nonplastic fines, brown.
	55							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 23 **DATE START/END:** 7/13/2016 - 7/15/2016
VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

BORING B202

PAGE 3 of 4

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
	56						SAND AND GRAVEL	
	57							
	58							
	59	S13	59 to 61	24/13	9-16-15-15			S13: NARROWLY GRADED SAND WITH SILT (SP-SM) ~90% fine to medium sand, ~10% nonplastic fines, some slight black mottling, brown.
	60							
	61							
	62							
-40	63							
	64	S14	64 to 66	24/16	13-16-23-23			S14 (0-10): WIDELY GRADED SAND (SW) ~95% fine to coarse sand, ~5% nonplastic fines, brown. S14 (10-16): SILTY SAND (SM) ~65% mostly fine sand, ~35% nonplastic fines, brown.
	65							
	66							
	67							
	68							
	69	S15	69 to 71	24/18	25-38-42-45			S15: NARROWLY GRADED SAND (SP) ~95% fine to medium sand, ~5% nonplastic fines, brown.
	70							
	71							
	72							
-50	73							
	74	S16	74 to 76	24/16	16-25-33-38			S16: NARROWLY GRADED SAND (SP) ~95% fine to medium sand, ~5% nonplastic fines, brown.
	75							
	76							
	77							
	78							
	79	S17	79 to 81	24/14	22-30-31-30			S17: WIDELY GRADED SAND WITH GRAVEL (SW) ~55% fine to coarse sand, ~35% fine to coarse gravel up to 1", ~10% nonplastic fines, brown.
	80							
	81							
	82							
-60	83							
	84	S18	84 to 86	24/15	21-24-27-25			S18: NARROWLY GRADED SAND (SP) ~95% fine to medium sand, ~5% nonplastic fines, brown. Alternating fine sand and medium sand strata.
	85							
	86							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 23
VERTICAL DATUM: Boston City Base
DATE START/END: 7/13/2016 - 7/15/2016
DRILLING COMPANY: New England Boring

BORING B202

PAGE 4 of 4

Elev. (ft)	Depth (ft)	Sample Information Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	87							
	88					Silty chunks in wash.		
	89	S19	89 to 91	24/20	23-30-22-35			S19 (0-12): WIDELY GRADED SAND WITH SILT (SW-SM) ~80% fine to coarse sand, ~10% slightly-plastic fines, ~10% coarse gravel up to 1", brown/red. TILL.
	90						TILL	
	91							S19 (12-20): SILT WITH SAND (ML) ~80% nonplastic fines, ~20% fine sand, light gray, possible lean clay present.
	92							
-70	93					Rig chatter, hard drilling at 92 ft.		
	94	S20	94 to 94.8	9/7	65-100/3"			S20: GRAVELLY LEAN CLAY WITH SAND (CL) ~50% low plasticity fines, ~30% fine to coarse gravel up to 1", ~20% fine to coarse sand, light gray. Gravel is weathered bedrock.
	95					Light gray clay bits in wash.		
	96					S20: Gravel appears similar to weathered bedrock.		
	97							
	98					Notable roller bit resistance increase at 97.5 ft.	WEATHERED BEDROCK	
	99	S21	99 to 99.8	9/8	16-100/3"			S21: LEAN CLAY WITH SAND (CL) ~60% low plasticity fines, ~25% fine to coarse sand, ~15% fine to coarse gravel up to 1", light gray. Possible weathered bedrock.
	100							
	101							
	102					Rig chatter at 101 ft.		
-80	103					Cored using slow rotation speed		
	104	C1	104 to 109	60/56	69	Coring Advancement (min./ft.): 4.5-6-7-9-8.5	BEDROCK	C1: CONGLOMERATE, hard, moderately weathered, quartz sandstone matrix, rounded gravel clasts matrix has faint stratification, coarse clasts and fine siltstone intraclasts appear from 31-47, fractures every 4" to 6", light gray/purple throughout.
	105							
	106							
	107							
	108							
	109							Bottom of boring at 109 ft. Borehole tremie grouted upon completion.
	110							
	111							
	112							
-90	113							
	114							
	115							
	116							
	117							
	118							

NOTES:

PROJECT NAME: Tremont Crossing
CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

BORING INFORMATION

LOCATION: See boring location plan

GROUND SURFACE EL. (ft): 22.5

DATE START/END: 6/28/2016 - 6/29/2016

VERTICAL DATUM: Boston City Base

DRILLING COMPANY: New England Boring

TOTAL DEPTH (ft): 70.2

DRILLER NAME: P. Labossier

LOGGED BY: K. Gleichauf

RIG TYPE: Mobile B-53 Truck

BORING

B203 (OW)

PAGE 1 of 3

DRILLING INFORMATION

HAMMER TYPE: Safety Hammer - rope and cathead

CASING I.D./O.D.: 4 inch / 4.5 inch

CORE BARREL TYPE: NX

AUGER I.D./O.D.: NA / NA

DRILL ROD O.D.: NM

CORE BARREL I.D./O.D. NA / NA

DRILLING METHOD: Mud Rotary Wash

WATER LEVEL DEPTHS (ft): ⊻ 2.5 6/26/2016 7:30 am

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer

S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger

Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter

NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
	1 2	S1	0 to 2	24/16	1-7-12-50		FILL	S1: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM) ~60% fine to coarse sand, ~30% fine gravel, ~10% non-plastic fines, gray. Piece of brick at 10". FILL.
20	3 4 5							
	6 7	S2	5 to 7	24/16	13-35-46-45			S2 (0-6"): SILTY SAND WITH GRAVEL (SM) ~60% fine to coarse sand, ~25% non-plastic fines, ~15% fine gravel, gray. FILL. S2 (6-16"): WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM) ~60% fine to coarse sand, ~30% fine to coarse gravel up to 1 inch, ~10% non-plastic fines, gray. Bricks. FILL.
	8 9 10					Rig chatter at 8 feet.	SAND AND GRAVEL	
	11 12	S3	10 to 12	24/8	8-9-8-8			S3: WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM) 58.7% fine to coarse gravel, 34.3% fine to coarse sand, 7% non-plastic fines, brown.
10	13 14 15					Rig chatter at 12 feet.		
	16 17	S4	15 to 17	24/3	8-7-6-7			S4: WIDELY GRADED SAND WITH GRAVEL (SW) ~75% fine to coarse sand, ~20% coarse gravel up to 1.25 inch, ~5% non-plastic fines, brown. Piece of coarse gravel stuck in tip.
	18 19 20							
	21 22	S5	20 to 22	24/9	6-10-11-8			S5: WIDELY GRADED SAND WITH GRAVEL (SW) ~75% fine to coarse sand, ~20% fine gravel up to 1/2 inch, ~5% non-plastic fines, brown.
0	23							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts

GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 22.5
DATE START/END: 6/28/2016 - 6/29/2016
VERTICAL DATUM: Boston City Base
DRILLING COMPANY: New England Boring

BORING
B203 (OW)

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
	25	S6	25 to 27	24/13	14-24-32-29		SAND AND GRAVEL	S6: WIDELY GRADED SAND (SW) ~90% mostly medium sand, ~5% fine gravel up to 1/2 inch, ~5% non-plastic fines, brown/gray.
	28					Rig chatter at 28.5 feet.		
	30	S7	30 to 32	24/11	15-23-17-27			S7 (0-6"): NARROWLY GRADED SAND WITH SILT (SP-SM) ~90% mostly fine sand, ~10% non-plastic fines, gray/brown. S7 (6-11"): NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) ~70% fine to coarse sand, ~20% fine gravel up to 1/2 inch, ~10% non-plastic fines, brown.
-10	32.5							
	35	S8	35 to 37	24/16	15-24-29-37			S8: NARROWLY GRADED SAND (SP): ~90% fine to medium sand, ~5% fine gravel up to 1/2 inch, ~5% non-plastic fines, brown.
	40	S9	40 to 42	24/17	26-26-32-35			S9 (0-5"): SILTY SAND (SM) ~85% fine sand, ~15% non-plastic fines, gray. S9 (5-15"): NARROWLY GRADED SAND WITH SILT (SP-SM) ~90% fine to medium sand, ~10% non-plastic fines, red to gray. S9 (15-17"): WIDELY GRADED SAND ~75% fine to coarse sand, ~20% fine to coarse gravel up to 1 inch, ~5% non-plastic fines, gray.
-20	42.5							
	45	S10	45 to 46.3	16/9	10-100/4"	Sv = 0.2 tsf	TILL	S10: SANDY LEAN CLAY (CL) ~60% low plasticity fines, ~30% fine to coarse sand, ~10% fine to coarse gravel up to 1 inch, light gray. TILL.
	47					Rig chatter at 47.5 feet.		
	50	S11	50 to 52	24/12	15-22-22-19			S11: CLAYEY GRAVEL WITH SAND (GC) ~40% fine gravel up to 3/4 inch, ~30% fine to coarse sand, ~30% low plasticity fines, light gray. TILL.
-30	52.5							
	55							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 22.5
VERTICAL DATUM: Boston City Base
DATE START/END: 6/28/2016 - 6/29/2016
DRILLING COMPANY: New England Boring

BORING
B203 (OW)

Elev. (ft)	Depth (ft)	Sample Information Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S12	55 to 57	24/13	29-43-46-53		TILL	S12: CLAYEY GRAVEL WITH SAND (GC) ~40% fine gravel up to 3/4 inch, ~30% fine to coarse sand, ~30% low plasticity fines, light gray. TILL.
	56							
	57							
	58							
	59							
	60	S13	60 to 60.6	7/7	33-100/1"			S13: GRAVELLY LEAN CLAY (CL) ~60% low plasticity fines, ~40% fine to coarse gravel up to 1", gray. TILL
	61							
	62							
-40								
	63							
	64							
	65	S14 C1	65 to 65.2 65.2 to 70.2	2/2 60/51	100/2" 0	65-65.8 ft: Weathered Bedrock	BEDROCK	S14: WIDELY GRADED GRAVEL WITH CLAY (GW-GC): 90% fine to coarse gravel, ~10% low plasticity fines, gray. Highly weathered soft bedrock. C1 (0-8"): SANDSTONE, soft, highly weathered, homogeneous, gray. Fractures at 1" to 2". C1 (8-51"): CONGLOMERATE, hard, moderately weathered, no visible stratification, rounded clasts of purple blue and gray (0.5-2 inch diameter) in fine grained, light gray matrix.
	66							
	67							
	68							
	69							
	70							
								Bottom of boring at 70.2 ft. Borehole backfilled with soil cuttings upon completion, Installed well upon location on 7/11/2016.
	71							
	72							
-50								
	73							
	74							
	75							
	76							
	77							
	78							
	79							
	80							
	81							
	82							
-60								
	83							
	84							
	85							
	86							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

Groundwater Well Installation Log

B203 (OW)

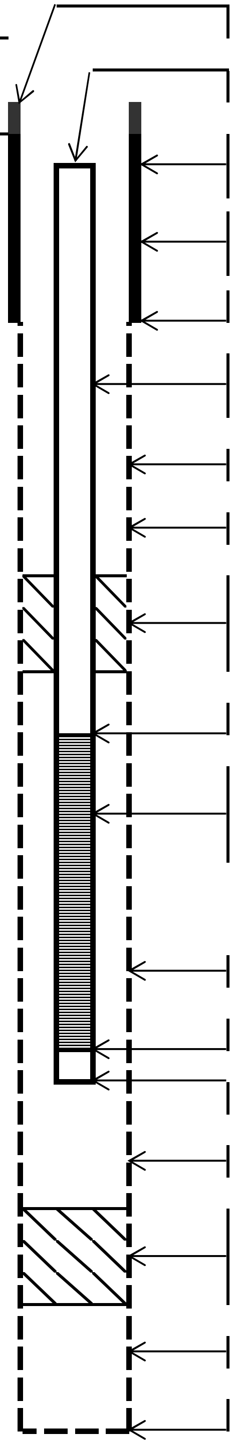
Project	Tremont Crossing	**GEI Proj. No.**	1609300
City / Town	Boston, MA	**Location**	B203
Client	FELDCO		
Contractor	New England Boring		
Driller	P. Labossier **GEI Rep.** K.Gleichauf	**Install Date**	7/11/2016

Survey Datum: **Boston City**

Ground Elevation: 23'

Date	Time	Distance to ▼ below top of riser pipe

General Soil Conditions (Not to Scale)



Length of Surface Casing above Ground	0
Dist. Top of Surf. Casing to Top of Riser Pipe	0.25'
Type and Thickness of Seal around Surface Casing	Grout, 0.5'
ID of Surface Casing	0.5'
Type of Surface Casing	
Depth Bottom of Surface Casing	0.8'
ID and OD of Riser Pipe	2", 2.5"
Type of Riser Pipe	
Type of Backfill around Riser Pipe	Cuttings
Diameter of Borehole	4"
Depth Top of Seal	24'
Type of Seal	Bentonite Chips
Depth Bottom of Seal	26'
Depth Top of Screened Section	27.9'
Type of Screen	Slotted Pipe
Description of Screen Openings	Slots
ID and OD of Screened Section	2", 2.5"
Type of Filter Material	Silica Sand
Depth Bottom of Screened Section	37.9'
Depth Bottom of Silt Trap	38'
Depth Bottom of Filter Material	39'
Depth Top of Seal	--
Type of Seal	--
Depth Bottom of Seal	--
Type of Backfill below Filter Material	Cuttings
Bottom of Borehole	

Notes: Installed on B203 location that was previously drilled and backfilled with cuttings

BORING INFORMATION

LOCATION: See boring location plan

GROUND SURFACE EL. (ft): 19.5

VERTICAL DATUM: Boston City Base

TOTAL DEPTH (ft): 69.0

LOGGED BY: K. Gleichauf

DATE START/END: 6/29/2016 - 6/29/2016

DRILLING COMPANY: New England Boring

DRILLER NAME: P. Labossier

RIG TYPE: Mobile B-53 Truck

BORING

B204

PAGE 1 of 3

DRILLING INFORMATION

HAMMER TYPE: Safety Hammer - rope and cathead

AUGER I.D./O.D.: NA / NA

CASING I.D./O.D.: 4 inch / 4.5 inch

DRILL ROD O.D.: NM

CORE BARREL TYPE: NX

CORE BARREL I.D./O.D. NA / NA

DRILLING METHOD: Mud Rotary Wash

WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer

S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger

Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter

NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
								6" ASPHALT.
	1	S1	0.5 to 2.5	24/12	3-3-11-17		FILL	S1 (0-3"): WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM) ~60% fine sand, ~35% fine to coarse gravel, ~5% non-plastic fines, brown. FILL.
	2					Driller mixed mud.		
	3							S1 (3-12"): CLAYEY SAND WITH GRAVEL (SC) ~55% fine to coarse sand, ~25% fine to coarse gravel up to 1", ~20% nonplastic fines, dark brown/black. Piece of coal from 10-12", traces of brick. FILL.
	4							
	5	S2	5 to 7	24/10	4-8-13-22			S2 (0-8"): WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM) ~50% fine to coarse gravel, ~40% fine to coarse sand, ~10% nonplastic fines, dark brown, brick fragments throughout. FILL.
	6							
	7							S2 (8-10"): NARROWLY GRADED SAND WITH CLAY (SP-SC) ~80% fine to medium sand, ~20% low plasticity fines, brown. FILL.
	8							
10	9						SAND AND GRAVEL	
	10	S3	10 to 12	24/14	13-17-16-23			S3 (0-5"): SILT (ML) ~85% non-plastic fines, ~15% fine sand, brown.
	11							
	12							S3 (5-14"): NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) 73.9% fine to medium sand, 19.1% coarse gravel up to 1 inch, 7% non-plastic fines, brown. Gravel in seams from 5-6" and 12-13".
	13					Pressuremeter test 11.5-14 feet.		
	14							
	15	S4	15 to 17	24/11	14-13-15-14			S4: WIDELY GRADED SAND WITH GRAVEL (SW) ~60% fine to coarse sand, ~35% fine to coarse gravel up to 1", ~5% non-plastic fines, gray.
	16					Pressuremeter test 15-17.5 feet.		
	17							
	18							
0	19							
	20	S5	20 to 22	24/12	21-18-21-16			S5: WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM) ~50% fine to coarse gravel up to 1 inch, ~40% fine to coarse sand, ~10% non-plastic fines.
	21							
	22							
	23							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts

GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan

GROUND SURFACE EL. (ft): 19.5 **DATE START/END:** 6/29/2016 - 6/29/2016

VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

BORING B204

PAGE 2 of 3

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
	25	S6	25 to 27	24/10	18-14-18-19	Pressuremeter test 25-27.5 feet.	SAND AND GRAVEL	S6 (0-5"): NARROWLY GRADED SAND WITH GRAVEL (SP) ~80% fine to medium sand, ~15% fine to coarse gravel, ~5% non-plastic fines, brown. Gravel pieces on top. S6 (5-10"): WIDELY GRADED SAND WITH GRAVEL (SW) ~55% fine to coarse sand, ~40% fine to coarse gravel up to 1 inch, ~5% non-plastic fines, brown.
-10	30	S7	30 to 32	24/12	12-14-23-46			S7: SILTY GRAVEL WITH SAND (GM) ~55% fine to coarse gravel up to 1 inch, ~30% fine to coarse sand, ~15% nonplastic fines, brown.
	35	S8	35 to 37	24/15	33-42-32-41			S8: Similar to S7.
-20	40	S9	40 to 42	24/9	25-28-26-12	Pressuremeter test 40-42.5 feet.		S9: WIDELY GRADED GRAVEL WITH SAND (GW) ~70% fine to coarse gravel up to 1 inch, ~25% fine to coarse sand, ~5% non-plastic fines, brown.
	45	S10	45 to 46.3	16/3	24-18-14-21			S10: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM) ~60% fine to coarse sand, ~30% fine to coarse gravel, ~10% non-plastic fines, brown.
-30	50	S11	50 to 52	24/13	12-13-25-25			S11 (0-9"): WIDELY GRADED SAND (SW) ~90% fine to medium sand ~5% fine gravel, ~5% non-plastic fines, brown.
							TILL	S11 (9-13"): CLAYEY SAND WITH GRAVEL (SC) ~50% fine to coarse sand, ~35% low plasticity fines, ~15% fine to coarse gravel up to 1 inch, brown. TILL.
	55							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts

GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 19.5 **DATE START/END:** 6/29/2016 - 6/29/2016
VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

BORING
B204
PAGE 3 of 3

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	56	S12	55 to 57	24/13	18-10-20-20		TILL	S12: CLAYEY GRAVEL WITH SAND (GC) ~50% fine to coarse gravel up to 1.25", ~ 30% low plasticity fines, ~20% fine to coarse sand, light gray. TILL.
	57							
	58							
	59							
-40	60	S13	60 to 60.6	7/12	26-26-39-53			S13: CLAYEY GRAVEL WITH SAND (GC) ~60% fine to coarse gravel up to 1 inch, ~25% low plasticity fines, ~15% fine to coarse sand, light gray. TILL.
	61							
	62							
	63						HIGHLY WEATHERED BEDROCK	
	64	C1	64 to 69	60/10	0	Casing refusal at 63 feet. Coring Advancement (min./ft.): 5.5-4-4-3.5-4.5		C1: CONGLOMERATE, medium hard to hard, weathered, highly fractured conglomerate.
	65							
	66							
	67							
	68							
	69							Bottom of boring at 69 ft. Borehole tremie grouted upon completion.
-50	70							
	71							
	72							
	73							
	74							
	75							
	76							
	77							
	78							
	79							
-60	80							
	81							
	82							
	83							
	84							
	85							
	86							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

BORING INFORMATION

LOCATION: See boring location plan

GROUND SURFACE EL. (ft): 22.5

DATE START/END: 7/8/2016 - 7/12/2016

VERTICAL DATUM: Boston City Base

DRILLING COMPANY: New England Boring

TOTAL DEPTH (ft): 104.0

DRILLER NAME: B. Cross

LOGGED BY: D. McVeety/K. Gleichauf

RIG TYPE: Mobile B-53 ATV

BORING

B205 (OW)

PAGE 1 of 4

DRILLING INFORMATION

HAMMER TYPE: Safety Hammer - rope and cathead

CASING I.D./O.D.: 4 inch / 4.5 inch

CORE BARREL TYPE: NX

AUGER I.D./O.D.: NA / NA

DRILL ROD O.D.: NM

CORE BARREL I.D./O.D. NA / NA

DRILLING METHOD: Mud Rotary Wash

WATER LEVEL DEPTHS (ft): ⊻ 15.1 7/11/2016 7:35 am

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
	1	S1	0 to 2	24/13	7-10-17-16		FILL	S1 (0-4): SILTY SAND WITH GRAVEL (SM) ~45% fine to coarse sand, ~35% mostly fine gravel, ~15% nonplastic fines, brown. Much of gravel is possible pulverized red brick fragments. FILL. S1 (4-9): ASPHALT S1 (9-13): Similar to S1 (0-4). FILL.
	2							
20								
	3							
	4							
	5	S2	4 to 6	24/6	15-9-7-10			S2: CLAYEY GRAVEL WITH SAND (GC) ~40% fine to coarse gravel up to 3/4", ~30% low plasticity fines (both clay and silt present), ~30% fine to coarse sand, brown. ~1" possible pulverized asphalt in bottom of sample. FILL.
	6							
	7					Very high driving resistance when advancing casing from 4 to 9 feet.		
	8							
	9							
	10	S3	9 to 11	24/12	12-19-23-40	At ~8.5 feet, wash becomes significantly darker.		S3: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM) ~70% fine to coarse sand, ~20% fine gravel, ~10% nonplastic fines. Alternating bands of light brown, dark brown and black with seams of white. Possible ash. Material in spoon had foul odor. FILL.
	11							
	12							
10								
	13							
	14							
	15	S4	14 to 16	24/6	10-9-8-12			S4 (0-2): WIDELY GRADED SAND WITH CLAY (SW-SC) ~90% fine to coarse sand, ~10% low plasticity fines, gray and light brown. Possible FILL. S4 (2-6): WIDELY GRADED SAND (SW) ~95% fine to coarse sand, <5% nonplastic fines, black. Possible FILL.
	16						ORGANICS	
	17					Little resistance to rollerbit starting at 15 feet.		
	18							
	19							
	20	S5	19 to 21	24/22	WOH/19"-2	Sv: 0.2, 0.3, 0.2, 0.2 TSF		S5: PEAT (PT) dark brown/gray, fibrous, organic odor.
	21							
	22					Qp: 0, 0, 0, 0 TSF		
0								
	23					Based on rollerbit resistance, bottom of organics is at ~22.9 feet.		

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts

GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION:	See boring location plan		
GROUND SURFACE EL. (ft):	22.5	**DATE START/END:**	7/8/2016 - 7/12/2016
VERTICAL DATUM:	Boston City Base	**DRILLING COMPANY:**	New England Boring

BORING
B205 (OW)
PAGE 2 of 4

Elev. (ft)	Depth (ft)	Sample Information Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S6	24 to 26	24/5	19-18-15-17		SAND AND GRAVEL	S6: WIDELY GRADED SAND WITH GRAVEL (SW) ~75% fine to coarse sand, ~20% fine gravel, <5% fines, dark gray.
	26							
	27							
	28							
	29	S7	29 to 31	24/5	25-22-13-14			S7 (0-2): WIDELY GRADED SAND WITH GRAVEL (SW) similar to S6. S7 (2-5) NARROWLY GRADED SAND (SP) ~95% fine to medium sand, <5% nonplastic fines, light brown and orangeish brown.
	30							
	31							
-10	32							
	33							
	34	S8	34 to 36	24/1	10-11-10-13	S8: Poor recovery likely due to damaged SS catcher; replaced prior to S9.		S8: NARROWLY GRADED SAND WITH GRAVEL (SP) ~70% coarse sand, ~30% fine gravel up to 1/8". Possible wash.
	35							
	36							
	37							
	38							
	39	S9	39 to 41	24/20	6-5-5-9			S9: NARROWLY GRADED SAND (SP) ~90% mostly fine sand, 10% nonplastic fines, light brown.
	40							
	41							
-20	42							
	43							
	44	S10	44 to 46	24/8	7-6-5-8			S10: WIDELY GRADED SAND (SW) ~95% fine to coarse sand, 5% nonplastic fines, light brown.
	45							
	46							
	47							
	48							
	49	S11	49 to 51	24/6	10-16-15-10			S11 (0-2): NARROWLY GRADED SAND (SP) ~95% fine sand, 5% nonplastic fines, light brown. S11 (2-6): WIDELY GRADED SAND WITH GRAVEL (SW) ~75% fine to coarse sand, ~25% fine to coarse gravel up to 3/4", light brown.
	50							
	51							
-30	52							
	53							
	54	S12	54 to 56	24/10	7-10-9-8			S12: NARROWLY GRADED SAND (SP) 94.2% mostly fine sand, 5.8% nonplastic fines, light brown.
	55							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts

GEI PROJECT NUMBER: 1609300

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 22.5 **DATE START/END:** 7/8/2016 - 7/12/2016
VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

BORING
B205 (OW)
PAGE 3 of 4

Elev. (ft)	Depth (ft)	Sample Information Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	56						SAND AND GRAVEL	
	57							
	58							
	59	S13	59 to 61	24/8	12-11-18-23			S13 (0-6): WIDELY GRADED SAND (SW) ~90% fine to coarse sand, ~10% nonplastic fines, light brown. S13 (6-8): WIDELY GRADED SAND (SW) ~85% fine to coarse sand, ~10% nonplastic fines, ~5% fine gravel to 1/4"
	60							
	61							
	62							
-40								
	63							
	64	S14	64 to 66	24/0	26-30-29-25	Three pieces of ~3/4" gravel in spoon tip.		S14: WIDELY GRADED GRAVEL (GW) ~85% fine to coarse subangular to subrounded up to 2 1/4" gravel, ~10% coarse sand, <5% low plasticity fines, dark gray.
	65							
	66							
	67							
	68							
	69	S15	69 to 71	24/9	17-23-22-21			S15: WIDELY GRADED SAND WITH GRAVEL (SW) ~80% fine to coarse sand, ~15% fine to coarse subrounded gravel up to 3/4", ~5% nonplastic fines, light brown.
	70							
	71							
	72							
-50								
	73							
	74	S16	74 to 76	24/8	24-21-23-20			S16: NARROWLY GRADED SAND (SP) 95% mostly fine sand, ~5% nonplastic fines, light brown.
	75							
	76							
	77							
	78							
	79	S17	79 to 81	24/10	19-20-25-26	No soil within sample 5" to 10", possible due to nonplastic fines.		S17 (0-3): NARROWLY GRADED SAND WITH SILT (SP-SM) ~90% fine sand, ~10% nonplastic fines, light brown. S17 (3-10): SILTY SAND (SM) ~55% fine sand, ~45% nonplastic fines, light brown. Seam (<1/8") of fine to coarse sand at 5".
	80							
	81							
	82							
-60								
	83							
	84	S18	84 to 86	24/8	32-40-27-32			S18: WIDELY GRADED SAND WITH GRAVEL (SW) ~50% fine to coarse sand, ~45% fine gravel, <5% nonplastic fines, light brown.
	85							
	86							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 22.5 **DATE START/END:** 7/8/2016 - 7/12/2016
VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

BORING
B205 (OW)
PAGE 4 of 4

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	87							
	89	S19	89 to 90.6	19/9	19-16-15-100/1"		TILL	S19: SANDY LEAN CLAY WITH GRAVEL (CL) ~45% low plasticity fines, ~35% fine to coarse sand, ~20% fine gravel up to 3/4", gray. TILL.
-70								
	94	S20	94 to 96	24/15	31-35-39-45	Open hole sample.		S20: GRAVELLY SILT WITH SAND (ML) ~40% nonplastic fines, ~35% fine to coarse gravel, ~25% fine to coarse sand, light gray. Weathered rock present. TILL.
	98					Bit stopped advancing at 97.5 feet without down pressure.	WEATHERED BEDROCK	
	99	S21	99 to 99.1	1/1	100/1"			S21: SILTY GRAVEL WITH SAND (GM) ~60% fine to coarse gravel, ~20% nonplastic fines, ~20% fine to coarse sand, light gray. Weathered bedrock.
	100					Added down pressure to advance to 99 feet.		
-80	103					Angular bedrock fragments in wash. Increased drilling resistance with depth.		
	104	C1	104 to 109	60/54	20	Coring Advancement (min./ft.): 6.5-8.5-9.0-7.5-12.5	BEDROCK	C1: CONGLOMERATE hard, medium grained sand matrix, larger clasts are rounded and up to 2", highly weathered, alternating coarse and fine strata. Fractures every 0.5" to 4", joints tend to follow coarse strata along larger clasts matrix is light gray, clasts are pink, purple, dark blue.
	108					Cored with slow barrel speed.		
	109							Bottom of boring at 109 ft. Installed well upon completion.
-90								
	118							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

Groundwater Well Installation Log

B205 (OW)

Project Tremont Crossing
City / Town Boston, MA
Client FELDCO
Contractor New England Boring
Driller B. Cross **GEI Rep.** K.Gleichauf

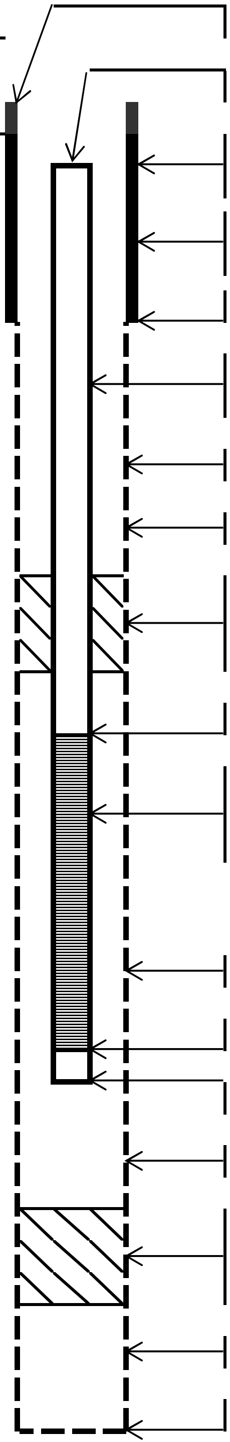
GEI Proj. No. 1609300
Location B205
Install Date 7/13/2016

Survey Datum: **Boston City**

Ground Elevation: 21.5

Date	Time	Distance to ▼ below top of riser pipe

General Soil Conditions (Not to Scale)



Length of Surface Casing above Ground	3'
Dist. Top of Surf. Casing to Top of Riser Pipe	4"
Type and Thickness of Seal around Surface Casing	soil
ID of Surface Casing	4"
Type of Surface Casing	Steel Casing
Depth Bottom of Surface Casing	2'
ID and OD of Riser Pipe	2", 2.5"
Type of Riser Pipe	PVC
Type of Backfill around Riser Pipe	Cuttings
Diameter of Borehole	4"
Depth Top of Seal	24.5'
Type of Seal	Bentonite Chips
Depth Bottom of Seal	26.5'
Depth Top of Screened Section	38.9'
Type of Screen	Slotted Pipe
Description of Screen Openings	Slots
ID and OD of Screened Section	2", 2.5"
Type of Filter Material	Silica Sand
Depth Bottom of Screened Section	38.9'
Depth Bottom of Silt Trap	39'
Depth Bottom of Filter Material	40'
Depth Top of Seal	--
Type of Seal	--
Depth Bottom of Seal	--
Type of Backfill below Filter Material	Native Sand
Bottom of Borehole	104'

Notes: Installed in B205 borehole

GEI Consultants

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BORING INFORMATION

LOCATION: See boring location plan

GROUND SURFACE EL. (ft): 19

DATE START/END: 6/30/2016 - 7/5/2016

VERTICAL DATUM: Boston City Base

DRILLING COMPANY: New England Boring

TOTAL DEPTH (ft): 64.0

DRILLER NAME: P. Labossier/S. Cooley

LOGGED BY: K. Gleichauf

RIG TYPE: Mobile B-53 Truck

BORING
B206
PAGE 1 of 3

DRILLING INFORMATION

HAMMER TYPE: Safety Hammer - rope and cathead

CASING I.D./O.D.: 4 inch / 4.5 inch

CORE BARREL TYPE: NX

AUGER I.D./O.D.: NA / NA

DRILL ROD O.D.: NM

CORE BARREL I.D./O.D. NA / NA

DRILLING METHOD: Mud Rotary Wash

WATER LEVEL DEPTHS (ft): ▼ 11.0 7/5/2016

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer

S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger

Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter

NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
								6" CONCRETE sidewalk.
	1	S1	0.5 to 2.5	24/9	19-1-9-19		FILL	S1: WIDELY GRADED SAND WITH GRAVEL (SW) ~70% fine to coarse sand, ~20% fine gravel up to 1/2 inch, ~10% non-plastic fines, grass. TOPSOIL.
	2							
	3							
	4							
	5	S2	5 to 7	24/16	19-7-6-6	Casing refusal at 4 feet. Offset hole onto sidewalk to avoid obstruction.		S2 (0-11"): SILTY SAND WITH GRAVEL (SM) ~75% fine to coarse sand, ~15% non-plastic fines, ~1% fine gravel up to 1/2", mottled black, gray. FILL.
	6							
	7							S2 (11-16"): SANDSTONE, soft, friable, red. FILL.
	8							
10	9					Mixed bentonite mud		
	10	S3	10 to 12	24/8	8-7-7-5	Drove 3" SS from 10-12.5 feet for PMT test.		S3: WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM) ~50% fine to coarse gravel up to 1 inch, ~40% fine to coarse sand, ~10% non-plastic fines, brown. Possible FILL.
	11							
	12	S3A	12 to 12.5	6/3		Pressuremeter test 10-12.5 feet.		S3A: SANDY LEAN CLAY (CL) ~60% low plasticity fines, ~30% fine to coarse sand, ~10% fine to coarse gravel up to 1/2 inch. Possible FILL.
	13							
	14							
	15	S4	15 to 17	24/19	2-2-2-3	WC = 85.6%	ORGANICS	S4: ORGANIC SOIL (OL) ~100% low plasticity organic fines, black, trace veg.
	16							
	17							
	18							
0	19							
	20	S5	20 to 22	24/8	17-12-19-18		SAND AND GRAVEL	S5: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM) ~60% fine to coarse sand, ~25% fine to coarse gravel up to 3/4 inch, ~15% non-plastic fines, dark gray.
	21							
	22							
	23							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts

GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 19
VERTICAL DATUM: Boston City Base
DATE START/END: 6/30/2016 - 7/5/2016
DRILLING COMPANY: New England Boring

BORING B206

PAGE 2 of 3

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S6	25 to 27	24/12	11-10-12-12	Hard drilling.	SAND AND GRAVEL	S6: WIDELY GRADED SAND WITH GRAVEL ~80% fine to coarse sand, ~20% fine gravel, gray/brown. Red layer 7-8". Gravel amount increases with depth.
	26							
	27							
	28							
-10	29							
	30	S7	30 to 32	24/10	10-12-9-15			S7: WIDELY GRADED SAND WITH GRAVEL (SW) ~70% medium to coarse sand, ~25% fine gravel up to 1/2 inch, ~5% non-plastic fines, brown/gray, streak of red 5-6".
	31							
	32							
	33							
	34							
	35	S8	35 to 37	24/12	8-8-11-12			S8: WIDELY GRADED SAND (SW) ~95% fine to coarse sand, ~5% non-plastic fines, gray/brown.
	36							
	37							
	38							
-20	39							
	40	S9	40 to 42	24/15	9-11-15-16			S9: NARROWLY GRADED SAND (SP) ~95% fine to medium sand, ~5% non-plastic fines, gray/brown.
	41							
	42					Pressuremeter test 41-43.5 feet.		
	43							
	44							
	45	S10	45 to 46.2	14/11	38-39-100/2"			S10 (0-5"): WIDELY GRADED SAND ~95% fine to coarse sand, ~5% non-plastic fines, brown.
	46						TILL	S10 (5-11"): CLAYEY SAND WITH GRAVEL (SC) ~40% low plasticity fines, ~35% fine to coarse sand, ~25% fine gravel up to 1/2", light gray. TILL.
	47							
	48							
-30	49							
	50	S11	50 to 52	24/9	14-14-11-17			S11: CLAYEY SAND WITH GRAVEL (SC) ~55% fine to coarse sand, ~25% low plasticity fines, ~20% fine gravel up to 1", light gray. TILL.
	51					100% water loss while drilling for pressuremeter test.		
	52							
	53							
	54							
	55							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 19
VERTICAL DATUM: Boston City Base
DATE START/END: 6/30/2016 - 7/5/2016
DRILLING COMPANY: New England Boring

BORING
B206
PAGE 3 of 3

Elev. (ft)	Depth (ft)	Sample Information Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	56	S12	55 to 55.1	1/1	100/1"		WEATH. BEDROCK	S12: WEATHERED BEDROCK.
	57							
	58							
-40	59	C1	59 to 64	60/60	13	Coring Advancement (min./ft.): 3.5-4.5-4.5-5-6	BEDROCK	C1: CONGLOMERATE, hard, coarse grained, light gray matrix with 1-2" clasts of rounded blue, green, and purple stones, no laminations, moderately weathered, highly fractured.
	60							
	61							
	62							
	63							
	64							Bottom of boring at 64 ft. Borehole tremie grouted upon completion.
	65							
	66							
	67							
	68							
-50	69							
	70							
	71							
	72							
	73							
	74							
	75							
	76							
	77							
	78							
-60	79							
	80							
	81							
	82							
	83							
	84							
	85							
	86							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

BORING INFORMATION

LOCATION: See boring location plan

GROUND SURFACE EL. (ft): 16

DATE START/END: 7/5/2016 - 7/6/2016

VERTICAL DATUM: Boston City Base

DRILLING COMPANY: New England Boring

TOTAL DEPTH (ft): 85.1

DRILLER NAME: B. Cross

LOGGED BY: D. McVeety

RIG TYPE: Mobile B-53 Truck

BORING

B207

PAGE 1 of 3

DRILLING INFORMATION

HAMMER TYPE: Safety Hammer - rope and cathead

CASING I.D./O.D.: 4 inch / 4.5 inch

CORE BARREL TYPE: NX

AUGER I.D./O.D.: NA / NA

DRILL ROD O.D.: NM

CORE BARREL I.D./O.D. NA / NA

DRILLING METHOD: Mud Rotary Wash

WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer

S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger

Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter

NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
	1	S1	0 to 2	24/9	2-5-14-15		FILL	S1: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM) ~75% fine to coarse sand, ~15% mostly fine to medium gravel, ~10% non-plastic fines, light brown. FILL
	2							
	3							
	4							
	5	S2	4 to 6	24/2	16-16-11-10			S2: NARROWLY GRADED SAND WITH GRAVEL (SP) ~70% coarse sand, ~30% fine gravel, brown. 1/2 inch fragment of possible concrete in spoon tip. FILL.
10	6							
	7							
	8							
	9							
	10	S3	9 to 9.2	2/2	100/2"			S3: WIDELY GRADED SAND (SW) ~75% fine to coarse sand, ~20% fine gravel, ~5% non-plastic fines, brown. FILL.
	11							
	12						SAND AND GRAVEL	
	13							
	14							
	15	S4	14 to 16	24/7	2-5-9-18			S4: SANDY SILT WITH GRAVEL (ML) ~40% nonplastic fines, ~30% fine to coarse sand, ~30% fine to coarse gravel, gray.
0	16							
	17							
	18							
	19							
	20	S5	19 to 21	24/1	16-24-28-31			S5: NARROWLY GRADED SAND WITH GRAVEL (SP) ~50% medium to coarse sand, ~ 50% fine gravel, light brown. Spoon tip contained ~30% low plasticity fines.
	21							
	22							
	23							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts

GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 16 **DATE START/END:** 7/5/2016 - 7/6/2016
VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

BORING
B207
PAGE 2 of 3

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S6	24 to 26	24/23	2-7-11-12		SAND AND GRAVEL	S6 (0-10"): LEAN CLAY WITH SAND (CL) ~80% low plasticity fines, ~20% fine sand, light brown. S6 (10-23"): CLAYEY SAND (SC) ~70% fine to medium sand, ~30% low plasticity fines, light brown.
-10	26 27 28							
	29 30	S7	29 to 31	24/12	15-25-21-10	S7(9-12"): Qp = 0.75 tsf.		S7 (0-9"): SANDY LEAN CLAY WITH GRAVEL (SC) ~50% low plasticity fines, ~30% fine to coarse sand, ~20% fine gravel, brown/gray. S7 (9-12"): LEAN CLAY (CL) ~90% low plasticity fines, ~10% fine sand, light brown.
	31 32 33							
	34 35	S8	34 to 36	24/6	12-22-24-15			S8: WIDELY GRADED SAND WITH GRAVEL (SW) ~70% fine to coarse sand, ~25% fine to coarse gravel up to 3/4 inch, <5% non-plastic fines, brown.
-20	36 37 38					Mud added to wash when washing down to 39 feet.		
	39 40	S9	39 to 41	24/7	10-8-10-12			S9: WIDELY GRADED SAND WITH GRAVEL (SW) ~65% fine to coarse sand, ~30% fine to coarse rounded gravel, <5% fines, reddish brown and brown.
	41 42 43							
	44 45	S10	44 to 46	24/3	8-11-8-8			S10: WIDELY GRADED GRAVEL WITH SAND (GW) ~65% fine to coarse gravel up to 1 inch, ~30% medium to coarse sand, <5% fines, reddish brown.
-30	46 47 48							
	49 50	S11	49 to 51	24/4	17-13-20-14			S11: Similar to S10.
	51 52 53						TILL	
	54 55	S12	54 to 56	24/11	17-19-23-21			S12: SANDY LEAN CLAY WITH GRAVEL (CL) ~60% low plasticity fines, ~20% fine gravel up to 1/2 inch, ~20% fine to coarse sand, gray. TILL.

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 16 **DATE START/END:** 7/5/2016 - 7/6/2016
VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

BORING
B207
PAGE 3 of 3

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
-40	56						TILL	
	57							
	58							
	59	S13	59 to 61	24/3	10-17-11-6			S13: CLAYEY SAND WITH GRAVEL (SC) ~50% fine to coarse sand, ~30% fine gravel, ~20% non-plastic to low plasticity fines, gray. TILL.
	60							
	61							
	62							
	63							
	64	S14	64 to 65.5	18/4	67-79-102	Driller indicates increase in drilling resistance 63 feet..		S14: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM) ~50% fine to coarse sand, ~40% fine to coarse gravel, ~10% non-plastic fines, reddish brown. Possibly completely weathered rock (with staining throughout). TILL.
	65							
-50	66							
	67							
	68							
	69	S15	69 to 69.1	1/0	100/1"			S15: No recovery.
	70	C1	70 to 75	60/10	0	SS was bouncing during S15; Advanced casing to 70 ft prior to C1. Coring Advancement (min./ft.): 3.5-4.5-6-5.5-7	WEATHERED BEDROCK	C1: WIDELY GRADED GRAVEL, weathered bedrock. Subrounded gravel 1/4-1.25 inch with little staining. Possible clasts of Roxbury conglomerate, purple and gray.
	71							
	72							
	73							
	74					Casing driven to refusal at 73 ft. prior to C2		
	75	C2	75 to 80	60/13	0	Coring Advancement (min./ft.): 4.5-8.5-7.5-7.5-11.5 End 7/6/2016; Start 7/7/2016		C2: WIDELY GRADED GRAVEL, weathered bedrock. Subangular gravel 1/4-1.5. Possible clasts of Roxbury conglomerate, purple and gray.
-60	76							
	77							
	78							
	79					Driller slowed coring rotation speed for C2 and C3		
	80	S16 C3	80 to 80.1 80.1 to 85.1	1/1 60/15	100/1" 0	Performed with 3 inch SS and 300 lb safety hammer. After C2, ream out hole to 80 ft Coring Advancement (min./ft.): 10-10.5-7.5-5.5-6.5		S16: NARROWLY GRADED GRAVEL WITH SAND (GP) 70% fine angular gravel up to 1/4", 30% coarse sand; purple and gray. C3: WIDELY GRADED GRAVEL Subrounded-to-angular gravel with little staining, <1/4" to 1"; purple and gray. Highly fractured Robury Conglomerate.
	81							
	82							
	83							
	84							
	85							Bottom of boring at 85.1 ft. Borehole tremie grouted upon completion.
-70	86							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

BORING INFORMATION

LOCATION: See boring location plan

GROUND SURFACE EL. (ft):	17	**DATE START/END:**	7/7/2016 - 7/8/2016
VERTICAL DATUM:	Boston City Base	**DRILLING COMPANY:**	New England Boring
TOTAL DEPTH (ft):	84.0	**DRILLER NAME:**	S. Cooley
LOGGED BY:	K. Gleichauf	**RIG TYPE:**	Mobile B-53 Truck

BORING

B208

PAGE 1 of 3

DRILLING INFORMATION

HAMMER TYPE:	Safety Hammer - rope and cathead	**CASING I.D./O.D.:**	4 inch / 4.5 inch	**CORE BARREL TYPE:**	NX
AUGER I.D./O.D.:	NA / NA	**DRILL ROD O.D.:**	NM	**CORE BARREL I.D./O.D.**	NA / NA

DRILLING METHOD: Mud Rotary Wash

WATER LEVEL DEPTHS (ft): ▼ 9.5 7/8/2016

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer

S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger

Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter

NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
		S1	0 to 2	24/9	7-4-3-2			ASPHALT.
	1						FILL	S1: NARROWLY GRADED SAND WITH SILT (SP-SM) ~70% fine to coarse sand, ~20% fine to coarse gravel up to 1 inch, ~10% non-plastic fines, brown/black. Asphalt fragments. FILL.
	2							
	3							
	4							
	5	S2	5 to 7	24/6	9-5-3-4			S2: SILTY SAND WITH GRAVEL (SM) ~50% fine to coarse sand, ~35% non-plastic fines, ~15% fine gravel up to 3/4", brown. Black asphalt fragments, piece of ceramic was at top. FILL.
	6							
10	7							
	8						ORGANICS	S3 (REDRIVE): ORGANIC SOIL (OL) ~80% low plasticity organic fines, ~20% fine to coarse sand, visible plant matter, alternating black organic and dark gray silty layers, seam of coarse gravel at top.
	9	S3	9 to 11	24/1	4-2-3-3			
	10					WC = 59.2% Redrive S3 (9-11') with 3" SS for 12" recovery.		
	11							
	12							
	13							
	14	S4	14 to 16	24/0	3-2-4-4	Wash return changed color to dark gray.		S4: ORGANIC SOIL (OL) ~100% low plasticity organic fines, visible plant matter, dark gray.
	15							
	16					WC = 80.4% Redrive S4 (14-16') with 3" SS for 19" recovery.		
0	17							
	18						SAND AND GRAVEL	
	19	S5	19 to 21	24/10	11-14-19-37	Hard driving casing at 18 feet.		S5: WIDELY GRADED SAND WITH SILT AND GRAVEL ~55% fine to coarse sand, ~35% fine gravel, ~10% non-plastic fines, brown.
	20							
	21							
	22							
	23							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts

GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 17
DATE START/END: 7/7/2016 - 7/8/2016
VERTICAL DATUM: Boston City Base
DRILLING COMPANY: New England Boring

BORING B208

PAGE 2 of 3

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S6	24 to 26	24/8	15-11-23-26		SAND AND GRAVEL	S6: WIDELY GRADED SAND WITH GRAVEL (SW) ~80% fine to coarse sand, ~15% coarse gravel up to 1.25 inch, ~5% low plasticity fines, dark brown. Small amount of light brown clay in tip.
	26							
-10	27							
	28							
	29							
	30	S7	29 to 31	24/5	15-11-8-9	Rig chatter at 28.5 feet.		S7: WIDELY GRADED GRAVEL WITH SAND (GW) ~55% fine to coarse gravel up to 1.25 inch, ~40% fine to coarse sand, ~5% non-plastic fines, brown.
	31							
	32							
	33							
	34					Rig chatter at 32.5 feet.		
	35	S8	34 to 36	24/11	17-7-7-10			S8: WIDELY GRADED SAND (SW) ~95% fine to coarse sand, ~5% non-plastic fines, brown/red. Coarser sand layer 0-2".
	36							
-20	37							
	38							
	39							
	40	S9	39 to 41	24/13	22-11-13-18			S9: NARROWLY GRADED SAND (SP) ~95% fine to medium sand, ~5% non-plastic fines, brown, some black layers.
	41							
	42							
	43							
	44							
	45	S10	44 to 46	24/12	5-5-9-13			S10: NARROWLY GRADED SAND WITH SILT (SP-SM) ~90% mostly fine sand, ~10% non-plastic fines, brown, some red veins.
	46							
-30	47							
	48							
	49							
	50	S11	49 to 51	24/6	7-7-8-7			S11: WIDELY GRADED GRAVEL WITH SAND (GW) ~60% fine to coarse gravel up to 1.25 inch, ~35% fine to coarse sand, ~5% non-plastic fines, brown.
	51							
	52							
	53							
	54							
	55	S12	54 to 56	24/11	17-8-9-12			S12: WIDELY GRADED SAND (SW) ~95% fine to coarse sand, ~5% non-plastic fines, red/brown and coarser bottom half, gray and finer in upper half.

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan

GROUND SURFACE EL. (ft): 17 **DATE START/END:** 7/7/2016 - 7/8/2016

VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

BORING B208

PAGE 3 of 3

Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	56						SAND AND GRAVEL	
-40	57							
	58							
	59	S13	59 to 61	24/6	14-17-17-16			S13: WIDELY GRADED SAND WITH SILT AND GRAVEL (SE-SM) ~55% fine to coarse sand, ~35% fine to coarse gravel up to 1 inch, ~10% non-plastic fines; brown with a black layer 5"-6".
	60							
	61							
	62							
	63							
	64	S14	64 to 66	24/12	4-5-10-10			S14: NARROWLY GRADED SAND (SP) 96.3% fine to medium sand, 2.0% non-plastic fines, 1.7% fine gravel, brown/grey.
	65							
	66							
-50	67							
	68							
	69	S15	69 to 71	24/18	8-9-17-17	Change in wash return: light gray clay observed		S15: NARROWLY GRADED SAND WITH SILT (SP-SM) ~90% fine sand, ~10% nonplastic fines, brown.
	70							
	71							
	72							
	73							
	74	S16	74 to 76	24/16	42-48-69-72	Casing refusal at 73.5 feet.	TILL	S16: LEAN CLAY WITH SAND AND GRAVEL (CL) ~65% low plasticity fines, ~20% fine to coarse sand, ~15% fine to coarse gravel up to 3/4 inch, brown-light brown. Weathered rock in tip. TILL.
	75							
	76							
-60	77							
	78							
	79	C1	79 to 84	60/28	15	Coring Advancement (min./ft.): 4.5-5-4-4.5-4.5 Cored using slow barrel speed.	BEDROCK	C1: CONGLOMERATE, hard, highly weathered, light gray sandy matrix, purple, green, dark blue rounded clasts 1/4" to 2", some coarse to fine alternating strata, fractures every 0.25" to 2". Joints are along coarse layers, gravel returned where weathered matrix was washed out.
	80							
	81							
	82							
	83							
	84							Bottom of boring at 84 ft. Borehole tremie grouted upon completion.
	85							
	86							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts

GEI PROJECT NUMBER: 1609300

GEI Consultants

BORING INFORMATION

LOCATION: See boring location plan

GROUND SURFACE EL. (ft):	18	**DATE START/END:**	7/11/2016 - 7/11/2016
VERTICAL DATUM:	Boston City Base	**DRILLING COMPANY:**	New England Boring
TOTAL DEPTH (ft):	8.0	**DRILLER NAME:**	P. Labossier
LOGGED BY:	K. Gleichauf	**RIG TYPE:**	Mobile B-53 Truck

BORING

B209

PAGE 1 of 1

DRILLING INFORMATION

HAMMER TYPE:	Safety Hammer - rope and cathead	**CASING I.D./O.D.:**	4 inch / 4.5 inch	**CORE BARREL TYPE:**	NA
AUGER I.D./O.D.:	NA / NA	**DRILL ROD O.D.:**	NM	**CORE BARREL I.D./O.D.**	NA / NA

DRILLING METHOD: Mud Rotary Wash

WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer

S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger

Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter

NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
	1							
	2					Hole was hand cleared to 5'		
	3							
	4						FILL	
	5	S1	5 to 7	24/9	8-7-5-8			S1: SILTY SAND WITH GRAVEL (SM) ~ 50% fine to coarse sand, ~25% fine gravel, ~ 25% nonplastic fines, dark brown. FILL.
	6							
	7							
10	8					Casing hit refusal at 8', possible utility.		Bottom of boring at 8 ft. Hole abandoned and backfilled with cuttings due to obstruction.
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
	17							
0	18							
	19							
	20							
	21							
	22							
	23							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

BORING INFORMATION

LOCATION: See boring location plan

GROUND SURFACE EL. (ft): 17 **DATE START/END:** 7/18/2016 - 7/19/2016

VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

TOTAL DEPTH (ft): 68.5 **DRILLER NAME:** B. Cross

LOGGED BY: K. Gleichauf/D. McVeety **RIG TYPE:** Mobile B-53 ATV

BORING

B209A

PAGE 1 of 3

DRILLING INFORMATION

HAMMER TYPE: Safety Hammer - rope and cathead **CASING I.D./O.D.:** 4 inch / 4.5 inch **CORE BARREL TYPE:** NX

AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.** NA / NA

DRILLING METHOD: Mud Rotary Wash

WATER LEVEL DEPTHS (ft): ⊻ 8.3 7/19/2016 7:30 am

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer

S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger

Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter

NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
	1	S1	0 to 2	24/16	6-9-12-11		FILL	S1: SILTY SAND WITH GRAVEL (SM); ~70% fine to coarse sand, ~15 non-plastic fines, ~15% fine to coarse gravel up to 1 in.; light brown. FILL.
	2							
	3							
	4	S2	4 to 6	24/10	4-9-13-12			S2 (0-4): WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~70% fine to coarse sand, ~20% gravel, ~10% non-plastic fines; black/brown. Charcoal, brick, and glass fragments. FILL. S2(4-10): WIDELY GRADED GRAVEL WITH SAND; ~80% fine to coarse gravel up to 1 1/4 in., ~20% fine to coarse sand; brown. FILL.
	5							
	6							
10	7							
	8					Rig chatter 7-9 ft.		
	9	S3	9 to 11	24/8	6-4-3-4	S3 (4-8"): WC = 12.2%		S3 (0-4): CLAYEY SAND WITH GRAVEL (SC); ~45% fine to coarse sand, ~35% fine to coarse gravel up to 1 1/4 in., ~25% low-plasticity fines; brown. FILL. S3 (4-8): SANDY LEAN CLAY (CL); ~55% low-plasticity fines, ~35% fine to coarse sand, ~10% fine gravel, blue/gray. FILL.
	10							
	11							
	12							
	13						ORGANICS	
	14	S4	14 to 16	24/0	4-4-5-5	WC = 68.4% No recovery; redriven with 3 in. SS for recovery		S4: ORGANIC SOIL (OL) ~90% low plasticity fines, ~10% fine to coarse sand, black/gray, visible plant matter.
	15							
	16							
0	17							
	18						SAND AND GRAVEL	
	19	S5	19 to 21	24/7	23-18-11-11			S5: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM) ~60% fine to coarse sand, ~ 30% fine gravel, ~10% nonplastic fines, brown.
	20							
	21							
	22					Rig chatter		
	23							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts

GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 17 **DATE START/END:** 7/18/2016 - 7/19/2016
VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

BORING B209A
PAGE 2 of 3

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
		S6	24 to 26	24/8	7-9-8-9		SAND AND GRAVEL	S6 (0-4): WIDELY GRADED SAND WITH GRAVEL (SW) ~70% fine to coarse sand, ~25% fine gravel, ~5% nonplastic fines, brown. S6 (4-8): SILTY SAND WITH GRAVEL (SM) ~65% fine to coarse sand, ~20% fine gravel, ~15% nonplastic fines, brown.
	25							
	26							
-10	27					Rig chatter		
	28							
	29	S7	29 to 31	24/8	27-22-11-7			S7: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM) ~60% fine to coarse sand, ~30% fine gravel, ~10% nonplastic fines, brown.
	30							
	31							
	32							
	33							
	34	S8	34 to 36	24/10	17-20-17-18			S8: WIDELY GRADED SAND WITH GRAVEL (SW) ~70% fine to coarse sand, ~25% fine to coarse gravel up to 1", ~ 5% nonplastic fines, dark brown.
	35							
	36							
-20	37							
	38							
	39	S9	39 to 41	24/10	18-16-19-20			S9: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM) ~60% fine to coarse sand, ~30% fine to coarse gravel up to 1", ~10% non-plastic fines, red/brown.
	40							
	41							
	42					End 7/18/2016; Start 7/19/2016		
	43						TILL	
	44	S10	44 to 46	24/10	15-18-20-13			S10: SANDY LEAN CLAY WITH GRAVEL (CL) ~50% low plasticity fines, ~25% fine to coarse sand, ~25% fine to coarse gravel, gray. TILL.
	45							
	46							
-30	47							
	48							
	49	S11	49 to 51	24/10	10-31-25-21			S11: SANDY LEAN CLAY WITH GRAVEL (CL) ~50% low plasticity fines, ~25% fine to coarse sand, ~25% fine to coarse gravel, gray. TILL.
	50							
	51							
	52							
	53							
	54	S12	54 to 56	24/13	27-22-31-22			S12: SILTY GRAVEL WITH SAND (GM) ~ 50% fine to coarse gravel, ~35% fine to coarse sand, ~15% nonplastic fines, brown. TILL.
	55							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 17
VERTICAL DATUM: Boston City Base
DATE START/END: 7/18/2016 - 7/19/2016
DRILLING COMPANY: New England Boring

BORING B209A

PAGE 3 of 3

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	56						TILL	
-40	57							
	58						WEATHERED BEDROCK	
	59	S13	59 to 59	0/0	100/0.5"			S13: No recovery, spoon bounced when driven.
	60					Prior to S13, wash then drive casing to 59 ft. to refusal at 57.2 ft. Post S13, rollerbit to 63.5 ft.		
	61							
	62							
	63							
	64	C1	63.5 to 68.5	60/60	8		BEDROCK	C1: CONGLOMORATE, hard, moderately weathered, moderately to highly fractured. Light gray matrix with purple, dark blue clasts. Fine grain matrix with fine gravel clasts. Non planar fractures spaced <1/4" to 5" (many fractures are along clasts).
	65							
	66							
-50	67							
	68							
	69							Bottom of boring at 68.5 ft. Borehole tremie grouted and topped with cuttings.
	70							
	71							
	72							
	73							
	74							
	75							
	76							
-60	77							
	78							
	79							
	80							
	81							
	82							
	83							
	84							
	85							
	86							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

BORING INFORMATION

LOCATION: See boring location plan

GROUND SURFACE EL. (ft): 17

DATE START/END: 7/5/2016 - 7/5/2016

VERTICAL DATUM: Boston City Base

DRILLING COMPANY: New England Boring

TOTAL DEPTH (ft): 79.0

DRILLER NAME: S. Cooley

LOGGED BY: K. Gleichauf

RIG TYPE: Mobile B-53 Truck

BORING

B210 (OW)

PAGE 1 of 3

DRILLING INFORMATION

HAMMER TYPE: Safety Hammer - rope and cathead

CASING I.D./O.D.: 4 inch / 4.5 inch

CORE BARREL TYPE: NX

AUGER I.D./O.D.: NA / NA

DRILL ROD O.D.: NM

CORE BARREL I.D./O.D. NA / NA

DRILLING METHOD: Mud Rotary Wash

WATER LEVEL DEPTHS (ft): Not measured.

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer

S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger

Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter

NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/9	6-6-9-8			ASPHALT
	1						FILL	S1: WIDELY GRADED SAND WITH GRAVEL AND SILT (SW-SM) ~70% fine to coarse sand, ~20% fine gravel up to 1/2 inch, ~10% non-plastic fines, brown/black. Contains brick fragments. FILL.
	2							
	3							
	4							
	5	S2	5 to 7	24/10	8-6-3-3			S2: SILTY SAND WITH GRAVEL (SM) ~50% fine to coarse sand, ~35% fine gravel, ~15% non-plastic fines, black/gray. Contains brick fragments. FILL.
	6							
10	7							
	8							
	9						ORGANICS	
	10	S3	10 to 12	24/24	WOH/12"-1-2	S3: Qp = 0.25, 0.2 tsf; Sv = 1.0 tsf. WC = 81.3%		S3: ORGANIC SOIL (OL) Black/gray, contains fragments of wood, organics.
	11							
	12							
	13							
	14							
	15	S4	15 to 17	24/20	WOH/12"-3-2	S4: Qp = 0.3, 0.35 tsf; Sv = 1.4, 1.5 tsf. WC = 63.2%		S4: ORGANIC SOIL (OL) Dark gray. No visible organic matter.
	16							
0	17							
	18							
	19						SAND AND GRAVEL	
	20	S5	20 to 22	24/4	7-9-10-36			S5: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM) 51.4% fine to coarse sand, 38.1% fine gravel up to 1/2 inch, 10.5% non-plastic fines, dark gray/blue.
	21							
	22							
	23							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts

GEI PROJECT NUMBER: 1609300

GEI Consultants

GEI WOBURN STD 1-LOCATION-LAYER NAME 1609300 TREMONT CROSSING.GPJ 8/3/16

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 17 **DATE START/END:** 7/5/2016 - 7/5/2016
VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

BORING
B210 (OW)
PAGE 2 of 3

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
	25	S6	25 to 27	24/1	10-10-12-13		SAND AND GRAVEL	S6: CLAYEY SAND (SC) ~60% fine to coarse sand, ~40% low plasticity fines, light grey. Low recovery.
	26							
-10	27							
	28							
	29							
	30	S7	30 to 32	24/17	7-10-11-16			S7 (0-4"): NARROWLY GRADED SAND (SP) ~95% mostly fine sand, ~5% non-plastic fines, dark gray/blue. S7 (4-17"): WIDELY GRADED SAND (SW) ~85% fine to coarse sand, ~10% fine gravel, ~5% non-plastic fines. Pockets of sandy lean clay (CL), ~60% low plasticity fines. ~40% fine sand.
	31							
	32							
	33							
	34							
	35	S8	35 to 37	24/8	8-7-7-7			S8: WIDELY GRADED SAND WITH GRAVEL (SW) ~55% fine to coarse sand, ~40% fine to coarse gravel up to 1", <5% nonplastic fines, brown.
	36							
-20	37							
	38							
	39							
	40	S9	40 to 42	24/8	8-6-8-8		SANDY CLAY/CLAYEY SAND	S9 (0-4"): WIDELY GRADED SAND (SW) ~85% fine to coarse sand, ~10% fine gravel, ~5% non-plastic fines, brown/gray. S9 (4-8"): SANDY LEAN CLAY (CL) ~65% low plasticity fines, ~35% fine to medium sand, brown.
	41							
	42							
	43							
	44							
	45	S10	45 to 47	24/12	33-14-14-14			S10 (0-3"): WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM) ~50% fine to coarse sand, ~40% fine to coarse gravel up to 3/4 inch, ~10% nonplastic fines, brown. S10 (3-12"): CLAYEY SAND (SC): ~50% fine to coarse sand, ~40% low plasticity fines, ~10% fine gravel up to 1/2 inch, light brown.
	46							
-30	47							
	48					Driller notes change in wash from gravel to clay.		
	49							
	50	S11	50 to 51.2	14/10	13-13-14-17		SAND AND GRAVEL	S11 (0-4"): Similar to S10 (3-12"). S11 (4-10"): WIDELY GRADED SAND WITH GRAVEL (SW), ~60% fine to coarse sand, ~35% fine to coarse gravel up to 1", ~5% non-plastic fines, brown.
	51							
	52							
	53							
	54							
	55							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 17 **DATE START/END:** 7/5/2016 - 7/5/2016
VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** New England Boring

BORING
B210 (OW)
PAGE 3 of 3

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	56	S12	55 to 57	24/17	8-23-28-27			S12: NARROWLY GRADED SAND WITH GRAVEL (SP) ~80% fine to medium sand, ~15% fine gravel, ~5% non-plastic fines, brown.
-40	57							
	58							
	59							
	60						SAND AND GRAVEL	
	61	S13	60 to 62	24/18	10-12-24-43			S13: WIDELY GRADED SAND (SW), ~95% fine to coarse sand, ~5% non-plastic fines, brown.
	62							
	63							
	64					Hard driving casing ~62.5-63 feet.		
	65	S14	64.5 to 66.5	24/15	52-55-89-61			S14 (0-5"): NARROWLY GRADED GRAVEL WITH CLAY AND SAND (GP-GC) ~70% fine gravel up to 3/4 inch, ~20% fine to coarse sand, ~10% low plasticity fines, brown.
	66					Rollerbit to 64.5, possible till or weathered bedrock.		
-50	67							S14 (5-15"): CLAYEY GRAVEL WITH SAND (GC) ~60% fine to coarse gravel up to 1 inch, ~20% fine to coarse sand, ~20% low plasticity fines, light gray. TILL.
	68							
	69						TILL	
	70							
	71	S15	70 to 71.3	15/4	26-34-100/3"			S15: CLAYEY GRAVEL WITH SAND (GC) ~70% fine to coarse gravel, ~15% fine to coarse sand, ~15% low plasticity fines, light gray. TILL.
	72							
	73							
	74							
	75	C1	74 to 79	60/60	18	Coring Advancement (min./ft): 3-4.5-4-5.5-5		C1: CONGLOMERATE, hard, moderately to highly weathered, light gray matrix, rounded clasts of varying size, purple, blue, pink, joints along interface of larger clasts, fractures every 1/4" to 1".
	76						BEDROCK	
-60	77							
	78							
	79							Bottom of boring at 79 ft. Installed well upon completion.
	80							
	81							
	82							
	83							
	84							
	85							
	86							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Boston, Massachusetts
GEI PROJECT NUMBER: 1609300

GEI Consultants

Groundwater Well Installation Log

B210 (OW)

Project Tremont Crossing

City / Town Boston, MA

Client FELDCO

Contractor New England Boring

Driller S. Cooley **GEI Rep.** K.Gleichauf

GEI Proj. No. 1609300

Location B210

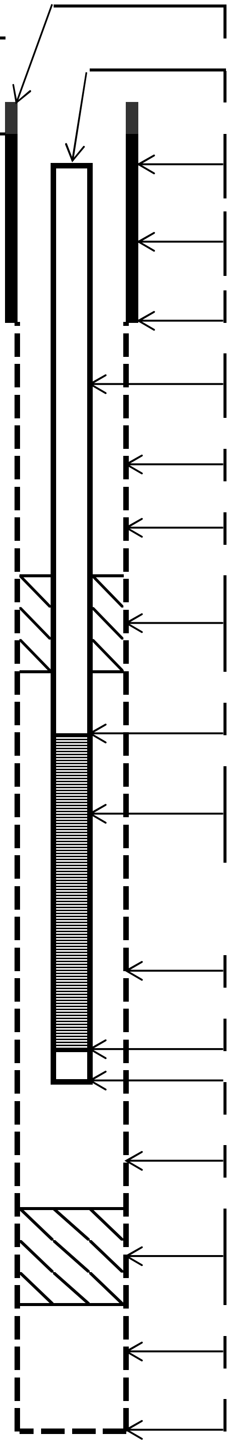
Install Date 7/6/2016

Survey Datum: **Boston City**

Ground Elevation: 17'

General Soil Conditions (Not to Scale)

Date	Time	Distance to ▼ below top of riser pipe



Length of Surface Casing above Ground 0

Dist. Top of Surf. Casing to Top of Riser Pipe 0.25'

Type and Thickness of Seal around Surface Casing Grout, 0.5'

ID of Surface Casing 0.5'

Type of Surface Casing

Depth Bottom of Surface Casing 0.8'

ID and OD of Riser Pipe 2", 2.5"

Type of Riser Pipe PVC

Type of Backfill around Riser Pipe Cuttings

Diameter of Borehole 4"

Depth Top of Seal 19'

Type of Seal Bentonite Chips

Depth Bottom of Seal 21'

Depth Top of Screened Section 22.9'

Type of Screen Slotted Pipe

Description of Screen Openings Slots

ID and OD of Screened Section 2", 2.5"

Type of Filter Material Silica Sand

Depth Bottom of Screened Section 32.9'

Depth Bottom of Silt Trap 33'

Depth Bottom of Filter Material 34'

Depth Top of Seal --

Type of Seal --

Depth Bottom of Seal --

Type of Backfill below Filter Material Cuttings

Bottom of Borehole 79'

Notes: Installed in B210 borehole

GEI Consultants

M:\Drafting\Office\Forms\Well Install Log Blank Form

BORING INFORMATION

LOCATION: See boring location plan

GROUND SURFACE EL. (ft): 19.6

DATE START/END: 7/25/2013 - 7/26/2013

VERTICAL DATUM: Boston City Base

DRILLING COMPANY: Northern Drill Service, Inc.

TOTAL DEPTH (ft): 79.0

DRILLER NAME: Chip Tucker

LOGGED BY: H. Shields

RIG TYPE: Mobile B-59 Truck Rig

BORING

B101

PAGE 1 of 3

DRILLING INFORMATION

HAMMER TYPE: Donut Hammer - rope and cathead

CASING I.D./O.D.: 4 inch/ 4.5 inch

CORE BARREL TYPE: NA

AUGER I.D./O.D.: NA / NA

DRILL ROD O.D.: 2.625

CORE BARREL I.D./O.D. NA / NA

DRILLING METHOD: Rotary Wash

WATER LEVEL DEPTHS (ft): ⊻ 11.8 7/26/2013 7:18 am

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer

S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger

Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter

NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
		S1	0.5 to 2.5	24/7	14-28-33-27	PID = 0	FILL	0 - 4": Asphalt. S1: WIDELY GRADED SAND WITH GRAVEL (SW); ~75% fine to coarse sand, ~20% fine to coarse gravel, <5% nonplastic fines. Light brown, top 2" are gray.
	5	S2	4 to 6	24/8	11-14-15-13	PID = 0	SAND AND SILT	S2: WIDELY GRADED SAND WITH SILT (SW-SM); ~85% fine to coarse sand, 10% nonplastic fines ~5% coarse gravel (one piece of 1.25" gravel) . Brown.
10	10	S3	9 to 11	24/10	12-13-20-24	PID = 0		S3: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% mostly fine to medium sand, ~10% nonplastic fines. Brown.
	15	S4	14 to 16	24/9	12-12-18-21	PID = 0		S4: WIDELY GRADED SAND WITH GRAVEL (SW); ~75% fine to coarse sand, ~20% mostly fine gravel, ~5% nonplastic fines. Brown.
0	20	S5	19 to 21	24/13	27-34-40-31	PID = 0		S5: WIDELY GRADED SAND WITH GRAVEL (SW); ~75% fine to coarse sand, ~20% mostly fine gravel, ~5% nonplastic fines. Light brown.

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Roxbury, Massachusetts

GEI PROJECT NUMBER: 132673-0

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 19.6
VERTICAL DATUM: Boston City Base
DATE START/END: 7/25/2013 - 7/26/2013
DRILLING COMPANY: Northern Drill Service, Inc.

BORING B101

PAGE 2 of 3

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
	25	S6	24 to 26	24/10	28-20-19-27	PID = 0	SAND AND SILT	S6 (0-4"): WIDELY GRADED SAND (SW); ~85% fine to coarse sand, ~10% mostly fine gravel, ~5% nonplastic fines. Brown. S6 (4-10"): NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% mostly fine sand, ~10% mostly fine gravel, ~10% nonplastic fines. Light brown.
		S7	26 to 28	24/4	10-14-19-24	PID = 0		S7: WIDELY GRADED SAND (SW); ~95% fine to coarse sand, <5% mostly fine grave. Brown.
-10	30	S8	29 to 31	24/13	11-17-24-27	PID = 0		S8: SILTY SAND (SM); 83% mostly fine sand, 17% nonplastic fines. Light brown.
	35	S9	34 to 36	24/11	16-33-33-32			S9: WIDELY GRADED SAND WITH GRAVEL AND SILT (SW-SM); ~75% fine to coarse sand, ~15% mostly fine gravel, ~10% nonplastic fines. Brown.
-20	40	S10	39 to 41	24/12	10-18-23-27			S10: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% mostly fine to medium sand, 10% nonplastic fines. Light brown.
	45	S11	44 to 46	24/18	9-10-13-18			S11: SANDY SILT (ML); 60% nonplastic fines, 40% fine sand. Light brown.
-30	50	S12	49 to 51	24/12	12-19-28-33			S12: NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% fine to medium sand, ~10% nonplastic fines, ~5% mostly fine gravel. Light brown.
	55	S13	54 to 55.5	18/2	39-57-75	Driller noted change in drilling at 53.5 ft. Color of wash water changed.	TILL	S13: WIDELY GRADED GRAVEL (GW); Fine to coarse angular gravel. Gray.

NOTES:

PROJECT NAME: Tremont Crossing
CITY/STATE: Roxbury, Massachusetts
GEI PROJECT NUMBER: 132673-0

BORING B101

PAGE 3 of 3

LOCATION: See boring location plan

GROUND SURFACE EL. (ft): 19.6

DATE START/END: 7/25/2013 - 7/26/2013

VERTICAL DATUM: Boston City Base

DRILLING COMPANY: Northern Drill Service, Inc.

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
						After S13, drove 3-in-OD split spoon to recover sample.	TILL	S13 Redrive: CLAYEY GRAVEL WITH SAND (GC); ~40% fine to coarse gravel up to 2", ~30% fine to coarse sand, ~30% low plasticity fines. Light gray.
-40	60	S14	59 to 61	24/14	51-50-73-106			S14: CLAYEY SAND WITH GRAVEL (SC); ~40% fine to coarse sand, ~35% fine to coarse gravel up to 1", ~25% low plasticity fines. Light gray.
	65							
-50	70	S15	69 to 69	0/0	50/0"	Possible weathered rock at ~69 feet.	WEATHERED ROCK	S15: No penetration, no recovery.
	75					Harder rock at ~73 feet.	BEDROCK	
-60	80	S16	79 to 79	0/0	50/0"			S16: No penetration, no recovery. Bottom of boring at depth 79 ft. Borehole backfilled with cuttings. Asphalt repaired with cold patch.
	85							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Roxbury, Massachusetts

GEI PROJECT NUMBER: 132673-0

GEI Consultants

BORING INFORMATION
LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 17.5
DATE START/END: 7/26/2013 - 7/27/2013
VERTICAL DATUM: Boston City Base
DRILLING COMPANY: Northern Drill Service, Inc.
TOTAL DEPTH (ft): 94.0
DRILLER NAME: Chip Tucker/Chris DeVillers
LOGGED BY: H. Shields
RIG TYPE: Mobile B-59 Truck Rig

BORING
B102(OW)
PAGE 1 of 4

DRILLING INFORMATION
HAMMER TYPE: Donut Hammer - rope and cathead
CASING I.D./O.D.: 4 inch/ 4.5 inch
CORE BARREL TYPE: NA
AUGER I.D./O.D.: NA / NA
DRILL ROD O.D.: 2.625
CORE BARREL I.D./O.D. NA / NA
DRILLING METHOD: Rotary Wash
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
		S1	0 to 2	24/18	5-9-14-27	PID = 0	FILL	S1 (0-4"): SILTY SAND (SM); ~60% mostly fine sand, ~40% low plasticity fines. Brown, plant fibers, slight organic odor, a few brick fragments. Topsoil. S1 (4-9"): Brick fragments. S1 (9-18"): SILTY GRAVEL WITH SAND (GM); ~50% fine to coarse gravel, ~30% fine to coarse sand, ~20% nonplastic fines. Gray and black, asphalt and concrete pieces.
	5	S2	4 to 6	24/11	15-13-21-20	PID = 0		S2: Brick fragments; ~90% fine to coarse brick fragments up to 1", ~10% fine to coarse sand. Red and gray.
10								
	10	S3	9 to 11	24/6	5-4-4-4	PID = 0	CLAY	S3: SANDY LEAN CLAY (CL); ~50% low plasticity fines, ~40% fine to coarse sand, ~10% fine gravel. Gray.
	15	S4	14 to 16	24/2	3-3-2-3	PID = 0	ORGANICS	S4: ORGANIC SILT (OL); Low plasticity fines. Dark gray, a few plant fibers, slight organic odor. S4 Redrive: Similar to S4.
0								
	20	S5	19 to 21	24/21	2-1-2-2	PID = 0		S5: ORGANIC SILT (OL); Similar to S4. Layer of peat at 12-16 inches.

NOTES:

PROJECT NAME: Tremont Crossing
CITY/STATE: Roxbury, Massachusetts
GEI PROJECT NUMBER: 132673-0

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 17.5 **DATE START/END:** 7/26/2013 - 7/27/2013
VERTICAL DATUM: Boston City Base **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING
B102(OW)
PAGE 2 of 4

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
	25	S6	24 to 26	24/10	14-9-22-25		SAND AND SILT	S6: SILTY SAND (SM); ~75% mostly fine to medium sand, 20% nonplastic fines, <5% fine gravel. Gray. Tip of sample contains WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~60% fine to coarse sand, ~30% mostly fine gravel, ~10% nonplastic fines. Orange-brown.
-10								
	30	S7	29 to 31	24/7	13-12-12-10			S7: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~60% fine to coarse sand, ~30% mostly fine gravel, ~10% nonplastic fines. Brown.
	35	S8	34 to 36	24/6	64-62-19-25			S8: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~75% fine to coarse sand, ~15% mostly fine gravel, ~10% nonplastic fines. Brown.
-20								
	40	S9	39 to 41	24/0	20-7-10-11			S9: No recovery. S9 Redrive: WIDELY GRADED SAND WITH GRAVEL (SW); ~65% fine to coarse sand, ~35% mostly fine gravel, <5% nonplastic fines. Brown.
	45							
-30								
	50	S10	49 to 51	24/2	12-12-10-10			S10: WIDELY GRADED SAND WITH GRAVEL (SW); Similar to S9 Redrive. S10 Redrive: WIDELY GRADED SAND WITH GRAVEL (SW); Similar to S9 Redrive.
	55							

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Roxbury, Massachusetts
GEI PROJECT NUMBER: 132673-0

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 17.5
DATE START/END: 7/26/2013 - 7/27/2013
VERTICAL DATUM: Boston City Base
DRILLING COMPANY: Northern Drill Service, Inc.

BORING
B102(OW)
PAGE 3 of 4

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
-40								
	60	S11	59 to 61	24/2	10-9-10-28			S11: WIDELY GRADED SAND WITH GRAVEL (SW); Similar to S9 Redrive. S11 Redrive: WIDELY GRADED SAND WITH SILT (SW-SM); ~85% mostly medium to coarse sand, ~10% nonplastic fines, <5% mostly fine gravel. Brown. Two pieces of 2" gravel stuck in tip of sampler.
	65	S12	64 to 66	24/0	10-6-10-10			S12: No recovery. S12 Redrive: One piece of 2" gravel, gray.
-50								
	70	S13	69 to 71	24/1	11-15-16-22		SAND AND SILT	S13: WIDLEY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~50% fine to coarse sand, ~40% mostly fine gravel, ~10% nonplastic fines. Brown. S13 Redrive: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% nonplastic fines. Brown.
	75	S14	74 to 76	24/0	16-21-22-21			S14: No recovery.
-60								
	80	S15	79 to 81	24/7	18-26-33-30			S15: NARROWLY GRADED SAND WITH SILT (SP-SM); 80% mostly fine to medium sand, 11% nonplastic fines, 9% mostly fine gravel. Brown, pieces of coarse gravel stuck in tip of sampler.
	85	S16	84 to 86	24/2	41-23-27-45			S16: NARROWLY GRADED GRAVEL WITH SAND (GP); ~80% mostly coarse gravel up to 1.25", ~15% fine to coarse sand, <5% low plasticity fines. Light brown and gray. S16 Redrive: NARROWLY GRADED GRAVEL WITH SAND (GP); ~60% mostly fine gravel (one piece of 2" gravel), ~35% fine to coarse sand, <5% nonplastic fines. Light brown.

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Roxbury, Massachusetts

GEI PROJECT NUMBER: 132673-0

GEI Consultants

LOCATION: See boring location plan
GROUND SURFACE EL. (ft): 17.5
VERTICAL DATUM: Boston City Base
DATE START/END: 7/26/2013 - 7/27/2013
DRILLING COMPANY: Northern Drill Service, Inc.

BORING
B102(OW)
PAGE 4 of 4

Elev. (ft)	Depth (ft)	Sample Information				Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD			
-70								
	90						SAND AND SILT	
								Soil collected from wash at 94 feet: NARROWLY GRADED SAND (SP); Similar to S15.
								Bottom of boring at depth 94 ft. Observation well installed - see separate installation log.
	95							
-80								
	100							
	105							
-90								
	110							
	115							
-100								

NOTES:

PROJECT NAME: Tremont Crossing

CITY/STATE: Roxbury, Massachusetts
GEI PROJECT NUMBER: 132673-0

GEI Consultants

Groundwater Well Installation Log

B102 (OW)

Project Tremont Crossing
City / Town Roxbury, Massachusetts
Client Feldco Development
Contractor Northern Drill Service
Driller Chris DeVillers **GEI Rep.** H. Shields

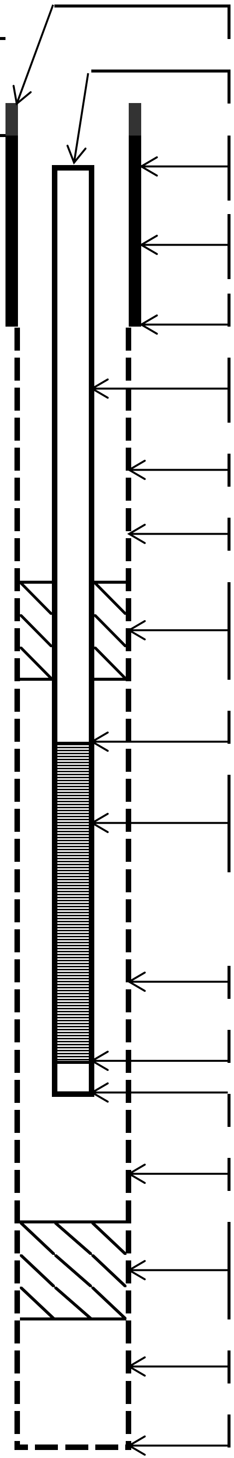
GEI Proj. No. 132673-0
Location Fenced area near intersection of Tremont St. and Whittier St.
Install Date 7/27/2013

Survey Datum: **Boston City Base**

Ground Elevation: 17.5

General Soil Conditions (Not to Scale)

Date	Time	Distance to ▼ below top of riser pipe
8/14/2013	12:10 PM	10.55 ft



Length of Surface Casing above Ground	4.5 inches
Dist. Top of Surf. Casing to Top of Riser Pipe	4.5 inches
Type and Thickness of Seal around Surface Casing	Concrete - 4 in. thick
ID of Surface Casing	3.75 inches
Type of Surface Casing	Steel Roadbox
Depth Bottom of Surface Casing	6.5 inches
ID and OD of Riser Pipe	2-in-ID / 2.4-in-OD
Type of Riser Pipe	Schedule 40 PVC
Type of Backfill around Riser Pipe	Cuttings / Borehole Collapsed
Diameter of Borehole	4.5 inches
Depth Top of Seal	21.3 feet
Type of Seal	Bentonite Chips
Depth Bottom of Seal	23.8 feet
Depth Top of Screened Section	25 feeet
Type of Screen	Schedule 40 PVC
Description of Screen Openings	#10 slot
ID and OD of Screened Section	2-in-ID / 2.4-in-OD
Type of Filter Material	Size 2 Filter Sand
Depth Bottom of Screened Section	40 feet
Depth Bottom of Silt Trap	40.1 feet
Depth Bottom of Filter Material	40.4 feet
Depth Top of Seal	NA
Type of Seal	NA
Depth Bottom of Seal	NA
Type of Backfill below Filter Material	Borehole Collapsed
Bottom of Borehole	94 feet

Notes:

GEI Consultants

Appendix B

Pressuremeter Test Data

Project Name: Tremont Crossing
GEI Project Number: 1609300
Operator: RCR
Engineer: JC
Date: June 29, 2016

PRESSUREMETER TEST RESULTS

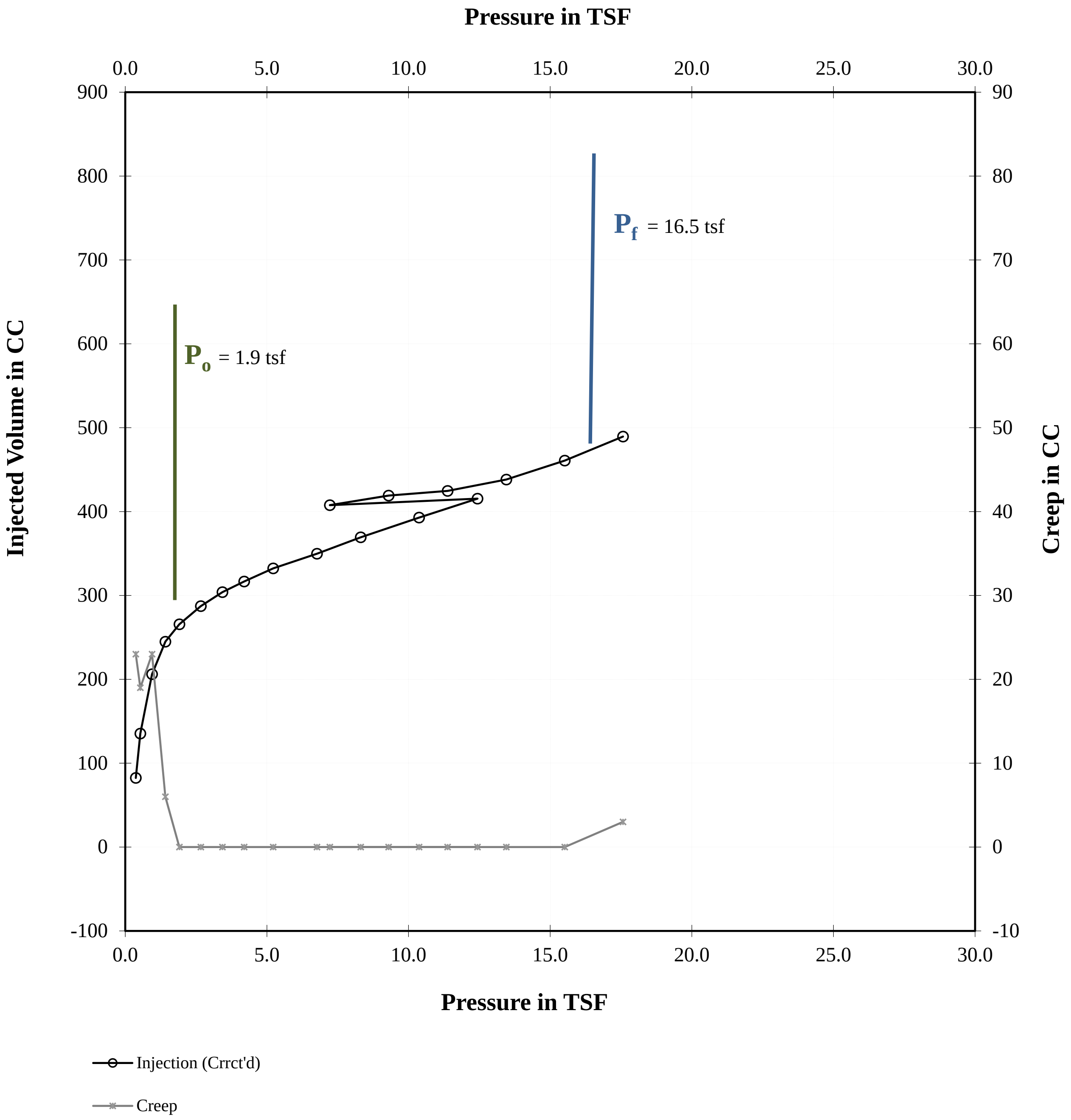
BORING NUMBER	GROUND SURFACE (ft)	TEST DEPTH (ft)	ELEVATION (Middle of test) (ft)	P_o (tsf)	P_f (tsf)	P_l (tsf)	E_d (tsf)	E^+ (tsf)	E_d/E^+	E_d/P_l^*	P_l/P_f
B-201	22	14.00 to 16.50	6.8	1.9	16.5	-	210	619	0.34	-	-
		19.00 to 21.50	1.8	1.4	16.3	28.0	267	1241	0.22	10.0	1.7
		29.00 to 31.50	-8.3	2.0	20.0	39.0	386	1993	0.19	10.4	2.0
		55.00 to 57.50	-34.3	2.5	15.0	34.0	179	1740	0.10	5.7	2.3
B-204	19.5	11.50 to 14.00	6.8	1.2	12.5	-	217	-	-	-	-
		15.00 to 17.50	3.3	2.5	>11.8	-	210	-	-	-	-
		25.00 to 27.50	-6.8	No test. Test zone too large.					-	-	-
		40.00 to 42.50	-21.8	2.1	>18.5	-	332	-	-	-	-
B-206	19	41.00 to 43.50	-23.3	2.3	18.7	35.0	258	1627	0.16	7.9	1.9

	E_d/E^+	E_d/P_l^*	P_l/P_f
AVERAGE:	0.20	8.5	2.0

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing	Operator:	RCR
GEI Job #:	1609300	Engineer:	JC
Test Date:	June 30, 2016	Boring No.:	B-201

Test Depth (ft): 14.0 to 16.5



E_d = 210 TSF

E^+ = 619 TSF

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing		
GEI Job Number:	1609300	Operator:	RCR
Test Date:	Thursday, June 30, 2016	Engineer:	JC
Boring No.:	B-201	Instr. Hght (ft):	3
Test Depth (ft):	14.0 to 16.5	Water Correction:	0.56

No.	Pressure Readings (bars)	Inertia Correction (bars)	Corrected Pressure (tsf)	30 Sec. Volume (cc)	60 Sec. Volume (cc)	Creep (cc)	Corrected 30 Sec. Volume (cc)	Corrected 60 Sec. Volume (cc)	Incremental Modulus (tsf)
1	0.00	0.20	0.4	60	83	23	59.4	82.4	
2	0.25	0.30	0.5	117	136	19	116.3	135.3	5
3	0.75	0.40	0.9	184	207	23	183.1	206.1	11
4	1.25	0.45	1.4	240	246	6	238.9	244.9	25
5	1.75	0.48	1.9	267	267	0	265.6	265.6	50
6	2.50	0.50	2.7	289	289	0	287.3	287.3	75
7	3.25	0.52	3.4	306	306	0	303.9	303.9	101
8	4.00	0.54	4.2	319	319	0	316.6	316.6	136
9	5.00	0.56	5.2	335	335	0	332.3	332.3	150
10	6.50	0.58	6.8	353	353	0	349.8	349.8	206
11	8.00	0.60	8.3	373	373	0	369.3	369.3	188
12	10.00	0.63	10.4	397	397	0	392.8	392.8	214
13	12.00	0.65	12.4	420	420	0	415.4	415.4	228
14	7.00	0.64	7.2	411	411	0	407.6	407.6	1690
15	9.00	0.66	9.3	423	423	0	419.1	419.1	457
16	11.00	0.66	11.4	429	429	0	424.6	424.6	958
17	13.00	0.68	13.5	443	443	0	438.2	438.2	392
18	15.00	0.70	15.5	466	466	0	460.8	460.8	239
19	17.00	0.73	17.6	492	495	3	486.4	489.4	193
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

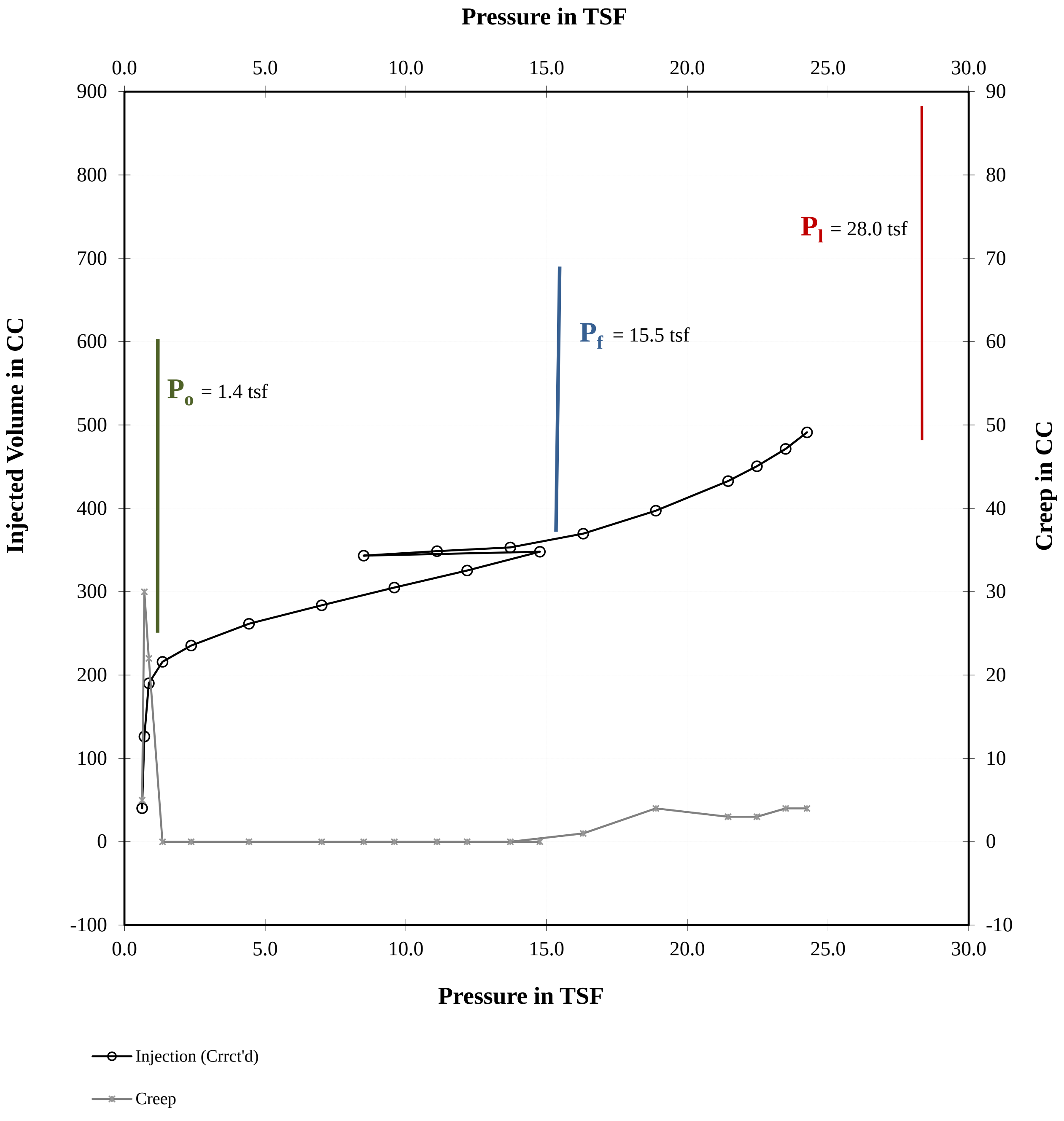
E_d= 210 TSF E^+= 619 TSF P_l= NA TSF

Test Zone Prep.: 2 1/2 SS

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing	Operator:	RCR
GEI Job #:	1609300	Engineer:	JC
Test Date:	June 30, 2016	Boring No.:	B-201

Test Depth (ft): 19.0 to 21.5



E_d = 267 TSF

E^+ = 1241 TSF

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing		
GEI Job Number:	1609300	Operator:	RCR
Test Date:	Thursday, June 30, 2016	Engineer:	JC
Boring No.:	B-201	Instr. Hght (ft):	3
Test Depth (ft):	19.0 to 21.5	Water Correction:	0.71

No.	Pressure Readings (bars)	Inertia Correction (bars)	Corrected Pressure (tsf)	30 Sec. Volume (cc)	60 Sec. Volume (cc)	Creep (cc)	Corrected 30 Sec. Volume (cc)	Corrected 60 Sec. Volume (cc)	Incremental Modulus (tsf)
1	0.00	0.11	0.6	36	41	5	35.3	40.3	
2	0.25	0.28	0.7	97	127	30	96.2	126.2	2
3	0.50	0.38	0.9	169	191	22	168.2	190.2	5
4	1.00	0.41	1.4	217	217	0	215.9	215.9	37
5	2.00	0.44	2.4	237	237	0	235.4	235.4	106
6	4.00	0.47	4.4	264	264	0	261.5	261.5	164
7	6.50	0.50	7.0	287	287	0	283.7	283.7	251
8	9.00	0.53	9.6	309	309	0	305.0	305.0	267
9	11.50	0.55	12.2	330	330	0	325.4	325.4	286
10	14.00	0.58	14.8	353	353	0	347.9	347.9	266
11	8.00	0.57	8.5	347	347	0	343.3	343.3	3143
12	10.50	0.58	11.1	353	353	0	348.7	348.7	1132
13	13.00	0.58	13.7	358	358	0	353.1	353.1	1372
14	15.50	0.60	16.3	374	375	1	368.7	369.7	374
15	18.00	0.63	18.9	399	403	4	393.2	397.2	229
16	20.50	0.67	21.4	436	439	3	429.7	432.7	183
17	21.50	0.69	22.5	454	457	3	447.6	450.6	149
18	22.50	0.72	23.5	474	478	4	467.4	471.4	130
19	23.25	0.74	24.3	494	498	4	487.2	491.2	104
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

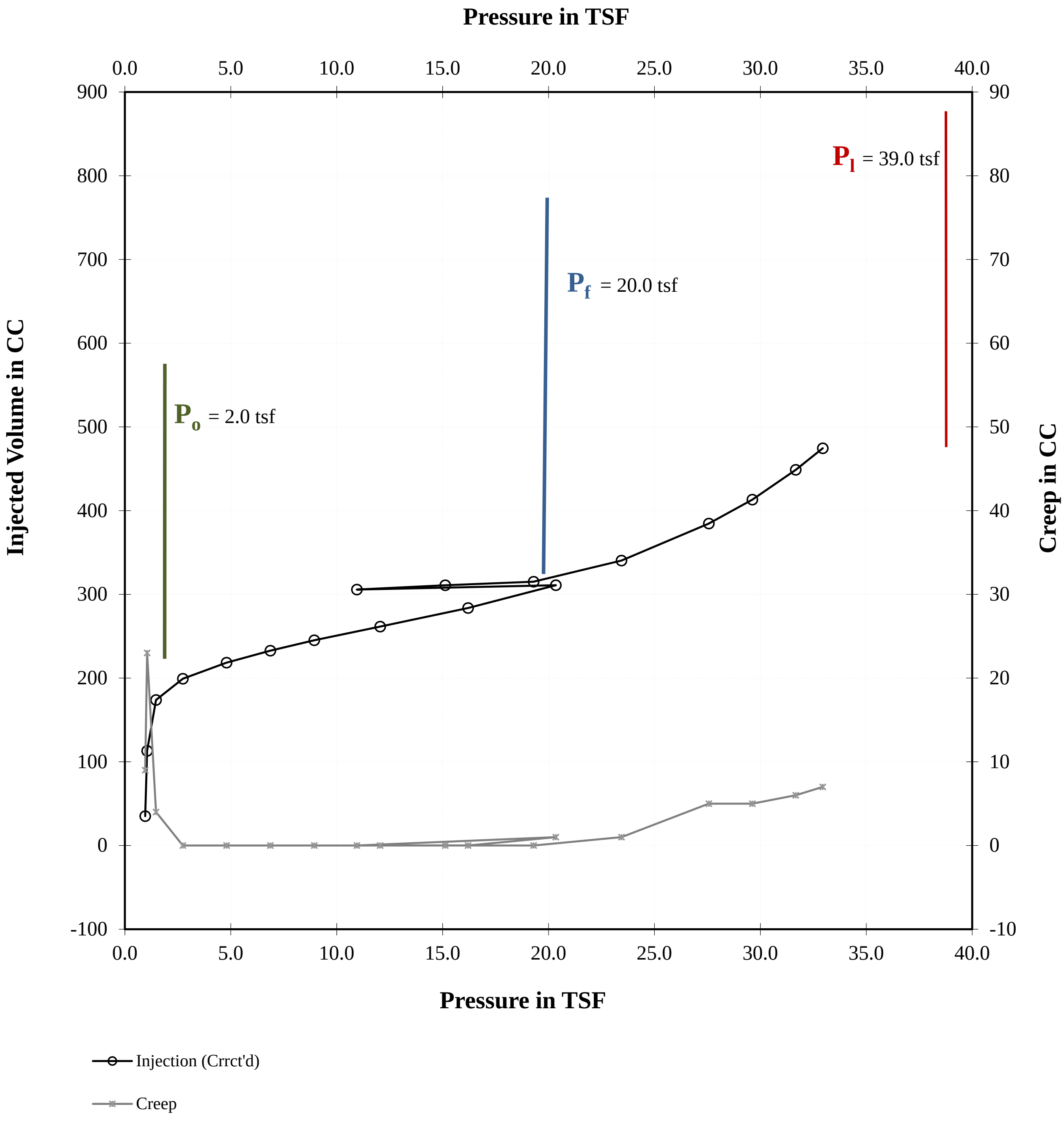
E_d= 267 TSF E^+= 1241 TSF P_l= 28.0 TSF

Test Zone Prep.: 2 1/2 SS

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing	Operator:	RCR
GEI Job #:	1609300	Engineer:	JC
Test Date:	June 30, 2016	Boring No.:	B-201

Test Depth (ft): 29.0 to 31.5



E_d = 386 TSF

E^+ = 1990 TSF

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing		
GEI Job Number:	1609300	Operator:	RCR
Test Date:	Thursday, June 30, 2016	Engineer:	JC
Boring No.:	B-201	Instr. Hght (ft):	3
Test Depth (ft):	29.0 to 31.5	Water Correction:	1.01

No.	Pressure Readings (bars)	Inertia Correction (bars)	Corrected Pressure (tsf)	30 Sec. Volume (cc)	60 Sec. Volume (cc)	Creep (cc)	Corrected 30 Sec. Volume (cc)	Corrected 60 Sec. Volume (cc)	Incremental Modulus (tsf)
1	0.00	0.10	1.0	27	36	9	26.1	35.1	
2	0.25	0.26	1.0	91	114	23	90.1	113.1	2
3	0.75	0.36	1.5	171	175	4	169.8	173.8	12
4	2.00	0.39	2.7	201	201	0	199.2	199.2	96
5	4.00	0.42	4.8	221	221	0	218.4	218.4	213
6	6.00	0.44	6.9	236	236	0	232.7	232.7	292
7	8.00	0.46	8.9	249	249	0	245.2	245.2	343
8	11.00	0.48	12.1	266	266	0	261.5	261.5	400
9	15.00	0.50	16.2	289	289	0	283.7	283.7	401
10	19.00	0.54	20.3	316	317	1	309.9	310.9	337
11	10.00	0.53	11.0	310	310	0	305.7	305.7	4020
12	14.00	0.54	15.1	316	316	0	310.9	310.9	1807
13	18.00	0.54	19.3	321	321	0	315.1	315.1	2213
14	22.00	0.57	23.4	346	347	1	339.4	340.4	377
15	26.00	0.62	27.6	387	392	5	379.6	384.6	223
16	28.00	0.65	29.6	416	421	5	408.2	413.2	179
17	30.00	0.69	31.7	451	457	6	442.7	448.7	148
18	31.25	0.72	32.9	476	483	7	467.5	474.5	131
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

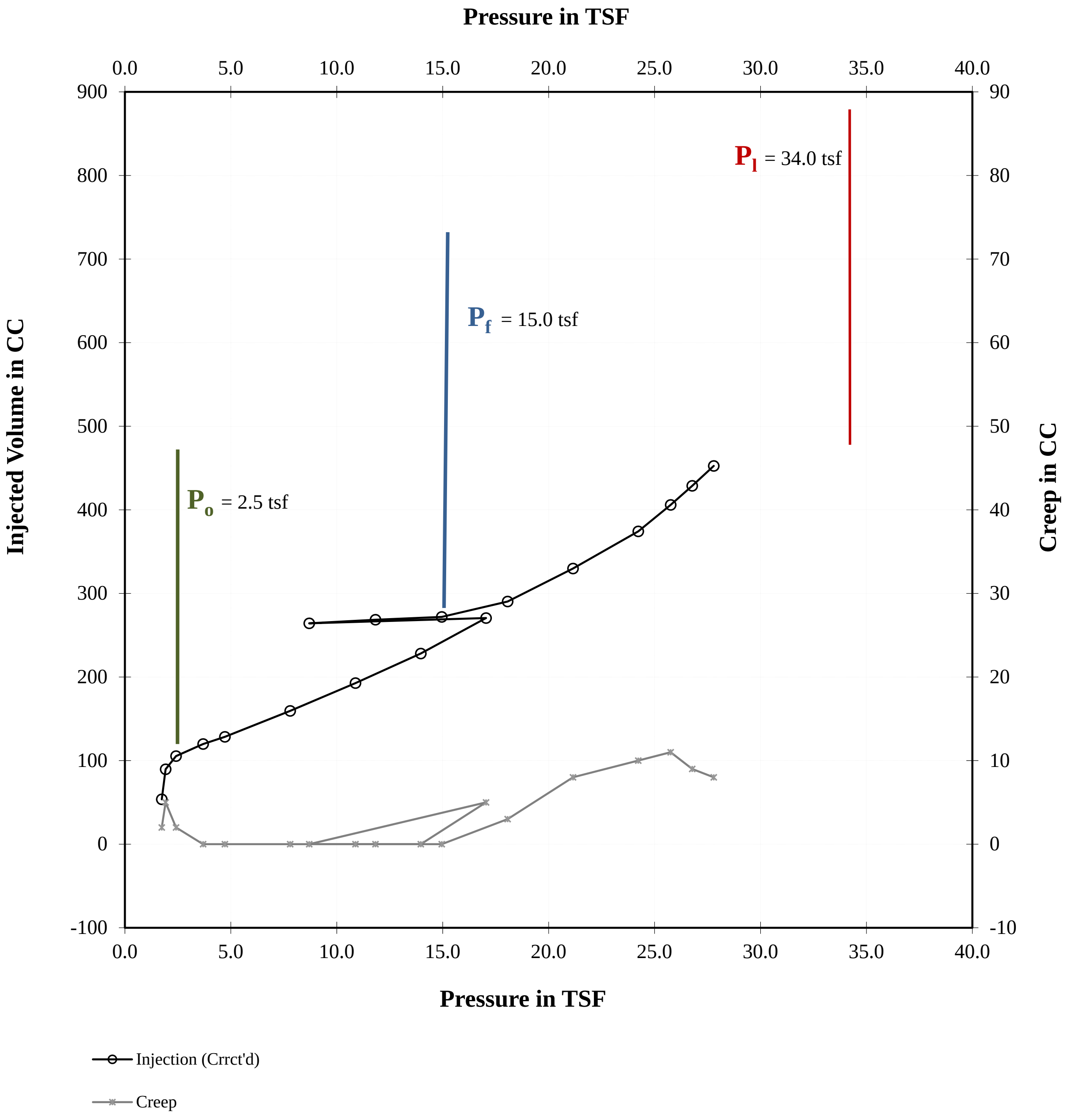
E_d= 386 TSF E^+= 1990 TSF P_l= 39.0 TSF

Test Zone Prep.: 2 1/2 SS

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing	Operator:	RCR
GEI Job #:	1609300	Engineer:	JC
Test Date:	July 1, 2016	Boring No.:	B-201

Test Depth (ft): 55.0 to 57.5



E_d = 179 TSF

E^+ = 1740 TSF

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing		
GEI Job Number:	1609300	Operator:	RCR
Test Date:	Friday, July 01, 2016	Engineer:	JC
Boring No.:	B-201	Instr. Hght (ft):	3
Test Depth (ft):	55.0 to 57.5	Water Correction:	1.81

No.	Pressure Readings (bars)	Inertia Correction (bars)	Corrected Pressure (tsf)	30 Sec. Volume (cc)	60 Sec. Volume (cc)	Creep (cc)	Corrected 30 Sec. Volume (cc)	Corrected 60 Sec. Volume (cc)	Incremental Modulus (tsf)
1	0.00	0.14	1.7	53	55	2	51.7	53.7	
2	0.25	0.22	1.9	86	91	5	84.6	89.6	8
3	0.75	0.25	2.4	105	107	2	103.4	105.4	52
4	2.00	0.27	3.7	122	122	0	119.8	119.8	152
5	3.00	0.29	4.7	131	131	0	128.4	128.4	210
6	6.00	0.34	7.8	163	163	0	159.5	159.5	179
7	9.00	0.39	10.9	197	197	0	192.7	192.7	175
8	12.00	0.44	14.0	233	233	0	228.1	228.1	173
9	15.00	0.49	17.0	271	276	5	265.5	270.5	151
10	7.00	0.48	8.7	268	268	0	264.2	264.2	2827
11	10.00	0.48	11.8	273	273	0	268.5	268.5	1555
12	13.00	0.49	15.0	277	277	0	271.9	271.9	1975
13	16.00	0.51	18.1	293	296	3	287.4	290.4	366
14	19.00	0.56	21.1	328	336	8	321.8	329.8	176
15	22.00	0.61	24.2	371	381	10	364.2	374.2	164
16	23.50	0.64	25.8	402	413	11	394.9	405.9	119
17	24.50	0.67	26.8	427	436	9	419.7	428.7	113
18	25.50	0.70	27.8	452	460	8	444.5	452.5	111
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

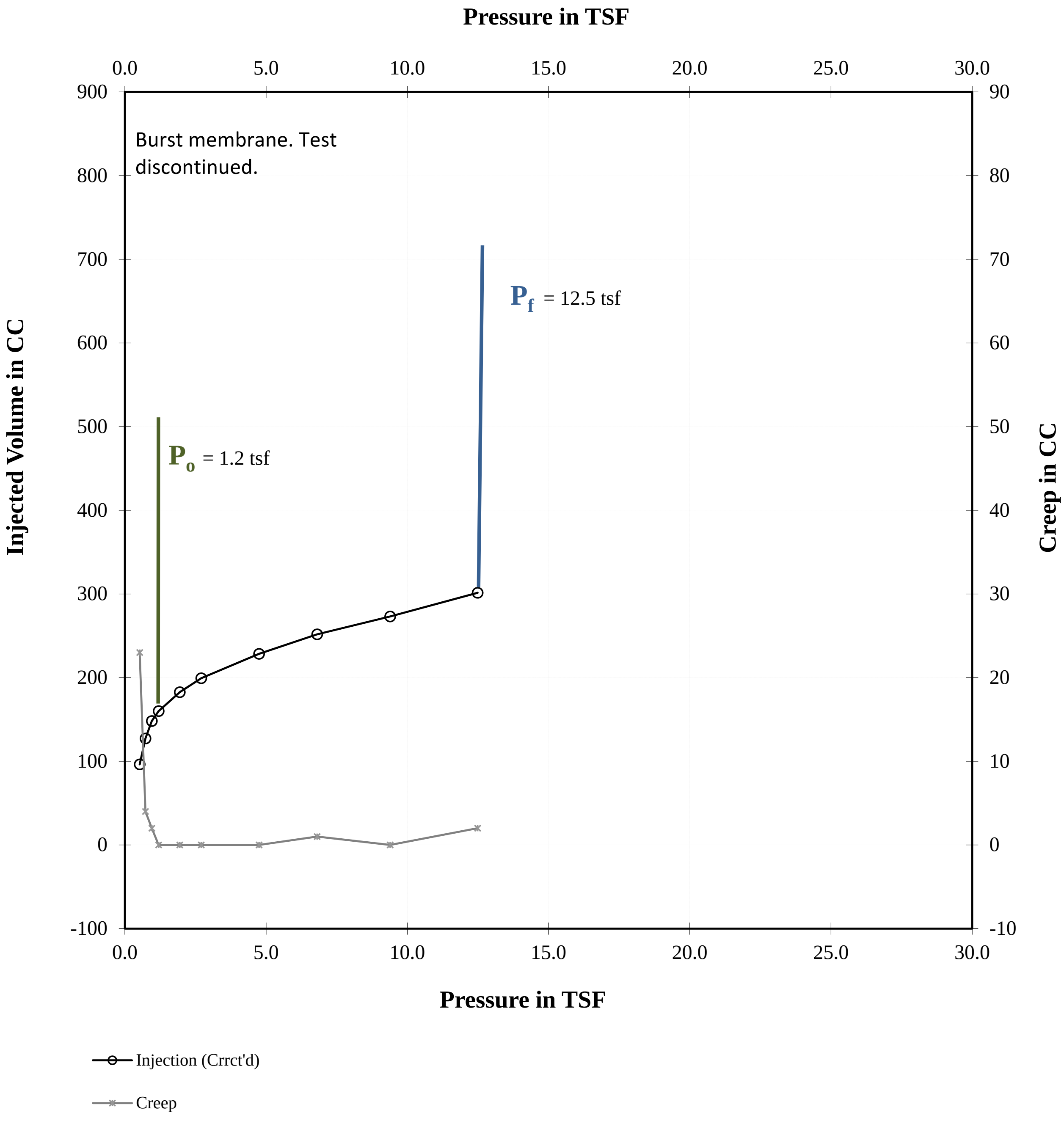
E_d= 179 TSF E^+= 1740 TSF P_l= 34.0 TSF

Test Zone Prep.: 2 5/8 RB

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing	Operator:	RCR
GEI Job #:	1609300	Engineer:	JC
Test Date:	June 29, 2016	Boring No.:	B-204

Test Depth (ft): 11.5 to 14.0



E_d = 217 TSF

E^+ = NA TSF

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing		
GEI Job Number:	1609300	Operator:	RCR
Test Date:	Wednesday, June 29, 2016	Engineer:	JC
Boring No.:	B-204	Instr. Hght (ft):	3
Test Depth (ft):	11.5 to 14.0	Water Correction:	0.48

No.	Pressure Readings (bars)	Inertia Correction (bars)	Corrected Pressure (tsf)	30 Sec. Volume (cc)	60 Sec. Volume (cc)	Creep (cc)	Corrected 30 Sec. Volume (cc)	Corrected 60 Sec. Volume (cc)	Incremental Modulus (tsf)
1	0.25	0.23	0.5	74	97	23	73.3	96.3	
2	0.50	0.28	0.7	124	128	4	123.2	127.2	11
3	0.75	0.32	1.0	147	149	2	146.1	148.1	19
4	1.00	0.34	1.2	161	161	0	160.0	160.0	37
5	1.75	0.37	1.9	184	184	0	182.6	182.6	62
6	2.50	0.39	2.7	201	201	0	199.3	199.3	88
7	4.50	0.43	4.7	231	231	0	228.4	228.4	140
8	6.50	0.46	6.8	254	255	1	250.8	251.8	182
9	9.00	0.49	9.4	277	277	0	273.1	273.1	257
10	12.00	0.52	12.5	304	306	2	299.4	301.4	239
11									
12	Burst membrane. Test discontinued.								
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

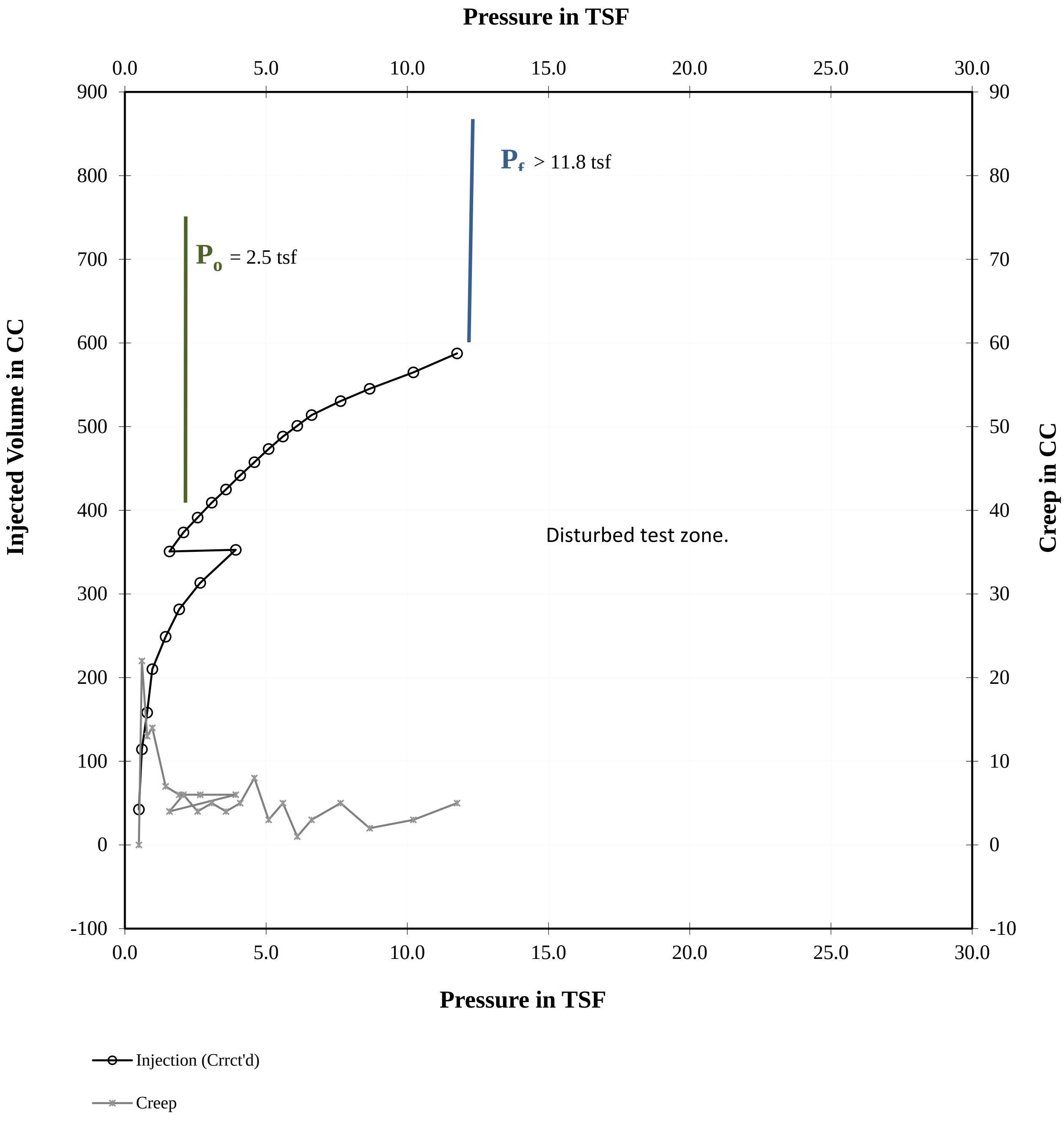
E_d= 217 TSF E^+= NA TSF P_l= NA TSF

Test Zone Prep.: 2 5/8 RB

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing	Operator:	RCR
GEI Job #:	1609300	Engineer:	JC
Test Date:	June 29, 2016	Boring No.:	B-204

Test Depth (ft): 15.0 to 17.5



E_d = 210 TSF

E^+ = NA TSF

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing		
GEI Job Number:	1609300	Operator:	RCR
Test Date:	Wednesday, June 29, 2016	Engineer:	JC
Boring No.:	B-204	Instr. Hght (ft):	3
Test Depth (ft):	15.0 to 17.5	Water Correction:	0.59

No.	Pressure Readings (bars)	Inertia Correction (bars)	Corrected Pressure (tsf)	30 Sec. Volume (cc)	60 Sec. Volume (cc)	Creep (cc)	Corrected 30 Sec. Volume (cc)	Corrected 60 Sec. Volume (cc)	Incremental Modulus (tsf)
1	0.00	0.11	0.5	43	43	0	42.4	42.4	
2	0.25	0.26	0.6	93	115	22	92.3	114.3	2
3	0.50	0.33	0.8	146	159	13	145.2	158.2	8
4	0.75	0.41	1.0	197	211	14	196.1	210.1	7
5	1.25	0.46	1.4	243	250	7	241.9	248.9	25
6	1.75	0.50	1.9	277	283	6	275.6	281.6	31
7	2.50	0.53	2.7	309	315	6	307.3	313.3	52
8	3.75	0.58	3.9	349	355	6	346.7	352.7	74
9	1.50	0.58	1.6	348	352	4	346.8	350.8	2834
10	2.00	0.60	2.1	369	375	6	367.5	373.5	52
11	2.50	0.62	2.6	389	393	4	387.3	391.3	69
12	3.00	0.64	3.1	406	411	5	404.1	409.1	70
13	3.50	0.66	3.6	423	427	4	420.9	424.9	81
14	4.00	0.68	4.1	439	444	5	436.7	441.7	77
15	4.50	0.70	4.6	452	460	8	449.5	457.5	83
16	5.00	0.71	5.1	473	476	3	470.3	473.3	85
17	5.50	0.73	5.6	486	491	5	483.1	488.1	92
18	6.00	0.74	6.1	503	504	1	500.0	501.0	108
19	6.50	0.76	6.6	514	517	3	510.8	513.8	110
20	7.50	0.78	7.6	529	534	5	525.5	530.5	173
21	8.50	0.79	8.7	547	549	2	543.2	545.2	199
22	10.00	0.81	10.2	566	569	3	561.9	564.9	229
23	11.50	0.83	11.8	587	592	5	582.5	587.5	202
24									
25	Disturbed test zone								
26									
27									
28									
29									
30									

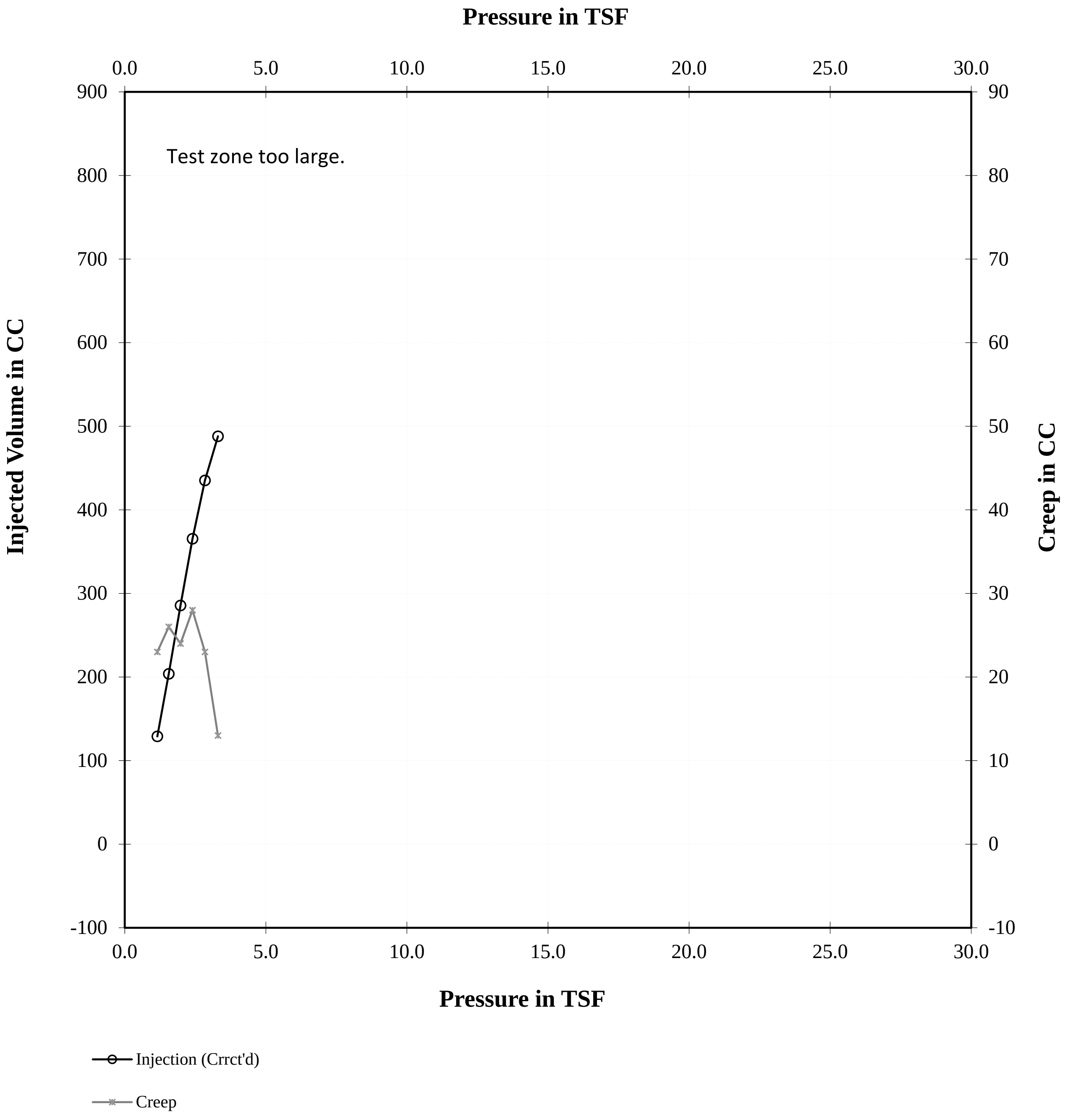
E_d= 210 TSF E^+= NA TSF P_l= NA TSF

Test Zone Prep.: 2 5/8 RB

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing	Operator:	RCR
GEI Job #:	1609300	Engineer:	JC
Test Date:	June 29, 2016	Boring No.:	B-204

Test Depth (ft): 25.0 to 27.5



E_d = NA TSF

E^+ = NA TSF

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing			
GEI Job Number:	1609300		Operator:	RCR
Test Date:	Wednesday, June 29, 2016		Engineer:	JC
Boring No.:	B-204		Instr. Hght (ft):	3
Test Depth (ft):	25.0 to 27.5		Water Correction:	0.89

No.	Pressure Readings (bars)	Inertia Correction (bars)	Corrected Pressure (tsf)	30 Sec. Volume (cc)	60 Sec. Volume (cc)	Creep (cc)	Corrected 30 Sec. Volume (cc)	Corrected 60 Sec. Volume (cc)	Incremental Modulus (tsf)
1	0.50	0.29	1.2	107	130	23	106.0	129.0	
2	1.00	0.40	1.6	179	205	26	177.8	203.8	10
3	1.50	0.50	2.0	263	287	24	261.6	285.6	11
4	2.00	0.59	2.4	339	367	28	337.4	365.4	12
5	2.50	0.67	2.8	414	437	23	412.2	435.2	16
6	3.00	0.73	3.3	477	490	13	475.0	488.0	23
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25	Test zone too large								
26									
27									
28									
29									
30									

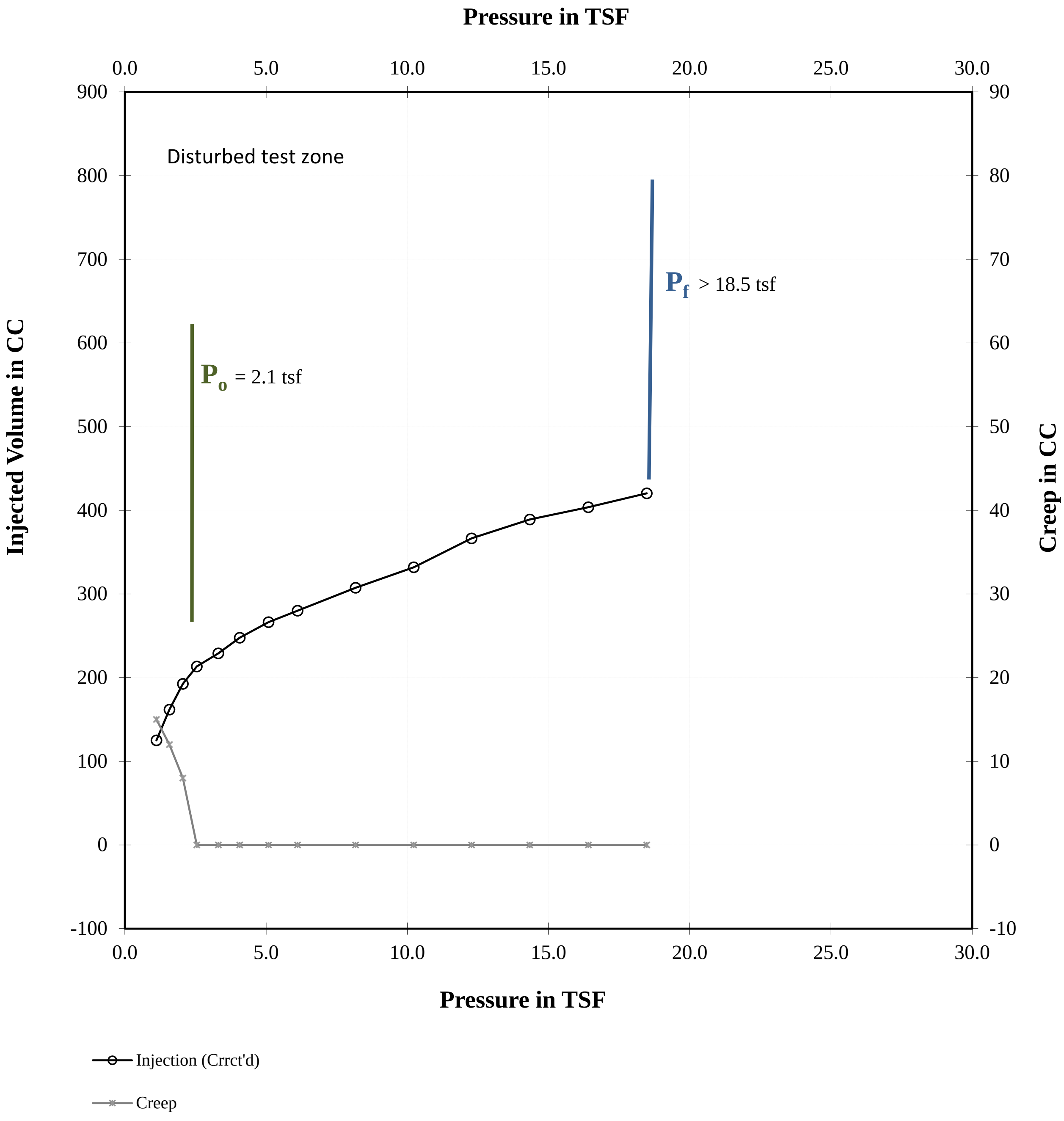
E_d= NA TSF E^+= NA TSF P_l= NA TSF

Test Zone Prep.: 2 5/8 RB

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing	Operator:	RCR
GEI Job #:	1609300	Engineer:	JC
Test Date:	June 30, 2016	Boring No.:	B-204

Test Depth (ft): 40.0 to 42.5



E_d = 332 TSF

E^+ = NA TSF

Pressuremeter Data Reduction (BX)

GEI Consultants

Project Name: Tremont Crossing
GEI Job Number: 1609300
Test Date: Thursday, June 30, 2016
Boring No.: B-204
Test Depth (ft): 40.0 to 42.5

Operator: RCR
Engineer: JC
Instr. Hght (ft): 3
Water Correction: 1.35

No.	Pressure Readings (bars)	Inertia Correction (bars)	Corrected Pressure (tsf)	30 Sec. Volume (cc)	60 Sec. Volume (cc)	Creep (cc)	Corrected 30 Sec. Volume (cc)	Corrected 60 Sec. Volume (cc)	Incremental Modulus (tsf)
1	0.00	0.28	1.1	111	126	15	110.0	125.0	
2	0.50	0.34	1.6	151	163	12	149.8	161.8	23
3	1.00	0.38	2.1	186	194	8	184.6	192.6	29
4	1.50	0.41	2.5	215	215	0	213.3	213.3	47
5	2.25	0.43	3.3	231	231	0	229.0	229.0	98
6	3.00	0.46	4.1	250	250	0	247.7	247.7	83
7	4.00	0.48	5.1	269	269	0	266.3	266.3	115
8	5.00	0.50	6.1	283	283	0	280.0	280.0	162
9	7.00	0.53	8.2	311	311	0	307.4	307.4	165
10	9.00	0.56	10.2	336	336	0	331.9	331.9	191
11	11.00	0.60	12.3	371	371	0	366.4	366.4	139
12	13.00	0.62	14.3	394	394	0	389.0	389.0	222
13	15.00	0.64	16.4	409	409	0	403.6	403.6	351
14	17.00	0.66	18.5	426	426	0	420.3	420.3	313
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25	Disturbed test zone								
26									
27									
28									
29									
30									

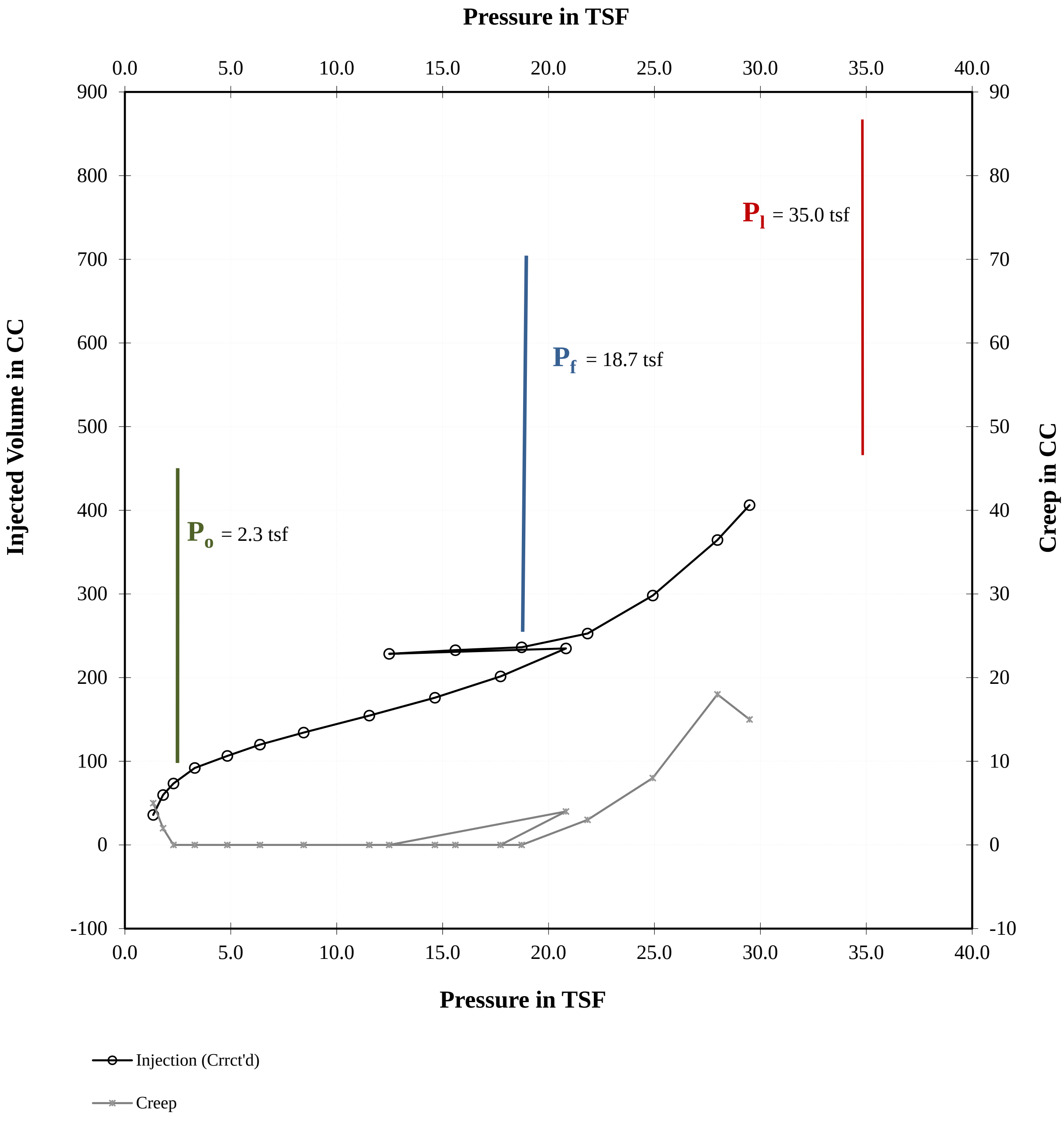
E_d= 332 TSF E^+= NA TSF P_l= NA TSF

Test Zone Prep.: 2 1/2 SS

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing	Operator:	RCR
GEI Job #:	1609300	Engineer:	JC
Test Date:	July 1, 2016	Boring No.:	B-206

Test Depth (ft): 41.0 to 43.5



E_d = 258 TSF

E^+ = 1627 TSF

Pressuremeter Data Reduction (BX)

Project Name:	Tremont Crossing		
GEI Job Number:	1609300	Operator:	RCR
Test Date:	Friday, July 01, 2016	Engineer:	JC
Boring No.:	B-206	Instr. Hght (ft):	3
Test Depth (ft):	41.0 to 43.5	Water Correction:	1.38

No.	Pressure Readings (bars)	Inertia Correction (bars)	Corrected Pressure (tsf)	30 Sec. Volume (cc)	60 Sec. Volume (cc)	Creep (cc)	Corrected 30 Sec. Volume (cc)	Corrected 60 Sec. Volume (cc)	Incremental Modulus (tsf)
1	0.00	0.10	1.3	32	37	5	30.9	35.9	
2	0.50	0.15	1.8	59	61	2	57.7	59.7	30
3	1.00	0.18	2.3	75	75	0	73.4	73.4	57
4	2.00	0.22	3.3	94	94	0	92.0	92.0	89
5	3.50	0.25	4.8	109	109	0	106.4	106.4	180
6	5.00	0.28	6.4	123	123	0	119.9	119.9	197
7	7.00	0.30	8.4	138	138	0	134.3	134.3	252
8	10.00	0.33	11.5	159	159	0	154.6	154.6	276
9	13.00	0.37	14.6	181	181	0	176.0	176.0	270
10	16.00	0.40	17.7	207	207	0	201.4	201.4	234
11	19.00	0.45	20.8	237	241	4	230.9	234.9	185
12	11.00	0.44	12.5	233	233	0	228.4	228.4	2629
13	14.00	0.44	15.6	238	238	0	232.8	232.8	1445
14	17.00	0.45	18.7	242	242	0	236.2	236.2	1861
15	20.00	0.47	21.8	256	259	3	249.7	252.7	392
16	23.00	0.52	24.9	297	305	8	290.1	298.1	146
17	26.00	0.60	28.0	354	372	18	346.5	364.5	106
18	27.50	0.65	29.5	399	414	15	391.2	406.2	89
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

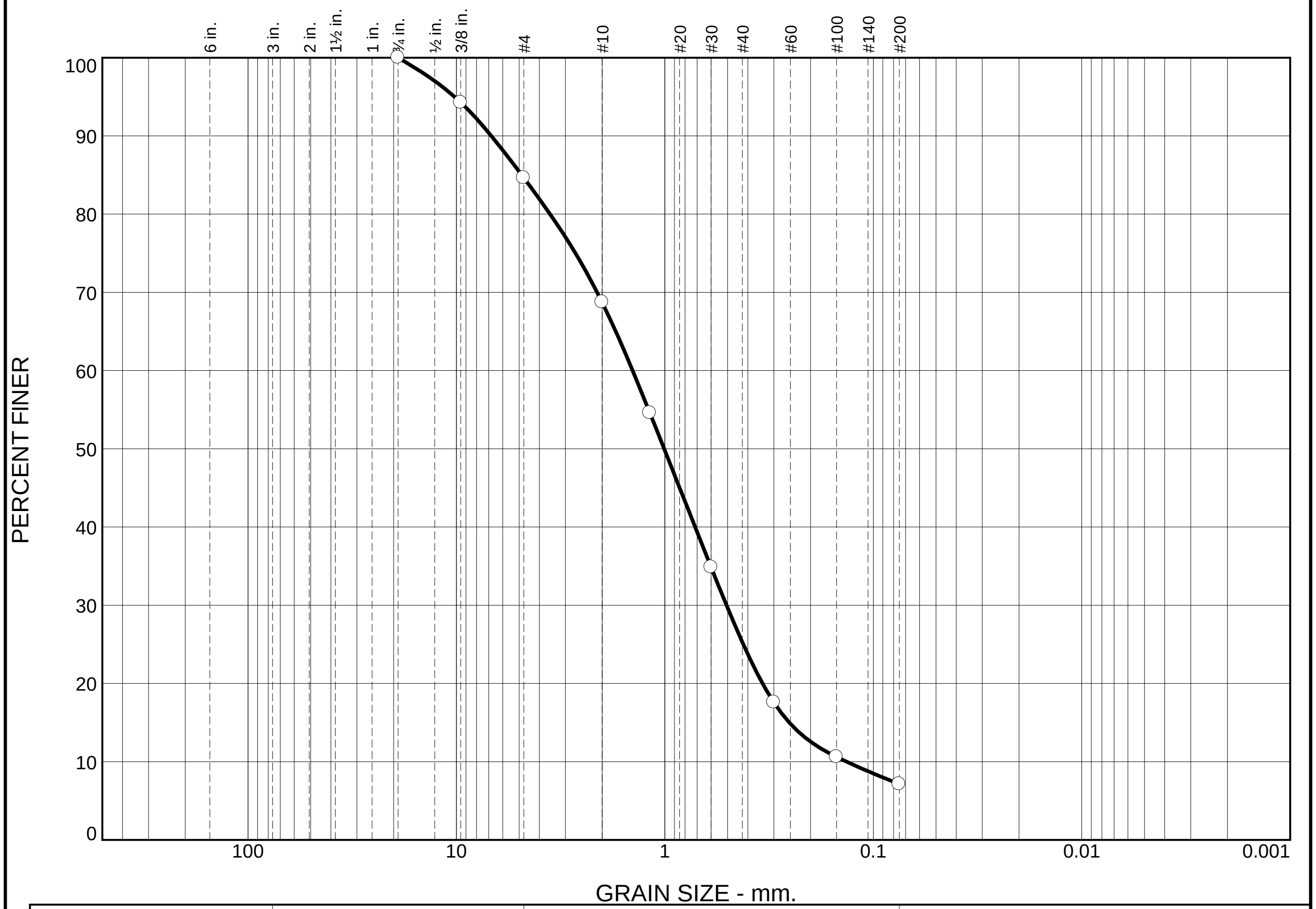
E_d= 258 TSF E^+= 1627 TSF P_l= 35.0 TSF

Test Zone Prep.: 2 5/8 RB

Appendix C

Laboratory Test Data

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	15.4	15.9	43.4	18.2	7.1

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	4.8648	1.4284	1.0076	0.5062	0.2529	0.1345	1.33	10.62

Material Description	USCS	AASHTO
○ Widely graded SAND with silt and gravel	SW-SM	A-1-b

Project No. 1609300 **Client:** Feldco

Project: Tremont Crossing

○ **Source of Sample:** B201 **Depth:** 9-11 ft **Sample Number:** S3

Remarks:

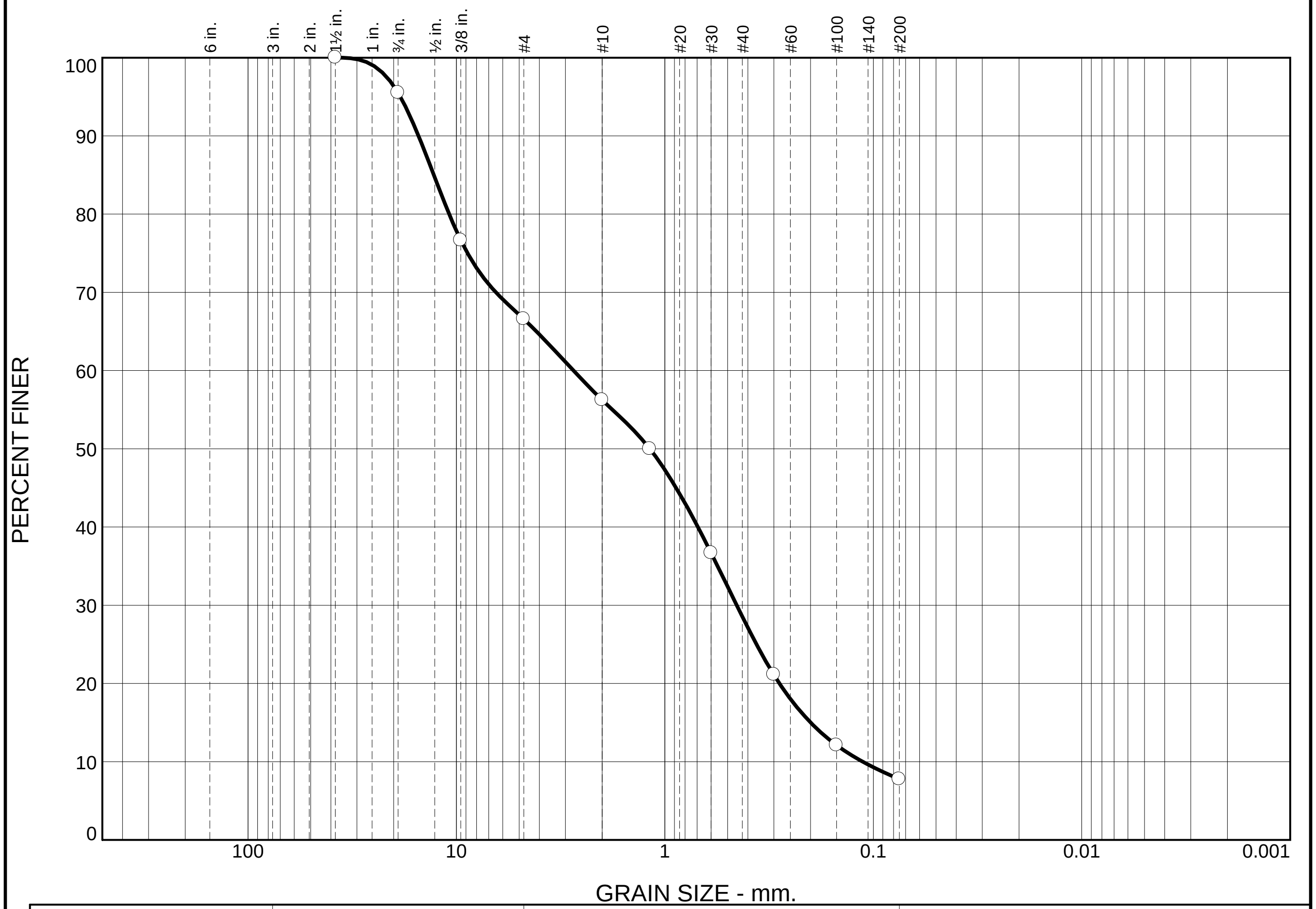
○As rec'd WC=12.0%

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

Figure C 1

Tested By: KPG **Checked By:** DJA

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	4.5	28.9	10.4	27.7	20.7	7.8

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	12.8365	2.7435	1.1811	0.4523	0.1999	0.1125	0.66	24.39

Material Description	USCS	AASHTO
○ Narrowly graded SAND with silt and gravel	SP-SM	A-1-b

Project No. 1609300 **Client:** Feldco

Project: Tremont Crossing

○ **Source of Sample:** B201 **Depth:** 14-16 ft **Sample Number:** S4

Remarks:

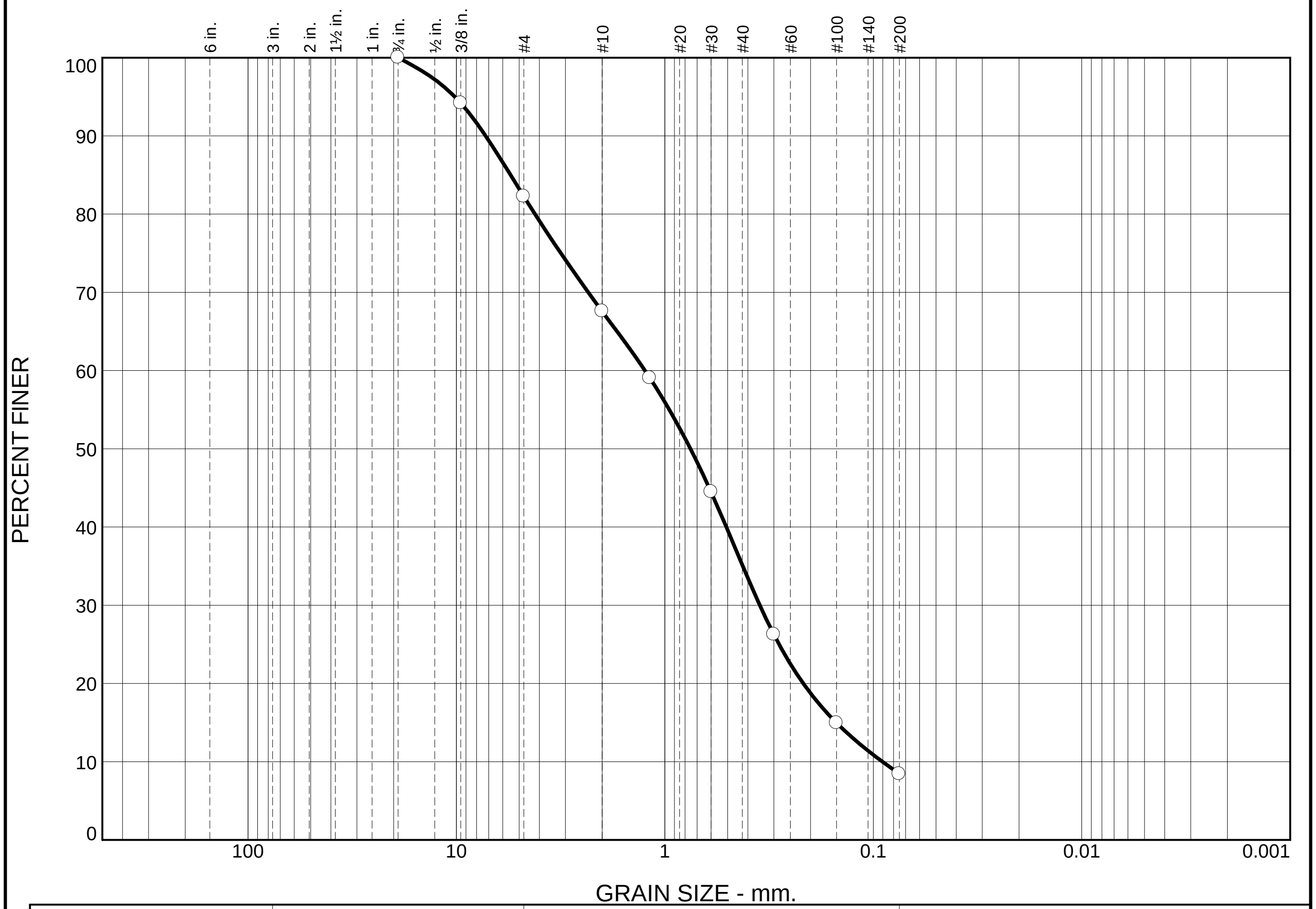
○As rec'd WC=13.9%

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

Figure C 2

Tested By: KPG **Checked By:** DJA

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	17.7	14.7	32.5	26.7	8.4

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	5.5014	1.2461	0.7536	0.3502	0.1506	0.0904	1.09	13.79

Material Description	USCS	AASHTO
○ Widely graded SAND with silt and gravel	SW-SM	A-1-b

Project No. 1609300 **Client:** Feldco

Project: Tremont Crossing

○ **Source of Sample:** B201 **Depth:** 19-21 ft **Sample Number:** S5

Remarks:

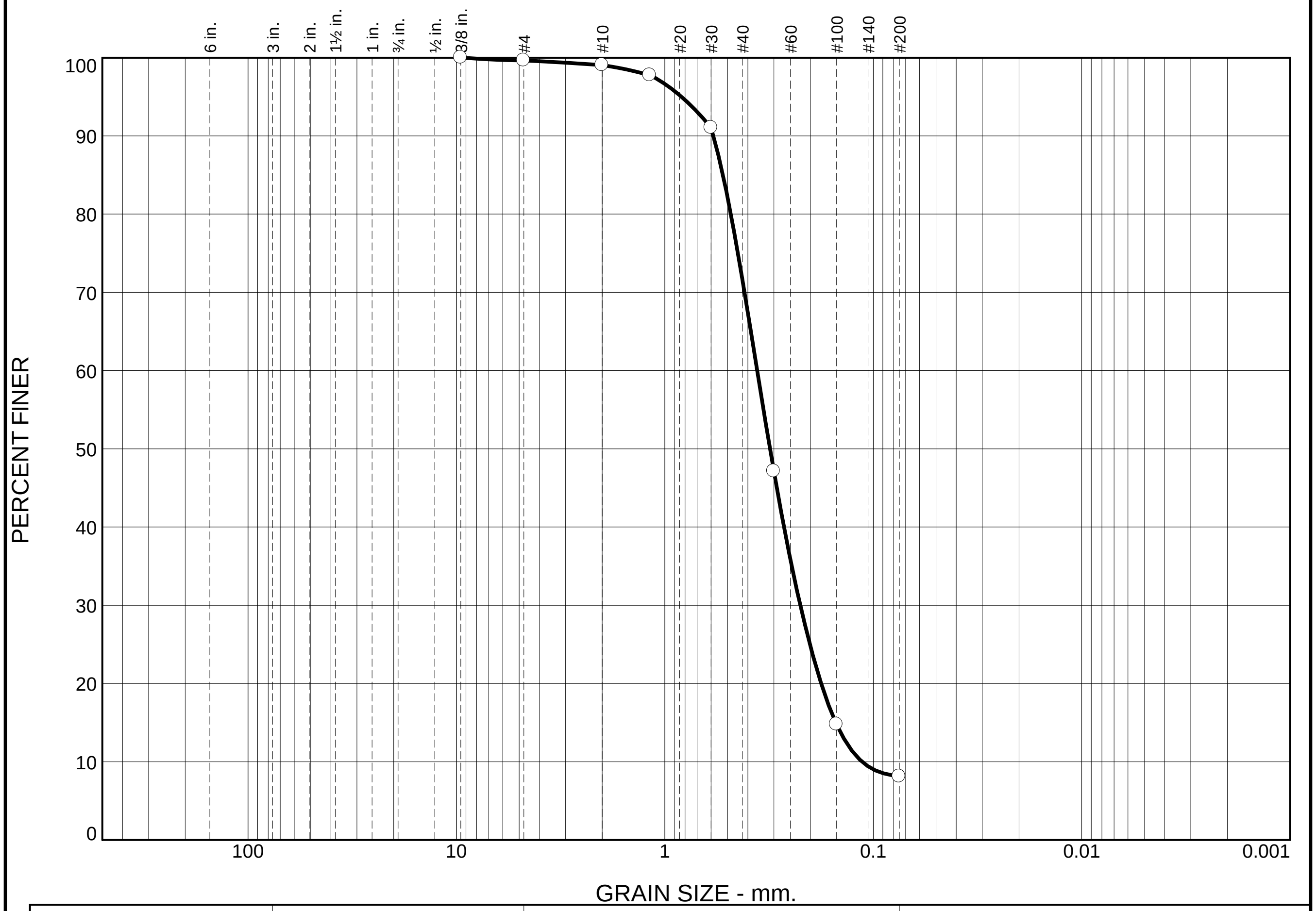
○As rec'd WC=14.7%

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

Figure C 3

Tested By: KPG **Checked By:** DJA

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.4	0.5	27.4	63.6	8.1

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.5265	0.3604	0.3129	0.2240	0.1514	0.1132	1.23	3.18

Material Description	USCS	AASHTO
○ Narrowly graded SAND with silt	SP-SM	A-3

Project No. 1609300 **Client:** Feldco
Project: Tremont Crossing

○ **Source of Sample:** B201 **Depth:** 44-46 ft **Sample Number:** S10

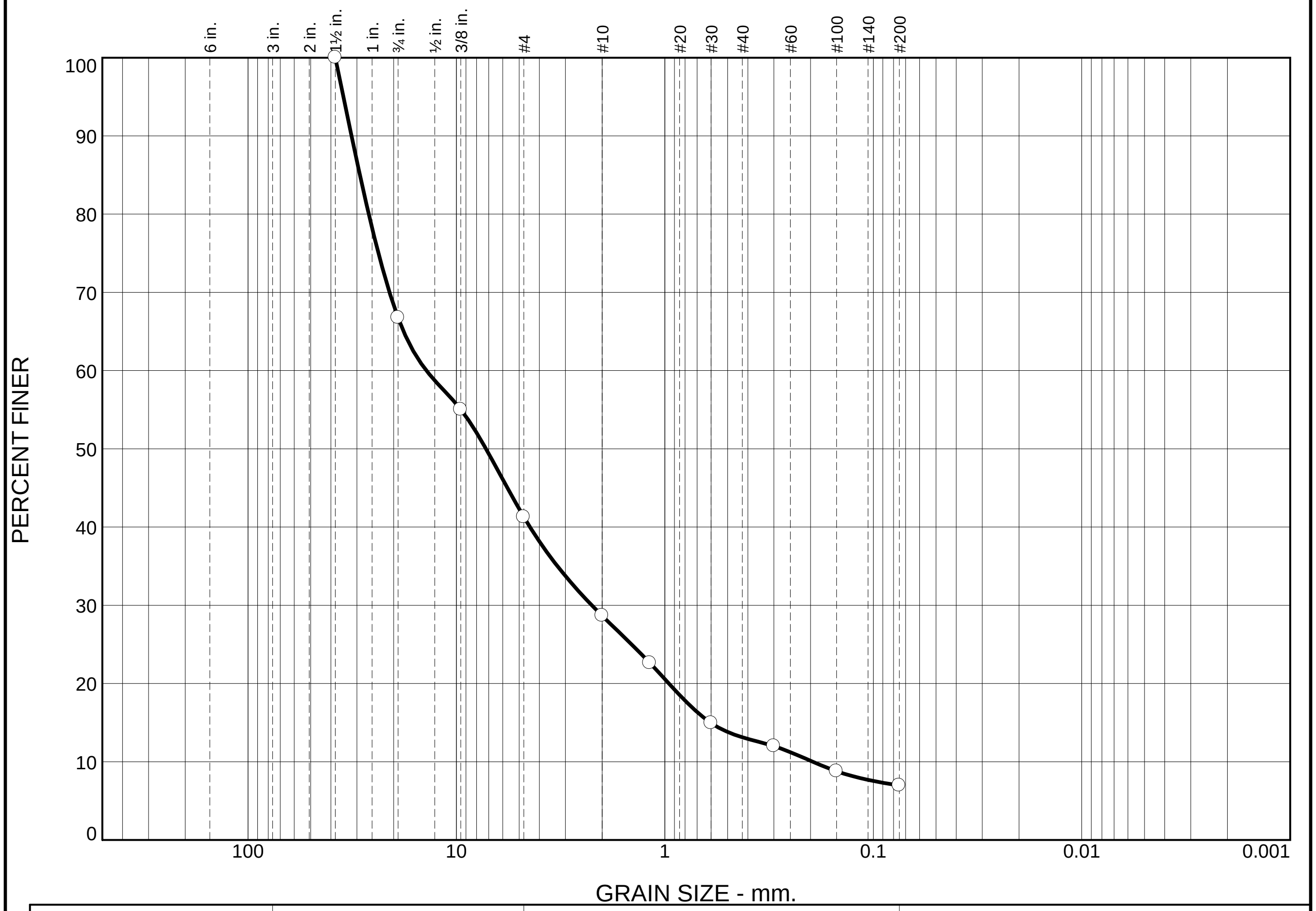
Remarks:
○As rec'd WC=21.9%

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

Figure C 4

Tested By: KPG **Checked By:** DJA

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	33.3	25.4	12.6	15.6	6.1	7.0

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	29.0400	13.9442	7.2154	2.2411	0.6043	0.1951	1.85	71.46

Material Description	USCS	AASHTO
○ Widely graded GRAVEL with silt and sand	GW-GM	A-1-a

Project No. 1609300 **Client:** Feldco

Project: Tremont Crossing

○ **Source of Sample:** B203 **Depth:** 10-12 ft **Sample Number:** S3

Remarks:

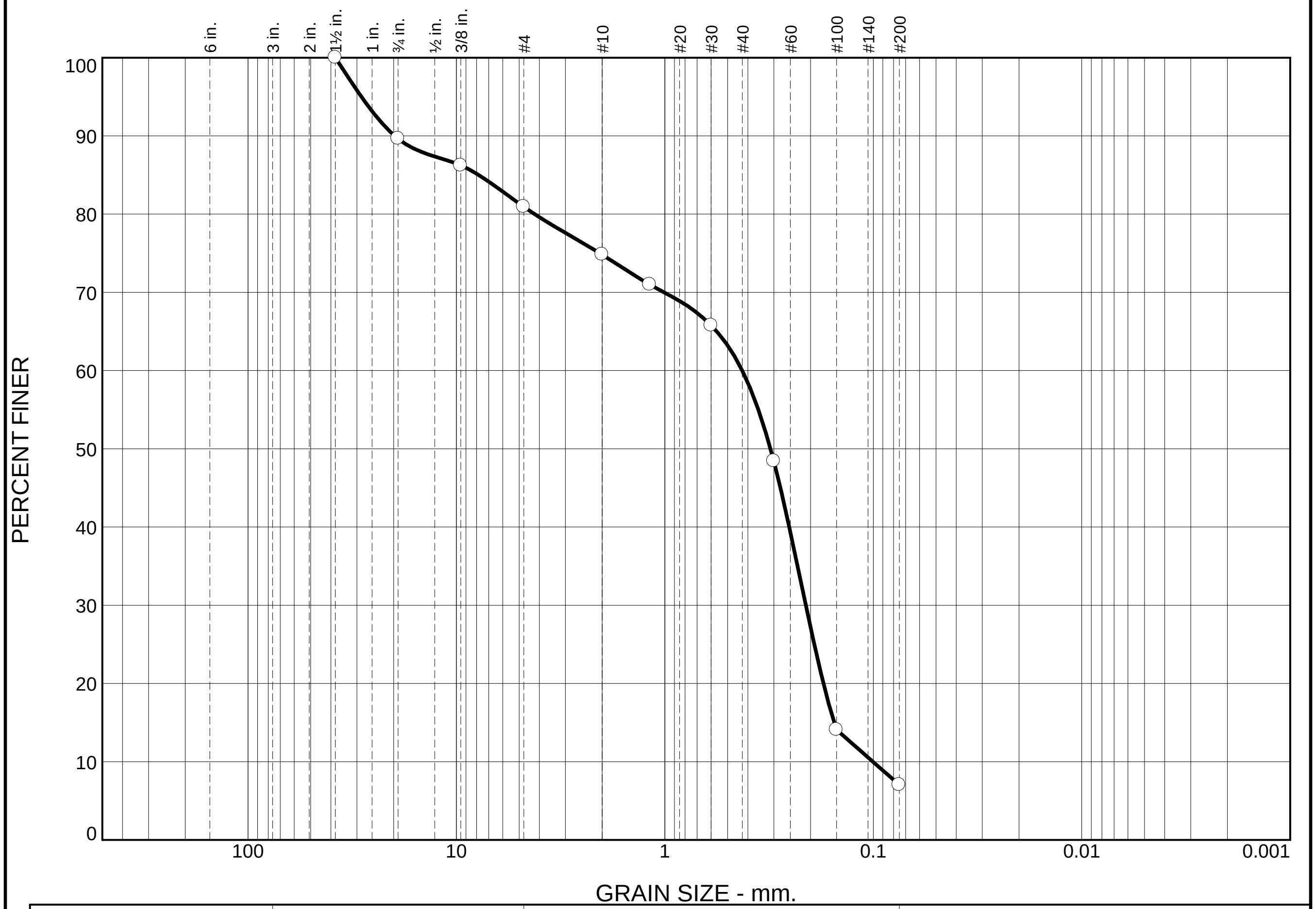
○As rec'd WC=9.1%

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

Figure C 5

Tested By: KPG **Checked By:** DJA

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	10.4	8.7	6.1	14.8	53.0	7.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	7.8241	0.4255	0.3112	0.2108	0.1540	0.1004	1.04	4.24

Material Description	USCS	AASHTO
○ narrowly graded SAND with silt and gravel	SP-SM	A-3

Project No. 1609300 **Client:** Feldco

Project: Tremont Crossing

○ **Source of Sample:** B204 **Depth:** 10-12 ft **Sample Number:** S3 (5-14)

Remarks:

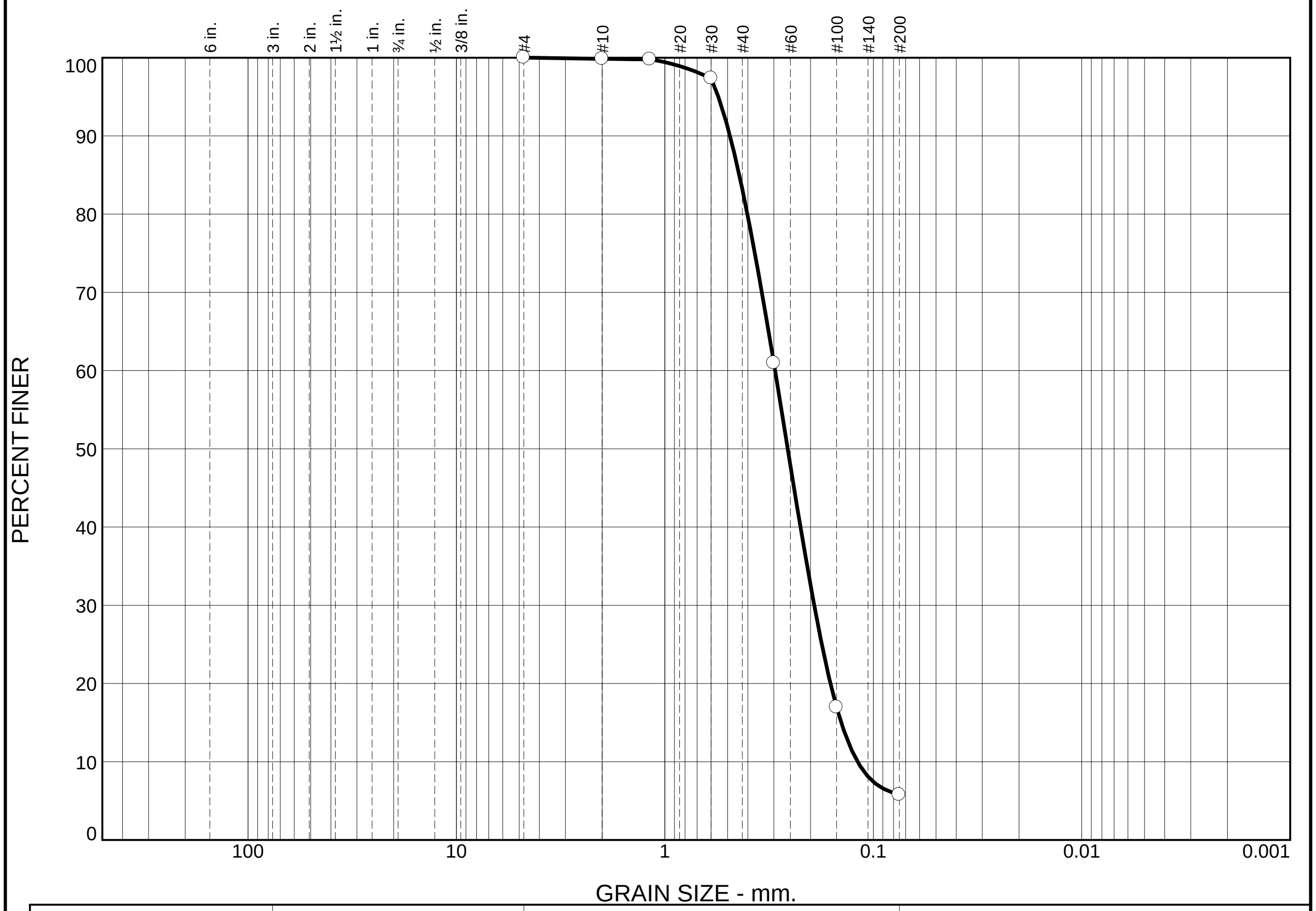
○As rec'd WC=6.3%

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

Figure C 6

Tested By: KPG **Checked By:** DJA

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.1	16.7	77.4	5.8

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	0.4396	0.2959	0.2574	0.1922	0.1426	0.1190	1.05	2.49

Material Description	USCS	AASHTO
○ Narrowly Graded SAND with Silt	SP-SM	

Project No. 1609300 **Client:** Feldco

Project: Tremont Crossing

○ **Source of Sample:** B205 **Depth:** 54-56 ft **Sample Number:** S12

Remarks:

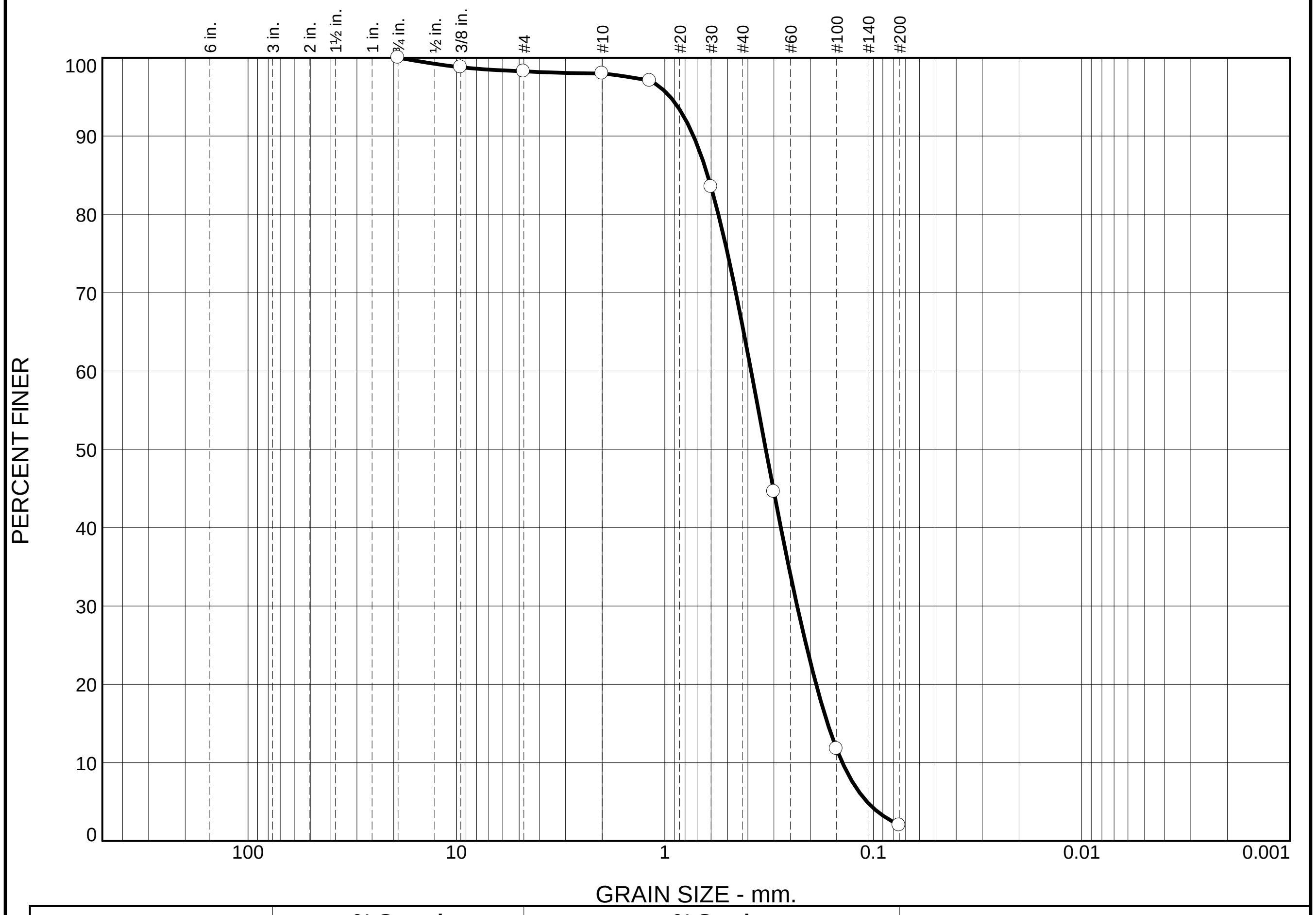
○As rec'd WC = 19.8%

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

Figure C 7

Tested By: N. Mazzella

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	1.7	0.3	32.1	63.9	2.0

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.6233	0.3855	0.3278	0.2318	0.1657	0.1407	0.99	2.74

Material Description	USCS	AASHTO
○ Narrowly graded SAND	SP	A-3

Project No. 1609300 **Client:** Feldco

Project: Tremont Crossing

○ **Source of Sample:** B208 **Depth:** 64-66 ft **Sample Number:** S14

Remarks:

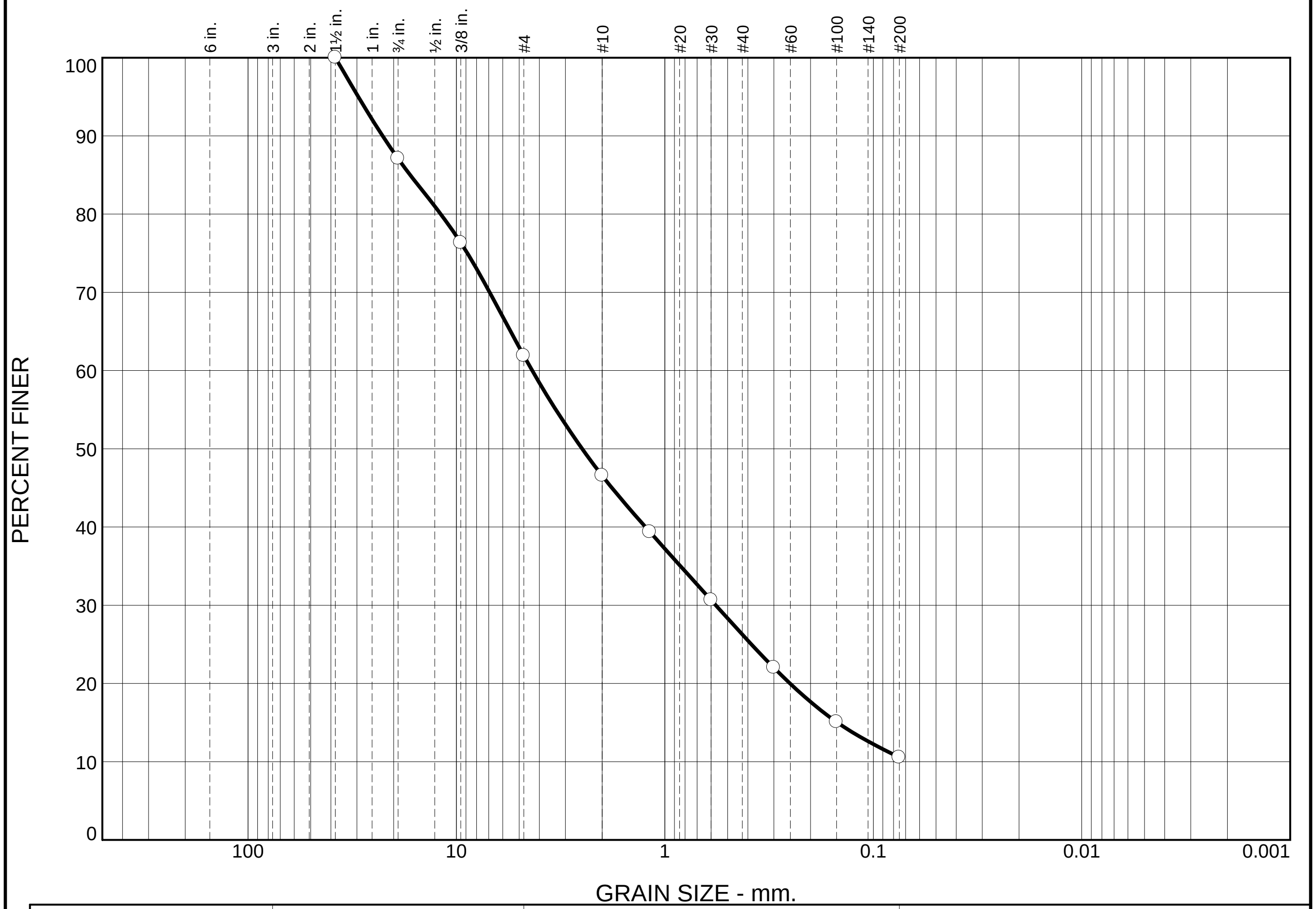
○As rec'd WC=25.2%

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

Figure C 8

Tested By: KPG **Checked By:** DJA

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	12.9	25.2	15.3	20.3	15.8	10.5

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	16.6544	4.3290	2.4936	0.5698	0.1486			

Material Description	USCS	AASHTO
○ Narrowly graded SAND with silt and gravel	SP-SM	A-1-a

Project No. 1609300 **Client:** Feldco

Project: Tremont Crossing

○ **Source of Sample:** B210 **Depth:** 20-22 ft **Sample Number:** S5

Remarks:

○As rec'd WC=11.7%

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

Figure C 9

Tested By: KPG **Checked By:** DJA

APPENDIX 5

PHASE 1 ENVIRONMENTAL SITE ASSESSMENT

DRAFT Phase I Environmental Site Assessment

Parcel P-3, Tremont & Whittier Streets
Roxbury, Massachusetts

Submitted to:
Feldco Development Corporation.
222 Newbury Street, 4th Floor
Boston, MA 02116

Submitted by:
GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA, 01801
781-721-4000

February XX, 2016

Project 132673-3

Catherine G. Johnson, P.G., LSP
Project Manager

Ileen S. Gladstone, P.E., LSP
Senior Vice President

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RAM/CMM/CGJ:jam
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Executive Summary

GEI Consultants, Inc. has completed an ASTM Phase I Environmental Site Assessment (ESA), on behalf of Feldco Development Corporation, for the property located at Parcel P-3 on Tremont and Whittier Streets in Boston, Massachusetts (the Property).

Recognized Environmental Conditions

Based on our evaluation of current Property conditions and the review of available records for the Property, we identified the following RECs, defined as evidence of past, current or future potential releases of oil or hazardous material (OHM), at the Property:

- Starting in the 1890's to 1998 the Property has been occupied by different industrial, commercial, and manufacturing companies that stored and used OHM. Tremont Foundry Machine Company (Co.), Eastern Electric Cable Co., The Roxbury Carpet Co., A.J. Tower Oil Clothing Manufactory, the former Whittier Street Health Center (WSHC), and Connolly's Tavern formerly stored and utilized various forms of OHM at the Property. Although subsurface investigations have been conducted on the eastern portion of the Property, the western section of the Property (Area 3) has not been investigated for releases of OHM. In particular, the former Roxbury Carpet Company parcel has not been investigated.
- Area 1 and Area 2 of the Property comprise a disposal site identified by the Massachusetts Department of Environmental Projection (MassDEP) on-line database. MassDEP assigned release tracking number (RTN) 3-15009 for the release of total petroleum hydrocarbons (TPH), certain polycyclic aromatic hydrocarbons (PAHs), and lead in soil on April 14, 1997. The disposal site remains open with a Tier II Classification. Although an Activity and Use Limitations (AUL) has been recommended for the disposal site, it has yet to be implemented at the Property to allow for its closure.

Historic Recognized Environmental Conditions

We identified five historic RECs (HRECs), defined as a past release of OHM that has achieved regulatory closure without the use of required controls or conditions (e.g. AULs, engineering controls, etc.) at the Property:

- During subsurface investigations in February 2010 at a former gasoline filling station located at 1290 Tremont Street, concentrations of volatile petroleum hydrocarbons (VPH) C_9-C_{10} aromatic fractions and 2-methylnathalene were detected in the soil at concentrations above applicable reportable concentrations. MassDEP assigned RTN 3-29371 to the release. The disposal site abuts the Property to the west. Following additional subsurface investigations, a Method 3 Risk Characterization concluded that the site posed a condition of No Significant Risk (NSR) and was closed with a Class B-1 Response Action Outcome (RAO).

- The property located at 1177-1229 Tremont Street is a disposal site (RTN 3-3429). The site is located north of the Property across Tremont Street and was formerly occupied by gasoline filling stations. A release of TPH and volatile organic compounds (VOCs) to soil was reported to MassDEP on January 15, 1991. It was concluded that the site posed a condition of NSR and was closed with a Class A-2 RAO.
- The Massachusetts Bay Transportation Authority (MBTA) Parcel 18B located adjacent to the Ruggles “T” Station is a disposal site (RTN 3-0739). The site is located approximately 615 feet northeast of the Property. Various PAHs, metals, and TPH were detected in soil above reportable concentrations at the property and reported to MassDEP on October 15, 1988. A Method 1 Risk Characterization demonstrated that the site posed a condition of NSR and was closed with a Class B-1 RAO.
- During the removal of a 550-gallon No. 2 fuel oil underground storage tank (UST) at the MBTA Ruggles Street “T” Station located on Forsyth Street in January 1999, soil samples collected in the UST grave exceeded reportable concentrations for PAHs (RTN 3-18303). The site is located approximately 950 feet north of the Property. Following subsurface investigations, a Method 1 Risk Characterization concluded that the site posed a condition of NSR and was closed with a Class A-2 RAO.
- The property located at 1170 Tremont Street is a disposal site (RTN 3-11181). The site abuts the Property to the northeast. A release of No. 2 fuel oil occurred on March 18, 1997 and was reported to MassDEP. The storage tank and approximately 100 yd^3 of contaminated soil were removed and transported offsite. The site was cleaned up to background and was closed with a Class A-2 RAO.

Controlled Recognized Environmental Conditions

We identified the following controlled RECs (CRECs), defined as a past release of OHM that has achieved regulatory closure with the use of required controls or conditions (e.g. AULs, engineering controls, etc.) at the Property:

The MBTA Parcel 18 located adjacent to the Ruggles “T” Station is a disposal site (RTN 3-00739). The site is approximately 150 feet north of the Property. Various PAHs, metals, and TPH were detected in soil above reportable concentrations at the property. Based on a Method 3 Risk Characterization and an AUL, the site posed a condition of NSR and was closed with a Class A-3 RAO.

1. Introduction

GEI Consultants, Inc. has completed an ASTM Phase I Environmental Site Assessment (ESA), on behalf of Feldco Development Corporation, for Parcel P-3 located at Tremont Street and Whittier Street in Boston, Massachusetts (the Property; Fig. 1).

1.1 Purpose

The purposes of this Phase I ESA are to:

- Identify recognized environmental conditions (RECs), defined by ASTM as a condition with the potential for a past, current, or future release of oil or hazardous material (OHM) at the Property.
- Identify historic RECs (HRECs); defined by ASTM as a past release of OHM that has achieved regulatory closure without required controls or conditions.
- Identify controlled RECs (CRECs); defined by ASTM as a past release of OHM that has achieved regulatory closure with required controls or conditions.
- Evaluate the potential for a release of OHM at the Property.

1.2 Detailed Scope of Services

In accordance with our proposal dated and authorized on December 18, 2015, we:

- Reviewed available records at City of Boston offices.
- Reviewed documents and maps regarding local geologic and hydrogeologic conditions in the vicinity of the Property.
- Reviewed federal and state regulatory database records pertaining to the Property and surrounding area.
- Performed a site reconnaissance at the Property.
- Prepared this Phase I ESA report.

This report summarizes the information that we gathered as part of the ESA.

1.3 Significant Assumptions

Our opinion and conclusions are based on the information sources presented in this report and listed in Section 12 (References), and a site reconnaissance at the Property. GEI assumes that all available information obtained as part of this ESA, including database records, interview information, and historic information, is accurate and reliable.

1.4 Limitations and Exceptions

This report meets the general requirements for a Phase I ESA established by ASTM Standard E1527 13 with the following exceptions:

- A review of available records maintained by municipal offices was used to substitute for interviews with employees of those departments who were unable to be interviewed at length.
- No title search was performed to identify previous owners. Readily available public documentation, including, but not limited to, aerial photographs, regulatory database searches, etc. were used in a lieu of a title search.

Our conclusions are based on the information reported in this report. Additional information not available to us at the time this report was prepared may result in a modification of the findings of this ESA.

1.5 Special Terms and Conditions

This Phase I ESA was performed with no Special Terms and Conditions.

1.6 User Reliance

This report was prepared for the use of. Feldco Development Corporation, exclusively. Reliance on this report by others is conditioned on acceptance of all of the terms and conditions contained in our “Standard Professional Services Agreement,” a copy of which is in Appendix A, and on acceptance of the Limitations in Section 1.4 of this report.

2. Property Description

2.1 Property Locations and Legal Descriptions

The Property is located at Parcel P-3 on the southwest corner of the intersection of Tremont Street and Whittier Street in Boston, Massachusetts (Fig. 1). The Property is vacant and owned by the Boston Redevelopment Authority (BRA).

The latitude and longitude of the Property are 42°19'59.88"N and 71° 5'21.33"W, and UTM coordinates for the Property are 4,688,888mN and 327,826mE.

2.2 Property Vicinity and General Characteristics

According to the City of Boston Assessors on-line database, the Property is zoned as an exempt property and other public land. The address, assessor's parcel identification number, owner, and use of each of the abutting properties are summarized in Table 1.

2.3 Current Use of the Property

The Property is currently vacant.

2.4 Description of Structures, Roads, and Other Improvements on the Property

The Property occupies approximately 334,546 square feet or 7.7 acres. The former Whittier Street Health Center (WSHC) is a vacant, four-story brick building located in the southeast portion of the Property. The Property is bounded by Tremont Street to the north, Whittier Street to the east, Downing Street to the south, and an unnamed road to the west that accesses the parking lots behind the Madison Park High School. Additionally, Vernon Street bisects the eastern and western portions of the Property. In the eastern portion of the Property, an undeveloped road, formerly Hampshire Street, bisects the Property north of the former WSHC building (Fig. 2).

2.5 Current Use of the Adjoining Properties

The current use of the abutting properties are primarily residential apartments, vacant buildings, school buildings, a church, a police department, a health center, and commercial companies.

3. User Provided Information

3.1 Title Records

A title search was not performed as part of this ESA.

3.2 Environmental Liens or Activity and Use Limitations

There are no Activity and Use Limitations (AULs) on the Properties, nor are there any known environmental liens.

3.3 Specialized Knowledge

No specialized knowledge or experience related to the Property was provided by the user of this ESA (Feldco Development Corporation).

3.4 Commonly Known or Reasonably Ascertainable Information

The user of this ESA (Feldco Development Corporation) did not provide GEI with any commonly known or reasonably ascertainable information within the local community that is relevant to identifying RECs at the Property.

3.5 Valuation Reduction for Environmental Issues

According to the user of this ESA (Feldco Development Corporation), the purchase price for the Property reflects the fair market value.

3.6 Owner, Property Manager, and Occupant Information

The Property is owned by the Boston Redevelopment Authority. The Property is currently unoccupied.

3.7 Reason for Performing ESA

GEI has completed this ESA, on behalf of Feldco Development Corporation, as part of the due diligence for a potential real estate transaction.

4. Summary of Previous Environmental Reports

4.1 Phase I Initial Investigation Tier Classification (1998)

Weston & Sampson Engineers, Inc. (WSE) was retained by the BRA to perform a Phase I Initial Site Investigation at Parcel P-3 of the Property in 1996 and 1997. The report is included in Appendix B. During their site reconnaissance and records review, permits for seven historic storage tanks that were located on the Property were identified. These historic storage tanks included a 3,000-gallon fuel oil underground storage tank (UST) in the basement of the former WSHC (Table 2). No permits were identified for the abandonment or removal of these storage tanks. In addition, WSE observed persistent dumping of solid waste including fill, construction, and demolition debris throughout the site.

Between November 1996 to March 1997, WSE excavated 7 test pits, advanced 31 soil borings, and installed 12 monitoring wells throughout the eastern portion of the Property. Fig. 3 shows the limits of the WSE investigation.

WSE submitted soil and groundwater samples to AMRO Environmental Laboratories Corporation (AMRO) of Merrimack, New Hampshire, for an analysis of total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and RCRA 8 metals. Soil samples collected from the filled area to the north contained TPH, PAHs, and lead at concentrations which exceeded applicable Reportable Concentrations for S-1 soils (RCS-1). Additionally, certain PAHs exceeded applicable reportable conditions below the pavement southwest of the WSHC. Based on a gauging round of the monitoring wells in December 1996, WSE inferred a south-southeast groundwater flow direction at the Property.

BRA submitted a Release Notification Form (RNF) to DEP on April 14, 1997. The Massachusetts Department of Environmental Protection (MassDEP) consequently assigned release tracking number (RTN) 3-15009 to the release. In accordance with 310 CMR 40.1500, WSE completed a Numerical Ranking System Scoresheet (NRS) and Tier Classification based on the data collected during the Phase I investigation. Based on the NRS score of 143, the site was classified as a Tier II site.

4.2 Phase II Comprehensive Site Assessment and Phase III Remedial Action Plan (2002)

WSE was retained by the BRA to perform a Phase II Comprehensive Site Assessment and Phase III Remedial Action Plan the Property. The report is included in Appendix B. WSE conducted additional subsurface investigations on the Property, which included the advancement of soil borings, the installation of monitoring wells, and the collection of soil and groundwater samples for analysis of volatile petroleum hydrocarbons (VPH) including target VOCs, extractable petroleum hydrocarbons (EPH) including target PAHs, polychlorinated biphynels (PCBs), and RCRA 8 metals. Contaminants in the urban fill and stockpiles were predominantly TPH, PAHs, and lead located east of Vernon Street (Fig. 3). One soil sample collected east of Vernon Street also exceeded the Toxicity Characteristic Leaching Procedure (TCLP) hazardous waste threshold for lead. As a result of the chemical testing at the Property, WSE divided Parcel 3 into three areas (Fig. 3):

- Area 1: Approximately 1.5 acres, unpaved behind former Connolly's Tavern.
- Area 2: Approximately 1.0 acre, paved behind the former WSHC.
- Area 3: Approximately 5.5 acres, western portion.

WSE identified the MCP Site as the portion of the Property comprised of Area 1 and Area 2 . Based on the limited number of soil borings and soil samples, WSE excluded Area 3 from the MCP Site.

WSE conducted a Method 1 and Method 3 Risk Characterization at Areas 1 and 2. The results of their risk characterization indicated that a condition of No Significant Risk (NSR) did not exist at the Site. WSE proposed excavating the “hot spot” of lead-contaminated soil in Area 2 and placing an AUL on Area 1, which would restrict residential development.

The lead hot spot was not excavated and the AUL was not prepared for the MCP Site. The next regulatory deadline for the site was a Phase IV Remedial Implementation Plan (RIP) by 2003; which was never completed. The site is currently out of compliance with its MCP deadlines.

5. Records Review

5.1 Standard Environmental Records Sources

Environmental Data Resources (EDR) of Shelton, Connecticut conducted a search of federal and state databases for sites within approximately 1 mile of the Property. A copy of the EDR reports are in Appendix C.

The EDR reports were reviewed for sites that could potentially affect environmental conditions at the Property. Although we reviewed sites within approximately 1 mile of the Property, it is our opinion that sites greater than 0.125 mile from the Property are generally not likely to affect environmental conditions at the Property; therefore, they are not summarized below. Comprehensive listings of sites up to one mile from the Property are in the EDR Reports in Appendix C. Based on information provided by EDR, sites within 0.125 mile of the Property are summarized in Table 3. According to EDR, releases that have occurred on the Property include:

- The Property at Tremont & Whittier Streets is a MassDEP disposal site. MassDEP assigned RTN 3-15009 to the site for a release of PAHs, TPH, and lead on April 17, 1997. The site remains open with a Tier II classification. This MCP disposal site on the Property is considered a REC and is discussed further in Section 5.2.1.1.

Sites located beyond the Property but that may still affect environmental conditions at the Property include:

- The property at 1290 Tremont Street reported a release of OHM on July 13, 2010. MassDEP (RTN 3-29371). The site abuts the Property by approximately 25 feet to the west and is likely cross-gradient from the Property. However, due to its proximity, it has the potential to affect environmental conditions at the Property and is discussed further in Section 5.2.1.2.
- The property at 1177-1229 Tremont Street reported a release of OHM to MassDEP on January 15, 1991 (RTN 3-03429). The site is approximately 110 feet to the northwest and likely upgradient of the Property across Tremont Street, based on topography and according to EDR. The site has since achieved regulatory closure with a Response Action Outcome (RAO). Based on proximity to the Property it is discussed further in Section 5.2.1.3.
- The property at Whittier Street reported a release of OHM to MassDEP on July 15, 1988 (RTN 3-01645). The site is located approximately 145 feet east and upgradient from the Property. The current status of the site is MassDEP Not Disposal Site (DEPNDS) and is unlikely to affect conditions at the Property.

- The property at 75 New Dudley Street reported a release of OHM to MassDEP on July 15, 1988(RTN 3-01641). The site is approximately 250 feet southwest and likely cross-gradient from the Property. However, since the site contains MassDEP No Further Action (DEPNFA) status, it is unlikely to affect conditions at the Property.
- The property at Elmwood and New Dudley Street reported a release of OHM to MassDEP on March 12, 1999 (RTN 3-18113). The site is approximately 280 feet southwest and cross-gradient from the Property. However, the disposal site has achieved regulatory closure with a RAO and is unlikely to affect conditions at the Property.
- The Boston Housing Authority Apartment at 190 Ruggles Street reported a release of No. 4 fuel oil from a leaking underground storage tank (LUST) to MassDEP on September 15, 2005 (RTN 3-25237). The site is approximately 315 feet cross-gradient from the Property. The Site has been closed with a Response Action Outcome Not Required (RAONR) and unlikely to affect conditions at the Property.
- An apartment complex at 180 Ruggles Street reported a release of approximately 40 gallons of No. 4 fuel oil from a leaking aboveground storage tank (LAST) on March 3, 2011 (RTN 3-29839). The site is located approximately 340 feet northeast and cross-gradient from the Property. The Site has achieved regulatory closure with a RAO and is unlikely to affect conditions at the Property.
- The property at Ruggles and Tremont Street reported a release of oil from a LUST to MassDEP on October 15, 1988 (RTN 3-00739). The site is located approximately 555 feet northeast and upgradient of the Property. The disposal site has achieved regulatory closure with an AUL at the property. The site has the potential to affect conditions at the Property and is discussed further in Section 5.2.1.4.
- The Ruggles Street Massachusetts Bay Transportation Authority (MBTA) "T" Station at Ruggles and Forsyth Street reported a release of PAHs to MassDEP on July 10, 1999 during the removal of an UST (RTN 3-18303). The disposal site is located over 600 feet north and upgradient of the Property. Because it is upgradient, it has the potential to affect conditions and is discussed further in Section 5.2.1.5.

5.1.1 AULs and other Environmental Liens

There are no AULs for the Property, nor are there any known environmental liens.

There are 15 AULs within approximately 0.5 mile of the Property. Of these fifteen AULs, three are located within 0.25 mile of the Property and include the properties at the intersection of Tremont and Ruggles Streets (RTN 3-00739); New Dudley Street (RTN 3-12460); and the intersection of Ruggles and Leon Streets (RTN 3-22950). The AULs located at New Dudley Street (RTN 3-12460) and Ruggles and Leon Streets (RTN 3-22950) are located over 500 feet and likely downgradient or cross-gradient from the Property. Therefore these two sites are unlikely to affect environmental conditions at the Property. The AUL at Tremont and Ruggles Street (RTN 3-0739) is likely upgradient of the Property and is discussed further in Section 5.2.1.4.

5.2 Additional Environmental Records Sources

We reviewed the most recent, available MassDEP lists of confirmed disposal sites and reported releases in Boston, Massachusetts. We also reviewed the MassDEP historical releases database to identify releases that occurred between 1980 and 1993.

One historic release has been recorded within 0.125 mile of the Property:

- The property at 15 King Street reported a release of gasoline from abandoned gas tanks to MassDEP on June 8, 1987 (N87-0750). The disposal site has since been closed and is unlikely to affect conditions at the Property.

As identified in Section 5.1, there are twelve closed and one open MassDEP listed sites or spills within 0.125 mile of the Properties. One open site is on a portion of the Property (RTN 3-15009). Of the twelve closed sites, seven are likely cross-gradient or downgradient of the Property, have achieved regulatory closure with a RAO, and are unlikely to affect conditions at the Property. These seven disposal sites include Whittier Street (RTN 3-1645), New Dudley Street (RTN 3-1641), Elmwood and New Dudley Street (RTN 3-18113), 190 Ruggles Street (RTN 3-25237), 180 Ruggles Street (RTN 3-29839), 10 Whittier Street (RTN 3-12401), and Dudley Street (3-12460).

The disposal sites located on the Property (RTN 3-15009), 1290 Tremont Street (RTN 3-29371), 1177-1229 Tremont Street (RTN 3-3429), Tremont and Ruggles Street (RTN 3-0739), Ruggles and Forsyth Street (RTN 3-18303), and 1170 Tremont Street (RTN 3-11181) have the potential to affect environmental conditions at the Property and are discussed below.

5.2.1.1 The Property at Tremont & Whittier Street (RTN 3-15009)

The Property is a MassDEP disposal site (RTN 3-15009). Phase I and Phase II/III Investigations were performed at the Property in 1998 and 2002, respectively. These reports are previously discussed in Section 4.1 and 4.2. On November 7, 2014, GEI submitted a memorandum to Feldco Development Corporation to summarize the soil contaminant conditions at the Property after reviewing various environmental reports at the Property. The selected remedy for the MCP Site (Area 1 and Area 2) included excavating a “hot spot” in Area 2 and placing an AUL on Area 1, which would restrict residential development (Fig. 3). Cleanup of the MCP Site was to be completed by April 2003, however, it was not conducted and an AUL has not been placed on the MCP Site. The Property remains open with a Tier 2 Classification and is therefore considered a REC.

5.2.1.2 1290 Tremont Street (RTN 3-29371)

1290 Tremont Street is a MassDEP disposal site that abuts the Property to the west on Tremont Street. The property was formerly occupied by gasoline filling stations. On July 12, 2010, MassDEP assigned RTN 3-29371 to a release of VPH C_9-C_{10} aromatic fractions and 2-methylnapthalene at concentrations above the applicable RCS-1 standards collected from a soil boring in February 2010.

From May to June of 2010, Lightship Engineering, LLC (Lightship Engineering) performed additional subsurface investigations to better delineate the extent of the release and conducted a Method 3 Risk Characterization for the site. Lightship Engineering conducted an electromagnetic and ground penetrating radar survey to locate former USTs, advanced seven soil borings, installed two groundwater monitoring wells, and collected soil and groundwater samples for analyses. With the exception of the VPH C_5-C_8 aliphatic, C_9-C_{10} aromatic fractions and 2-methylnapthalene detected in soil samples, no target analytes were reported above applicable reportable concentrations. Based on a Method 3 Risk Characterization, the site posed a condition of NSR and was closed with a Class B-1 RAO. The release of OHM at 1290 Tremont Street is considered a HREC.

5.2.1.3 1177-1229 Tremont Street (RTN3-03429)

The property located at 1177-1229 Tremont Street is listed as a disposal site by MassDEP for the presence of petroleum hydrocarbons detected in the soil and groundwater at the property (RTN 3-03429). The site is located north of Tremont Street, approximately 125 feet from the Property. According to the Phase I Investigation performed by Rizzo Associates, Inc. (Rizzo) in July 1989, two gasoline services stations formerly existed at the site. From July 1989 to October 1994, Rizzo conducted subsurface investigations at the property. These investigations included the advancement of soil borings, test pits, installation of groundwater monitoring wells, and the collection of soil, groundwater, and soil gas samples for analysis. The investigations detected concentrations of TPH and VOCs above reportable concentrations in the northern portion of the site, as well as PAHs and lead associated in the fill material consistent throughout the site.

During an Interim Measure (IM) conducted at the site by McPhail Associates, Inc. (McPhail) in June and July 1995, five USTs were removed from the site. McPhail collected soil samples from the tank grave after the USTs were removed. Soil samples collected from the tank grave of a 1,500-gallon UST located in the northern end of the site indicated the presence of petroleum contamination, which was consistent with the previous findings of Rizzo. Based on a Method 3 Risk Characterization the site posed a condition of NSR and was closed with a Class A-2 RAO. The release of OHM at 1177-1229 Tremont Street is considered a HREC.

5.2.1.4 Tremont Street and Ruggles Street (RTN 3-0739)

The MBTA Parcel 18 and 18B is a disposal site located adjacent to the Ruggles Street “T” Station and approximately 150 feet upgradient of the Property. According to the City of Boston Assessors Department, the disposal site includes the five parcels from 1115-1175 Tremont Street. From 1987 to 1992, several environmental studies and remediation activities were performed by Haley & Aldrich, Inc. (H&A) for the redevelopment of the property. Results of laboratory testing found the soil to be contaminated with gasoline, kerosene, fuel oil, lubricating oils, low levels of pesticides, heavy metals, and PAHs. Laboratory analysis of groundwater samples collected from the site detected TPH, VOCs, metals, and pesticides above reportable concentrations MassDEP assigned RTN 3-0739 to the release on October 14, 1988. In June 1991, five USTs were removed from the parcel. Soil samples collected from the bottom and sidewalls of each tank excavation revealed elevated concentrations of TPH in the soil. From June 1997 to October 1998, Rizzo conducted additional subsurface investigations on both parcels (18 and 18B) of the site.

Various PAHs, metals, and TPH were detected in soil samples collected from Parcel 18 at concentrations which exceeded the applicable Method 1 cleanup standards. Rizzo performed a Method 3 Risk Characterization for Parcel 18 and demonstrated that a condition of NSR did not exist for unrestricted use of the site. With the implementation of an AUL, the site achieved regulatory closure with a Class A-3 RAO and is considered a CREC.

5.2.1.5 Ruggles Street and Forsyth Street (RTN 3-18303)

The MBTA Ruggles Street “T” Station located on Forsyth Street in Boston, MA is a MassDEP disposal site for a release of PAHs in soil during the removal of a 550-gallon No. 2 fuel oil UST in January 1999. The site is located approximately 950 feet upgradient of the Property. Rizzo was retained by the MBTA to observe the tank removal. Rizzo screened the soil using a photoionization detector (PID) and collected six soil samples that were submitted for analysis of VPH and EPH parameters with target VOCs and PAHs. The tank appeared to be structurally intact upon removal and all the PID readings were below 100 parts per million (ppm). However, PAHs exceeded applicable RCS-1 in several of the soil samples. MassDEP subsequently assigned RTN 3-18303 to the release.

MBTA contracted WSE to perform a Phase I – Initial Site Investigation to investigate the release. In June 2000, WSE performed subsurface investigations in the vicinity of the former UST excavation at the site, which included the advancement of four soil borings, the installation of four groundwater monitoring wells, soil and groundwater sampling and analyses, and a groundwater elevation survey. Based on a Method 1 Risk Characterization, the site posed a condition of NSR and was closed with a Class A-2 RAO. The extent of the contamination has been confined to the site and is unlikely to affect conditions at the Property.

5.2.1.6 1170 Tremont Street (3-11181)

1170 Tremont Street is a MassDEP disposal site located approximately 210 feet upgradient of the Property (RTN 3-11181). According to a Release Notification Form (RNF) submitted to MassDEP on March 18, 1997, a release of No. 2 fuel oil from an UST occurred at the site on June 21, 1994. A revised RAO Statement was submitted to MassDEP on August 3, 1994, which indicated that a No. 2 fuel oil tank was removed from the site along with 100 cubic yards (yd^3) of contaminated soil. The disposal site achieved regulatory closure with a Class A-2 RAO. Since contamination at the site was reduced to background levels, it is unlikely to affect environmental conditions at the Property.

5.3 Physical Setting Sources

5.3.1 Surface Topography

In general the topography at the Property slopes gently toward the northeast. However, the northeast portion of the Property, Area 1, contains a raised land surface, which is approximately 5 to 10 feet above the surrounding pavement (Fig. 3). Based on the United States Geological Survey Topographic Map for the South Boston Quadrangle, the surface elevations of the Properties range from approximately 10 to 20 feet above the National Geodetic Vertical Datum (NGVD) of 1988.

5.3.2 Geologic Setting

The Property is located throughout the Boston South Quadrangle (7.5 X 7.5 Minute Series), in eastern Massachusetts. According to the USGS Bedrock Geologic Map of Massachusetts, bedrock in the vicinity of the Property typically consists of conglomerate, sandstone, siltstone, argillite, and melaphyre of the Roxbury Conglomerate. Bedrock was not encountered during subsurface investigations; it is estimated to be 50 feet deep.

WSE performed subsurface at the Property from November 1996 to September 2001 (Fig. 3). Based on conditions observed during these subsurface investigations, the shallow subsurface in Area 1 and Area 2 of the Property consists of fill, clay, organics, glacial outwash sand, and glacial till as described below.

- Fill – A layer of fill was encountered immediately below the ground surface. The thickness of the fill was from 3 feet to 17 feet. This soil ranged from widely graded sand with gravel, to widely graded gravel with sand, and silty sand. Brick, concrete, glass, coal, wood, and asphalt fragments were encountered in the fill.
- Clay – A layer of sandy lean clay was encountered in some portions of the Property below the fill.

- Organics – Organic silt with layers of peat was encountered below the lean clay. This soil layer primarily consisted of low plasticity fines with a few plant fibers and layers of peat.
- Glacial Outwash Sand – A glacial outwash layer was encountered in some locations below the organics and consisted of widely graded sand to narrowly graded sand with varying amounts of silt and gravel.
- Glacial Till – A layer of glacial till was encountered below the glacial outwash. The glacial till generally consisted of very dense, light gray clayey sand and gravel.

5.3.3 Hydrogeologic Setting

Based on WSE's subsurface investigation, groundwater at the Property flows south to southeast. Regionally, groundwater flow is expected to be east towards Boston Harbor.

According to the MassGIS Site Scoring Map (Appendix D), the Property is not located within a Zone II Wellhead Protection Area, Sole Source Aquifer, an Interim Wellhead Protection Area (IWPA), a Potentially Productive Aquifer (PPA), or any Non Potential Drinking Water Source areas. There are no public or private water supply wells within 1-mile of the Property.

There are no wetlands, Natural Heritage and Endangered Species Program Priority or Estimated Habitats of Rare Wildlife, Vernal Pools, Certified Vernal Pools, or Areas of Critical Environmental Concern (ACEC) within 500 feet of the Property. There are Protected Open Spaces located east and south of the Property.

According to the reporting classification in the MCP, based on its location within 500 feet of a residence or residentially zoned area, the Property is classified RCS-1 for the purposed of reporting releases of OHM in soil. The Property is not located within 500 feet of a PPA, and therefore is classified RCGW-2 for reporting releases in groundwater.

5.4 Historical Use Information on the Properties

Historical use of the Property was obtained from Sanborn Fire Insurance Maps (Sanborn Maps) from 1888 to 2002 and aerial photographs taken periodically from 1938 to 2012. Sanborn Maps and aerial photographs are in Appendices E and F, respectively. A list of historic storage tanks is summarized in Table 2. Additional information for portions of the Property was provided by the City of Boston Inspectional Services Department (Appendix G) and is summarized briefly below.

The 1888 Sanborn Map shows the Property was developed by many residential, industrial, and commercial manufacturing companies. The northern portion of the Property south of Tremont Street contained Tremont Foundry Machine Company (Co.), Eastern Electric

Cable Co., St. John's Episcopal Church, and various stores and residential buildings. In the central portion of the Property, there were one to two-story residential and commercial buildings, along with the Roxbury Carpet Co. which was located adjacent to Vernon Street to the west. According to the Sanborn Map, coal and dye materials were stored in the four-story warehouse occupied by Roxbury Carpet Co. South of Roxbury Carpet Co., A.J. Tower, an oil and clothing manufactory, occupied three to four-story warehouse buildings.

By the 1919 Sanborn Map, Tremont Foundry Machine Co. and Eastern Electric Cable Co. were replaced by smaller manufacturing and machine shops. A scrap iron yard and market place were also developed on the northern portion of the Property. The Roxbury Carpet Co. contained a 4,500-gallon, 20,000-gallon, and 1,000-gallon tanks of unspecified contents along with many transformers. Also, A.J. Tower Oil Clothing Manufactory contained 500-gallon gasoline and a 4,500-gallon pressurized tank. The remaining developments on the Property remain largely unchanged as residential. Culvert Street to the east of the Property was changed to Whittier Street.

According to the Sanborn Map from 1950, many of the residences and stores were demolished in the southeastern portion of the Property and the four-story WSHC was constructed in 1933. It contained clinics, offices, a solarium, and a basement. An additional five oil tanks were located in the eastern portion of A.J. Tower Co. Roxbury Carpet Co. no longer operated on the Property and two laundry business were developed in the northern portion of the Property. There was no indication that the businesses contained dry cleaning services, however.

By 1988, all the structures on the Property were demolished and the Property remained vacant apart from the former WSHC located at 20 Whittier Street and a 1-story store located at 1182-1184 Tremont Street. According to permits provided by the City of Boston Inspectional Services Department 1182-1184 Tremont Street was occupied by a restaurant known as Connolly's Tavern. Additionally, a playground was built west of the health center on the Property.

By 1998, Connolly's Tavern was demolished and the Property remains largely unchanged and undeveloped until the present apart from vacant WSHC located at 20 Whittier Street.

Historically, the Property was occupied by industrial, commercial, and manufacturing businesses that contained and stored OHM. Therefore, the historical uses of the Property are considered an REC.

5.5 Historical Use Information on Adjoining Properties

Historical use of the adjoining Properties was obtained from Sanborn Maps from 1888 to 2002 and aerial photographs taken periodically from 1938 to 2012. Sanborn Maps and aerial photographs are in Appendices E and F, respectively. Additional information pertaining to the current use of adjoining properties was obtained during the site reconnaissance on January 22, 2016 and MassDEP on-line searchable sites database. The Sanborn Maps do not include information on portions of the western adjoining properties.

The land adjoining the Property was largely occupied by one to five-story commercial stores and residential buildings apart from the Whittier Machine Co. located east of the Property across Culvert Street starting in 1888.

By 1950, the developments located east of the Property across Whittier Street were demolished. The remaining adjoining properties remain largely unchanged apart from the development of the two-story Grant Memorial Church south of the Property. According to the 1964 Sanborn Map, three to seven-story brick apartment units from 15-31 Whittier Street were developed as a portion of the Whittier Street Apartment Complex. Also, a gasoline filling station was built across Tremont Street from the Property at approximately 1177-1189 Tremont Street. Additionally, according to an RAO Statement by Lightship Engineering in 2010 (Section 5.2.1.2), a gasoline filling stations formerly existed at 1290 Tremont Street from 1926 to the 1970s.

By 1988, a majority of the buildings north of the Property across Tremont Street were demolished and a four-story police headquarters was built by 1995. Additionally a day care center, community center, and Madison Park High School was constructed to the southwest of the Property and Grant Memorial Church was renamed Good Shepard Church.

By 2012, an NSTAR facility and the new Whittier Street Heath Center were constructed to the west of the Property. All the adjoining properties have remained largely unchanged from 2012 to the present. The historical uses as former gasoline filling stations and associated releases of OHM at the abutters located at 1290 Tremont Street and 1177-1229 Tremont Street are considered HRECs as previously described in Section 5.2.1.2 and 5.2.1.3, respectively.

6. Interviews

6.1 Interview with Current Owner and Property Manager

During the site reconnaissance, GEI interviewed Francis Collins of the BRA. Mr. Collins was not aware of operations with the potential to adversely impact the environmental condition of the Properties. Information obtained from Mr. Collins is presented in Section 7 of this report.

6.2 Interview with Current Occupants

The Property is currently unoccupied and therefore current occupants were not available for interview.

6.3 Interview with Past Owner/Occupants

Past owners and occupants of the Properties were not available for interview.

6.4 Interview with Local Government Officials

We requested available files, or reviewed physical files on-line for the Properties from the following City of Boston offices:

- Assessor’s Office
- Inspectional Services Department
- Water and Sewer Commission
- Public Health Commission
- Fire Department, Fire Prevention Division

Copies of pertinent records from these offices are in Appendix G.

6.4.1 Assessor’s Office

According to the City of Boston Online Assessor’s website accessed on February 1, 2016, the Property is owned by the BRA. Previous ownership was not provided. Table 1 shows current ownership information for the Property and abutters.

6.4.2 Inspection Services Department

The City of Boston maintains records of historical and current building permits that can be accessed online. Permits were available for the following addresses on the Property;
20 Whittier Street, 41 Hampshire Street, 1182 Tremont Street, and 1234 Tremont Street.

Available permits for the former WSHC located at 20 Whittier Street included permits to build in 1932 and 1936, permits to install and alter an elevator in 1932 and 1951, public safety inspection and a notice of violation in 1965, a plumbing and permit to perform office work in 1980, and a demolition permit in 2001.

Available permits for the property at 1182 Tremont Street included permits to build in 1882, inspection certificates in 1958 and 1997, notice of violation in 1958, a gas fitting permit in 1994, and a demolition permit in 1998.

One permit for building alterations was available for the property located at 61 Hampshire Street in 1967.

Available permits for the property located at 1234 Tremont Street included a permit to build in 1949 and permits to erect signs in 1948 and 1959. These permits indicated that property was occupied by a used car lot and a car wash during these times. Due to the use of OHM associated with automobile shops and car washes, the historic use of the property at 1234 Tremont is considered a REC.

6.4.3 Water and Sewer Commission

We requested available records for the Property from the City of Boston Water and Sewer Commission. On January 28, 2016, the Water and Sewer Commission provided water and sewer utility plans for the Property. The Property is currently connected to municipal water and sewer utilities.

6.4.4 Public Health Commission

We requested available records for the Property from the City of Boston Public Health Commission. They provided a letter on January 22, 2016 that explained they had no asbestos permits, environmental hazard inspections, violations, enforcement activity case files, or MassDEP correspondence for the Property.

6.4.5 Fire Department, Fire Prevention Division

We requested available records for the Property from the City of Boston Fire Prevention Office. We received an email on January 22, 2016 that the Fire Prevention Office had no information on aboveground storage tanks (ASTs) or USTs for the Property.

7. Site Reconnaissance

GEI visited the Property on January 22, 2016. The purpose of the site reconnaissance was to collect current Property information, document Property conditions, and observe and document conditions related to the potential presence of OHM. During the site reconnaissance, we were accompanied by Francis Collins of the BRA.

During the site reconnaissance, we observed only the exterior of the Property. We could not access the former WSHC building located at 20 Whittier Street. Photographs taken during the Property visit are in Appendix H.

7.1 Building Interior

7.1.1 Building Description

The former WSHC building is a four-story brick building. According to Mr. Collins, the building has been vacant for over ten years and is currently vandalized. We were unable to observe the interior of the building due to unsafe conditions inside the building. However, the exterior was in good condition, with no indication of deterioration.

7.1.2 Building Heating and Cooling

According to Mr. Collins, the building is not currently heated. However, a vent and fill pipe was observed on the exterior of the northern wall of the building. This indicates that a fuel oil storage tank likely existed in the building. This is consistent with the 3,000-gallon fuel oil UST observed by WSE during their Phase I Investigations at the Property in 1997 (Section 4.1).

7.1.3 Stains or Corrosion

The interior of the building was not observed.

7.1.4 Odors

The interior of the building was not observed.

7.1.5 Drains, Sumps or Pools of Liquid

The interior of the building was not observed.

7.2 Property Exterior Observation

7.2.1 Property Description

The Property is approximately 334,546 square feet or 7.7 acres. The former WSHC located in the southeast portion of the Property at 20 Whittier Street is the only remaining structure. The Property is bounded by Tremont Street to the north, Whittier Street to the east, Downing Street to the south, and an unnamed road to the west that accesses the parking lots behind the Madison Park High School. Additionally, Vernon Street bisects the eastern and western portions of the Property. In the eastern portion of the Property, an undeveloped road, formerly Hampshire Street, bisects the Property north of the former WSHC building (Fig. 2).

According to the MCP site designation of the Property by WSE in 2000 (Section 4.2), Area 1 is approximately 1.5 acres located in the northeast portion of the Property (Fig. 3). Area 1 contains a raised land surface of approximately 5 to 10 feet above the surrounding pavement, except for the northeast portion which is landscaped and at normal grade. Dumped items observed include metal, concrete, and brick debris, tires, and trash. The eastern portion of Area 1 was observed to be overgrown with trees, while the western portion is cleared of vegetation. According to Mr. Collins, these areas were cleared to prevent homeless from camping out. Additionally, in the southwest portion of Area 1, thirteen approximately 8-foot diameter concrete pipe sections were observed.

Area 2 is approximately 1.0 acres located south of Area 1 and east of Vernon Street on the Property. The four-story brick WSHC building is located on the eastern portion and is surrounded by paved asphalt. The northern half of the western portion of Area 2 has been cleared of vegetation, while the southern half remains overgrown with trees. Dumped debris was also observed throughout the western portion of Area 2 and included brick, metal, concrete, and wood debris. Additionally, a few corroded 1-gallon containers, 5-gallon buckets containing unknown substances, and an electrical box were observed in the southwest corner of Area 2.

Area 3 is approximately 5.5 acres west of Vernon Street on the Property. It is primarily paved asphalt parking lots. Area 3 also contains some landscaped areas and a small community garden (Whittier Community Garden).

7.2.2 Pits, Ponds, and Lagoons

We did not observe pits, ponds, or lagoons at the Property.

7.2.3 Stained Soil or Pavement

We did not observe significantly stained soil or pavement on the Property. However, soil and pavement was covered by snow in many areas of the Property.

7.2.4 Odors and Stressed Vegetation

We did not observe odors or significantly stressed vegetation on the Property.

7.2.5 Solid Waste

We did not observe any solid waste containers onsite.

7.2.6 Wastewater Disposal

Stormwater drains were observed in areas of pavement throughout the Property including in the pavement located north and south of the former WSHC building and the parking lots located west of Vernon Street. The Property is connected to the City of Boston sanitary sewer.

7.2.7 Wells

No drinking water wells were observed on the Property. Approximately nine groundwater monitoring wells were observed throughout the Property. These wells were likely installed during subsurface investigations by WSE from November 1996 to March 2001 (Section 4.1 and 4.2).

7.2.8 Septic Systems

We did not observe evidence of septic systems or cesspools. The Property building is connected to the City of Boston sanitary sewer system.

7.3 Oil/Chemical Storage

7.3.1 Current Chemical Storage/Waste Generation

The vent and fill pipe observed along the northern exterior of the former WSHC building indicates the likely presence of a current or former oil storage tank inside the building. Additionally, a stained two 5-gallon bucket and three 1-gallon corroded containers were observed in the southern portion of the Property adjacent to Vernon Street to the east.

7.3.2 Past Chemical Storage/Waste Generation

As described in Section 5.4, the Property was historically occupied by residential, commercial, industrial, and manufacturing businesses. According to the Phase I conducted by WSE (Section 4.1) and the Sanborn Maps obtained by EDR (Appendix C), some of these former buildings stored OHM. A summary of the previous chemical storage on the Property is included in Table 2.

7.4 On-Site Storage Tanks

No storage tanks were observed during the site reconnaissance on January 22, 2016. However, we observed evidence of a current or former storage tank existing in the former WSHC as a result of a fill and vent pipe located on the northern exterior of the building. We were unable to confirm whether a storage tank exists in the building.

7.5 PCB-Containing Equipment

We did not observe any transformers or equipment suspected of containing PCBs on the Property. Furthermore, no equipment suspected of containing PCBs was observed on the Property.

7.6 Surficial Dumping

We observed dumped debris throughout the Property but mostly located in the undeveloped portions of Area 1 and Area 2. Dumped debris included trash, wood, concrete, brick, metal, and building fragments along with aluminum cans and 5-gallon buckets.

8. Findings

GEI Consultants, Inc. has completed an ASTM Phase I Environmental Site Assessment (ESA), on behalf of Feldco Development Corporation, for the property located at Parcel P-3 on Tremont and Whittier Streets in Boston, Massachusetts (the Property).

Recognized Environmental Conditions

Based on our evaluation of current Property conditions and the review of available records for the Property, we identified the following RECs, defined as evidence of past, current or future potential releases of OHM, at the Property:

- Starting in the 1890's to 1998 the Property has been occupied by different industrial, commercial, and manufacturing companies that stored and used OHM. Tremont Foundry Machine Company (Co.), Eastern Electric Cable Co., The Roxbury Carpet Co., A.J. Tower Oil Clothing Manufactory, the former Whittier Street Health Center (WSHC), and Connolly's Tavern formerly stored and utilized various forms of OHM at the Property. Although subsurface investigations have been conducted on the eastern portion of the Property, the western section of the Property (Area 3) has not been investigated for releases of OHM. In particularly, the former Roxbury Carpet Company parcel has not been investigated.
- Area 1 and Area 2 of the Property comprise a disposal site identified by the MassDEP on-line database. MassDEP assigned release tracking number (RTN) 3-15009 for the release of TPH, certain PAHs, and lead in soil on April 14, 1997. The disposal site remains open with a Tier II Classification. Although an AUL has been recommended for the disposal site, it has yet to be implemented at the Property to allow for its closure.

Historic Recognized Environmental Conditions

We identified five historic RECs (HRECs), defined as a past release of OHM that has achieved regulatory closure without the use of required controls or conditions (e.g. AULs, engineering controls, etc.) at the Property:

- During subsurface investigations in February 2010 at a former gasoline filling station located at 1290 Tremont Street, concentrations of VPH C_9-C_{10} aromatic fractions and 2-methylnathalene were detected in the soil at concentrations above applicable reportable concentrations. MassDEP assigned RTN 3-29371 to the release. The disposal site abuts the Property to the west. Following additional subsurface investigations, a Method 3 Risk Characterization concluded that the site posed a condition of NSR and was closed with a Class B-1 RAO.

- The property located at 1177-1229 Tremont Street is a disposal site (RTN 3-3429). The site is located north of the Property across Tremont Street and was formerly occupied by gasoline filling stations. A release of TPH and VOCs to soil was reported to MassDEP on January 15, 1991. It was concluded that the site posed a condition of NSR and was closed with a Class A-2 RAO.
- During the removal of a 550-gallon No. 2 fuel oil UST at the MBTA Ruggles Street “T” Station located on Forsyth Street in January 1999, soil samples collected in the UST grave exceeded reportable concentrations for PAHs (RTN 3-18303). The site is located approximately 950 feet north of the Property. Following subsurface investigations, a Method 1 Risk Characterization concluded that the site posed a condition of NSR and was closed with a Class A-2 RAO.
- The property located at 1170 Tremont Street is a disposal site (RTN 3-11181). The site abuts the Property to the northeast. A release of No. 2 fuel oil occurred on March 18, 1997 and was reported to MassDEP. The storage tank and approximately 100 yd^3 of contaminated soil were removed and transported offsite. The site was cleaned up to background and was closed with a Class A-2 RAO.

Controlled Recognized Environmental Conditions

We identified the following controlled RECs (CRECs), defined as a past release of OHM that has achieved regulatory closure with the use of required controls or conditions (e.g. AULs, engineering controls, etc.) at the Property:

The MBTA Parcel 18 located adjacent to the Ruggles “T” Station is a disposal site (RTN 3-00739). The site is approximately 150 feet north of the Property. Various PAHs, metals, and TPH were detected in soil above reportable concentrations at the property. Based on a Method 3 Risk Characterization and an AUL, the site posed a condition of NSR and was closed with a Class A-3 RAO.

9. Deviations

Limitations and exceptions are discussed in Section 1.4. In addition, we identified the following data gaps associated with the findings of the Phase I ESA:

- The absence of historic documents for the Property and abutters at municipal offices.
- Inability to access the interior of the former WSHC building located at 20 Whittier Street due to safety concerns.
- Snow cover prevented us from seeing some of the soil.
- Uncertainty regarding whether certain USTs or ASTs have been removed from the Properties or abutters.

10. Additional Services

No additional services were performed as part of the Phase I ESA.

11. Environmental Professionals Statement

Resumes for staff involved in the preparation of this report are attached in Appendix I.
To the best of our professional knowledge and belief, we meet the definition of an Environmental Professional, as defined in 40 CFR 312.10. We have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the Property. We have developed and performed all the appropriate inquiries in conformance with the standards and practices set forth in 40 CFR 312.

12. References

EDR (2016). The EDR Radius Map™ Report with Geocheck®, Feldco Development, Tremont St./Whittier St., Boston, MA 02120 Inquiry Number 4513182.2s, Environmental Data Resources Inc., Shelton, Connecticut, January 14, 2016.

EDR (2016). The EDR Aerial Photo Decade Package, Feldco Development, Tremont St./Whittier St., Boston, MA 02120 Inquiry Number 4513182.5, Environmental Data Resources Inc., Shelton, Connecticut, January 14, 2016.

EDR (2016). EDR Certified Sanborn® Map Report, Feldco Development, Tremont St./ Whittier St., Boston, MA 02120 Inquiry Number 4513182.3, Environmental Data Resources Inc., Shelton, Connecticut, January 14, 2016.

GEI (2016). Site reconnaissance on January 22, 2016.

GEI (2016). City of Boston Assessor’s Office online database accessed on February 1, 2016.

GEI (2016). Email correspondence with the City of Boston Board of Health Commission on January 14 and 22, 2016.

GEI (2016). City of Boston Building and Inspection Services Department online database accessed on January 25, 2016 and February 2, 2016.

GEI (2016). Email correspondence with the City of Boston Fire Prevention Office on January 14 and 22, 2016.

GEI (2016). Email correspondence with the City of Boston Water and Sewer Department on January 25 and 28, 2016.

MassDEP (2016). MassDEP online database as of February 1, 2016.

MassDEP (2016). MassDEP Historic Release and Spills database accessed on February 1, 2016.

USGS (1983). “Bedrock Geologic Map of Massachusetts,” Department of the Interior United States Geological Survey, 1983.

USGS (2015). Boston South Quadrangle, Massachusetts, 7.5-Minute Series, 1:24,000, United States Department of the Interior - United States Geological Survey, 2015.

Tables

Table 1. Summary of Property Abutters

Phase I Environmental Site Assessment
Tremont Street & Whittier Street
Boston, Massachusetts

Subject Property	Abutting Property			
Address/ Parcel ID	**Direction**	**Address**	**Parcel ID**	**Owner**
Tremont St / 902980100	Northern Abutter	1176-1158 Tremont Street	902643000	City of Boston
		1175 Tremont Street	902704050	Northeastern University
		1 Schroeder Place	902771010	City of Boston
	Eastern Abutter	1290 Tremont Street	902980081	Bay State Physical Therapy
		1290 R Tremont Street	902951000	Boston Edison Company
		Linden Park Street	902951025	Boston Redevelopment Authority
		Prentiss Street	902819000	Mass Bay Transportation Authority
		Tremont Street	902980050	Commonwealth of Massachusetts
	Western Abutter	Pawning Street	902667000	Boston Redevelopment Authority
		Cabot Street	902668000	
		Downing Street	902678000	
		137 Vernon Street	902676000	
		Vernon Street	902677000	
		129 Vernon Street	902674000	Good Shepherd Church of God
	Southern Abutter	55 Malcolm X Boulevard	902980000	City of Boston

Notes:

1. Information obtained from the City of Boston Assessor's Office on-line database on January 20, 2016.

Table 2. Summary of Past Chemical Storage

Phase I Environmental Site Assessment

Tremont Street & Whittier Street

Boston, Massachusetts

Subject Property	Former Address within Property	Name of Registrant	Type of Fuel/Quantity	Number of Tanks	Date
Tremont St / 902980100	20 Whittier Street	City of Boston Health Unit	3,000-gallon fuel oil	1	6/30/1996
	1176 Tremont Street	Estate of William B Rice	1,500-gallon gasoline	1	12/24/2019
		Henry D. Mac Ritchie	acetylene and oxygen	1	10/9/1933
	1178-1180 Tremont Street	Greenlow Motor Parts	550-gallon fuel oil	1	10/23/1961
	1184 Tremont Street	Connolly's Café	Cert. of Occupancy	1	1/4/1983
	1186 Tremont Street	Paul George Realty	550-gallon fuel oil	1	NA
		Hub Refrigeration Co.	550-gallon fuel oil	1	3/16/1965
	36-40 Culvert / Whittier Street	NA	Coal Storage	2	1888-1919
	84-130 Hampshire Street	Roxbury Carpet Company	Coal Storage	7	1888-1919
			20,000 gallon	1	1919-1964
			4,500-gallon pressurized	3	1919-1964
	30 Simmons Street	A.J. Tower Company	Coal Storage	2	1919-1950
			Oil tanks	5	1919-1964
			500-gallon gasoline	1	1919-1950
			4,500-gallon pressurized	2	1919-1964

Notes:

1. Information obtained from the Sanborn Fire Insurance Maps (Sanborn Maps) provided by Environmental Data Resources (EDR) reports for the property at Tremont St. & Whittier St. on January 14, 2016.
2. Information obtained from the Phase I Initial Investigation/Tier Classification Parcel P-3, Tremont / Whittier Street completed on April 1998 by Weston & Sampson Engineers, Inc.

Table 3. Summary of Federal and State Sites Database Search
Within 0.125 Miles of the Property

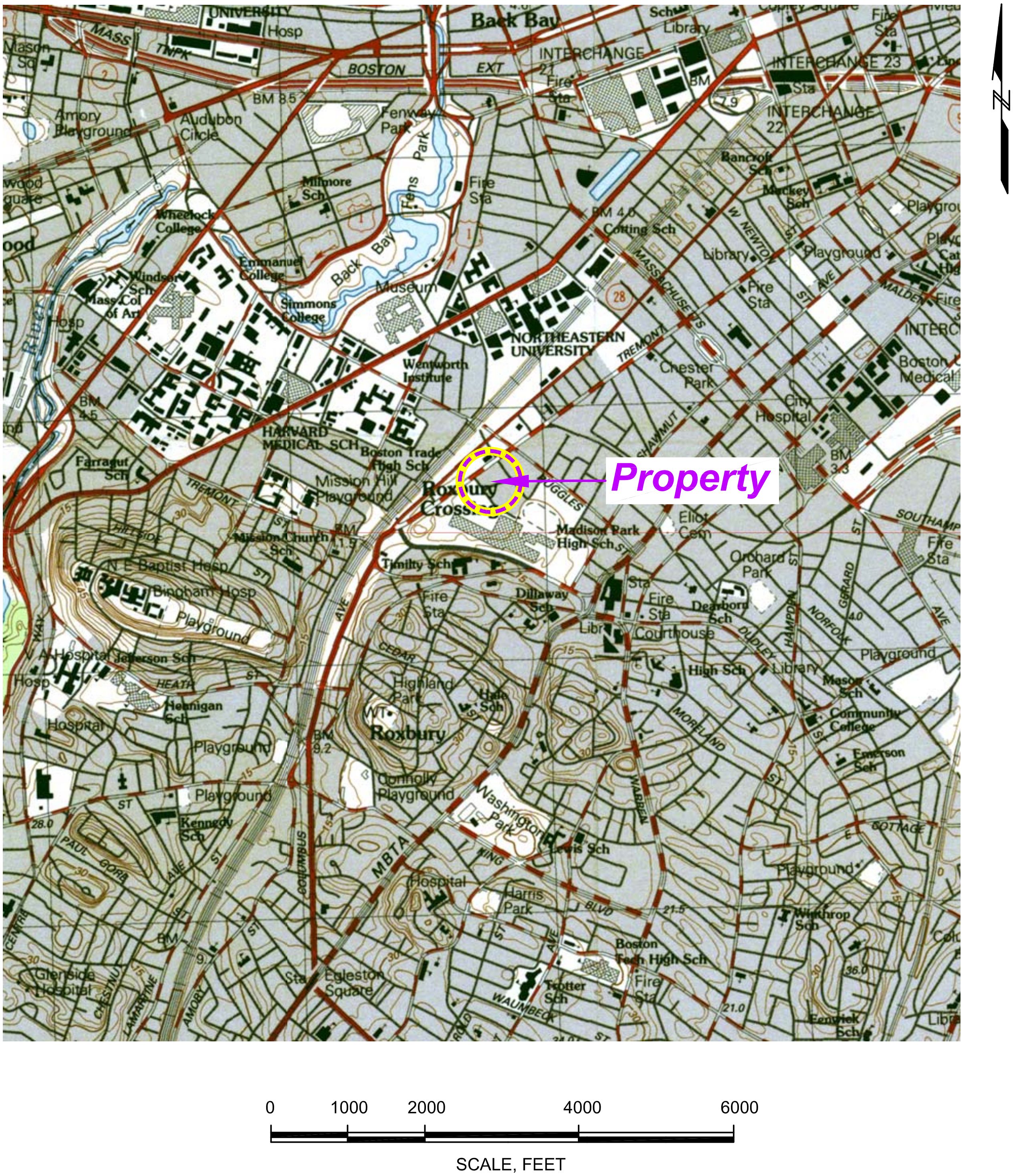
Phase I Environmental Site Assessment
Tremont Street & Whittier Street
Boston, Massachusetts

Address	Federal and State Listed Sites within 1/8 mile of the Properties							
	Distance from Site to Closest Property (miles)	Site Type	Date	RTN/ID#	Chemical Type	Compliance Statues	Groundwater Flow Relative to Property	REC / HREC / VEC
Parcel P-3 Tremont W	0.003	SHWS, RELEASE, ENF	4/14/1997	3-15009	PAH, Lead, TPH	Tier II	PROPERTY	REC
1234 Columbus Ave	0.004	RCRA NonGen / NLR	5/31/1988	1000165298	Hazardous Material	NA	Downgradient	NA
		FTTS, FINDS	8/15/1995	MAD985271600	NA	NA		
1290 Tremont St	0.005	SHWS, RELEASE	7/13/2010	3-29371	Oil	RAO (B1)	Cross-gradient	HREC
1199 Tremont St	0.021	HW GEN	NA	MV6173434690	Hazardous Material	NA	Upgradient	NA
1177-1229 Tremont St	0.021	SHWS, RELEASE	1/15/1991	3-03429	Unknown	RAO (A2)	Upgradient	HREC
Tremont & Ruggles St	0.021	CERCLIS-NFRAP	4/9/1990	MAD985278076	NA	NA	Upgradient	NA
Whitter St	0.026	SHWS, RELEASE	7/15/1988	3-01645	Unknown	TCTRNS	Upgradient	NA
New Dudley St	0.048	SHWS, RELEASE	7/15/1988	3-01641	Unknown	DEPNFA	Cross-gradient	NA
Elmwood and New Dudley St	0.053	SHWS, RELEASE	3/12/1999	3-18113	Oil	RAO (A2)	Cross-gradient	NA
190 Ruggles St	0.060	LUST, RELEASE	10/12/2005	3-25237	No. 4 fuel oil	RAONR	Downgradient	NA
180 Ruggles St	0.064	SHWS, RELEASE, LAST	3/3/2011	3-29839	No. 4 fuel oil	RAO (A2)	Downgradient	NA
75 Malcolm X Blvd	0.065	HW GEN	NA	MV6176358970	Hazardous Material	NA	Downgradient	NA
55 Malcolm X Blvd	0.079	HW GEN	NA	MV6176359932	Hazardous Material	NA	Downgradient	NA
Tremont St Ruggles St	0.105	SHWS, RELEASE, LUST, INST CONTROL	10/15/1988	3-0739	Oil	RAO (A3)	Upgradient	HREC/REC
Ruggles and Forsyth St	0.115	SHWS, RELEASE	6/10/1999	3-18303	Oil	RAO (A2)	Upgradient	HREC

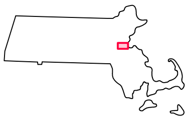
General Notes:

1. DEPNFA = MassDEP No Further Action Required
2. LUST = Leaking Underground Storage Tank
3. LAST = Leaking Aboveground Storage Tank
4. NA = Not Applicable or Not Available
5. RAO = Response Action Outcome
6. RAONR = Response Action Outcome Not Required
7. SHWS = State Hazardous Waste Sites
8. UST = Underground Storage Tank
9. ENF = Enforcement Action Cases
10. HW GEN = Hazardous Waste Generator
11. RCRA = Resource Conservation and Recovery Act
12. NonGen / NLR = Database that includes sites which generate, transport, store, treat an/or dispose of hazardous waste.
13. REC = Recognized Environmental Concern
14. HREC = Historic Recognized Environmental Concern
15. VEC = Vapor Encroachment Concern
16. TCTRNS = Tier Classified Transition Sites
17. Information obtained from Environmental Data Resources (EDR) reports for the property at Tremont St. & Whittier St. on January 14, 2016.

Figures



This Image provided by MassGIS is from U.S.G.S.
Topographic 7.5 X 15 Minute Series
Boston South, MA Quadrangle, 1987.
Datum is National Geodetic Vertical Datum (NGVD).
Contour Interval is 3 Meters.



MASSACHUSETTS
QUADRANGLE LOCATION

ASTM Phase I Environmental Site Assessment
Tremont Street & Whittier Street
Boston, Massachusetts

Feldco Development Corporation
Boston, Massachusetts

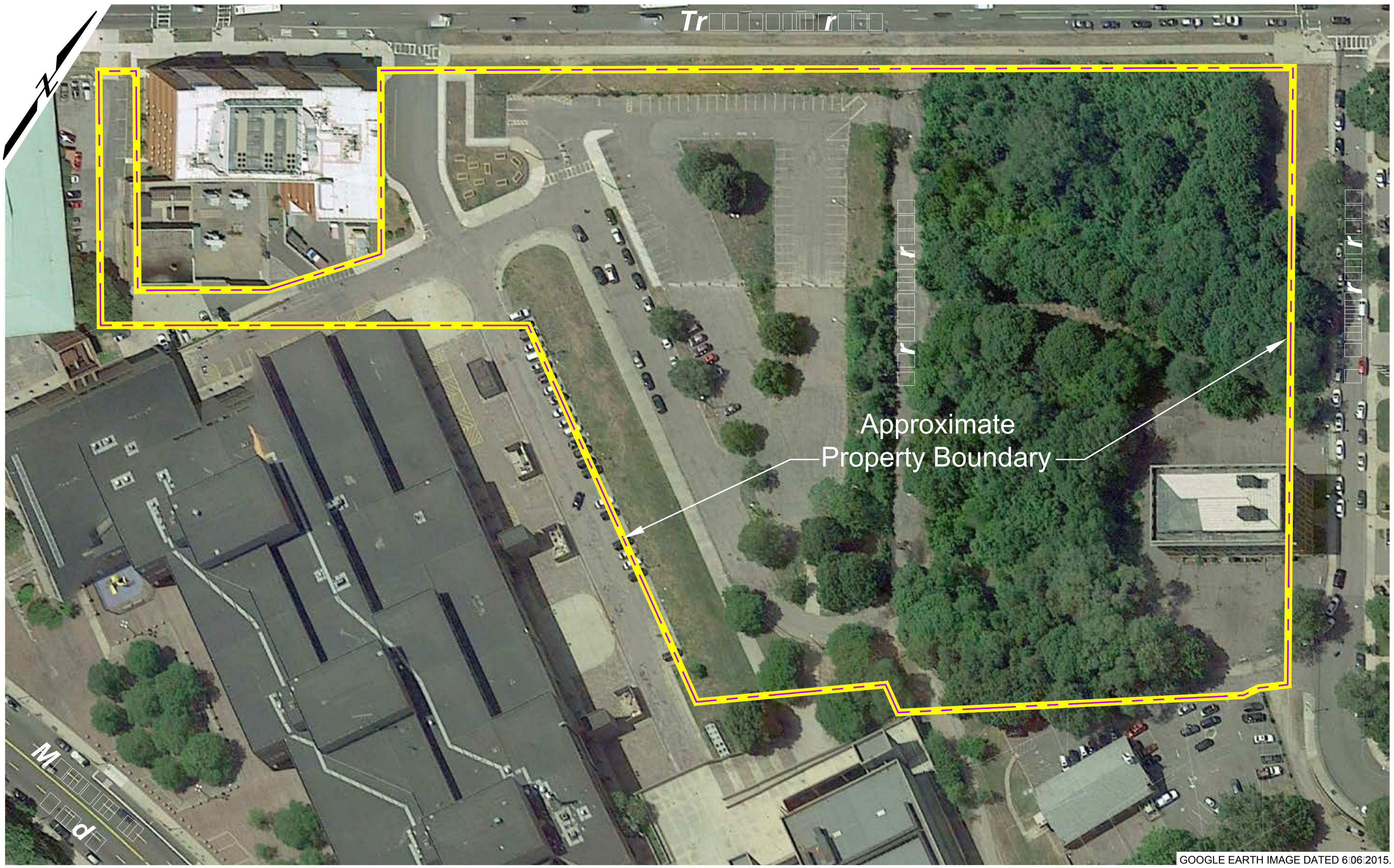
GEI Consultants

Project 132673-3

PROPERTY
LOCATION MAP

February 2016

Fig. 1



GOOGLE EARTH IMAGE DATED 6□06□2015.

0 120 2□0

Approximate Scale, Feet

ASTM Phase I Environmental Site Assessment
Tremont Street □ Whittier Street
Boston, Massachusetts

Feldco Development Corporation
Boston, Massachusetts

GEI Consultants

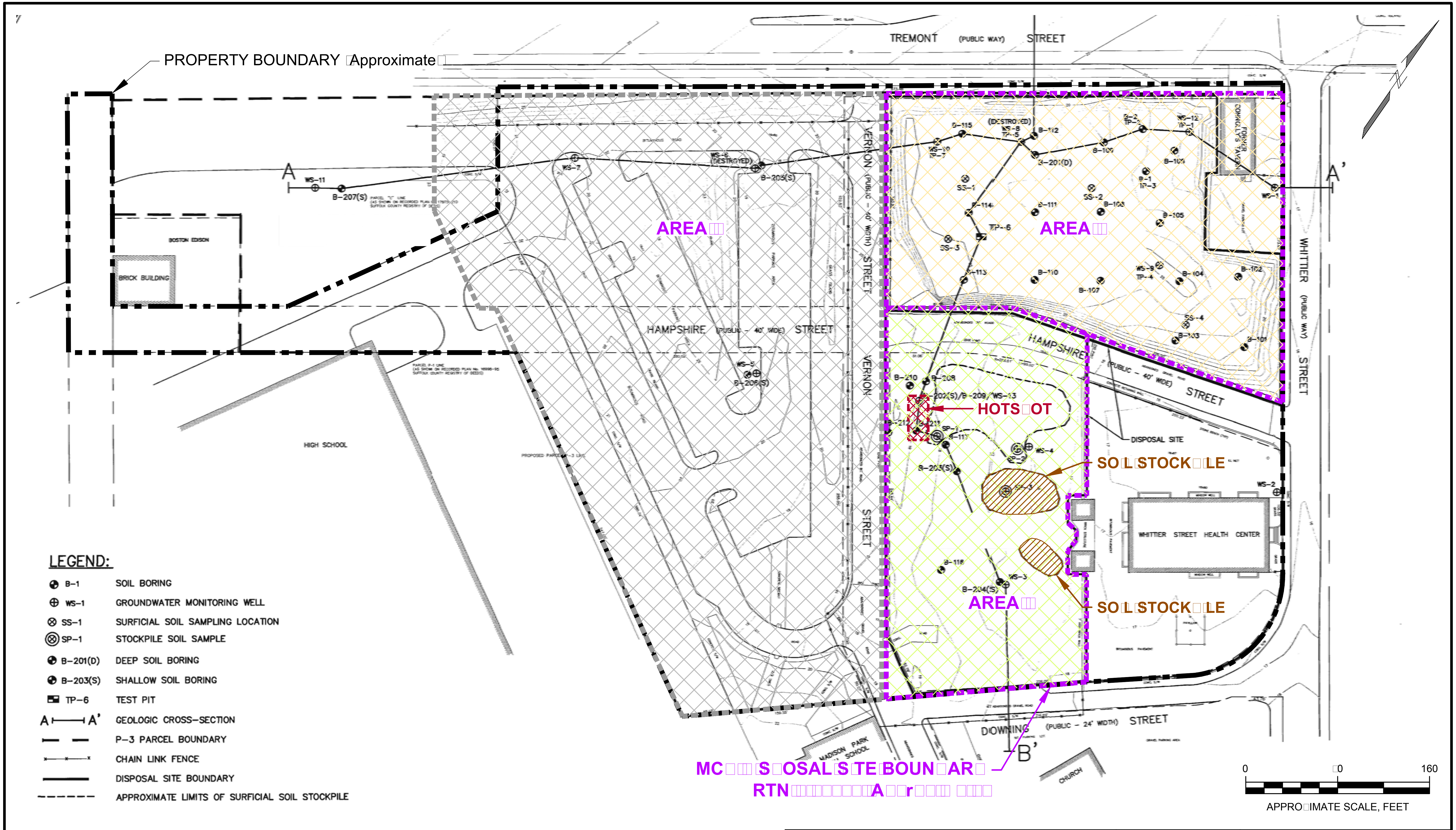
Project 1326□3-3

PROPERTY PLAN

February 2016

Fig. 2

\\bos1v-□s02\ M:\DRAFTING\2013\1326□3\1326□33\1326□33-01.d□g - 1□2□2016



NOTE:

1. BASE PLAN FROM FIGURE TITLED *"FIG. 2 ROXBURY, MASSACHUSETTS, BRA PARCEL P-3, SITE PLAN,"* PREPARED BY WESTON [illegible] SAMPSON ENGINEERS, INC. AND DATED MARCH 2002.

ASTM Phase I Environmental Site Assessment Tremont Street [illegible] Whittier Street Roxbury, Massachusetts	GEI Consultants	MCP SITE INVESTIGATION PLAN
Feldco Development Corp. Cambridge, Massachusetts	Project 1326[illegible]3-3	February 2016 Fig. 3

M:\DRAFTING\2013\1326[illegible]3\1326[illegible]33\1326[illegible]33-02

APPENDIX 6

CLIMATE CHANGE CHECKLIST

Climate Change Preparedness and Resiliency Checklist for New Construction

In November 2013, in conformance with the Mayor's 2011 Climate Action Leadership Committee's recommendations, the Boston Redevelopment Authority adopted policy for all development projects subject to Boston Zoning Article 80 Small and Large Project Review, including all Institutional Master Plan modifications and updates, are to complete the following checklist and provide any necessary responses regarding project resiliency, preparedness, and to mitigate any identified adverse impacts that might arise under future climate conditions.

For more information about the City of Boston's climate policies and practices, and the 2011 update of the climate action plan, *A Climate of Progress*, please see the City's climate action web pages at http://www.cityofboston.gov/climate

In advance we thank you for your time and assistance in advancing best practices in Boston.

Climate Change Analysis and Information Sources:

1. Northeast Climate Impacts Assessment (www.climatechoices.org/ne/)
2. USGCRP 2009 (http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/)
3. Army Corps of Engineers guidance on sea level rise (http://planning.usace.army.mil/toolbox/library/ECs/EC11652212Nov2011.pdf)
4. Proceeding of the National Academy of Science, “Global sea level rise linked to global temperature”, Vermeer and Rahmstorf, 2009 (http://www.pnas.org/content/early/2009/12/04/0907765106.full.pdf)
5. “Hotspot of accelerated sea-level rise on the Atlantic coast of North America”, Asbury H. Sallenger Jr*, Kara S. Doran and Peter A. Howd, 2012 (http://www.bostonredevelopmentauthority.org/planning/Hotspot of Accelerated Sea-level Rise 2012.pdf)
6. “Building Resilience in Boston”: Best Practices for Climate Change Adaptation and Resilience for Existing Buildings, Linnean Solutions, The Built Environment Coalition, The Resilient Design Institute, 2103 (http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf)

Checklist

Please respond to all of the checklist questions to the fullest extent possible. For projects that respond “Yes” to any of the D.1 – Sea-Level Rise and Storms, Location Description and Classification questions, please respond to all of the remaining Section D questions.

Checklist responses are due at the time of initial project filing or Notice of Project Change and final filings just prior seeking Final BRA Approval. A PDF of your response to the Checklist should be submitted to the Boston Redevelopment Authority via your project manager.

Please Note: When initiating a new project, please visit the BRA web site for the most current Climate Change Preparedness & Resiliency Checklist.

A.1 - Project Information

Project Name:	**Tremont Crossing**
Project Address Primary:	**Tremont Street and Whittier Street**
Project Address Additional:	**Parcel P-3**
Project Contact (name / Title / Company / email / phone):	**Jeffrey Feldman, Feldco Development, jfeldman@feldwest.com, 617.982.6962**

A.2 - Team Description

Owner / Developer:	**P-3 Partners, LLC**
Architect:	**Cambridge Seven Associates**
Engineer (building systems):	**WSP | Parsons Brinckerhoff**
Sustainability / LEED:	**Cambridge Seven Associates**
Permitting:	**Feldco Development**
Construction Management:	**TBD**
Climate Change Expert:	**N/A**

A.3 - Project Permitting and Phase

At what phase is the project – most recent completed submission at the time of this response?

PNF / Expanded PNF Submission	**Draft** / Final **Project Impact Report Submission**	BRA Board Approved	Notice of Project Change
Planned Development Area	BRA Final Design Approved	Under Construction	Construction just completed:

A.4 - Building Classification and Description

List the principal Building Uses:	**Residential, Retail, Office, Parking Garage and Museum & Art Studio.**
List the First Floor Uses:	**Retail, Office Lobby, Parking Garage and Residential Lobbies, Museum lobby.**

What is the principal Construction Type – select most appropriate type?

Wood Frame	Masonry	**Steel Frame w/ concrete deck**	**Concrete (parking garage)**

Describe the building?

Site Area:	**315810** *SF*	Building Area:	**1,293,700** *GSF*
Building Height:	**Up to 278.0** *Ft.*	Number of Stories:	**3-22** *Flrs.*
First Floor Elevation (reference Boston City Base):	**18' – 28'** *Elev.*	Are there below grade spaces/levels, if yes how many:	**No** / *Number of Levels*

A.5 - Green Building

Which LEED Rating System(s) and version has or will your project use (by area for multiple rating systems)?

Select by Primary Use:	**New Construction**	Core & Shell	Healthcare	Schools
	Retail	Homes Midrise	Homes	Other
Select LEED Outcome:	Certified	**Silver**	Gold	Platinum

Will the project be USGBC Registered and / or USGBC Certified?

Registered:	*Yes /* **No**	Certified:	***Yes*** */* No

A.6 - Building Energy

What are the base and peak operating energy loads for the buildings?

Electric:	***East:*** *1,986 (kW)* ***West:*** *1,321 (kW)* ***Office:*** *725 (kW)* ***Parking***: *15.2 (kW)*	Heating:	***East:*** *20.2 (MMBtu/hr)* ***West:*** *14.6 (MMBtu/hr)* ***Office:*** *9.74 (MMBtu/hr)* ***Parking***: *.055 (MMBtu/hr)*
What is the planned building Energy Use Intensity:	*East:67 (kbtu/SF/year)* *West: 69.2 (kbtu/SF/year)* *Office:48.8 (kbtu/SF/year)* *Parking: 4.7 (kbtu/SF/year)*	Cooling:	***East:*** *1,617 (tons)* ***West:*** *1,210 (tons)* ***Office:*** *865 (tons)* ***Parking***: *2.73 (tons)*

What are the peak energy demands of your critical systems in the event of a service interruption?

Electric:	*Total -* ***2400*** *(kW)*	Heating:	*125 (KW)*
		Cooling:	*34(Tons)*

What is nature and source of your back-up / emergency generators?

Electrical Generation:	***2400*** *(kW)*		Fuel Source:	*Diesel*
System Type and Number of Units:	**Combustion Engine**	Gas Turbine	Combine Heat and Power	***3****(Units)*

B - Extreme Weather and Heat Events

Climate change will result in more extreme weather events including higher year round average temperatures, higher peak temperatures, and more periods of extended peak temperatures. The section explores how a project responds to higher temperatures and heat waves.

B.1 - Analysis

What is the full expected life of the project?

Select most appropriate:	10 Years	**25 Years**	50 Years	75 Years

What is the full expected operational life of key building systems (e.g. heating, cooling, ventilation)?

Select most appropriate:	10 Years	**25 Years**	50 Years	75 Years

What time span of future Climate Conditions was considered?

Select most appropriate:	10 Years	25 Years	50 Years	**75 Years**

Analysis Conditions - What range of temperatures will be used for project planning – Low/High?

7/87 Deg.

What Extreme Heat Event characteristics will be used for project planning – Peak High, Duration, and Frequency?

91 *Deg.*	***1.5*** Days	***1*** *Event / yr.*

What Drought characteristics will be used for project planning – Duration and Frequency?

45-60 *Days*	1 *Events / yr.*

What Extreme Rain Event characteristics will be used for project planning – Seasonal Rain Fall, Peak Rain Fall, and Frequency of Events per year?

44 *Inches / yr.*	4.6 *Inches*	0.1 *Events / yr.*

What Extreme Wind Storm Event characteristics will be used for project planning – Peak Wind Speed, Duration of Storm Event, and Frequency of Events per year?

C7 Peak Wind	*C7 Hours*	*C7 Events / yr.*

B.2 - Mitigation Strategies

What will be the overall energy performance, based on use, of the project and how will performance be determined?

Building energy use below code:	*East Block=??%* *West Block=??%* *Office Block=??%* *Garage=??%*
How is performance determined:	*e-Qeust*

What specific measures will the project employ to reduce building energy consumption?

Select all appropriate:	**High performance building envelop**	**High performance lighting & controls**	Building day lighting	**EnergyStar equip. / appliances**
	High performance HVAC equipment	**Energy recovery ventilation**	No active cooling	No active heating
Describe any added measures:				

What are the insulation (R) values for building envelop elements?

Roof:	*R = 21*	Walls / Curtain Wall Assembly:	*R = 15.5*

Foundation:	*R = N/A*	Basement / Slab:	*R = 33.3*
Windows:	*R = 1.81 / U =.55*	Doors:	*R = 3 / U =.33*

What specific measures will the project employ to reduce building energy demands on the utilities and infrastructure?

	On-site clean energy / CHP system(s)	Building-wide power dimming	Thermal energy storage systems	Ground source heat pump
	On-site Solar PV	On-site Solar Thermal	Wind power	**None**
Describe any added measures:				

Will the project employ Distributed Energy / Smart Grid Infrastructure and /or Systems?

Select all appropriate:	**Connected to local distributed electrical**	Building will be Smart Grid ready	Connected to distributed steam, hot, chilled water	Distributed thermal energy ready

Will the building remain operable without utility power for an extended period?

	Yes / *No*	If yes, for how long:	*.5Days*
If Yes, is building "Islandable?	NO		
If Yes, describe strategies:			

Describe any non-mechanical strategies that will support building functionality and use during an extended interruption(s) of utility services and infrastructure:

Select all appropriate:	Solar oriented – longer south walls	Prevailing winds oriented	External shading devices	Tuned glazing,
	Building cool zones	**Operable windows**	Natural ventilation	Building shading
	Potable water for drinking / food preparation	**Potable water for sinks / sanitary systems**	Waste water storage capacity	**High Performance Building Envelop**
Describe any added measures:				

What measures will the project employ to reduce urban heat-island effect?

Select all appropriate:	High reflective paving materials	**Shade trees & shrubs**	**High reflective roof materials**	Vegetated roofs
Describe other strategies:				

What measures will the project employ to accommodate rain events and more rain fall?

Select all appropriate:	**On-site retention systems & ponds**	**Infiltration galleries & areas**	vegetated water capture systems	Vegetated roofs
Describe other strategies:				

What measures will the project employ to accommodate extreme storm events and high winds?

Select all appropriate:	Hardened building structure & elements	**Buried utilities & hardened infrastructure**	Hazard removal & protective landscapes	Soft & permeable surfaces (water infiltration)
Describe other strategies:				

C - Sea-Level Rise and Storms

Rising Sea-Levels and more frequent Extreme Storms increase the probability of coastal and river flooding and enlarging the extent of the 100 Year Flood Plain. This section explores if a project is or might be subject to Sea-Level Rise and Storm impacts.

C.1 - Location Description and Classification:

Do you believe the building to susceptible to flooding now or during the full expected life of the building?

Yes / **No**

Describe site conditions? **Site is within a low risk flood zone (Zone X, Unshaded).**

Site Elevation – Low/High Points: **18'-28'** *Boston City Base Elev.(Ft.)*

Building Proximity to Water: **2,750** *Ft.*

Is the site or building located in any of the following?

Coastal Zone: *Yes* / **No**

Velocity Zone: *Yes* / **No**

Flood Zone: *Yes* / **No**

Area Prone to Flooding: *Yes* / **No**

Will the 2013 Preliminary FEMA Flood Insurance Rate Maps or future floodplain delineation updates due to Climate Change result in a change of the classification of the site or building location?

2013 FEMA Prelim. FIRMs: *Yes* / **No**

Future floodplain delineation updates: *Yes* / **No**

What is the project or building proximity to nearest Coastal, Velocity or Flood Zone or Area Prone to Flooding?

2700 +/- *Ft.*

If you answered YES to any of the above Location Description and Classification questions, please complete the following questions. Otherwise you have completed the questionnaire; thank you!

C - Sea-Level Rise and Storms

This section explores how a project responds to Sea-Level Rise and / or increase in storm frequency or severity.

C.2 - Analysis

How were impacts from higher sea levels and more frequent and extreme storm events analyzed:

Sea Level Rise: *Ft.*

Frequency of storms: *per year*

C.3 - Building Flood Proofing

Describe any strategies to limit storm and flood damage and to maintain functionality during an extended periods of disruption.

What will be the Building Flood Proof Elevation and First Floor Elevation:

Flood Proof Elevation: *Boston City Base Elev.(Ft.)* First Floor Elevation: *Boston City Base Elev. (Ft.)*

Will the project employ temporary measures to prevent building flooding (e.g. barricades, flood gates):

Yes / No If Yes, to what elevation *Boston City Base Elev. (Ft.)*

If Yes, describe:

What measures will be taken to ensure the integrity of critical building systems during a flood or severe storm event:

Systems located above 1st Floor.	Water tight utility conduits	Waste water back flow prevention	Storm water back flow prevention

Were the differing effects of fresh water and salt water flooding considered:

Yes / No

Will the project site / building(s) be accessible during periods of inundation or limited access to transportation:

Yes / No If yes, to what height above 100 Year Floodplain: *Boston City Base Elev. (Ft.)*

Will the project employ hard and / or soft landscape elements as velocity barriers to reduce wind or wave impacts?

Yes / No

If Yes, describe:

Will the building remain occupiable without utility power during an extended period of inundation:

Yes / No If Yes, for how long: *days*

Describe any additional strategies to addressing sea level rise and or sever storm impacts:

C.4 - Building Resilience and Adaptability

Describe any strategies that would support rapid recovery after a weather event and accommodate future building changes that respond to climate change:

Will the building be able to withstand severe storm impacts and endure temporary inundation?

Select appropriate:	*Yes / No*	Hardened / Resilient Ground Floor Construction	Temporary shutters and or barricades	Resilient site design, materials and construction

Can the site and building be reasonably modified to increase Building Flood Proof Elevation?

Select appropriate:	*Yes / No*	Surrounding site elevation can be raised	Building ground floor can be raised	Construction been engineered

Describe additional strategies:

Has the building been planned and designed to accommodate future resiliency enhancements?

Select appropriate:	*Yes / No*	Solar PV	Solar Thermal	Clean Energy / CHP System(s)
		Potable water	Wastewater	Back up energy

		storage	storage	systems & fuel
Describe any specific or additional strategies:				

Thank you for completing the Boston Climate Change Resilience and Preparedness Checklist!

For questions or comments about this checklist or Climate Change Resiliency and Preparedness best practices, please contact: John.Dalzell.BRA@cityofboston.gov

APPENDIX 7

ENERGY MODELING

WSP | PARSONS BRINCKERHOFF

88 Black Falcon Avenue
Suite 210
Boston, MA 02210
Main: 617-210-1600
wspgroup.com/usa
pbworld.com/usa

Tremont Crossing – Energy Modeling Results
August 7, 2016

Parking

	Baseline	Proposed	% Savings
Electric Use (kWh)	75,723	66,440	12.3%
Natural Gas Use (Therms)	949	949	0.0%
Total Energy Usage (Million Btu)	353	322	9.0%
Total Cost	$13,159	$11,674	11.3%

East Block

	Baseline	Proposed	% Savings
Electric Use (kWh)	12,681,412	10,966,268	13.5%
Natural Gas Use (Therms)	113,091	98,363	13.0%
Total Energy Usage (Million Btu)	54,590	47,263	13.4%
Total Cost	$2,153,426	$1,862,802	13.5%

West Block

	Baseline	Proposed	% Savings
Electric Use (kWh)	9,125,799	7,401,924	18.9%
Natural Gas Use (Therms)	82,327	75,921	7.8%
Total Energy Usage (Million Btu)	39,379	32,854	16.6%
Total Cost	$1,550,688	$1,267,821	18.2%

Office Building

	Baseline	Proposed	% Savings
Electric Use (kWh)	2,310,530	1,874,302	18.9%
Natural Gas Use (Therms)	41,015	36,557	10.9%
Total Energy Usage (Million Btu)	11,987	10,053	16.1%
Total Cost	$414,801	$340,101	18.0%

```
TC - East Block - BASELINE                                                       DOE-2.2-48m    8/07/2016    17:03:54  BDL RUN  1
REPORT- BEPS Building Energy Performance                                                    WEATHER FILE- Boston       MA TMY2
---------------------------------------------------------------------------------------------------------------------------------

                         TASK     MISC    SPACE   SPACE      HEAT    PUMPS     VENT    REFRIG  HT PUMP   DOMEST    EXT
               LIGHTS   LIGHTS   EQUIP   HEATING  COOLING   REJECT   & AUX     FANS   DISPLAY  SUPPLEM  HOT WTR   USAGE    TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    MBTU       7992.2      0.0  17914.5      0.0  10723.0      2.5   1067.9   5581.2      0.0      0.0      0.0      0.0   43281.3

FM1  NATURAL-GAS
    MBTU          0.0      0.0      0.0   8338.8      0.0      0.0      0.0      0.0      0.0      0.0   2970.2      0.0   11309.1
              =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  ========

    MBTU       7992.2      0.0  17914.5   8338.8  10723.0      2.5   1067.9   5581.2      0.0      0.0   2970.2      0.0   54590.3


                   TOTAL SITE ENERGY     54590.34 MBTU     77.4 KBTU/SQFT-YR GROSS-AREA     77.4 KBTU/SQFT-YR NET-AREA
                   TOTAL SOURCE ENERGY  141153.03 MBTU    200.2 KBTU/SQFT-YR GROSS-AREA    200.2 KBTU/SQFT-YR NET-AREA

                   PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.53
                   PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
                   HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =    46
                   HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =     0

                   NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
TC - East Block - BASELINE                                                       DOE-2.2-48m    8/07/2016    17:03:54  BDL RUN  1

REPORT- BEPU Building Utility Performance                                                   WEATHER FILE- Boston       MA TMY2
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                         TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT    REFRIG  HT PUMP   DOMEST    EXT
               LIGHTS   LIGHTS   EQUIP   HEATING  COOLING   REJECT   & AUX     FANS   DISPLAY  SUPPLEM  HOT WTR   USAGE    TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    KWH      2341718.       0. 5248946.       0. 3141829.     733.  312881. 1635302.       0.       0.       0.       0. 12681412.

FM1  NATURAL-GAS
    THERM          0.       0.       0.   83388.       0.       0.       0.       0.       0.       0.   29702.       0.   113091.


           TOTAL ELECTRICITY  12681412. KWH        17.989 KWH     /SQFT-YR GROSS-AREA   17.989 KWH     /SQFT-YR NET-AREA
           TOTAL NATURAL-GAS    113091. THERM       0.160 THERM   /SQFT-YR GROSS-AREA    0.160 THERM   /SQFT-YR NET-AREA


           PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.53
           PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
           HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =    46
           HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =     0

           NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
TC - East Block - BASELINE                                                       DOE-2.2-48m    8/07/2016    17:03:54  BDL RUN  1

REPORT- ES-D Energy Cost Summary                                                            WEATHER FILE- Boston       MA TMY2
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                                                                           METERED             TOTAL      VIRTUAL
                                                                            ENERGY            CHARGE         RATE   RATE USED
UTILITY-RATE                       RESOURCE           METERS              UNITS/YR               ($)     ($/UNIT)   ALL YEAR?
--------------------------------   ----------------   -----------   -------------------   ----------   ----------   ---------

E Rate                             ELECTRICITY        EM1            12681412. KWH          2029026.       0.1600      YES

NG Rate                            NATURAL-GAS        FM1              113091. THERM         124400.       1.1000      YES

                                                                                          ==========
                                                                                            2153426.

                                                             ENERGY COST/GROSS BLDG AREA:      3.05
                                                               ENERGY COST/NET BLDG AREA:      3.05
```

```
TC - East Block - Proposed                                                       DOE-2.2-48m    8/07/2016    16:55:17  BDL RUN  1

REPORT- BEPS Building Energy Performance                                                    WEATHER FILE- Boston       MA TMY2
---------------------------------------------------------------------------------------------------------------------------------

                         TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT    REFRIG  HT PUMP   DOMEST   EXT
               LIGHTS   LIGHTS   EQUIP   HEATING  COOLING   REJECT   & AUX     FANS   DISPLAY  SUPPLEM  HOT WTR   USAGE    TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    MBTU       7140.5      0.0  17914.5      4.0   7544.4     13.3   1161.8   3649.0      0.0      0.0      0.0      0.0   37427.5

FM1  NATURAL-GAS
    MBTU          0.0      0.0      0.0   7400.7      0.0      0.0      0.0      0.0      0.0      0.0   2435.6      0.0    9836.3
              =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  ========

    MBTU       7140.5      0.0  17914.5   7404.7   7544.4     13.3   1161.8   3649.0      0.0      0.0   2435.6      0.0   47263.9


                   TOTAL SITE ENERGY     47263.85 MBTU     67.0 KBTU/SQFT-YR GROSS-AREA     67.0 KBTU/SQFT-YR NET-AREA
                   TOTAL SOURCE ENERGY  122119.05 MBTU    173.2 KBTU/SQFT-YR GROSS-AREA    173.2 KBTU/SQFT-YR NET-AREA

                   PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.47
                   PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
                   HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =    41
                   HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =     0

                   NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
TC - East Block - Proposed                                                       DOE-2.2-48m    8/07/2016    16:55:17  BDL RUN  1

REPORT- BEPU Building Utility Performance                                                   WEATHER FILE- Boston       MA TMY2
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                         TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT    REFRIG  HT PUMP   DOMEST    EXT
               LIGHTS   LIGHTS   EQUIP   HEATING  COOLING   REJECT   & AUX     FANS   DISPLAY  SUPPLEM  HOT WTR   USAGE    TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    KWH      2092159.       0. 5248946.    1176. 2210517.    3901.  340395. 1069154.       0.       0.       0.       0. 10966268.

FM1  NATURAL-GAS
    THERM          0.       0.       0.   74007.       0.       0.       0.       0.       0.       0.   24356.       0.    98363.



           TOTAL ELECTRICITY  10966268. KWH        15.556 KWH     /SQFT-YR GROSS-AREA   15.556 KWH     /SQFT-YR NET-AREA
           TOTAL NATURAL-GAS     98363. THERM       0.140 THERM   /SQFT-YR GROSS-AREA    0.140 THERM   /SQFT-YR NET-AREA


           PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.47
           PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
           HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =    41
           HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =     0

           NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
TC - East Block - Proposed                                                       DOE-2.2-48m    8/07/2016    16:55:17  BDL RUN  1

REPORT- ES-D Energy Cost Summary                                                            WEATHER FILE- Boston       MA TMY2
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                                                                           METERED             TOTAL      VIRTUAL
                                                                            ENERGY            CHARGE         RATE   RATE USED
UTILITY-RATE                       RESOURCE           METERS              UNITS/YR               ($)     ($/UNIT)   ALL YEAR?
--------------------------------   ----------------   -----------   -------------------   ----------   ----------   ---------

E Rate                             ELECTRICITY        EM1            10966268. KWH          1754603.       0.1600      YES

NG Rate                            NATURAL-GAS        FM1               98363. THERM         108199.       1.1000      YES

                                                                                          ==========
                                                                                            1862802.

                                                             ENERGY COST/GROSS BLDG AREA:      2.64
                                                               ENERGY COST/NET BLDG AREA:      2.64
```

```
TC - Office - BASELINE                                                           DOE-2.2-48m    8/07/2016    18:54:27  BDL RUN  1

REPORT- BEPS Building Energy Performance                                                    WEATHER FILE- Boston       MA TMY2
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                         TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT   REFRIG  HT PUMP   DOMEST     EXT
               LIGHTS   LIGHTS   EQUIP  HEATING  COOLING   REJECT    & AUX     FANS  DISPLAY  SUPPLEM  HOT WTR   USAGE    TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    MBTU       2061.1      0.0   1983.0      6.4   1642.5      4.8    800.2   1387.8      0.0      0.0      0.0      0.0    7885.8

FM1  NATURAL-GAS
    MBTU          0.0      0.0      0.0   4101.5      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0    4101.5
              =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  ========

    MBTU       2061.1      0.0   1983.0   4107.8   1642.5      4.8    800.2   1387.8      0.0      0.0      0.0      0.0   11987.3



                   TOTAL SITE ENERGY     11987.27 MBTU     58.2 KBTU/SQFT-YR GROSS-AREA     58.2 KBTU/SQFT-YR NET-AREA
                   TOTAL SOURCE ENERGY   27758.83 MBTU    134.8 KBTU/SQFT-YR GROSS-AREA    134.8 KBTU/SQFT-YR NET-AREA

                   PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.02
                   PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
                   HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =     0
                   HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =     1

                   NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
TC - Office - BASELINE                                                            DOE-2.2-48m    8/07/2016    18:54:27  BDL RUN  1

REPORT- BEPU Building Utility Performance                                                    WEATHER FILE- Boston       MA TMY2
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                              TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT   REFRIG  HT PUMP   DOMEST      EXT
               LIGHTS   LIGHTS    EQUIP  HEATING  COOLING   REJECT    & AUX     FANS  DISPLAY  SUPPLEM  HOT WTR    USAGE     TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    KWH       603908.       0.  581023.    1861.  481255.    1405.  234456.  406616.       0.       0.       0.       0.  2310530.

FM1  NATURAL-GAS
    THERM          0.       0.       0.   41015.       0.       0.       0.       0.       0.       0.       0.       0.    41015.


           TOTAL ELECTRICITY   2310530. KWH        11.219 KWH     /SQFT-YR GROSS-AREA   11.219 KWH     /SQFT-YR NET-AREA
           TOTAL NATURAL-GAS     41015. THERM       0.199 THERM   /SQFT-YR GROSS-AREA    0.199 THERM   /SQFT-YR NET-AREA


           PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.02
           PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
           HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =     0
           HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =     1

           NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
TC - Office - BASELINE                                                           DOE-2.2-48m    8/07/2016    18:54:27  BDL RUN  1

REPORT- ES-D Energy Cost Summary                                                            WEATHER FILE- Boston       MA TMY2
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                                                                           METERED             TOTAL      VIRTUAL
                                                                            ENERGY            CHARGE         RATE   RATE USED
UTILITY-RATE                       RESOURCE           METERS              UNITS/YR               ($)     ($/UNIT)   ALL YEAR?
--------------------------------   ----------------   -----------   -------------------   ----------   ----------   ---------

E Rate                             ELECTRICITY        EM1             2310530. KWH           369685.       0.1600      YES

NG Rate                            NATURAL-GAS        FM1               41015. THERM          45116.       1.1000      YES

                                                                                          ==========
                                                                                             414801.


                                                             ENERGY COST/GROSS BLDG AREA:      2.01
                                                               ENERGY COST/NET BLDG AREA:      2.01
```

```
Tremont Crossing - Office Building Rev_3                                         DOE-2.2-48m    8/07/2016    18:56:46  BDL RUN  1

REPORT- BEPS Building Energy Performance                                                    WEATHER FILE- Boston       MA TMY2
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                         TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT   REFRIG  HT PUMP   DOMEST      EXT
               LIGHTS   LIGHTS   EQUIP  HEATING  COOLING   REJECT    & AUX     FANS  DISPLAY  SUPPLEM  HOT WTR    USAGE    TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    MBTU       1513.3      0.0   1983.0     14.5   1338.8      4.3    422.0   1120.9      0.0      0.0      0.0      0.0    6396.9

FM1  NATURAL-GAS
    MBTU          0.0      0.0      0.0   3655.7      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0    3655.7
              =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  ========

    MBTU       1513.3      0.0   1983.0   3670.2   1338.8      4.3    422.0   1120.9      0.0      0.0      0.0      0.0   10052.6


                   TOTAL SITE ENERGY     10052.63 MBTU     48.8 KBTU/SQFT-YR GROSS-AREA     48.8 KBTU/SQFT-YR NET-AREA
                   TOTAL SOURCE ENERGY   22846.52 MBTU    110.9 KBTU/SQFT-YR GROSS-AREA    110.9 KBTU/SQFT-YR NET-AREA

                   PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.56
                   PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
                   HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =     0
                   HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =    49

                   NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
Tremont Crossing - Office Building Rev_3                                         DOE-2.2-48m    8/07/2016    18:56:46  BDL RUN  1

REPORT- BEPU Building Utility Performance                                                   WEATHER FILE- Boston       MA TMY2
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                         TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT   REFRIG  HT PUMP   DOMEST      EXT
               LIGHTS   LIGHTS   EQUIP  HEATING  COOLING   REJECT    & AUX     FANS  DISPLAY  SUPPLEM  HOT WTR    USAGE    TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    KWH       443397.       0.  581023.    4255.  392279.    1261.  123656.  328430.       0.       0.       0.       0.  1874302.

FM1  NATURAL-GAS
    THERM          0.       0.       0.   36557.       0.       0.       0.       0.       0.       0.       0.       0.    36557.


           TOTAL ELECTRICITY   1874302. KWH         9.101 KWH     /SQFT-YR GROSS-AREA    9.101 KWH     /SQFT-YR NET-AREA
           TOTAL NATURAL-GAS     36557. THERM       0.178 THERM   /SQFT-YR GROSS-AREA    0.178 THERM   /SQFT-YR NET-AREA


           PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.56
           PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
           HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =     0
           HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =    49

           NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
Tremont Crossing - Office Building Rev_3                                         DOE-2.2-48m    8/07/2016    18:56:46  BDL RUN  1

REPORT- ES-D Energy Cost Summary                                                            WEATHER FILE- Boston       MA TMY2
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                                                                           METERED             TOTAL      VIRTUAL
                                                                            ENERGY            CHARGE         RATE   RATE USED
UTILITY-RATE                       RESOURCE           METERS              UNITS/YR               ($)     ($/UNIT)   ALL YEAR?
--------------------------------   ----------------   -----------   -------------------   ----------   ----------   ---------

E Rate                             ELECTRICITY        EM1             1874302. KWH           299888.       0.1600      YES

NG Rate                            NATURAL-GAS        FM1               36557. THERM          40213.       1.1000      YES

                                                                                          ==========
                                                                                             340101.


                                                             ENERGY COST/GROSS BLDG AREA:      1.65
                                                               ENERGY COST/NET BLDG AREA:      1.65
```

```
TC - Parking - Baseline                                                          DOE-2.2-48m    8/06/2016    10:27:39  BDL RUN  2

REPORT- BEPS Building Energy Performance                                                    WEATHER FILE- Boston       MA TMY2
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                         TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT    REFRIG  HT PUMP   DOMEST    EXT
               LIGHTS   LIGHTS   EQUIP   HEATING  COOLING   REJECT   & AUX     FANS   DISPLAY  SUPPLEM  HOT WTR   USAGE    TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    MBTU         14.5      0.0     11.5      0.0      3.4      0.0      0.0     16.4      0.0      0.0      0.0    212.7     258.4

FM1  NATURAL-GAS
    MBTU          0.0      0.0      0.1     90.2      0.0      0.0      0.0      0.0      0.0      0.0      4.6      0.0      94.9
              =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  ========

    MBTU         14.5      0.0     11.6     90.2      3.4      0.0      0.0     16.4      0.0      0.0      4.6    212.7     353.3


                   TOTAL SITE ENERGY       353.30 MBTU      5.1 KBTU/SQFT-YR GROSS-AREA      5.1 KBTU/SQFT-YR NET-AREA
                   TOTAL SOURCE ENERGY     870.18 MBTU     12.7 KBTU/SQFT-YR GROSS-AREA     12.7 KBTU/SQFT-YR NET-AREA

                   PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.00
                   PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
                   HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =     0
                   HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =     0

                   NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
TC - Parking - Baseline                                                          DOE-2.2-48m    8/06/2016    10:27:39  BDL RUN  2

REPORT- BEPU Building Utility Performance                                                   WEATHER FILE- Boston       MA TMY2
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                         TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT   REFRIG  HT PUMP   DOMEST      EXT
               LIGHTS   LIGHTS    EQUIP  HEATING  COOLING   REJECT    & AUX     FANS  DISPLAY  SUPPLEM  HOT WTR    USAGE    TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    KWH         4243.       0.    3367.       0.     997.       0.       0.    4805.       0.       0.       0.   62311.    75723.

FM1  NATURAL-GAS
    THERM          0.       0.       1.     902.       0.       0.       0.       0.       0.       0.      46.       0.      949.


           TOTAL ELECTRICITY     75723. KWH         1.103 KWH     /SQFT-YR GROSS-AREA    1.103 KWH     /SQFT-YR NET-AREA
           TOTAL NATURAL-GAS       949. THERM       0.014 THERM   /SQFT-YR GROSS-AREA    0.014 THERM   /SQFT-YR NET-AREA

           PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.00
           PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
           HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =     0
           HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =     0

           NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
TC - Parking - Baseline                                                          DOE-2.2-48m    8/06/2016    10:27:39  BDL RUN  2

REPORT- ES-D Energy Cost Summary                                                            WEATHER FILE- Boston       MA TMY2
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                                                                           METERED             TOTAL      VIRTUAL
                                                                            ENERGY            CHARGE         RATE   RATE USED
UTILITY-RATE                       RESOURCE           METERS              UNITS/YR               ($)     ($/UNIT)   ALL YEAR?
--------------------------------   ----------------   -----------   -------------------   ----------   ----------   ---------

Electric Rate                      ELECTRICITY        EM1                   75723. KWH            12116.       0.1600      YES

Natural Gas Rate                   NATURAL-GAS        FM1                     949. THERM           1043.       1.1000      YES

                                                                                          ==========
                                                                                              13159.

                                                             ENERGY COST/GROSS BLDG AREA:      0.19
                                                               ENERGY COST/NET BLDG AREA:      0.19
```

```
TC - Parking - Proposed                                                          DOE-2.2-48m    8/06/2016    10:33:05  BDL RUN  1

REPORT- BEPS Building Energy Performance                                                    WEATHER FILE- Boston       MA TMY2
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                         TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT   REFRIG  HT PUMP   DOMEST     EXT
               LIGHTS   LIGHTS   EQUIP   HEATING  COOLING   REJECT   & AUX     FANS  DISPLAY  SUPPLEM  HOT WTR   USAGE     TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    MBTU         14.5      0.0     11.5      0.0      3.6      0.0      0.0     16.4      0.0      0.0      0.0    180.8     226.8

FM1  NATURAL-GAS
    MBTU          0.0      0.0      0.1     90.2      0.0      0.0      0.0      0.0      0.0      0.0      4.6      0.0      94.9
              =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  ========

    MBTU         14.5      0.0     11.6     90.2      3.6      0.0      0.0     16.4      0.0      0.0      4.6    180.8     321.6


                   TOTAL SITE ENERGY       321.62 MBTU      4.7 KBTU/SQFT-YR GROSS-AREA      4.7 KBTU/SQFT-YR NET-AREA
                   TOTAL SOURCE ENERGY     775.13 MBTU     11.3 KBTU/SQFT-YR GROSS-AREA     11.3 KBTU/SQFT-YR NET-AREA

                   PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.00
                   PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
                   HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =     0
                   HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =     0

                   NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
TC - Parking - Proposed                                                          DOE-2.2-48m    8/06/2016    10:33:05  BDL RUN  1

REPORT- BEPU Building Utility Performance                                                   WEATHER FILE- Boston       MA TMY2
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                         TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT    REFRIG  HT PUMP   DOMEST   EXT
               LIGHTS   LIGHTS   EQUIP   HEATING  COOLING   REJECT   & AUX     FANS   DISPLAY  SUPPLEM  HOT WTR   USAGE    TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    KWH         4243.       0.    3367.       0.    1060.       0.       0.    4805.       0.       0.       0.   52964.    66440.

FM1  NATURAL-GAS
    THERM          0.       0.       1.     902.       0.       0.       0.       0.       0.       0.      46.       0.      949.



           TOTAL ELECTRICITY     66440. KWH         0.967 KWH     /SQFT-YR GROSS-AREA    0.967 KWH     /SQFT-YR NET-AREA
           TOTAL NATURAL-GAS       949. THERM       0.014 THERM   /SQFT-YR GROSS-AREA    0.014 THERM   /SQFT-YR NET-AREA


           PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.00
           PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
           HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =     0
           HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =     0

           NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
TC - Parking - Proposed                                                         DOE-2.2-48m    8/06/2016    10:33:05  BDL RUN  1

REPORT- ES-D Energy Cost Summary                                                          WEATHER FILE- Boston       MA TMY2
---------------------------------------------------------------------------------------------------------------------------------

                                                                            METERED           TOTAL      VIRTUAL
                                                                             ENERGY          CHARGE         RATE   RATE USED
UTILITY-RATE                       RESOURCE           METERS                UNITS/YR            ($)     ($/UNIT)   ALL YEAR?
--------------------------------   ----------------   -----------   -------------------   ----------   ----------   ---------

Electric Rate                      ELECTRICITY        EM1               66440. KWH           10630.       0.1600      YES

Natural Gas Rate                   NATURAL-GAS        FM1                 949. THERM          1043.       1.1000      YES

                                                                                          ==========
                                                                                              11674.

                                                              ENERGY COST/GROSS BLDG AREA:       0.17
                                                                ENERGY COST/NET BLDG AREA:       0.17
```

```
TC - West Block - BASELINE                                                       DOE-2.2-48m    8/07/2016    17:54:43  BDL RUN  1

REPORT- BEPS Building Energy Performance                                                    WEATHER FILE- Boston       MA TMY2
---------------------------------------------------------------------------------------------------------------------------------

                         TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT   REFRIG  HT PUMP   DOMEST     EXT
               LIGHTS   LIGHTS   EQUIP  HEATING  COOLING   REJECT    & AUX     FANS  DISPLAY  SUPPLEM  HOT WTR   USAGE    TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    MBTU       5346.0      0.0  12064.5      0.0   8945.8      2.0    971.5   3816.3      0.0      0.0      0.0      0.0   31146.1

FM1  NATURAL-GAS
    MBTU          0.0      0.0      0.0   5262.5      0.0      0.0      0.0      0.0      0.0      0.0   2970.2      0.0    8232.7
              =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  ========

    MBTU       5346.0      0.0  12064.5   5262.5   8945.8      2.0    971.5   3816.3      0.0      0.0   2970.2      0.0   39378.8


                   TOTAL SITE ENERGY     39378.80 MBTU     82.9 KBTU/SQFT-YR GROSS-AREA     82.9 KBTU/SQFT-YR NET-AREA
                   TOTAL SOURCE ENERGY  101671.05 MBTU    214.2 KBTU/SQFT-YR GROSS-AREA    214.2 KBTU/SQFT-YR NET-AREA

                   PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.14
                   PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
                   HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =    12
                   HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =     0

                   NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
TC - West Block - BASELINE                                                       DOE-2.2-48m    8/07/2016    17:54:43  BDL RUN  1

REPORT- BEPU Building Utility Performance                                                   WEATHER FILE- Boston       MA TMY2
---------------------------------------------------------------------------------------------------------------------------------

                         TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT   REFRIG  HT PUMP   DOMEST     EXT
               LIGHTS   LIGHTS   EQUIP  HEATING  COOLING   REJECT   & AUX     FANS  DISPLAY  SUPPLEM  HOT WTR   USAGE    TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    KWH      1566386.       0. 3534910.       0. 2621124.     594.  284635. 1118185.       0.       0.       0.       0.  9125799.

FM1  NATURAL-GAS
    THERM          0.       0.       0.   52625.       0.       0.       0.       0.       0.       0.   29702.       0.    82327.



           TOTAL ELECTRICITY   9125799. KWH        19.223 KWH     /SQFT-YR GROSS-AREA   19.223 KWH     /SQFT-YR NET-AREA
           TOTAL NATURAL-GAS     82327. THERM       0.173 THERM   /SQFT-YR GROSS-AREA    0.173 THERM   /SQFT-YR NET-AREA


           PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.14
           PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
           HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =    12
           HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =     0

           NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
TC - West Block - BASELINE                                                        DOE-2.2-48m    8/07/2016    17:54:43  BDL RUN  1

REPORT- ES-D Energy Cost Summary                                                             WEATHER FILE- Boston       MA TMY2
----------------------------------------------------------------------------------------------------------------------------------

                                                                            METERED             TOTAL      VIRTUAL
                                                                             ENERGY            CHARGE         RATE   RATE USED
UTILITY-RATE                       RESOURCE           METERS               UNITS/YR               ($)     ($/UNIT)   ALL YEAR?
--------------------------------   ----------------   -----------    -------------------   ----------   ----------   ---------

E Rate                             ELECTRICITY        EM1                  9125799. KWH          1460128.       0.1600      YES

NG Rate                            NATURAL-GAS        FM1                    82327. THERM          90560.       1.1000      YES

                                                                                           ==========
                                                                                             1550688.

                                                              ENERGY COST/GROSS BLDG AREA:      3.27
                                                                ENERGY COST/NET BLDG AREA:      3.27
```

```
TC - West Block - Proposed                                                       DOE-2.2-48m    8/07/2016    17:56:31  BDL RUN  2

REPORT- BEPS Building Energy Performance                                                    WEATHER FILE- Boston       MA TMY2
---------------------------------------------------------------------------------------------------------------------------------

                         TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT    REFRIG  HT PUMP   DOMEST    EXT
               LIGHTS   LIGHTS   EQUIP   HEATING  COOLING   REJECT   & AUX     FANS   DISPLAY  SUPPLEM  HOT WTR   USAGE    TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    MBTU       4630.8      0.0  12064.5      3.3   5301.4      9.9    913.9   2338.8      0.0      0.0      0.0      0.0   25262.5

FM1  NATURAL-GAS
    MBTU          0.0      0.0      0.0   5156.5      0.0      0.0      0.0      0.0      0.0      0.0   2435.6      0.0    7592.1
              =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  =======  ========

    MBTU       4630.8      0.0  12064.5   5159.8   5301.4      9.9    913.9   2338.8      0.0      0.0   2435.6      0.0   32854.6


                   TOTAL SITE ENERGY     32854.62 MBTU     69.2 KBTU/SQFT-YR GROSS-AREA     69.2 KBTU/SQFT-YR NET-AREA
                   TOTAL SOURCE ENERGY   83379.78 MBTU    175.6 KBTU/SQFT-YR GROSS-AREA    175.6 KBTU/SQFT-YR NET-AREA

                   PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.10
                   PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
                   HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =     9
                   HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =     0

                   NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
TC - West Block - Proposed                                                       DOE-2.2-48m    8/07/2016    17:56:31  BDL RUN  2

REPORT- BEPU Building Utility Performance                                                   WEATHER FILE- Boston       MA TMY2
----------------------------------------------------------------------------------------------------------------------------------

                         TASK     MISC     SPACE    SPACE     HEAT    PUMPS     VENT    REFRIG  HT PUMP   DOMEST    EXT
               LIGHTS   LIGHTS    EQUIP  HEATING  COOLING   REJECT   & AUX     FANS   DISPLAY  SUPPLEM  HOT WTR   USAGE    TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    KWH      1356826.       0. 3534910.     956. 1553304.    2899.  267779.  685278.       0.       0.       0.       0.  7401924.

FM1  NATURAL-GAS
    THERM          0.       0.       0.   51565.       0.       0.       0.       0.       0.       0.   24356.       0.    75921.


           TOTAL ELECTRICITY   7401924. KWH        15.592 KWH     /SQFT-YR GROSS-AREA   15.592 KWH     /SQFT-YR NET-AREA
           TOTAL NATURAL-GAS     75921. THERM       0.160 THERM   /SQFT-YR GROSS-AREA    0.160 THERM   /SQFT-YR NET-AREA

           PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.10
           PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.00
           HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE                =     9
           HOURS ANY ZONE BELOW HEATING THROTTLING RANGE                =     0

           NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

```
TC - West Block - Proposed                                                         DOE-2.2-48m    8/07/2016    17:56:31  BDL RUN  2

REPORT- ES-D Energy Cost Summary                                                              WEATHER FILE- Boston       MA TMY2
------------------------------------------------------------------------------------------------------------------------------------

                                                                            METERED            TOTAL      VIRTUAL
                                                                             ENERGY           CHARGE         RATE   RATE USED
UTILITY-RATE                       RESOURCE           METERS                UNITS/YR              ($)    ($/UNIT)   ALL YEAR?
--------------------------------   ----------------   -----------   -------------------   ----------   ----------   ---------

E Rate                             ELECTRICITY        EM1              7401924. KWH          1184308.       0.1600      YES

NG Rate                            NATURAL-GAS        FM1                75921. THERM          83513.       1.1000      YES

                                                                                          ==========
                                                                                            1267821.


                                                              ENERGY COST/GROSS BLDG AREA:      2.67
                                                                ENERGY COST/NET BLDG AREA:      2.67
```

APPENDIX 8

ACCESSABILITY CHECKLIST

Accessibility Checklist

(to be added to the BRA Development Review Guidelines)

In 2009, a nine-member Advisory Board was appointed to the Commission for Persons with Disabilities in an effort to reduce architectural, procedural, attitudinal, and communication barriers affecting persons with disabilities in the City of Boston. These efforts were instituted to work toward creating universal access in the built environment.

In line with these priorities, the Accessibility Checklist aims to support the inclusion of people with disabilities. In order to complete the Checklist, you must provide specific detail, including descriptions, diagrams and data, of the universal access elements that will ensure all individuals have an equal experience that includes full participation in the built environment throughout the proposed buildings and open space.

In conformance with this directive, all development projects subject to Boston Zoning Article 80 Small and Large Project Review, including all Institutional Master Plan modifications and updates, are to complete the following checklist and provide any necessary responses regarding the following:

- improvements for pedestrian and vehicular circulation and access;
- encourage new buildings and public spaces to be designed to enhance and preserve Boston's system of parks, squares, walkways, and active shopping streets;
- ensure that persons with disabilities have full access to buildings open to the public;
- afford such persons the educational, employment, and recreational opportunities available to all citizens; and
- preserve and increase the supply of living space accessible to persons with disabilities.

We would like to thank you in advance for your time and effort in advancing best practices and progressive approaches to expand accessibility throughout Boston's built environment.

Accessibility Analysis Information Sources:

1. Americans with Disabilities Act – 2010 ADA Standards for Accessible Design
    a. http://www.ada.gov/2010ADAstandards_index.htm
2. Massachusetts Architectural Access Board 521 CMR
    a. http://www.mass.gov/eopss/consumer-prot-and-bus-lic/license-type/aab/aab-rules-and-regulations-pdf.html
3. Boston Complete Street Guidelines
    a. http://bostoncompletestreets.org/
4. City of Boston Mayors Commission for Persons with Disabilities Advisory Board
    a. http://www.cityofboston.gov/Disability
5. City of Boston – Public Works Sidewalk Reconstruction Policy
    a. http://www.cityofboston.gov/images_documents/sidewalk%20policy%200114_tcm3-41668.pdf
6. Massachusetts Office On Disability Accessible Parking Requirements
    a. www.mass.gov/anf/docs/mod/hp-parking-regulations-mod.doc
7. MBTA Fixed Route Accessible Transit Stations
    a. http://www.mbta.com/about_the_mbta/accessibility/

Article 80 | ACCESSIBILTY CHECKLIST

Project Information

Project Name:	**Tremont Crossing**
Project Address Primary:	**Tremont Street and Whittier Street, Boston, MA**
Project Address Additional:	**Parcel P-3**
Project Contact (name / Title / Company / email / phone):	**Jeffrey Feldman, Feldco Development, jfeldman@feldwest.com, 617.982.6962**

Team Description

Owner / Developer:	**P-3 Partners, LLC**
Architect:	**Cambridge Seven Associates**
Engineer (building systems):	**WSP | Parsons Brinckerhoff**
Sustainability / LEED:	**Cambridge Seven Associates**
Permitting:	**Feldco Development**
Construction Management:	**TBD**

Project Permitting and Phase

At what phase is the project – at time of this questionnaire?

PNF / Expanded PNF Submitted	**Draft** / Final **Project Impact Report Submitted**	BRA Board Approved
BRA Design Approved	Under Construction	Construction just completed:

Building Classification and Description

What are the principal Building Uses - select all appropriate uses?

Residential – One to Three Unit	**Residential - Multi-unit Studio 1, 2 & 3**	**Institutional**	**Education**
Commercial	**Office**	**Retail**	**Assembly**
Laboratory / Medical	Manufacturing / Industrial	Mercantile	Storage, Utility and **Other (Hotel and Parking)**

First Floor Uses (List): **Retail, Office, Parking Garage and Residential, Hotel, Museum lobbies.**

What is the Construction Type – select most appropriate type?

Wood Frame	Masonry	**Steel Frame w/ Concrete Deck**	**Concrete (Parking Structure)**

Describe the building?

Site Area:	**315,810** *SF*	Building Area:	**1,643,701** *GSF*
Building Height:	**Up to 278** *Ft.*	Number of Stories:	**3-22** *Flrs.*
First Floor Elevation:	**18' – 28'** *Elev.*	Are there below grade spaces:	*Yes /* ***No***

Assessment of Existing Infrastructure for Accessibility:

This section explores the proximity to accessible transit lines and proximate institutions such as, but not limited to hospitals, elderly and disabled housing, and general neighborhood information. The proponent should identify how the area surrounding the development is accessible for people with mobility impairments and should analyze the existing condition of the accessible routes through sidewalk and pedestrian ramp reports.

Provide a description of the development neighborhood and identifying characteristics.	**The Tremont Crossing project is a mixed-use, transit-oriented development proposed in Boston's Roxbury neighborhood on 7.25 acres of primarily vacant land with exception of an existing building and parking field. The project is bounded by Tremont Street to the northwest, Whittier Street to the northeast, Downing Street to the southeast, the Whittier Street Health Center to the southwest, and the Madison Park Technical Vocational High School to the southwest.**

List the surrounding ADA compliant MBTA transit lines and the proximity to the development site: Commuter rail, subway, bus, etc.	Roxbury Crossing Station (Subway and Bus) – 1200 ft. Museum of Fine Arts Station (Subway and Bus) – 2000 ft. Ruggles Station (Commuter rail, Subway and Bus) – 800 ft. Bus Routes on Tremont Street: #15, 22, 23, 28, 44, 45
List the surrounding institutions: hospitals, public housing and elderly and disabled housing developments, educational facilities, etc.	Boston Police HQ, Northeastern University, Reggie Lewis Track, John O'Bryant School of Math and Science, and Madison Park High School.
Is the proposed development on a priority accessible route to a key public use facility? List the surrounding: government buildings, libraries, community centers and recreational facilities and other related facilities.	It is unknown whether the Project Site is on a priority accessible route, however the project is located on Tremont Street which is heavily traveled corridor and have applied the Downtown Mixed-Use Complete Street standards for its accessible route design. The Project Site is proximate to the following: Boston Police HQ, Northeastern University, Reggie Lewis Track, John O'Bryant School of Math and Science, and Madison Park High School.

Surrounding Site Conditions – Existing:

This section identifies the current condition of the sidewalks and pedestrian ramps around the development site.

Are there sidewalks and pedestrian ramps existing at the development site?	Yes.
If yes above, list the existing sidewalk and pedestrian ramp materials and physical condition at the development site.	The existing sidewalks and pedestrian ramps are in fair condition.
Are the sidewalks and pedestrian ramps existing-to-remain? If yes, have the sidewalks and pedestrian ramps been verified as compliant? If yes, please provide surveyors report.	No, the Proponent will replace all sidewalks and pedestrian ramps adjacent to and within the Project Site.

Is the development site within a historic district? If yes, please identify.	No.

Surrounding Site Conditions – Proposed

This section identifies the proposed condition of the walkways and pedestrian ramps in and around the development site. The width of the sidewalk contributes to the degree of comfort and enjoyment of walking along a street. Narrow sidewalks do not support lively pedestrian activity, and may create dangerous conditions that force people to walk in the street. Typically, a five foot wide Pedestrian Zone supports two people walking side by side or two wheelchairs passing each other. An eight foot wide Pedestrian Zone allows two pairs of people to comfortable pass each other, and a ten foot or wider Pedestrian Zone can support high volumes of pedestrians.

Are the proposed sidewalks consistent with the Boston Complete Street Guidelines? See: www.bostoncompletestreets.org	Yes.
If yes above, choose which Street Type was applied: Downtown Commercial, Downtown Mixed-use, Neighborhood Main, Connector, Residential, Industrial, Shared Street, Parkway, Boulevard.	A Downtown Mixed-use was applied to Tremont Street. A Neighborhood Connector was applied to Whittier Street. The principal components and widths of a Neighborhood Connector Road were also applied to the internal site driveways, South and East Drive, where feasible. The shared street provision was applied to the plaza driveway.
What is the total width of the proposed sidewalk? List the widths of the proposed zones: Frontage, Pedestrian and Furnishing Zone.	<u>Public Ways:</u> Tremont Street: Pedestrian Zone is 10 ft. wide and Greenscape/Furnishing Zone is approximately 6 ft. wide. Whittier Street: Pedestrian Zone ranges from 5-10 ft. wide and Greenscape/Furnishing Zone is ranges from 4-5 ft. wide. <u>Private Driveways:</u> South and East Drive: Pedestrian Zone ranges from 5-10 ft. wide and Greenscape/Furnishing Zone ranges from 2.5-8 ft. wide. West Drive and Market Street: Pedestrian Zone ranges from 5-10 ft. wide and Greenscape/Furnishing Zone ranges from 2.5-8 ft. wide
List the proposed materials for each Zone. Will the proposed materials be on private property or will the proposed materials be on the City of Boston pedestrian right-of-way?	Minimum 5 feet wide concrete sidewalks will be installed both on private property and existing rights-of-way. The proposed sidewalk along Tremont Street will be within the existing righ-of-way. The proposed sidewalk along Whittier Street will be within a new easement granted to the City to accommodate both pedestrians and the proposed vehicular roadway widening. Both public ways also include the preferred width for added greenscape and furnishings.

If the pedestrian right-of-way is on private property, will the proponent seek a pedestrian easement with the City of Boston Public Improvement Commission?	**The Proponent does not presently anticipate seeking pedestrian easements within the project site, beyond widening Whittier Street, but the Proponent anticipates that all private driveways on the project site will comply with applicable requirements related to accessibility.**
Will sidewalk cafes or other furnishings be programmed for the pedestrian right-of-way?	**No.**
If yes above, what are the proposed dimensions of the sidewalk café or furnishings and what will the right-of-way clearance be?	N/A

Proposed Accessible Parking:

See Massachusetts Architectural Access Board Rules and Regulations 521 CMR Section 23.00 regarding accessible parking requirement counts and the Massachusetts Office of Disability Handicap Parking Regulations.

What is the total number of parking spaces provided at the development site parking lot or garage?	**Approximately 1,371 spaces on site (street parking) and within structured garage areas and street parking.**
What is the total number of accessible spaces provided at the development site?	**Approximately 24 accessible spaces.**
Will any on street accessible parking spaces be required? If yes, has the proponent contacted the Commission for Persons with Disabilities and City of Boston Transportation Department regarding this need?	**Yes, on-street accessible parking will be provided along Tremont Street and along the project driveways. Final locations and counts will be coordinated with the Commission for Persons with Disabilities and City of Boston Transportation Department.**
Where is accessible visitor parking located?	**See attached diagram Appendix 9_Exhibit A, B, C, D and E.**
Has a drop-off area been identified? If yes, will it be accessible?	**Yes, an accessible drop-off area will be provided along East Drive and within the pedestrian plaza area.**

Include a diagram of the accessible routes to and from the accessible parking lot/garage and drop-off areas to the development entry locations. Please include route distances.	See attached diagram Appendix 9_Exhibit A, B, C, D and E.

Circulation and Accessible Routes:

The primary objective in designing smooth and continuous paths of travel is to accommodate persons of all abilities that allow for universal access to entryways, common spaces and the visit-ability* of neighbors.

**Visit-ability – Neighbors ability to access and visit with neighbors without architectural barrier limitations*

Provide a diagram of the accessible route connections through the site.	See attached diagram Appendix 9_Exhibit A, B, C, D and E.
Describe accessibility at each entryway: Flush Condition, Stairs, Ramp Elevator.	The accessible entries to all buildings will have a flush condition.
Are the accessible entrance and the standard entrance integrated?	Yes.
If no above, what is the reason?	N/A
Will there be a roof deck or outdoor courtyard space? If yes, include diagram of the accessible route.	Yes. The roof areas will be dedicated to individual use groups and will be accessible to each use group.
Has an accessible routes way-finding and signage package been developed? If yes, please describe.	Not determined at this time.

Accessible Units: (If applicable)

In order to facilitate access to housing opportunities this section addresses the number of accessible units that are proposed for the development site that remove barriers to housing choice.

What is the total number of proposed units for the development?	Proposed units at this time include 685 residential units.

How many units are for sale; how many are for rent? What is the market value vs. affordable breakdown?	At this time all 685 residential units are for rent. The market value versus affordable breakdown has not been determined.
How many accessible units are being proposed?	Not determined at this time.
Please provide plan and diagram of the accessible units.	Not determined at this time.
How many accessible units will also be affordable? If none, please describe reason.	Not determined at this time.
Do standard units have architectural barriers that would prevent entry or use of common space for persons with mobility impairments? Example: stairs at entry or step to balcony. If yes, please provide reason.	No.
Has the proponent reviewed or presented the proposed plan to the City of Boston Mayor's Commission for Persons with Disabilities Advisory Board?	Not at this time.
Did the Advisory Board vote to support this project? If no, what recommendations did the Advisory Board give to make this project more accessible?	The Advisory Board has not reviewed the project at this time.

Thank you for completing the Accessibility Checklist!

For questions or comments about this checklist or accessibility practices, please contact:

kathryn.quigley@boston.gov | Mayors Commission for Persons with Disabilities

Figure 1 – Site Accessible Routes - Roads & Driveways

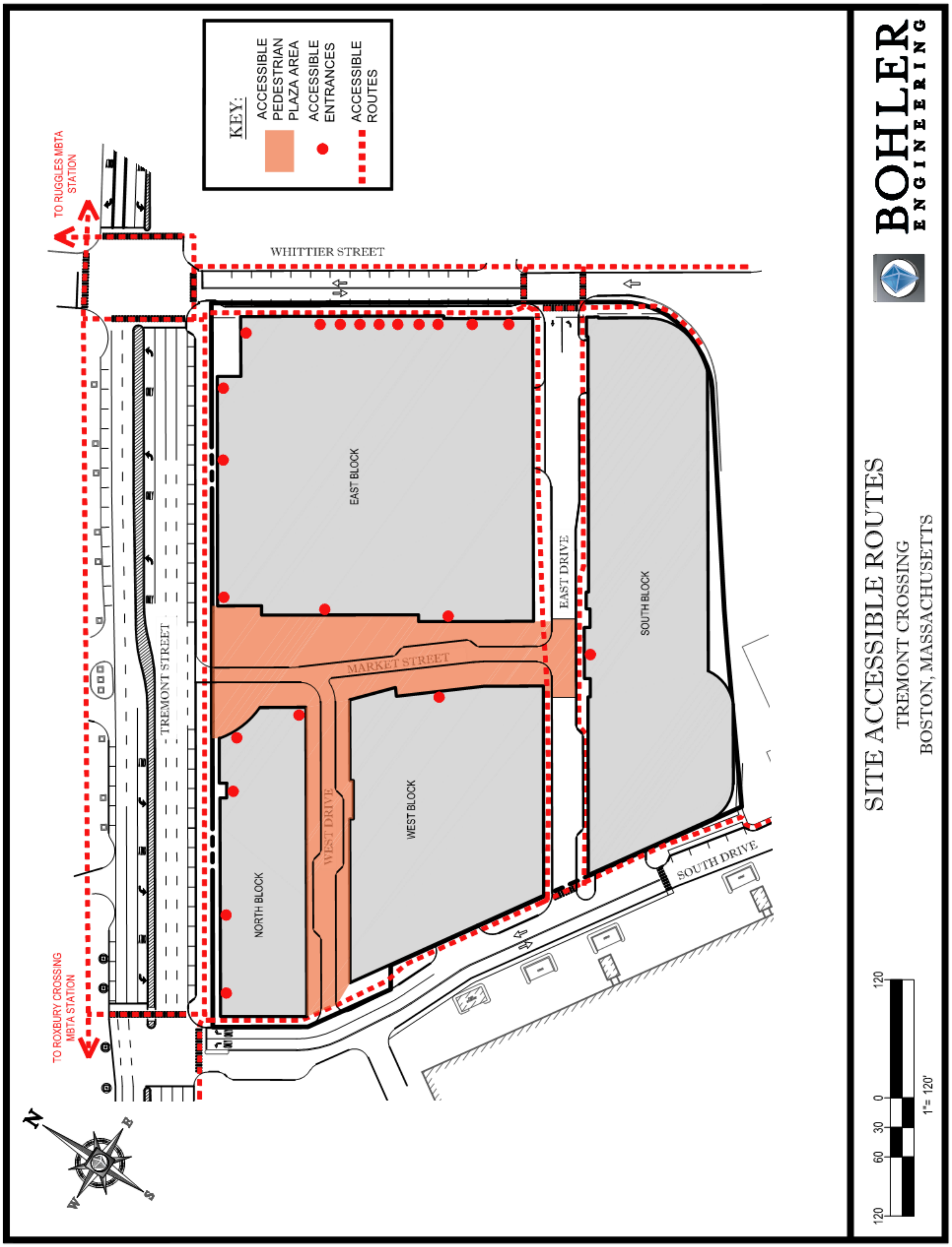
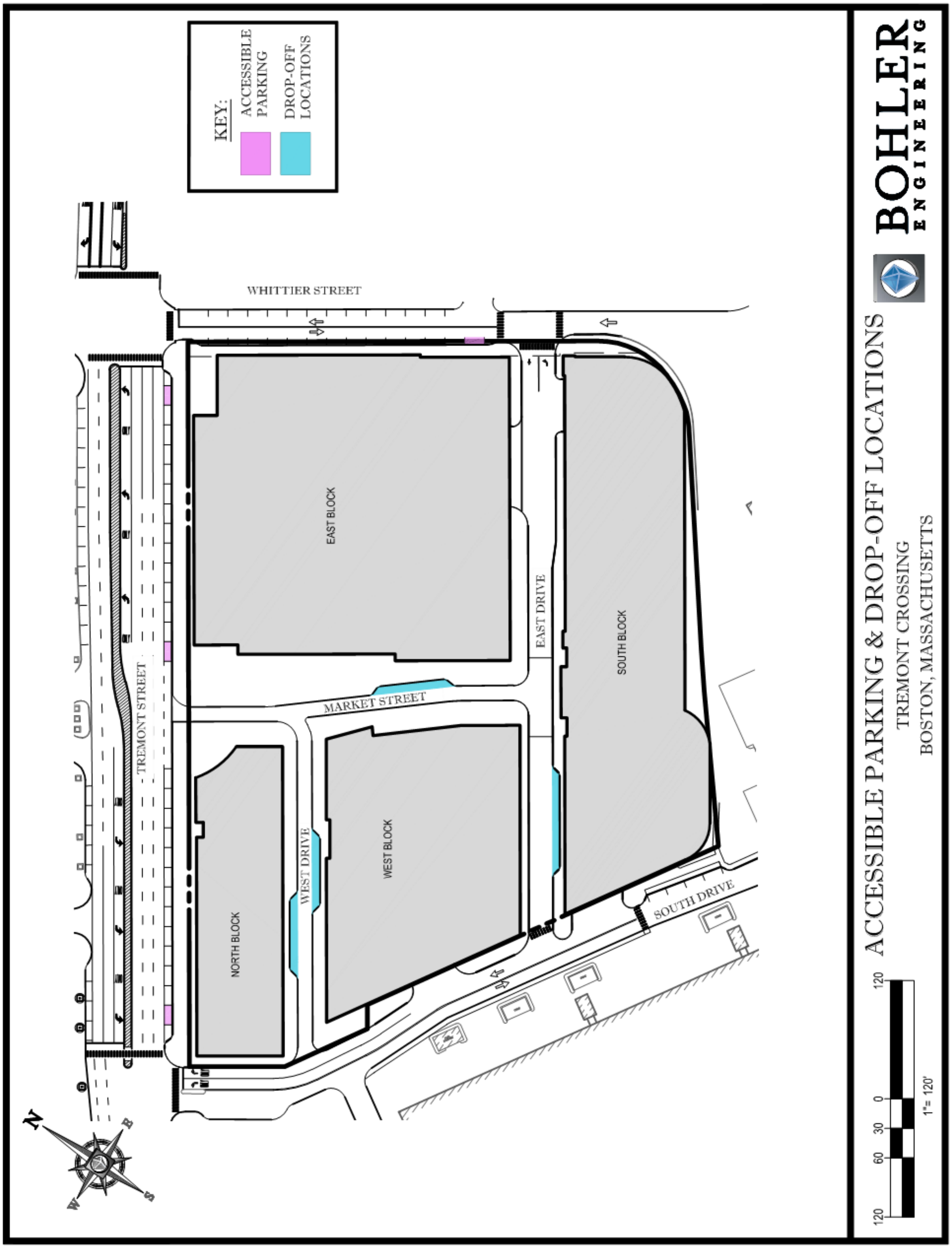
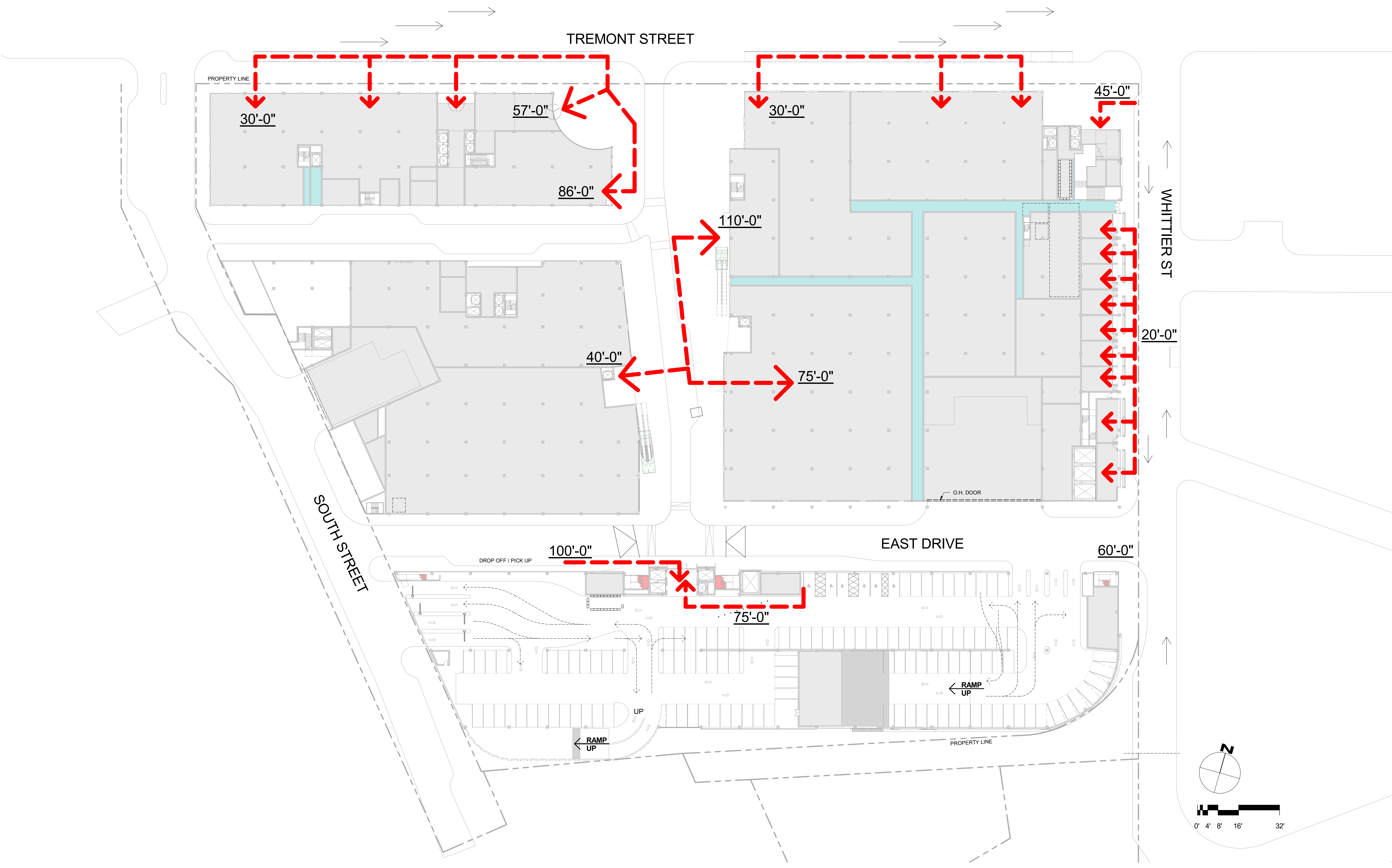


Figure 2 - Accessible Parking & Drop-Off Locations



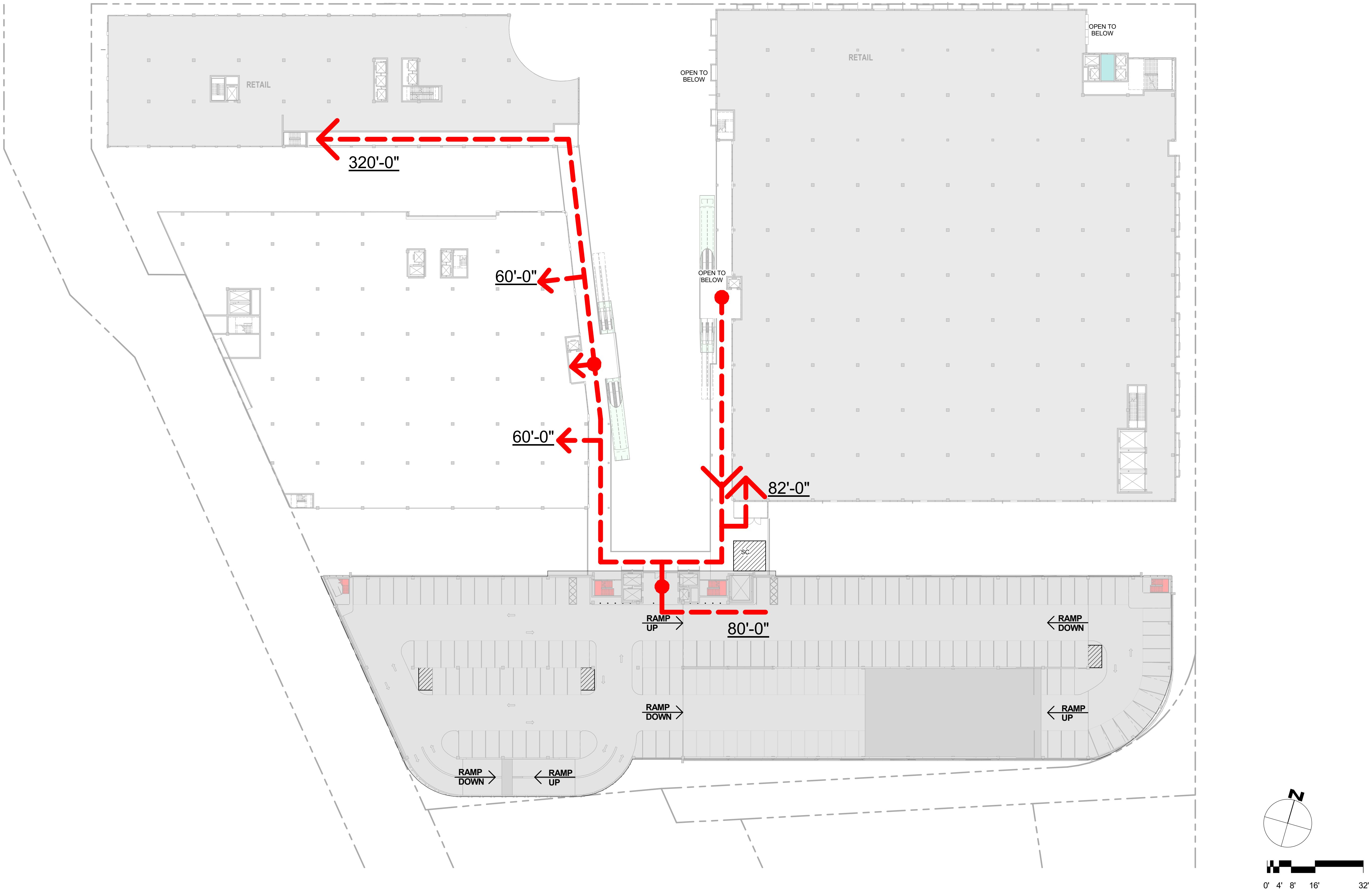


TREMONT CROSSING ACCESSIBLE ROUTES - LEVEL 1

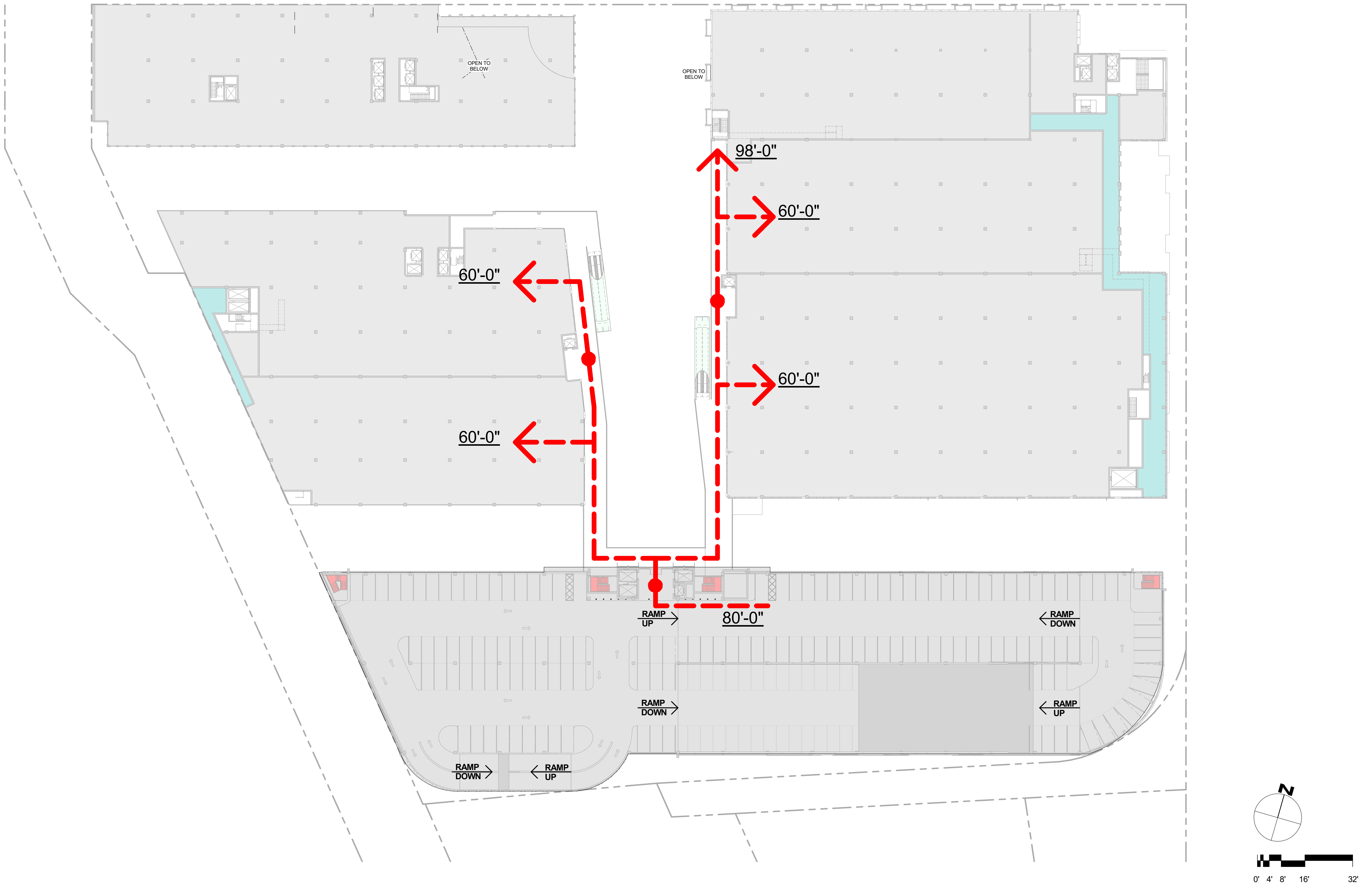
1/32" = 1'-0"

08.08. 2016

Appendix 9 - Figure 3



TREMONT CROSSING **ACCESSIBLE ROUTES - LEVEL 2** 1/32" = 1'-0" 08.08. 2016 Appendix 9 - Figure 4



TREMONT CROSSING **ACCESSIBLE ROUTES - LEVEL 3** 1/32" = 1'-0" 08.08. 2016 Appendix 9 - Figure 5