

# Dudley Square Transportation & Air Quality Study



**The Honorable Thomas M. Menino  
Mayor, City of Boston**

**Mark Maloney  
Director, Boston Redevelopment Authority**

**Andrea D'Amato  
Commissioner, Boston Transportation Department**

**November 2001**

# **Dudley Square Transportation & Air Quality Study**

*Prepared by:*

Bruce Campbell & Associates, Inc.

Primary Group, Inc.

Tech Environmental, Inc.

*Prepared for:*

**City of Boston**

Thomas M. Menino, Mayor

**Boston Redevelopment Authority**

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## **CHAPTER 1: PROJECT TEAM**

### **Community Members:**

Bruce Bickerstaff, Roxbury Neighborhood Council  
Josephine Brown, Resident  
Edna Bynoe, Orchard Gardens Resident Association  
D. Elaine Corbin, Human Site Guide  
Patricia A. Courtney, Urban Edge  
Bob Carlson, Resident  
Dan Cruz, Cruz Development Corporation  
Tina Dent, Urban League of Eastern MA  
Charles Dickerson, Resident  
Lucy Fazzino, Resident  
Fred Fairfield, Dudley Merchants  
Randy Gobeil, Resident  
James Goldstein, Tellus Institute  
James C. Green, Local Business  
Geneva C. Harris, Resident  
Arthur Hurley, Local Business  
Penn Loh, ACE  
Jean Morgan, Roxbury Neighborhood Council  
Francine G. Morse, Resident  
David Noiles, Roxbury Environmental Empowerment Project  
Hilda Novflett, Resident  
Jean Pinado, Madison Park Development Corp.  
John Rumpler, ACE  
Tauheedah Shakur, Roxbury Defenders  
Ron Shelburn, Roxbury Neighborhood Council  
Robert Springer, New Boston Associates  
Joyce Stanley, Dudley Square Main Streets  
Cynthia Suarez, Bay State Banner  
Jodi Sugerman-Brozan, ACE  
Michael Svelnis, Resident  
Clayton Turnbull, Dudley Square Merchants  
Karen Wepsic, Federation of Public Transportation  
Stanley Wiggins, Roxbury Environmental Empowerment Project

### **Elected Officials:**

The Honorable Gloria Fox  
The Honorable St. Fleur  
The Honorable Charles Turner  
The Honorable Dianne Wilkerson

### **Public Agencies:**

Boston Redevelopment Authority:  
Noah Luskin

Boston Transportation Department:  
Don Burgess  
Ralph DeNisco  
Carl McKenzie

Department of Neighborhood Development:  
Maureen Anderson  
Margaret Bursaw  
Steve Rumpler  
Chuck Worcester

Boston Police Department:  
Lt. Marcey Corwin  
Captain Al Goslin  
Mark Lynch

Boston Public Library:  
Worth Douglas  
Elaine McLean James  
Joe Sarro

Department of Public Health:  
Randal Cabral  
Suzanne Condon  
Marianne Fleckner  
Jim Hill  
Elaine Krueger

Massachusetts Bay Transit Authority:  
Peter Calcaterra  
David Carney  
Melissa Dullea

Roxbury District Court House  
Steve Carrol  
Margaret Cavanaugh  
Liz Minnis

### **Consultants:**

Matthew Bluetie, Primary Group  
Bonnie Polin, Bruce Campbell Associations, Inc.  
Dr. Robert J. Rossi, Tech Environmental, Inc.  
Kirk Sykes, Primary Group

## **CHAPTER 2: PROJECT SUMMARY**

### **I. Introduction**

The Boston Redevelopment Authority (BRA) and Boston Transportation Department (BTD) conducted the Dudley Square Transportation & Air Quality Study to develop a transportation agenda for the Dudley Square area that protects and builds on the area's unique environmental, urban design and land use character. The overall goals of the Study were to:

- Manage the combined impacts of the new development projects proposed for the area
- Create an implementation plan with specific transportation related improvements that will increase pedestrian safety, alleviate congestion and encourage the use of public transportation
- Coordinate with the Department of Neighborhood Development (DND) Municipal Building Study of the Dudley Police Station, Library and the surrounding plazas

The categories of focus for the Study are: (1) air quality;(2) pedestrian and bicycle issues;(3) parking and loading;(4) public transportation and (5) traffic management. The Study area is primarily the Dudley Square Commercial District (see Study Area map on page 5).

It is the intent of this Study to form a transportation agenda that captures all of the above objectives to allow the community to chart a course for the future that protects and enhances the existing diversity, uniqueness and vibrancy of the Dudley Square area. The transportation agenda is multi-modal in its approach and has tangible, implementable short and long-term recommendations. The outcome of the plan includes a set of community-prioritized changes/improvements to roadway circulation, parking, pedestrian environment and public transportation with resulting stabilization or improvements to the area's air quality. This set of Community Recommendations is based on community input and the consultants' analysis. The recommendations will be given to developers and City and State agencies, outlining how new development will occur in Dudley Square so that *transportation is improved and the public health of residents is protected*.

### **II. Framework of Study**

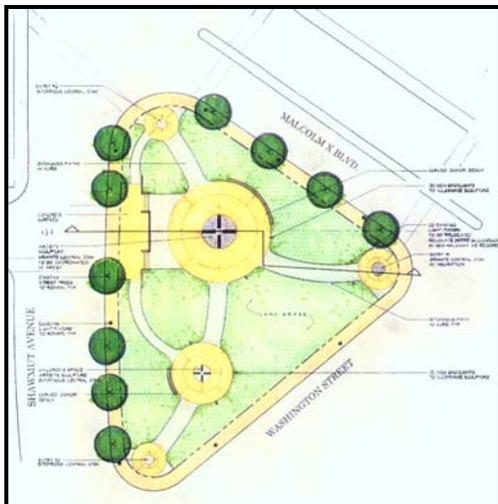
In 1998, the Commonwealth's Department of Public Health (DPH) was authorized to enter into a lease for office space at a site selected within Dudley Square. Between October 1998 and January 1999, the BRA worked together with BTD, DND and the Dudley Square Parking Task Force, an organization including members of the Dudley Square Merchants Association, Dudley Square Main Streets, Alternatives for Community & the Environment (ACE), Orchard Gardens and Madison Park, to identify a preferred site for the parking required by the DPH office project. As a result of this process, the former Modern Electroplating and Enameling Facility was identified as the appropriate site for the location of the required parking. In response to the number of proposed large-scale developments in Dudley Square, the Task Force requested that a Transportation & Air Quality Study be performed to examine the long-term impacts of these projects as a whole on Dudley Square

Proposed projects include:

- Modern Electroplating Site: The Dudley Square Executive Plaza is a proposed 60,000 square foot office building with retail on the ground floor. The project will also include a structured parking garage for tenants, DPH employees and the public.
- Department of Public Health Headquarters: Proposed 200,000 square foot office building at the Ferdinand Block that will bring over 1,200 DPH employees to Dudley Square each day.
- Justice Edward Gourdin Veterans Memorial Park: Located between the Modern Electroplating Site and the Fairfield Center, this parcel has been assembled and is now owned by the BRA. The City of Boston's Browne Fund approved a Design & Development Plan (~\$450,000) with final design, engineering and construction expected in 2002.
- Silver Line: Presently under construction, the Silver Line will be a bus rapid transit (BRT) service that will run along Washington Street from Dudley Square Station Downtown Crossing. The Silver Line buses will run in a reserved lane from Melnea Cass Boulevard to Herald Street.

It is critical that these potential projects meet the goals and objectives of ongoing studies in the area including the Roxbury Master Plan, Dudley Square Municipal Center Study and the public arts projects proposed for Dudley Square.

The Dudley Square Transportation & Air Quality Study began in September 2000. The scope of work was developed based on input from not only the BRA and BTM but also from the community and other agencies that are coordinating development initiatives in the area. Monthly meetings were held with community residents, business owners and other interested parties. This Study focuses on the recommendations that were developed as a result of the technical research and public process. The recommendations presented in Chapter 6 target specific issues that require mitigation.

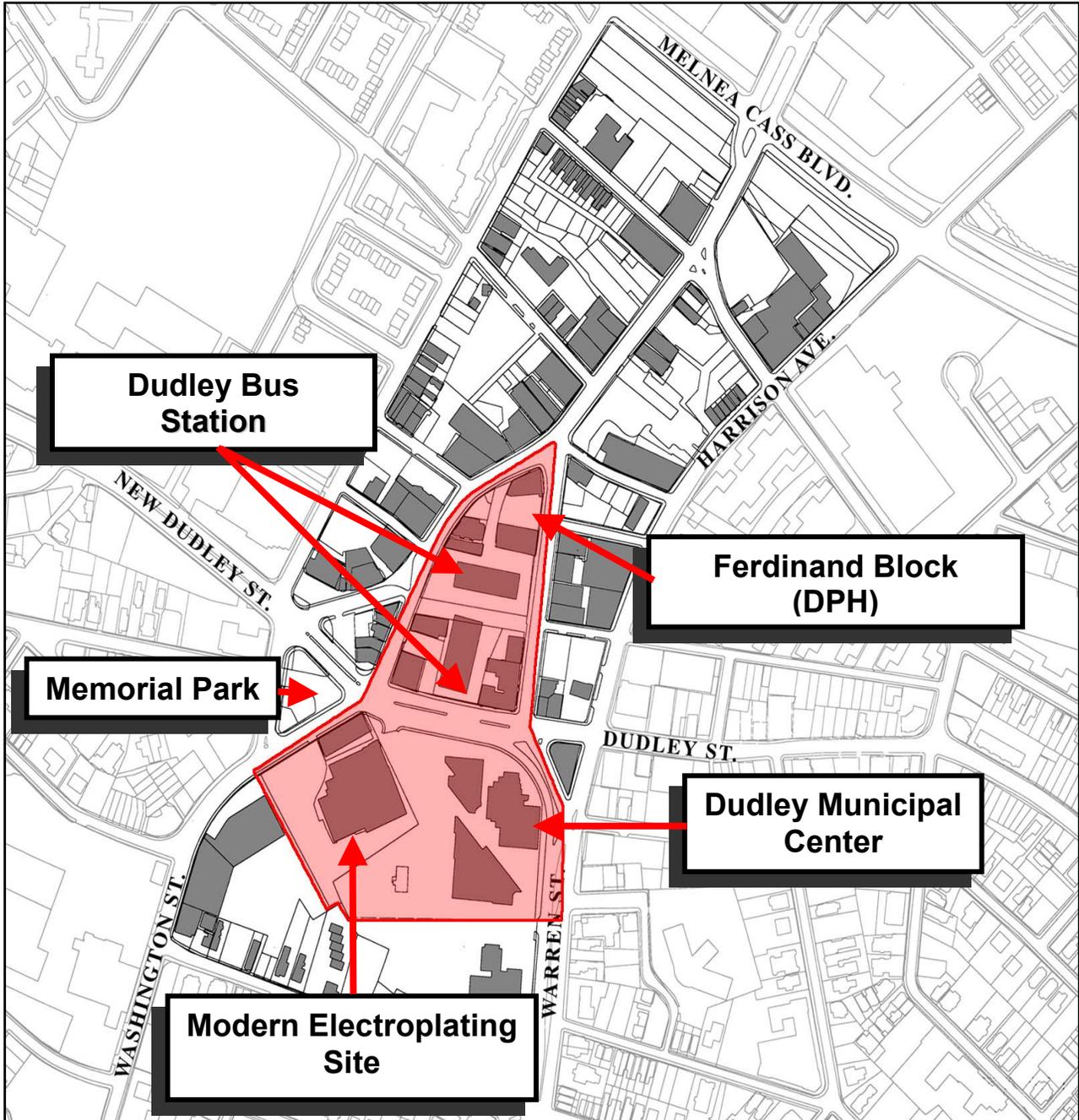


**Justice Edward O. Gourdin  
Veterans Memorial Park**



**Department of Public  
Health Headquarters**

## Dudley Square Transportation & Air Quality Study Area



### **CHAPTER 3: PROJECT METHODOLOGY**

As an outgrowth of the Dudley Square Parking Task Force and other related planning efforts, the Dudley Square community developed a comprehensive scope for the Transportation & Air Quality Study. These efforts allowed the Study to quickly delve into substantive and often technical issues while continual community input was gathered. In fact, much of the technical data for the Study was gathered even before the first community meeting, allowing even initial discussions to be well informed and to progress rapidly into the development of alternative solutions.

The Study benefited tremendously from an open, public process, which included area residents, merchants, user groups, institutional stakeholders and a variety of City and State agencies. These groups established and prioritized issues for the Study to explore (see Appendix). The group then focused on the development and analysis of proposed recommendations and later established the recommendations that are detailed in Chapter 6. Comparing Dudley’s infrastructure with other similar districts in the Boston region further developed the process. The table below is a sample of the comparative analysis developed. Using this data, discussions focused on the desired density and urban design of Dudley Square applying the positive and negative characteristics of these comparable “Squares.”

Comparison of Other “Squares” to Dudley Square			
Area	Total Number of Peak Hour Vehicles	Public Transit	Pedestrian Uses
Dudley Square	4,200	16 bus lines	<b>Residential and commercial uses with significant pedestrian crossing.</b>
Brookline Village	2,700 (excluding Route 9)	3 bus lines 1 light rail line	Residential and commercial uses with significant pedestrian crossing.
Central Square	3,800	8 bus lines 1 subway line	Residential and commercial uses with significant pedestrian crossing.
Kenmore Square	6,500	6 bus lines convergence of 3 light rail lines	Residential and commercial uses with significant pedestrian crossing.
Malden Center	3,600	14 bus lines 1 subway line	Residential and commercial uses with significant pedestrian crossing.
Medford Square	4,400	6 bus lines	Residential and commercial uses with significant pedestrian crossing.

Through open discussion, frank debate, and a willingness to explore unique alternatives, the Study was ultimately able to develop the recommendations presented in this report.

Below is an outline of the public meetings for this process. All meetings were held in the evening at the Dudley Square Library. The detailed Minutes of each meeting can be found in the Appendix.

**Meeting 1: Kick-off Meeting, November 28, 2000**

At the initial meeting, the BRA and BTM introduced the Project Team and presented the Scope and Schedule for the Study. The Consultants presented a brief summary of existing conditions as well as the findings from the first phase of the DND's Dudley Square Municipal Center Study. The meeting provided a forum for the community to express their impressions and concerns in the area. Concerns were listed and ranked as to their priority (see Appendix).

**Meeting 2: Existing and Future Conditions, January 30, 2001**

The consultants presented a detailed analysis of existing conditions in Dudley Square and a preliminary analysis of the expected impact of planned growth in Dudley. Existing data on traffic, public transportation, pedestrian use, parking, and air quality was presented and compared to the list of community concerns compiled from the previous meeting. The list of issues and scope of future work was further prioritized and goals were established to improve the transportation system and "experience" of Dudley. In addition, local students from the Roxbury Environmental Empowerment Project (REEP) presented their summary of Air Quality issues in Dudley Square that included a fact sheet, summarizing their presentation (See Appendix).

**Meeting 3: Development of Recommendations, February 27, 2001**

The consultants presented a variety of urban design and streetscapes from recognizable areas to allow the community an opportunity to analyze comparable urban environments. The areas chosen were comparable in size, transportation infrastructure and traffic volumes to Dudley Square. The images and urban environments provided guidance and lessons to be duplicated or avoided. Broadly defined transportation recommendations were developed based on community process to date. Through community discussion, alternative recommendations were narrowed down for further evaluation.

**Meeting 4: Preliminary Recommendations, June 6, 2001**

The consultants presented a preliminary series of Draft Recommendations. Each draft recommendation was presented in the context of the community concerns that it addressed. Recommendations were shown as the outgrowth of the preferred alternative strategy agreed to at the previous meeting. Each recommendation was developed, tested and analyzed based upon the data collected and how it met the Study's objectives. Comparative elements from other urban areas were presented to demonstrate how the recommendations would materialize in Dudley Square. For example, several landscaped median strips in Downtown Boston were shown to illustrate potential expansion of the Dudley Street median to enhance pedestrian safety. All recommendations were geared to an improved multimodal transportation system for the area, and for a more structured pedestrian experience. Community input was noted for each recommendation. Donna Smallwood from Caravan for Communities, presented information on Transportation Demand Management (TDM) programs and how other communities have established

Transportation Management Associations (TMA's) to increase non-auto travel in their districts. For more information on TDM programs please visit [www.commuter.com](http://www.commuter.com) or call 1-888-4-COMMUTE.

### **Meeting 5: Draft Recommendations and Next Steps, July 11, 2001**

The detailed recommendations of the Study were presented at the final meeting. The recommendations were refined based on community input at the previous public meeting. The consultants presented timelines and responsibility for implementation of the recommendations. A discussion on how these recommendations would be incorporated into the Dudley Square Municipal Center Study detailed the coordination of these two planning efforts. Updates on the Department of Public Health and Modern Electroplating projects were also given.



David Noiles and Stanley Wiggins from the Roxbury Environmental Empowerment Project (REEP) present their findings on local air quality issues

## **CHAPTER 4: EXISTING CONDITIONS**

In order to understand the Study objectives, the Existing Conditions and Anticipated Future Conditions (Chapter 5) must be understood. This report presents a brief overview on the existing and anticipated future conditions. Detailed analyses and backup can be found under separate cover. With this background information, the recommendations presented in Chapter 6 are easier to follow.

### **I. General Summary of Existing Conditions**

Dudley Square is a compact, dense urban business district that sits at the heart of Roxbury. It is well served by transit, traversed by thousands of commuters a day. Residential areas surround the Square. Dudley Square is undergoing rapid development today and experiencing the associated pains of traffic congestion, inadequate transit access and limited parking. Although Dudley Square may not reclaim its past as the second busiest commercial district in New England, its continual growth is certain and the impacts of this growth on its transportation demands, air quality and quality of life must be met.

There is currently a significant amount of vehicular, transit and pedestrian activity in Dudley Square. More than 4,000 vehicles an hour pass through Dudley Square during the commuter peak hours. During the morning peak period, the majority of the traffic is traveling north towards downtown Boston. During the evening peak hours, the majority of traffic is traveling southbound from the downtown Boston area. Approximately 180 MBTA buses access the Dudley Square Station during the peak hours. On a daily basis, nearly 28,000 passengers board / alight the MBTA buses on a total of 16 bus routes, seven of which terminate in Dudley Square. Pedestrian activity is intense with many pedestrians walking to and from buses, transferring between buses or walking to many destinations in and around Dudley Square. On and off-street parking spaces are also highly utilized. The north-south arterials are generally signed with 2-hour parking restrictions although enforcement has been limited. Many of the off-street lots and the on-street parking spaces are occupied by commuters destined to Downtown Boston who use the Dudley Square area for all day free parking. This leaves the availability of short-term parking very restrained.

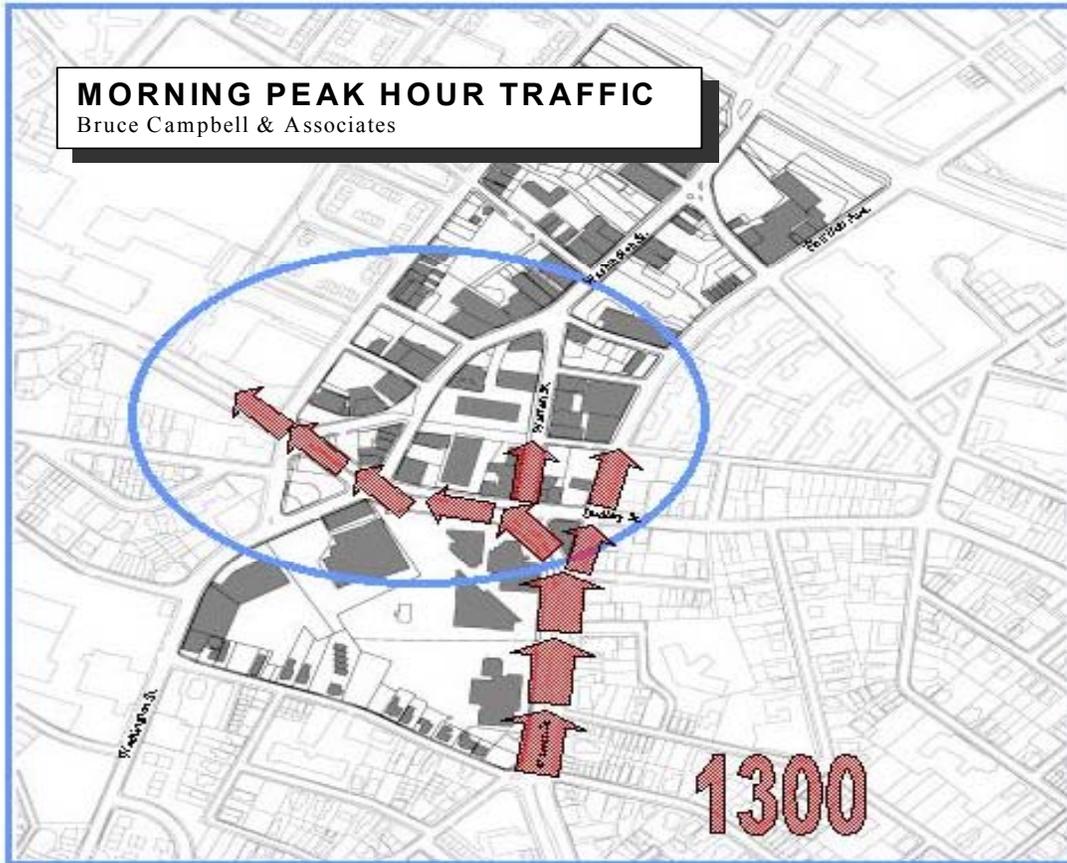
### **II. Existing Conditions By Category**

#### **A. Traffic Volumes & Management**

Traffic counts were conducted in September 2000 at the intersections along the Dudley Street corridor and at other intersections of concern. Traffic count information was collected by vehicle type (passenger cars, trucks and MBTA buses). The queuing on each approach to the intersections was recorded as well. Pedestrian activity was also measured. Traffic signal information and overall intersection operation were noted as well as some specific travel times. Level of Service (LOS) analyses were performed for the existing conditions and calibrated to the recorded delays and travel times. The existing traffic conditions can be summarized as follows (see Appendix for detailed traffic data):

- Approximately 4,000 vehicles pass through Dudley Square during each of the morning and afternoon peak hours
- Predominant movement in the morning is northbound from Warren Street (more than 30% of all entering vehicles)

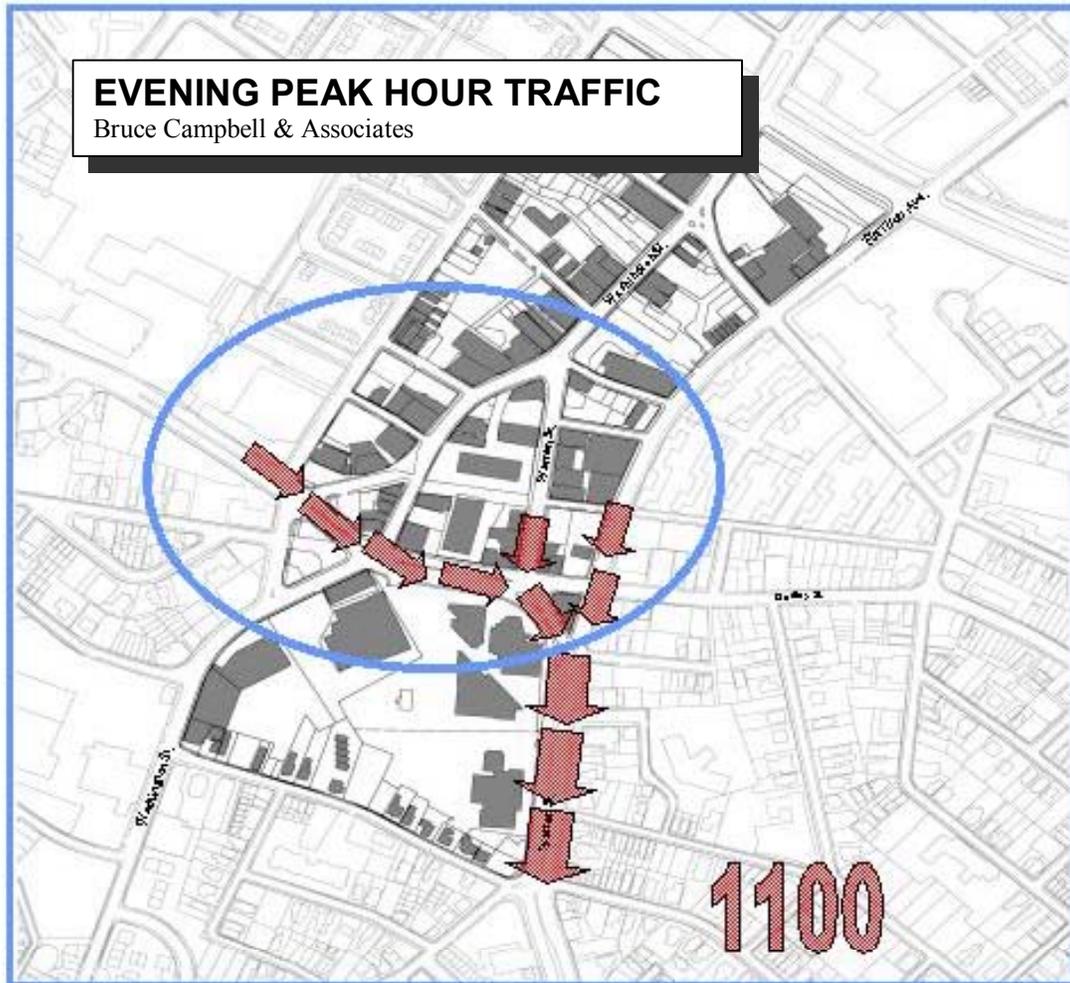
- Predominant movement in the afternoon is southbound to Warren Street (nearly 30% of all entering vehicles)
- As anyone familiar with the area would expect, several intersections are presently operating deficiently at level of LOS F conditions
- Gridlock is evident during peak hours and some off-peak hours
- Traffic signals within the Dudley Street corridor do not appear to be working as a coordinated system and several signal lenses are out



- About 4,000 vehicles travel through Dudley Square during the Morning Peak Hour
- 33% of all vehicles entering Dudley Square come from Warren Street (Northbound)
- Predominant movement during the morning commuter peak is northbound (50% of all traffic entering Dudley Square)
- 75% of traffic travels from the north or south
- 25% of traffic travels from the east or west

## EVENING PEAK HOUR TRAFFIC

Bruce Campbell & Associates



- About 4,200 vehicles travel through Dudley Square during the Evening Peak Hour
- 28% of all vehicles entering Dudley Square are destined for Warren Street (Southbound)
- Predominant movement during the evening commuter peak is southbound (46% of all traffic entering Dudley Square)
- 80% of traffic travels from the north or south
- 20% of traffic travels from the east or west

## B. Public Transportation

The Dudley Square Bus Terminal is the busiest in the MBTA System. Dudley Square is serviced by sixteen MBTA bus routes, seven terminating in Dudley Square and nine passing through Dudley Square. Based on MBTA daily ridership information, 15,226 passengers board and 12,130 passengers alight (including transfers) in Dudley Square.

MBTA Bus Routes in Dudley Square			
Bus Route	Origin – Destination	Bus Route	Origin – Destination
1	Harvard Square– Dudley Square	42	Forest Hills – Ruggles Station
8	UMass – Kenmore Square	44	Jackson Square – Ruggles Station
14	Roslindale Square – Dudley Square	45	Franklin Park Zoo – Ruggles Station
15	Kane Sq. Fields Corner – Ruggles Station	46	Heath Street – Dudley Square
19	Fields Corner – Ruggles Station	47	Central Square – Broadway Station
23	Ashmont – Ruggles Station	49	Dudley Square – Downtown
28	Mattapan – Ruggles Station	66	Harvard Square – Dudley Square
41	Centre/Eliot Streets – Dudley Square	170	Dudley Square – Waltham & Burlington

As a major hub for the MBTA Bus Network, Dudley Square serves a direct connection to many parts of the region. However, bus service suffers from overcrowding and the inconsistencies of schedule adherence. In fact, 73% of the bus routes with destination in Dudley Square arrive on time or early.

The configuration of Dudley Square itself contributes to traffic congestion and inefficient bus circulation as 77% of bus routes with origins in Dudley Square arrive on time or early at their destinations. A large percentage (75%) of the bus routes experience at or near capacity conditions during at least one time period of the day. Due to the configuration of the roadways and the Dudley Square Station, the outbound buses passing through Dudley Square (from Roxbury Crossing) must turn left into the station on Warren Street and then turn left out of the station onto Washington Street. This creates a loop that necessitates traveling eastbound on Dudley Street twice. Approximately 50 buses during the peak hours make this circuitous move exacerbating the traffic congestion on this stretch of roadway. During peak hours, it takes an average of over 3½ minutes to travel between the Dudley Street/Shawmut Street intersections to the Warren Street/Dudley Station entrance. Outbound buses must travel this roadway twice, which adds significant time to their scheduled routes, increasing traffic congestion.



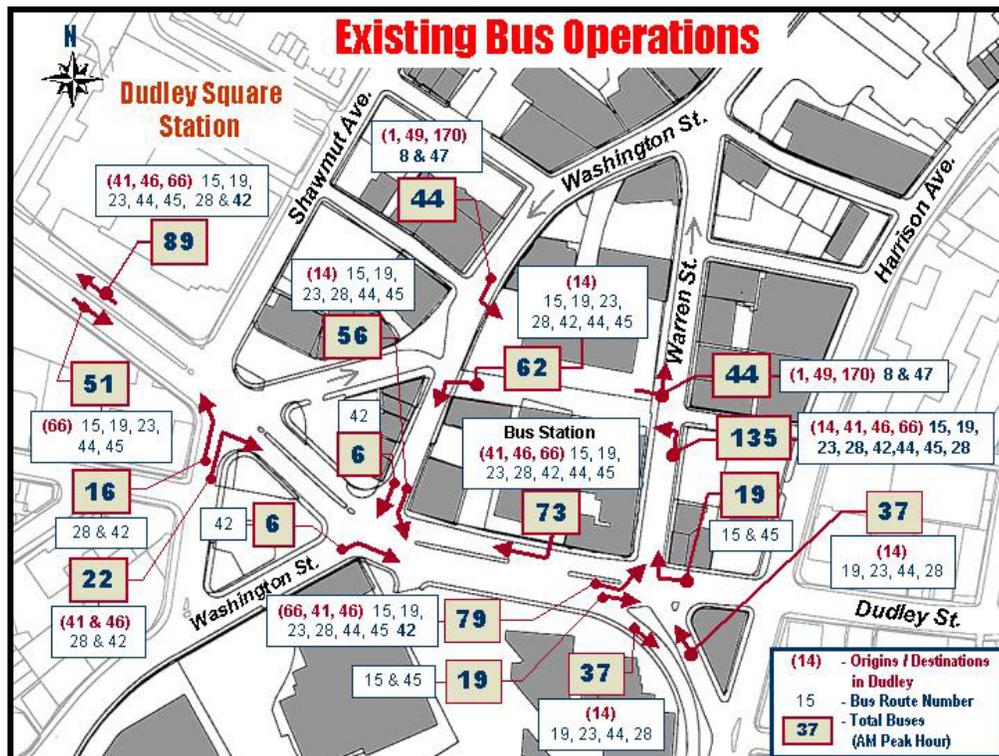
Although Dudley Square is well served by the MBTA Bus Network, it presently lacks a Rapid Transit Connection. The Silver Line, due to begin service in Spring 2002, will provide a direct Bus Rapid Transit link between Dudley Square and Downtown Crossing. The existing bus network links Dudley Square to the existing Rapid Transit Network to varying degrees. Connections to the Orange Line, for example, are very good, with most bus routes that serve Dudley Square continuing to Ruggles Station.

Riders can board these buses free at Dudley Square for service to Ruggles Station. However, Eastbound connections to the Red Line are significantly weaker as few bus routes run from Dudley Square to JFK UMass, Andrew or Broadway stations. This limits the transit accessibility of Dudley Square to the Red Line corridor.



*Mode Share:* Although not specific to Dudley Square but rather in a broader area, as identified by the Central Transportation Planning Staff (CTPS), autos made 43% of all trips originating in the area and occurring during the morning peak commuting period, 28% were made by transit and 28% by pedestrians. These figures encompass trips for all purposes including home to work, home to school, work to shopping as well as all other trips. The percentage of walking trips is relatively high because it includes home to school trips. When the presumed number of home to school trips is removed, the auto mode share went to 49%, the transit share to

33% and pedestrian share to 18%. This Trip Destination methodology was applied for trips coming into the expanded area around Dudley Square during the morning commuter peak period and resulted in the following presumed mode share for employees: 61% of all trips were made by auto, 23% by transit and 16% by pedestrians. While these numbers apply to a more broad area than just Dudley Square, one would expect the actual bus usage to be higher in Dudley Square because of the proximity to the Dudley Station.



### C. Pedestrian & Bicycle Activity

Businesses, residences, transit nodes and parking lots fill and surround Dudley Square. In this dense urban environment, pedestrian activity is intense. These existing conditions present challenges and opportunities. Pedestrian activity was monitored at all intersections where traffic counts were taken. It was noted that the heaviest pedestrian activity are crossings of Dudley Street at mid-block by Dudley Station rather than at the intersections of Dudley Street / Warren Street or Dudley Street / Washington Street. This occurred even though both intersections have exclusive pedestrian phases. Observations and community input showed that these intersections make the mid-block crossing appear safer than at the intersections. For example, the pedestrian indication at Dudley Street / Washington Street was not working during the numerous field visits. The indication to “Walk” would illuminate and then 7 seconds later it would turn off. Normally, after this time, a flashing “Don’t Walk” would become illuminated, indicating that a pedestrian should not begin to cross the street but pedestrians already in the crosswalk should proceed. Without the “Don’t Walk” indication, a pedestrian thinks that only 7 seconds are available to cross the entire street. A pedestrian does not feel safe crossing the street under this condition.



The traffic congestion and gridlock observed tend to make drivers more frustrated and aggressive. Driving examples raised by the community include drivers blocking crosswalks, running red lights and traveling outside their designated lanes. These conditions make pedestrian crossings even more difficult.

Based on the existing signal phasings and timings, the following three intersections in the Dudley Street corridor have exclusive pedestrian phases (where all vehicles are stopped in order for pedestrians to cross the street): (1) Dudley Street/Shawmut Avenue; (2) Dudley Street/Washington Street and (3) Dudley Street/Warren Street. The intersection of Dudley Street / Harrison Street does not have a phase in the traffic signal specifically dedicated to pedestrians so the pedestrians must cross at the same time as vehicles during a non-conflicting movement.

The overall streetscape in Dudley Square lacks a coherent structure that would allow pedestrians to flow through the area safely and efficiently. Streetscape amenities such as the following are missing:

- Adequately striped crosswalks
- Bicycle racks and bicycle lanes
- Benches and defined sitting spaces
- Signage and information kiosks
- Lighting



These streetscape elements would define the street edge and signal to pedestrians how the busy urban environment should be navigated. They also offer a human scale to the area allowing for a more enjoyable pedestrian experience. The key pedestrian spaces in the area are lacking definition and associated vitality. Currently the streetscape is littered with electrical boxes for the signal lights, misplaced planters and uninviting plaza spaces. This littering adds to the confusion of pedestrian flow through the area, undermining the sense of character necessary for an urban area such as Dudley Square to present a pedestrian friendly image.

#### **D. Parking & Loading**

In any business district, demand for parking and loading is intense. While offstreet facilities can help meet this demand, the competition for spaces is most directly felt at the curb. Employees, customers, visitors, commuters and service vehicles all must be accommodated to varying degrees in the limited space available. While new buildings and developments provide for these needs on their own sites off the streets, most of the older buildings in Dudley Square that remain in productive use simply do not have that option and must use the street.

Parking supply in Dudley Square is both limited and varied, existing both onstreet and in public and private parking lots. Onstreet parking is allowed on the major North-South streets in the Study area. Parking on Washington Street and Warren Street is regulated primarily as 2 Hour Parking. Harrison Avenue and Shawmut Avenue each allow parking on both sides of the street that is largely unregulated. However with a few exceptions, these streets are primarily residential, and thus less likely to desire regulation. Many of the cross streets between these streets and Washington Street are narrow and may only support parking on one side. Dedicated loading space on the street is minimal, disorganized and woefully inadequate to meet demand.

There are three municipal parking lots in Dudley Square that are owned and maintained by the Boston Transportation Department. Though these lots are relatively small, they are well dispersed through the Dudley Square area and together represent a fairly typical availability of public parking for neighborhood business districts in Boston. These lots, on Ruggles Street, Roxbury Street and Warren Street together total approximately 70 parking spaces. An additional facility, called the Blair Lot, is a potential development parcel owned by the BRA. Approximately 77 spaces are used as surface parking serving Dudley Square.

The public spaces must serve the majority of Dudley Square parking demand, as there is a limited amount of private offstreet parking available. In the area North of Dudley Street, only limited space exists behind some of the buildings and is often used for loading purposes rather than for parking. South of Dudley Street, the Courthouse and Boys & Girls Club seem to have adequate parking for their operations, but certainly no excess availability. The Police and the Library, however, have minimal parking, and the Police Department parking lot within the Municipal Center is accessed by a Dudley Street curb cut, that is uncontrolled and



immediately adjacent to the Washington Street/Dudley Street intersection. Due to a lack of sufficient parking, the curb space on the southerly side of Dudley Street is being used by Police officers for parking. Access and egress into this angled parking area can be tricky, especially when traffic on Dudley Street is heavy. The angle parking here negatively impacts traffic flow, pedestrian safety and the potential of the Municipal Plaza.

Commuter parking in Dudley Square exacerbates existing parking problems. Commuters who drive to Dudley Square park their cars all day (for free) and take the bus into Boston have made it difficult for local employees and visitors/shoppers to park. The Blair Lot is seen as the area most affected by this trend, as most of those spaces are full by 8:00 or 9:00 AM, before most businesses in Dudley Square even open. Requests for enforcement by merchants were made, yet once enforcement began, it was apparent that many merchants themselves were ticketed as they had no choice but to park onstreet in violation of parking regulations. A need for more offstreet parking, especially long-term parking was seen by the community as a key to opening up the street for short-term parking.

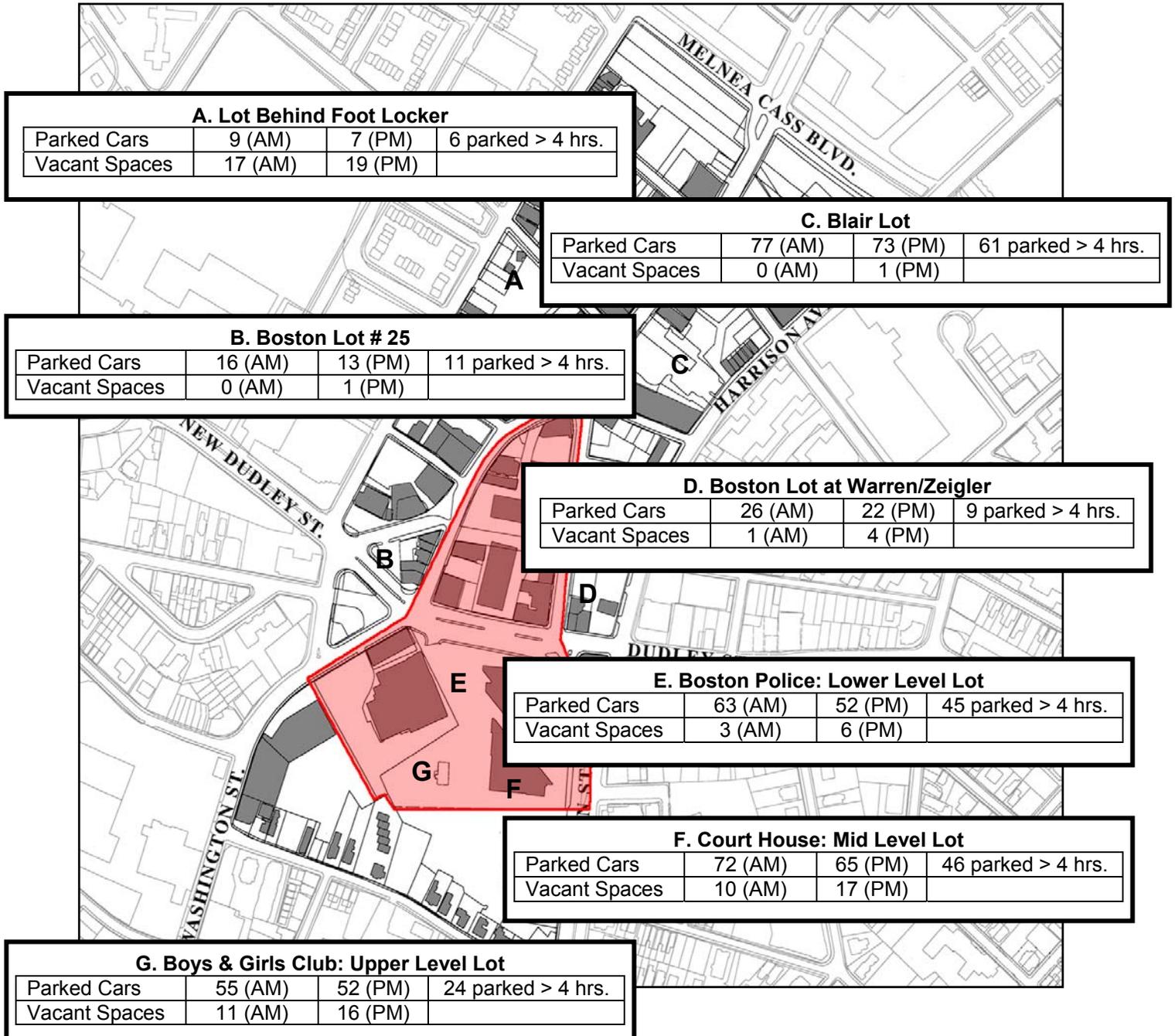
As part of the Study, an analysis of existing parking use was conducted in Dudley Square. The analysis included an evaluation of parking occupancy and parking turnover in onstreet and offstreet spaces. Parking occupancy determines how full parking spaces are at a given point in time, often used to measure potential excess capacity and the times that spaces are most or least full. Parking turnover shows how the spaces are being used and specifically for how long vehicles are parked. Parking turnover is particularly useful in determining the use of parking spaces by long-term parkers.

Surveys of on-street parking spaces have shown that on average 72% are occupied. Parking occupancy is higher during the morning, 78%, than the afternoon, 65%. A greater percentage of the parking vacancies occurred further north towards Melnea Cass, whereas closer to Dudley Square Station, the available on-street parking was more limited. One-quarter (25%) of all parked cars observed were parked in excess of the two-hour restriction.

On-Street Parking Survey								
Street Name	Area	Status	Morning (AM)		Evening (PM)		Parked more than Four hours	
			East Side	West Side	East Side	West Side	East Side	West Side
Harrison	Melnea Cass-Dudley	Parked	27	21	23	19	14	13
		Vacant	11	7	15	9		
Warren	St. James-Washington	Parked	62	49	45	32	27	16
		Vacant	6	9	21	18		
Washington	Melnea Cass-Dudley	Parked	41	51	32	45	17	22
		Vacant	4	17	10	24		
Shawmut	Washington-Melnea Cass	Parked	44	33	36	28	20	15
		Vacant	16	23	20	24		

Parking observations were also conducted at five off-street parking lots, the four publicly accessible lots listed above and at the parking facility serving the Police, Library, Court House and Boys and Girls Club.

### Off-Street Parking Survey



The Lot serving the Municipal Center site was 90% occupied during the course of the parking study, which is typically considered fully occupied. Long-term parkers, vehicles present for more than four hours, occupied 70% of those spaces. Many spaces are reserved for specific users (e.g. handicapped parking), so even if the lot is less than 100% parked, it does not mean that there are actual parking spaces available to the general public. Both the Blair Lot and the Roxbury Street Lot were 100% occupied and approximately 85% of their users were long-term parkers (more than four hours). The Warren/Ziegler lot was nearly full at 96% occupancy. The users of this lot were primarily short-term parkers; with only 41% of all parkers there for more than 4 hours. The lot on Ruggles Street was the parking and staging area for construction of 2201 Washington Street. This lot was mostly always closed to the general public. However, observations were made and it was found that approximately 50% of the lot was occupied, and all of the vehicles were long-term parkers (more than four hours). Currently there are no designated spaces for the Library. Police parking overflows onto the plaza.



## E. Air Quality

Many residents and people who work in Dudley Square have voiced concerns about air pollution and its impacts on health. Asthma hospitalization rates for Roxbury are consistently among the highest in the state and 5-6 times the state average<sup>a</sup>. Asthma is a chronic disease with complex causes, but attacks can be triggered by air pollution, including motor vehicle emissions.

Mobile sources of air pollution (e.g. automobiles, trucks and MBTA buses) are considered to be the most significant contributors to the air quality in Dudley Square. Motor vehicle emissions result from vehicles traveling on the roadways (free-flow emissions) and from vehicles queued at intersections or idling at maintenance facilities and parking lots (idling/queuing emissions).

An analysis of a representative roadway in Dudley Square during the morning peak traffic period indicates that motor vehicles, besides MBTA buses, contribute almost all of the mobile source emissions of carbon monoxide and volatile organic compound emissions in Dudley Square. MBTA diesel buses contribute the majority of mobile source emissions of oxides of nitrogen and particulate matter in Dudley Square.

Dudley Square is potentially a hot spot for air pollution. The Department of Environmental Protection established a comprehensive air monitoring station, known as AirBeat, in Dudley Square (corner of

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<sup>a</sup> Data from Mass. Executive Office of Health and Human Services, Division of Health Care Finance and Policy, State of Massachusetts Asthma Preventable Hospitalizations, Top 10 by # of Discharges, FY 1996-1997.

Zeigler and Harrison) in 1999.<sup>b</sup> A preliminary analysis of AirBeat data for ozone and fine particulate matter (PM<sub>2.5</sub>) shows that air quality was “good” for less than 60% of the time according to the EPA’s Air Quality Index. In Dudley Square, levels of Black Carbon Soot, a measure of pollution from diesel engines, were found to be 35% higher than at a monitoring site at the Harvard School of Public Health only about 1 mile away.<sup>c</sup> A study of air quality in Dudley Square published in 2001 by the Harvard School of Public Health (see Appendix) found higher levels of fine particulate matter and a type of air toxic (Polycyclic Aromatic Hydrocarbons) on roads with heavy bus traffic.<sup>d</sup> This Study also found that levels of fine particulate matter on the days that they sampled exceeded federal annual standards.

Additional information on existing air quality in Dudley Square can be found in the Appendix.

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<sup>b</sup> Other members of the AirBeat collaboration include the Alternatives for Community & Environment, Harvard School of Public Health, Northeast States for Coordinated Air Use Management, and Suffolk County Conservation District. Data is available via web at [www.airbeat.org](http://www.airbeat.org).

<sup>c</sup> Airbeat data was analyzed from April 1999 through February 2001.

<sup>d</sup> Levy, JI, EA Houseman, JD Spengler, P Loh, and L Ryan. “Fine Particulate Matter and Polycyclic Aromatic Hydrocarbon Concentration Patterns in Roxbury, Massachusetts: A Community-Based GIS Analysis,” *Environmental Health Perspectives*, vol 109, no 4, April 2001, pp 341-347.

## **CHAPTER 5: ANTICIPATED FUTURE CONDITIONS**

### **I. Development Projects**

The basis for this Study is the number of anticipated developments in Dudley Square. Several projects in the various stages of planning, construction and completion will have a great impact on the character and transportation demand of Dudley Square.

**Category 1:** These projects surrounding Dudley Square would impact the traffic flowing through Dudley Square and affect the MBTA ridership in and around Dudley Square. However, they may have relatively little impact on the parking within Dudley Square. These first classification types of projects include:

- Crosstown Center
- Boston University Medical Center Build-out
- Boston Water & Sewer Headquarters
- Northeastern University Build-out
- Orchard Gardens Elementary School
- Islamic Cultural Center

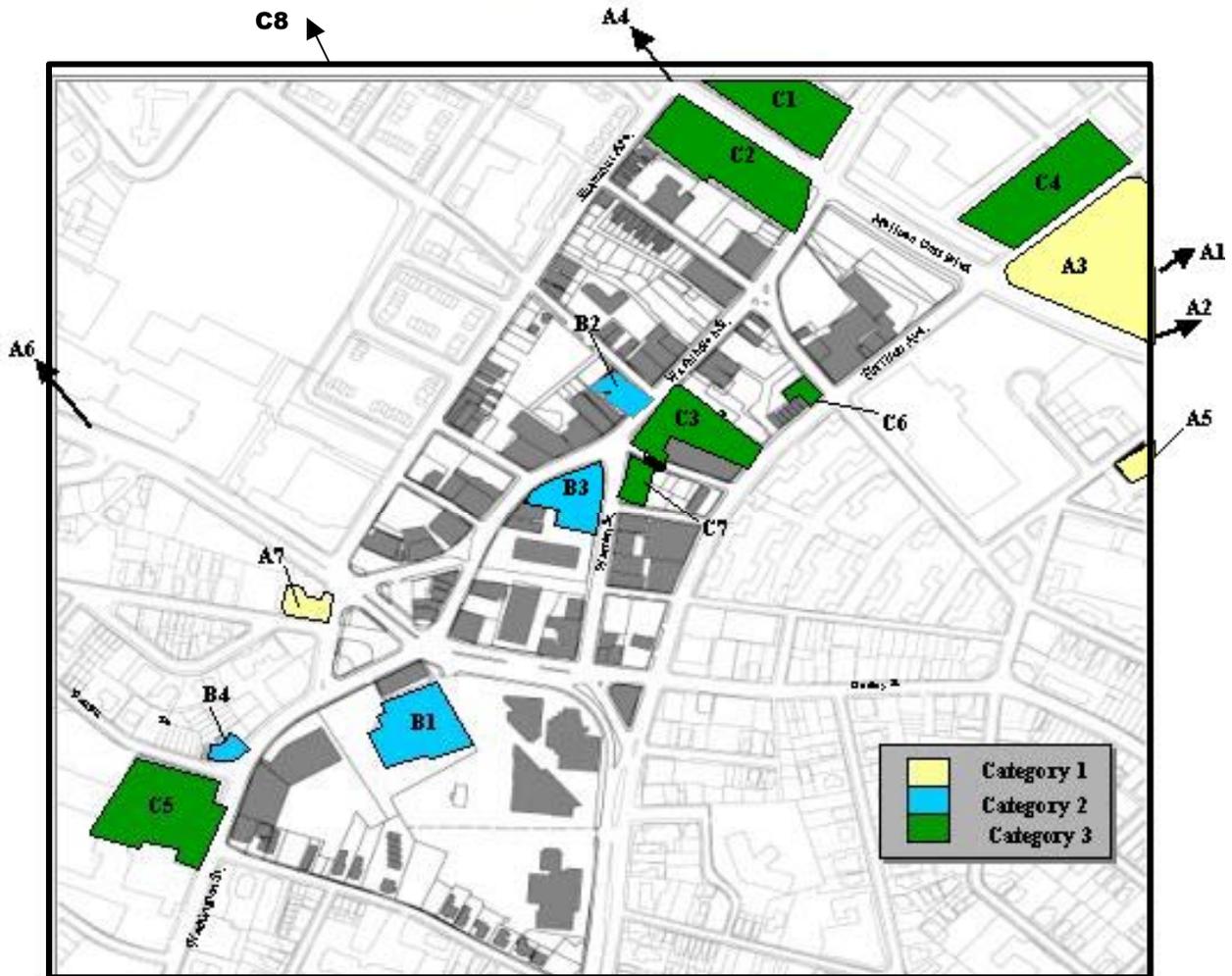
**Category 2:** The second classification of development projects consists of definite projects in the immediate vicinity of Dudley Square. These projects would impact the roadways in Dudley Square as well as the MBTA ridership and will have a great impact on parking within the immediate area. An increase in pedestrian movements, within the area, would be anticipated as well. These types of projects include:

- Modern Electroplating Site
- 2201 Washington Street
- Department of Public Health Headquarters
- Bartlett Housing Development

**Category 3:** The third classification of development is a potential project whose specific use is not yet known but may impact traffic, parking and transit use. Third classification projects include:

- Parcel 9 (off Melnea Cass)
- Parcel 10 (off Melnea Cass)
- Parcel P-3 (across from Police Headquarters on Tremont Street)
- Blair Lot
- Boston Water and Sewer Parcels
- Bartlett Yard
- Eustiss/Renfrew Townhouses
- Palmer Street Lot

# DEVELOPMENT PROJECTS



<b>CATEGORY 1</b>	<b>CATEGORY 2</b>	<b>CATEGORY 3</b>
<b>Definite Known Developments surrounding Dudley Square</b>	<b>Definite Known Developments in immediate vicinity of Dudley Square</b>	<b>Potential Developments that may impact Dudley Square</b>
<b>A1: Crosstown Center</b> <b>A2: Boston University Medical Center Buildout</b> <b>A3: Boston Water and Sewer</b> <b>A4: Northeastern University Buildout</b> <b>A5: Orchard Gardens Elementary School</b> <b>A6: Islamic Cultural Center</b> <b>A7: Fairfield Center</b>	<b>B1: Modern Electroplating</b> <b>B2: Office Space Renovation</b> <b>B3: Department of Public Health</b> <b>B4: Housing Development</b>	<b>C1: Parcel 9</b> <b>C2: Parcel 10</b> <b>C3: Blair Lot</b> <b>C4: Water and Sewer Parcels</b> <b>C5: Bartlett Yard</b> <b>C6: Eustis/Renfrew Townhouses</b> <b>C7: Palmer Street Lot</b> <b>C8: Parcel P-3</b>

## II. Transportation Projects

In addition to the development projects identified, there are several transportation projects either under construction or proposed in Dudley Square that will improve the transit infrastructure of the area.

Transportation projects include:

- Washington/Warren Street Construction: As part of the joint MassHighway/MBTA project to implement Silver Line service, both Washington and Warren Streets will be completely reconstructed between Dudley Street and Melnea Cass Boulevard. Both of these streets will be rebuilt from building face to building face. In a series of meetings with the community several years ago, the design elements for these streets were finalized and are currently being constructed. These new streets will have brick sidewalks, historic lighting, landscaping and new pavement. New traffic signals will be installed and communications equipment allowing for interconnected operation and real time control. This reconstruction represents a significant improvement in the look, character and operation of Dudley Square and will undoubtedly contribute to its continued revitalization. Reconstruction will be complete by Spring 2002.
- Washington Street Silver Line: The MBTA's newest transit line will begin operation in 2002 as a Bus Rapid Transit Service running on surface streets from Dudley Square to Downtown Crossing. The Silver Line will operate along Washington Street in a transit-preferred lane from Melnea Cass Boulevard to Herald Street. Operating with frequent headways, signal priority, and limited stops, these 60-foot articulated compressed natural gas ("CNG") vehicles will provide much improved connections between Dudley Square and Downtown Crossing. In addition, the CNG buses should improve local air quality by replacing diesel buses. The MBTA's future plans for the Silver Line include an eventual underground connection to Boylston Station with a continuation to South Station at which point the Washington Street and South Boston sections of the Silver Line will become one service.
- Urban Ring: The Urban Ring Transit Project is an MBTA initiative designed to improve the regional transportation system in Greater Boston. The urban ring will provide enhanced public transportation access in the developing and underserved corridor surrounding the urban core that runs from Columbia Point in Dorchester, through Roxbury, the Longwood Medical Area, Cambridge, Somerville, Everett, and Chelsea to Logan Airport. In the recently submitted Environmental Notification Form, the MBTA outlines a phased approach to the implementation of service, with several impacts for Dudley Square. Phase I of the Urban Ring is proposed as a series of Bus Rapid Transit Routes serving the corridor, including a reserved busway that would be located on Melnea Cass Boulevard. Phase II of the Urban Ring proposes a grade separated rapid transit system that would serve the corridor from Sullivan Square to a termination in Dudley Square.
- South Bay Harbor Trail: The South Bay Harbor Trail is a pedestrian and bicycle path that will connect Boston's diverse neighborhoods (Lower Roxbury, the South End, Chinatown, South Boston and Fort Point Channel) to the expanding amenities of Boston Harbor. Envisioned as a continuous path, the South Bay Harbor Trail would run from the Southwest Corridor Path at Ruggles Station to Boston Harbor. The Trail would link to existing paths, such as the one on Melnea Cass Boulevard, with new links and paths to be created.

### **III. Future Conditions By Category**

#### **A. Traffic Volumes**

From studies conducted in other neighborhoods and near major transit terminals, traffic volumes experience a general growth pattern based on the economy, general traffic background growth and increases in neighborhood development. Traffic volumes in Dudley Square will increase because of the development-related trip generation (employees commuting to their new jobs in Dudley Square, deliveries being made, etc.). Details of the development-related traffic can be found the Appendix.

#### **B. Public Transportation**

As a result of the developments identified earlier, transit use in Dudley Square is expected to increase by approximately 15% (approximately 2,000 passengers boarding/alighting daily). Given that some bus routes are presently operating at capacity, on-time performance will worsen due to the increase in traffic congestion. Furthermore, due to the proposed developments in Dudley Square, the area will become an employee destination and routes may have to be modified or added to reflect this change.

#### **C. Pedestrian & Bicycle Activity**

There will be an increase in pedestrian activity due to the new developments. DPH employees parking at the Modern Electroplating garage will have to cross Dudley Street in order to access the Department of Public Health building at the Ferdinand site. A general increase in pedestrian activity will be experienced due to the developments. Employees taking lunch breaks and running errands will be moving throughout Dudley Square. The existing problems for pedestrians in the area will be exacerbated by the increase in pedestrian activity and associated increase in vehicular activity. Measures need to be taken to improve pedestrian crossings and the overall streetscape in the area. In addition, increased vehicular traffic can exacerbate vehicle-bicycle conflicts. Bicycle lanes should be examined where possible and bicycle facilities should be incorporated at the proposed developments.

#### **D. Parking & Loading**

There will be an increased demand for long-term parking spaces due to the anticipated development in the area. Based on the existing mode share, the demand for long-term parking is expected to increase by approximately 650 parking spaces. With the existing problems of all-day commuter parkers taking up spaces and the shortage of parking spaces for short-term and local business use, the situation will worsen. A parking management program is needed to eliminate the all-day commuter parking, provide more short-term parking and provide spaces for the local users. The construction of the Modern garage will add 250 parking spaces designated for the Department of Public Health and 150 parking spaces will be reserved for public parking. The specific demand for these parking spaces will be dependent upon the fee structure established by the garage. The fee structure may be established in such a way as to reduce parking shortages in the area for a specific user type (long-term vs. short term parking).

Deliveries associated with the proposed developments will increase truck traffic and the demand for curb space during delivery hours. A coordinated loading plan with enforced regulations should be implemented to minimize traffic disruptions.

## **E. Air Quality**

Future trends in air quality in Dudley Square will depend on the trends in emission rates for mobile sources, the trend in the number of general motor vehicles and MBTA buses, and on changes in the amount of delay mobile sources experience at intersections in Dudley Square. Mobile source air pollutant emission rates can be expected to decrease somewhat in the near future based on US Environmental Protection Agency (EPA) regulatory strategies that will require improved emission controls on diesel buses and general motor vehicles.

The expected improvements in motor vehicle emissions may be negated to some extent by the increase in the number of vehicles and a potential increase in traffic congestion in Dudley Square resulting from the anticipated development in the area and from general population growth.

Future projects proposed for Dudley Square that will improve local air quality include the replacement of diesel buses with CNG buses, the relocation of the Bartlett Yard MBTA Facility to Arborway Yards, and the increase in public transportation use by the addition of the Silver Line.

As more air quality data is collected at the Dudley Square monitoring station, the air quality in Dudley Square can be characterized more accurately and trends in the concentrations of different air pollutants can be monitored.

## **CHAPTER 6: RECOMMENDATIONS**

The following chapter presents the consensus recommendations of the Study. As stated previously, the recommendations will be given to developers and City and State agencies, outlining how new development will occur in Dudley Square so that *transportation is improved and the public health of residents is protected*. Recommendations are interrelated to more than one Study objective so specific recommendations presented are not categorized by Study objective. The recommendations provided are designed to provide positive changes for the future of Dudley Square. Positive changes so that Dudley Square:

- Is accessible by all modes of transportation and is a key link in Boston's transit system, with improved access to downtown and the various subway, bus and commuter rail lines
- Has an enhanced urban environment for residents, businesses and visitors
- Is a vibrant residential and commercial hub
- Has healthy air quality

Following each recommendation is a summary of the issue being addressed. The pros and cons of each recommendation are then detailed. Public participation has been instrumental in the development of the recommendations and associated pros and cons. The result is a comprehensive and balanced set of possible solutions that could be implemented to address the stated objectives. The positive and negative effects of each solution can serve as a guide in future decisions as to which course of action is most appropriate to the Dudley Square area.

### **I. Immediate Recommendations**

These are recommendations that can be implemented immediately. These require no further process and can be completed as daily City and State operations. Many have been implemented during the course of this Study.

#### **(1) Provide Traffic Signal Coordination**

**Issue:** The four signalized intersections within the Dudley Square corridor (Dudley Street as it intersects with Shawmut Avenue, Washington Street, Warren Street and Harrison Avenue) are not well coordinated. Oftentimes, as a driver is given a green indication to pass through one traffic signal, the next traffic light is turning red. This starting and stopping exacerbates the queuing and gridlock problems, lowering air quality and making pedestrian crossing more difficult.

#### **Recommendations:**

- The four traffic signals should be coordinated so that vehicular movement can be improved
- Because of a large number of buses in the traffic stream, consideration should be given to designing for a slower moving (20-25 mph) platoon of traffic rather than the normal (30-35 mph) arterial speed

**Pros:** Although traffic congestion will not be eliminated, the queuing and gridlock will be somewhat reduced which will improve local air quality. Depending on how the intersections are coordinated, bus operations in this congested area may also be improved slightly. Traffic signal coordination will generally reduce emissions of all mobile source related air pollutants since there will be less time when motor vehicles are idling in a queue at a traffic signal. Idling vehicles make significant contributions to roadway emissions and reduced air quality.

**Cons:** If signals are coordinated in one direction for one corridor, it tends to impact the other signal approaches. However, given the close proximity of intersections on Dudley Street, this corridor needs to be given priority.

## **(2) Repair & Maintain Intersection Infrastructure**

**Issue:** While some concepts are being planned to improve the long-term intersection operations through the Dudley Square corridor, several immediate improvements can be made to provide a greater comfort level for pedestrians crossing Dudley Street. During field visits it has been noted that several of the traffic signal lenses are broken or not in service, particularly those involving pedestrian crossings. Pavement markings for pedestrian crosswalks are in need of repainting. The length of crossing time for the pedestrian phase should be evaluated. Residents have said that the crossing times are too short.

### **Recommendations:**

The Boston Transportation Department should:

- Fix the broken signal indications and reapply pavement markings where needed
- Evaluate the length of the pedestrian crossing time

**Pros:** This will provide pedestrians with a greater comfort level when attempting to cross Dudley Street. Also, drivers tend to be more respectful of pedestrians when the crosswalks are properly maintained.

**Cons:** None

## **(3) Implement Parking and Loading Plan for Dudley Square**

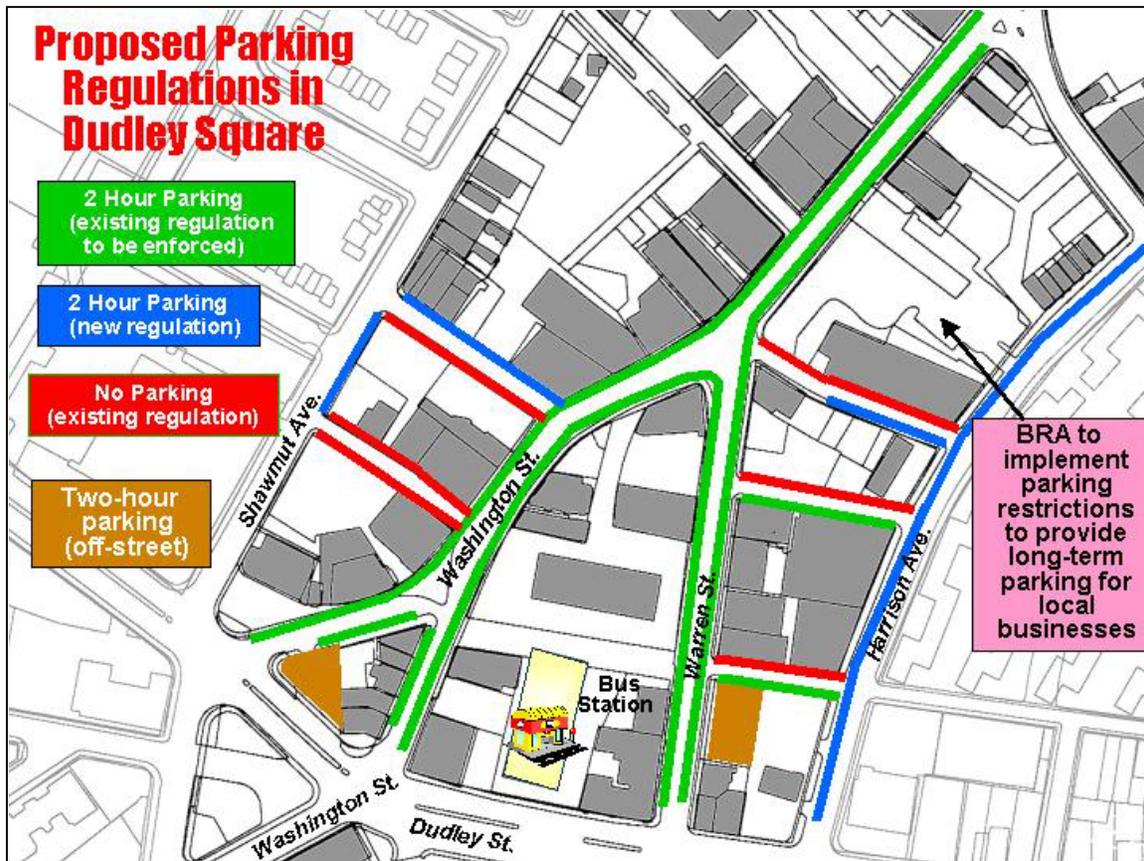
**Issue:** Parking in Dudley Square is a limited resource, and conflicts inevitably arise as the demands of merchants, residents, visitors, customers, and commuters face the limited supply of parking. According to the business community at the public meetings, the businesses in Dudley Square are primarily impacted by the lack of parking spaces for their employees and their patrons. Many parking regulations in Dudley Square, particularly those posted with two hour parking restrictions, are not strictly enforced. Commuters exacerbate the problem as they often drive to Dudley Square and park for free all day long while they board the #49 bus to Downtown Boston to access their jobs. Accommodation of service and loading activity is inefficient and disorganized, further reducing parking and adding to congestion. Lastly, as development increases, residents are concerned with parking overflow onto residential streets.

## Recommendations:

- A detailed parking plan that addresses parking issues identified in the Study has been developed with input from BTS, BRA and the local business community
- The plan prioritizes parking needs and establishing onstreet curb space as two-hour parking to serve customers and visitors
- Parking in the three BTS municipal lots will be regulated to minimize commuter parking and maintain long-term availability for employees and merchants in Dudley Square
- The Blair Lot is owned by the BRA and will be gated and opened only after 9:00 AM to minimize parking by commuters not destined for Dudley Square
- BTS should work with merchants to establish a time restricted loading program at key locations
- Shawmut and Harrison Avenues should be regulated with appropriate parking regulations

**Pros:** Parking spaces will be made available to both Dudley Square employees and patrons to remove the long-term commuter parkers that do not belong in the area, free up parking availability and reduce traffic movements within Dudley Square. This parking plan should ease enforcement and allow for greater utilization of available spaces. Establishing consistent regulations and generating turnover at the curb may increase business patronage by allowing customers to more easily access Dudley Square businesses. Organizing and time restricting loading activity will reduce congestion in Dudley Square.

**Cons:** As more spaces are regulated, long-term commuter parking may spread to adjacent residential streets. This will be addressed by consistent involvement and monitoring with the community.



#### **(4) Implement Basic Upgrades To Improve Air Quality and Use of Public Transit**

##### **Recommendations:**

- Enforce the anti-idling law in Dudley Square (MBTA and City of Boston)
- Post maps and schedules of the MBTA System in Dudley Station to ensure easy availability of route schedules and maps

## II. Near Future Recommendations

These recommendations may require further study, community input or funding prior to implementation. It is anticipated that as the development in Dudley Square continues, these recommendations will progress towards implementation. Additionally, many of these recommendations may be completed in phases, with short and long-term actions possible. Close coordination with the proposed developments will be required as the projects progress into design and development.

### (1) Minimize Circuitous Bus Movements in Dudley Square

**Issue:** Dudley Square is plagued by traffic congestion, especially during morning and evening peak hours. This problem is worst on Dudley Street as gridlock occurs from vehicles at one intersection queuing up into an adjacent intersection. Overall intersection delays are unacceptable. Buses contribute significantly to and suffer from this congestion as they represent over 10% of all vehicles in the corridor (on Dudley Street, between Washington Street and Warren Street) during peak hours. Bus routes headed south on Warren Street, or east on Dudley Street must travel on Dudley Street twice as they complete a loop through Dudley Station. This adds time (as much as 5-10 minutes) to their trip as well as causes traffic congestion traffic on Dudley Street.

#### **Recommendation:**

- Establish a bus stop on the South Side of Dudley Street, in front of the Municipal Center Plaza to accommodate the routes traveling south on Warren Street and East on Dudley Street. These routes, primarily originating at Ruggles Station represent a majority of routes that serve Dudley Station:

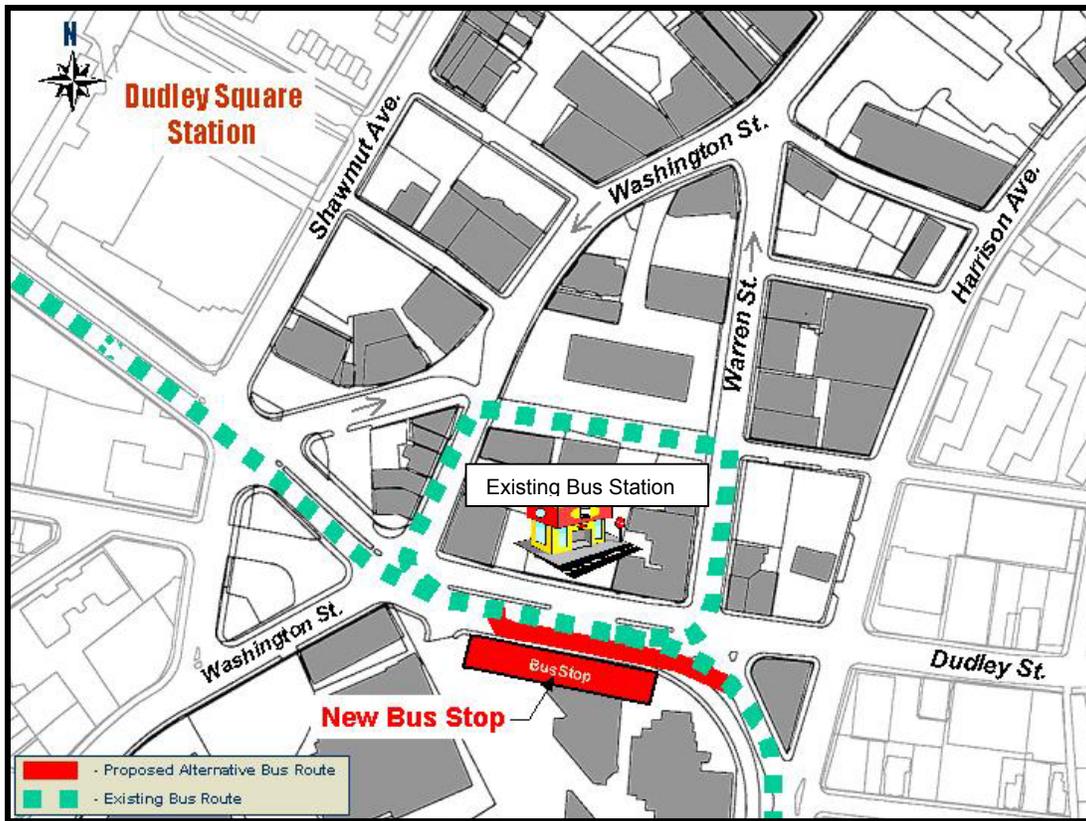
15	Ruggles – Kane Square/Fields Corner, via Dudley Street
19	Ruggles – Fields Corner, via Warren Street
23	Ruggles – Ashmont, via Warren Street
28	Ruggles – Mattapan Square, via Warren Street
44	Ruggles - Jackson Square, via Warren/Humboldt
45	Ruggles – Franklin Park Zoo, via Dudley/Blue Hill Avenue

**Pros:** Approximately 50 bus movements, particularly the more conflicting left turn movements, during the peak hours would be eliminated thereby improving intersection operation at the Washington Street / Dudley Street and Dudley Street / Warren Street intersections. Service performance could be improved, saving as much as five minutes on route time during peak hours. This would allow for additional trips to be placed on these routes at no additional expense. The additional trips would result in more frequent service, expanded service capacity and reduced bus crowding. Proper design of the bus waiting areas would help to bring vibrancy and activity to the front of the Municipal Center, a goal consistent with the objectives of DND's Municipal Center Planning Study. Bus waiting areas can be built with modern advances in variable message signs and ITS (intelligent transportation systems) which can be used to alert passengers of the exact arrival times of specific buses.

Relocation of many of the bus station stops to the south side of Dudley Street will reduce the vehicle miles traveled for some of the bus routes. The elimination of approximately 50 bus movements will

result in reduced emissions from MBTA buses. This will also lead to a general decrease in traffic congestion, particularly at the Washington Street/Dudley Street and Dudley Street/Warren Street intersections that will lead to a further reduction in motor vehicle emissions in Dudley Square.

**Cons:** A split Dudley Station will lead to longer walking distances between bus transfers and more Dudley Street crossings. Some transfers between routes that currently occur in Dudley Station would be split requiring riders to cross Dudley Street. These would occur however in only the outbound direction, as inbound transfers would still occur in the station itself. Improvements planned as part of this Study would be required to more safely accommodate pedestrians crossing Dudley Street. It was noted during the public meetings that the presence of a bus station in front of the Municipal Center Plaza could detract from the attractiveness of a newly designed public space and present a less defined edge to the street and sidewalks.



## **(2) Convert Bus Fuel to Compressed Natural Gases**

**Issue:** A significant number of MBTA diesel buses pass through Dudley Square (well over one hundred during the AM peak hour). Complaints have been heard regarding the air quality in Dudley Square, partly due to the bus exhaust.

### **Recommendation:**

- Convert MBTA buses from diesel fuel to alternative low emission fuel sources. The MBTA has ordered alternative fuel vehicles to serve Dudley Square

**Pros:** Conversion of MBTA buses from diesel fuel to CNG will lead to large reductions in emissions of oxide, nitrogen, particulate matter, and diesel exhaust odors. Particulate matter and other components of diesel exhaust are potential asthma triggers. The EPA has classified diesel particulate matter as a mobile source air toxic. Visually, the exhaust from buses operating on CNG will be significantly cleaner than the exhaust from diesel buses.

**Cons:** Buses operating on compressed natural gas will have higher emissions of volatile organic compounds and carbon monoxide than buses operating on diesel fuel. Diesel and CNG buses are both very small sources of these air pollutants when compared to general motor vehicles.

## **(3) Upgrade Transit Service To Meet Growing Demand**

**Issue:** Dudley Square is the busiest bus station in the MBTA system. Buses connect Dudley Square to many destinations in the City and region. However, MBTA Bus service is often unreliable, suffering from on-time performance and under-capacity on some of its busiest routes. Dudley Square lacks a direct rapid transit connection and many community residents feel that the presently under-construction Silver Line will not adequately function as the long-promised replacement service for Washington Street. Connections to the Orange Line from Dudley Square are fairly good, as many bus routes continue from Dudley to Ruggles Station. Connections to the Red Line however are minimal and complicated, although existing demand for the specific connection has not been recently measured. In the future, as Dudley Square continues to develop as an employment and cultural hub, thousands of additional employees and patrons will have destinations in and around Dudley Square. As this trend continues, and no parking or traffic capacity currently exists, expansion of public transportation service will be necessary to serve the existing and coming demand of Dudley Square.

### **Recommendations:**

- The Dudley Square community and City of Boston representatives should continually work with the MBTA to ensure that transit service is consistently reliable and adaptable to growing demand
- Free transfers should be provided from Ruggles Station on the Orange Line to Dudley Square (Free transfers from Dudley to Ruggles already exist)
- As demand for transit service increases the Silver Line service should be upgraded to a light rail system
- Silver Line service should be extended along Warren Street to Grove Hall, Franklin Park and Mattapan Square

- All phases of the Urban Ring should continue to address connectivity issues for Dudley Square: Phase II Bus Rapid Transit routes will provide enhanced connections to the Red Line Corridor and to the Longwood Medical Area; Phase III rail service, proposed to terminate at Dudley Station, should be extended to Uphams Corner and JFK/UMass

**Pros:** An improved transit system can enhance the development of Dudley Square while minimizing traffic congestion and parking needs. Dudley Square, already a hub of MBTA bus service and a termination point for the Silver Line, can continue to serve its historic role as an intermodal center at the transportation nexus of Roxbury. Transportation improvements to Dudley Square will serve not just the immediate area, but will also serve to provide improved access to jobs and recreational opportunities for residents of Roxbury and beyond. Employee growth in Dudley Square will grow significantly and increased transit service will allow this to occur without requiring additional parking.

**Cons:** Increased transit access tends to intensify development, adding density and presenting additional issues that will continually need to be addressed and managed by the MBTA and the City of Boston.

#### **(4) Relocate of Bartlett Yard MBTA Facility to the Arborway Site**

**Issue:** Twenty-six (26) bus routes are serviced through the Bartlett Garage although only five (5) on them provide service in and around Dudley Square. The remaining buses are stored and serviced in the Bartlett Garage but provide service to other locations. Nearly all of the other bus routes have origins and/or destination to the south, namely Forest Hills, Ashmont and Mattapan. The buses stored and serviced in Bartlett Garage, especially those that do not have routes in and around Dudley Square, add to the bus congestion and poor air quality.

#### **Recommendation:**

- Relocate MBTA’s Bartlett Garage outside of Dudley Square, and closer to the specific bus routes (this recommendation is ready for implementation by the MBTA)

**Pros:** Relocating the bus storage and maintenance from Bartlett Yard to the new Arborway facility will result in an improvement in air quality at Dudley Square. Presently, idling of diesel buses at Bartlett Yard creates a significant amount of air pollution near Dudley Square and contributes to bus movements through Dudley Square that do not service Dudley Square.

**Cons:** With the relocation of the garage to the Arborway, service may deteriorate slightly on the routes housed there, especially the first run.

#### **(5) Close Off Uncontrolled Dudley Street Police Access / Egress**

**Issue:** Police parking access/egress is via the uncontrolled curb cut on Dudley Street, immediately adjacent to the signalized intersection of Dudley Street/Washington Street. Due to the congestion at the intersection and the common occurrence of queuing on many of the intersection approaches, drivers exiting the police parking area will pull out into the intersection whenever the opportunity arises. This “opportunity” usually occurs during the signal phase when pedestrians are given an indication that it is

safe to cross the street. This simultaneous action of pedestrians crossing the street and drivers rapidly exiting the police parking area makes pedestrians uncomfortable and uncertain of their safety.

**Recommendation:**

- Close off the Dudley Street curb cut and provide alternative access/egress point for the police parking area

**Pros:** Plans call for some of the police parking to be relocated into the new Modern Electroplating garage. Access to the garage and to the existing surface lot would be via the main garage access point as well as possibly a second access point that would be restricted to official vehicle use only (police, court, Boys and Girls Club). Other Modern garage users would not be able to access the garage from this location. The closure of the curb cut will provide safer pedestrian crossings at Dudley Street / Washington Street. Conflict points for vehicles will be decreased.

**Cons:** Transferring of police parking access/egress to other locations (i.e., Modern, etc.) may result in minor access/egress issues elsewhere.

**(6) Relocate Police Parking Away From Dudley Street**

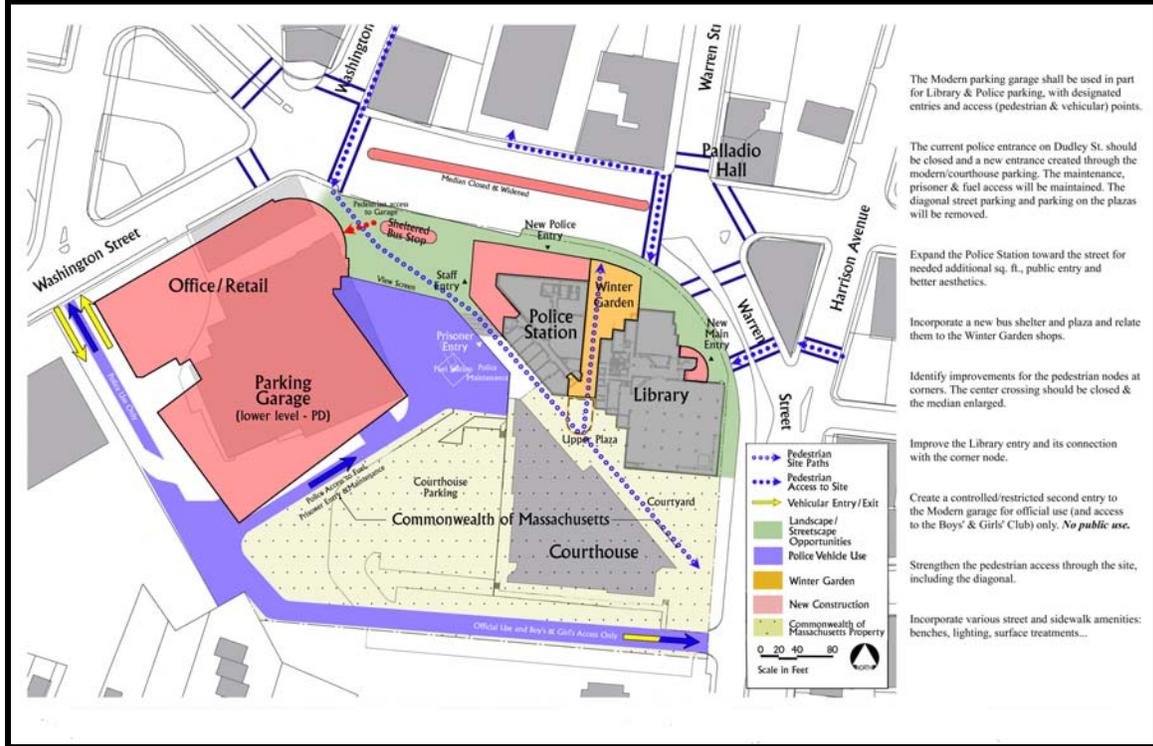
**Issue:** Presently police cars (marked, unmarked and private cars) are parked on an angle along the sidewalk and plaza on Dudley Street between Washington Street and Warren Street. This parking obstacle complicates pedestrian movements and affects the already congested traffic flow on Dudley Street. In the future, the parked vehicles will detract from proposed Municipal Center improvements in DND's Municipal Center Planning Study.

**Recommendations:**

- Relocate the police parking away from Dudley Street and possibly relocating them to the new Modern Electroplating garage can solve the above-mentioned problems
- When the improvement concepts are being designed for the Municipal Center area, consideration should be given to physically restricting the Dudley Street parking through the use of unmountable curbs or other design element features on the plaza

**Pros:** Traffic flow on Dudley Street would be improved, leading to a reduction in traffic congestion.

**Cons:** Assuming parking for the police vehicles can be relocated safely and efficiently and access/egress issues resolved, there are no negative impacts.



**(7) Design Modern Site With Main Pedestrian Access Onto Dudley Street and With Vehicular Access / Egress to Minimize Dudley Street Circulation**

**Issue:** The new Modern Electroplating garage facility should be designed to promote pedestrian movement and minimize vehicular circulation in and around Dudley Square.

**Recommendations:**

- The main pedestrian access/egress to the garage should be provided onto Dudley Street at the corner of Dudley Street / Washington Street
- Vehicular access/egress to the garage should be designed to minimize circulation through Dudley Square. Ideally this should be done with two access/egress points: (1) would form the forth leg of the Washington Street/Shawmut Street Extension intersection and (2) would be via the Courthouse/Boys and Girls Club access off Warren Street. The community has expressed a strong opinion that access off Warren Street should be restricted so as to minimize the potential pedestrian-vehicular conflict between drivers accessing the garage and the children of the Boys and Girls Club

**Pros:** With two access/egress points, circuitous movements into the garage can be eliminated to cut down on the congestion in the area. The queue for vehicles entering the garage would be minimized, as would the delay for vehicles exiting the garage. Based on local community opinion, restriction of the Warren Street access/egress may result in some circuitous movements. Allowing for police access/egress at the Warren Street location will eliminate some of these circuitous movements. The

pedestrian entrance/exit at the corner of Dudley Street/Washington Street would further encourage pedestrians to cross Dudley Street at a safe pedestrian crossing, rather than at a mid-block location.

**Cons:** Warren Street access / egress even a restricted basis would need careful design to coordinate with all adjacent land uses.

### **(8) Improve Dudley Street Corridor Intersection Operations**

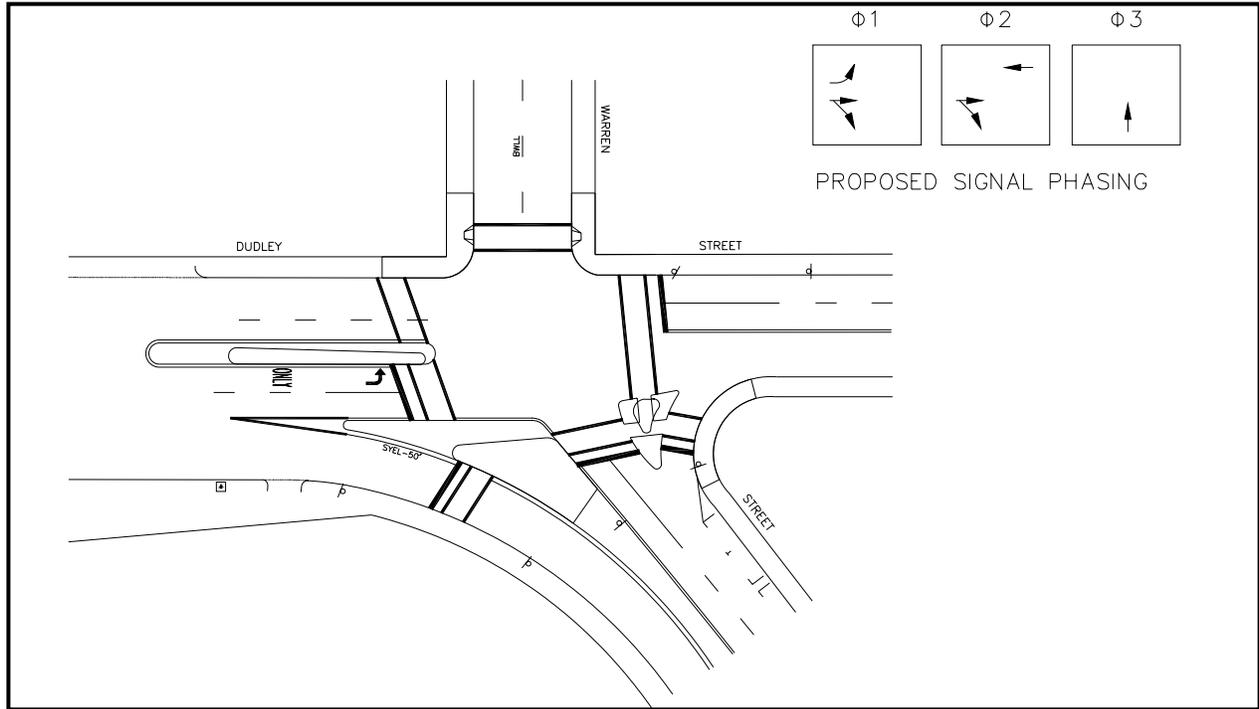
**Issue:** The intersection operations in the Dudley Square corridor can be improved. Most notably, the lane configuration and signal phasing of the Dudley Street / Warren Street intersection can be designed more efficiently to facilitate improved operations. Signal inefficiencies are partly required because of the existing lane configuration. The Dudley Street eastbound approach presently contains two general-purpose lanes and a relatively free right turn lane. Dudley Street eastbound traffic volumes during both peak periods and off-peak periods indicate that the left turn movement onto Warren Street is nearly equal to the traffic volumes passing through on Dudley Street. Changes could be made to both the lane configuration and the signal phasing to better coordinate this intersection with others in the corridor and to improve the operational efficiency.

The community has expressed the desire to reverse the direction of Roxbury Street to its original direction flow towards Dudley Street. It was suggested that by reversing Roxbury Street, MBTA buses would be able to utilize this new movement to access Dudley Street and Ruggles Station to eliminate bus traffic on Washington Street at Dudley Street. This proposed Roxbury Street reversal would then improve the overall operation of the area around Dudley Street / Washington Street and Dudley Street / Shawmut Street to previous conditions before roadway network changes were made over five years ago.

#### **Recommendations:**

- The intersection of Dudley Street / Warren Street should be redesigned to include an exclusive left turn lane, one through lane and the somewhat free right turn lane on the Dudley Street eastbound approach
- The signal phasing should be changed to accommodate an advance Dudley Street eastbound phase, then the eastbound left turn would be stopped and the Dudley Street eastbound and westbound through movements would be able to proceed through the intersection, and finally the Warren Street northbound approach would pass through the intersection
- Accommodate pedestrian activity through concurrent phasing (pedestrians can safely cross certain approaches during the signal phases where the vehicles are stopped) rather than an exclusive pedestrian phase
- Widen the median on Dudley Street to accommodate the increase in pedestrian use
- Roxbury Street should remain a one-way street and not be reversed as it does not serve bus traffic to Ruggles Station and would significantly increase traffic congestion on Dudley Street

## Proposed Dudley Street / Warren Street Redesign



**General Pros:** The redesign of the Dudley Street / Warren Street intersection and associated corridor improvements will improve traffic flow, decrease congestion to better air quality and provide safe pedestrian crossings.

**Roxbury Street Pros:** From a traffic operations standpoint, Roxbury Street should not be reversed. It is the perception that traffic operations and bus operations will improve. However, this is not the case. The intersection improvements, involving changes in the Dudley Street eastbound lane configuration and related signal phasings will improve traffic operations. Because the roadway network is vastly different than it was five years ago, the reversal of Roxbury Street would greatly degrade the operation of the Dudley Street / Washington Street intersection. Buses currently do not exit Dudley Station and proceed down Roxbury Street towards Ruggles Station. All buses that exit Dudley Station at this point travel down Washington Street and make a left turn onto Dudley Street. Furthermore, in order for the MBTA to make use of a roadway reversal, the Dudley Square station would need to be reconfigured so that the bus bays for buses destined to Roxbury Crossing and Ruggles Station would have to be moved into an area that presently cannot accommodate them. Until the MBTA relocates the bus bays, buses will not be able to access Roxbury Street. Finally, the reversal of Roxbury Street would make it extremely difficult (and circuitous) to access the parking lot on Roxbury Street. Drivers on Dudley Street, destined for the parking lot, would have to travel northbound on Warren Street and then turn left onto Washington Street, in front of the Ferdinand Building, in order to get into the parking lot. For all of the above reasons, Roxbury Street should not be reversed.

## (9) Improve Pedestrian Connections and Roadway Crossings

**Issue:** It is currently difficult for pedestrians to cross Dudley Street. The uncontrolled police access/egress provides a potential for vehicular-pedestrian conflicts during the exclusive pedestrian phase when pedestrians should feel comfortable crossing the street. With the proposed relocation of a number of bus route stops to the south side of Dudley Street and the proposed reserved parking area for the Department of Public Health in the new Modern Garage, the number of pedestrians crossing Dudley Street will increase and the difficulty in the Dudley Street crossing will be even greater.

### Recommendations:

- Dudley Street / Warren Street intersection should be redesigned, as mentioned above, with a new lane configuration on the eastbound approach and new signal phasing which removes the exclusive pedestrian phase and provides concurrent pedestrian crossings in a safe and convenient manner
- The median separating Dudley Street westbound and eastbound should be widened to approximately 12 feet
- The mid block crossing in front of the Dudley Station should be physically closed off and pedestrians rerouted to the improved pedestrian crosswalks at either the Dudley Street/Washington Street or Dudley Street/Warren street intersections
- The sidewalk on the northerly side of Dudley Street, in front of the Dudley Station, should be widened and reconstructed to accommodate the expected increase in pedestrian movements
- The streetscape enhancements need to include elements that discourage any street crossings outside of the striped paths at signal lights while remaining visually appealing



**Pros:** Improvements at two of the Dudley Street intersections are intended to reduce the congestion and to define the time intervals when pedestrians can safely cross the street. At Washington Street, the exclusive pedestrian phase will be conflict free and the pedestrian presence will be reinforced by well-maintained signal hardware, pavement markings and closure of the police curb cut. At Warren Street, the median will be widened to accommodate waiting pedestrians. The proposed signal phasing will provide more crossing time for pedestrians during each traffic signal cycle.

**Cons:** With a relocated bus stop to the south side of Dudley Street, pedestrians will have to walk longer distances and cross a busy arterial rather than remain within the confines of a single bus terminal. The recommendations of the Study would design the arterial to be pedestrian friendly.

## **(10) Install Descriptive Signage Designating Important Destinations and Events in the Area**

**Issue:** Dudley Square currently does not have any signage that identifies the important features within the Square or to direct pedestrians new to the area to their destinations. The streetscape has a nondescript character due to the lack of signage preventing pedestrians from clearly identifying the attractions Dudley Square has to offer.

### **Recommendations:**

- Descriptive signage should be added throughout the streetscape and buildings in the area should have street facing that clearly identifies their function
- Signage in the form of banners to advertise events within the Square and interactive signage installations that allow pedestrians the ability to learn about the area or research specific topics need to be included with overall streetscape improvements - signage allows for visitors to easily access the area and the larger community to identify the character of the Square (Dudley Square Main Streets is developing community designed banners and signage for the area)



**Pros:** The confusion of access and identity that currently exists throughout the site will be significantly reduced and a forum to advertise cultural events will be created adding to the turnout at the events and providing the organizers and presenters important publicity. Signage can serve to showcase the character and attractions of Dudley Square.

**Cons:** Standards for the size and style of signage should be developed so that the community maintains some control over the design. This will prevent a building owner from imposing signage that contrasts the character of the Square and will allow the community to develop a unified appearance.

## **(11) Improve Bicycle Amenities in Dudley Square**

**Issue:** Presently Dudley Square is not bicycle friendly. Although Dudley Square is located near several major bicycle corridors, it lacks both connections to these bicycle routes and amenities for bicycle riders.

### **Recommendations:**

- New office buildings should have bicycle facilities such as racks, storage and showers
- The City should install bicycle racks at key locations
- The City should explore possibility of bike lanes where appropriate
- The bicycle connection should be strengthened between Dudley Square and South Bay Harbor Trail as well as downtown

**Pros:** Making Dudley Square more bicycle friendly will encourage bicycle use that may decrease the usage of automobiles and thus reduce the need for parking and improve air quality.

**Cons:** None

## **(12) Promote Transit Use and Traffic Demand Management Strategies**

**Issue:** Dudley Square is rapidly developing as underutilized buildings are brought back into productive use and large projects, such as the renovation of the Ferdinand Building for the Department of Public Health, are planned. This new development will increase demand on a roadway network that is increasingly overburdened and congested with both cars and buses. As existing air quality is already a concern, the expected increase in development must be managed to minimize its automobile impacts on Dudley Square. Measures must be taken to minimize drive-alone commuters and to encourage the use of a more efficient transit system so that the traffic situation and air quality do not further deteriorate in Dudley Square.

### **Recommendations:**

- Developers and existing businesses should be required to implement traffic demand management strategies such as offering and/or subsidizing MBTA passes, emphasizing local hiring, providing bicycle storage facilities, providing designated parking for carpooling and engaging in employee ridesharing matchup programs
- Developers, large tenants such as the Department of Public Health, and existing merchants and institutions should work with CARAVAN for Commuters and the community to develop and provide Transportation Demand Management (TDM) measures for Dudley Square - A major goal should be to work towards the development of a Dudley Square Transportation Management Association (TMA) that would be supported by the community to administer and advocate for programs to increase non-auto mode share for travel to Dudley Square
- The City and community should continue to encourage and advocate for the enhancement of public transportation in Dudley Square - as development increases, and additional trip demand is placed on the transportation system, improved public transportation will be critical to the reduction of auto travel in Dudley Square

- The additional parking spaces provided in the new Modern garage will either encourage or discourage long-term parking, depending upon the parking fees charged. The establishment of the fee structure is an effective traffic demand management strategy to promote one parking user type over another (long term vs. short term) and to further promote transit use and discourage drive-alone commuters.

**Pros:** Positive development can be brought to Dudley Square without significantly increasing traffic congestion. TDM programs, coupled with improving transit service, would increase non-auto mode share and thereby improve air quality. Establishment of a TMA would help the Dudley Square community continue to advocate for improved transit service to this area.

**Cons:** A contingency of local business leaders and neighborhood residents needs to be formed to monitor the new development project recommendations, observe their *combined* impacts, and work with the City and State to quantify the results. Because developments and impacts evolve, the community and the City must be willing to adapt programs as necessary.

### **(13) Improve and Standardize Streetscape Materials and Amenities**

**Issue:** The streetscape throughout Dudley Square lacks human scale amenities that attract use and vitality critical to the success of any urban area. Many spaces within the Square are paved over in harsh concrete and lack a warm usable identity. The streetscape is cluttered at many points with misplaced planters, concrete benches that are unused, and mechanical boxes. The overall pedestrian experience throughout the Square is negatively impacted by these factors.

#### **Recommendations:**

- The streetscape needs to be enhanced with human scale materials and amenities such as brick sidewalk paving, wood benches, and small planters at building edges
- The overall urban edge throughout the Square needs to be clearly defined by these elements so that the pedestrian experience is shaped and vitality is created through use of such amenities



**Pros:** The overall pedestrian experience will be enhanced promoting more use within Dudley Square. New streetscape enhancements allow for the area to standardize initiatives and create one palette of materials and elements that will create a unified identity for the area and reinforce a cohesive identity.

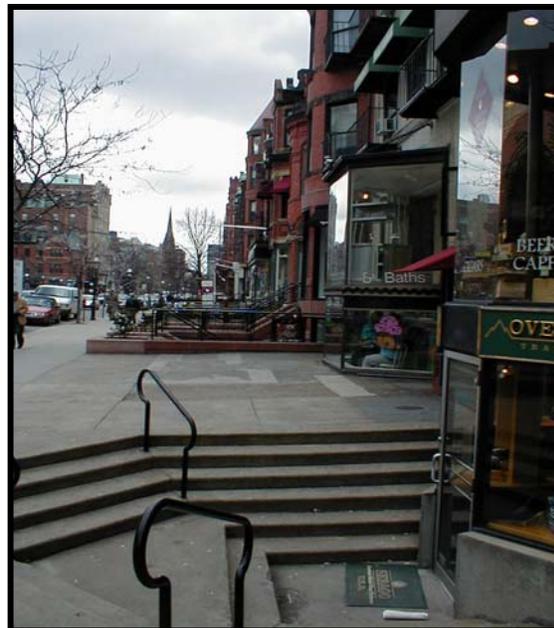
**Cons:** Amenities that are offered by private entities for public use need to be regulated so that owners do not prevent access or restrict times of use by the general public. If these amenities and specific spaces are not offered for public use without controlling access they will be as vacant as the current spaces.

#### **(14) Create Cultural and Retail Venues Near Major Crossings to Promote Positive Pedestrian Flow Through the Square**

**Issue:** Currently some portions of Dudley Square do not have street facing retail. This lack of retail is substituted with blank walls, which undermine the streetscape by not offering a connection with building interiors or amenities geared towards pedestrian use. Large segments of the Square are lacking use and vitality due to expanses of barren streetscape that do not create an inviting identity or offer a connection to the overall character of the Square.

#### **Recommendations:**

- Ground floor street-facing retail needs to be incorporated into proposed changes for the area
- New retail development projects proposed for the area should be located at key points throughout the Square that are pedestrian access points and that currently lack vitality



**Pros:** Infilling retail venues at specific points throughout the Square will enhance the overall streetscape and pedestrian experience. The implementation of pedestrian attractions such as retail at key points throughout the Square will promote safe street crossings at desired locations, increase pedestrian use of the Square, and create vitality through the increased use. Pedestrian safety throughout the Square will

be enhanced through a clearer path system with safer crossing points reinforced by public uses and an increase in the volume of people within the Square.

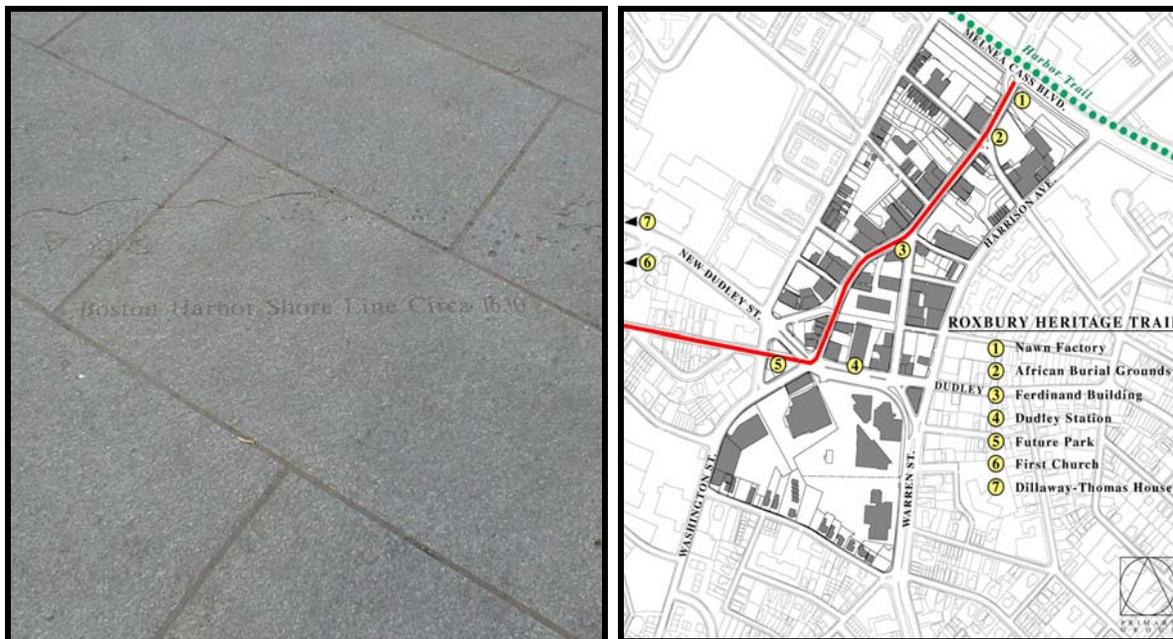
**Cons:** Retail venues added to the Square need to offer public amenities at their entrances to establish a connection with the general public. If establishments do not offer a clear identity and access they will not succeed in presenting an overall friendly and inviting image

### **(15) Accentuate Cultural Activities in the Area Through Definition of Significant Pathways in Paving Materials and Guided Tours**

**Issue:** Dudley Square is home to several artists and cultural venues that offer a wide variety of historic and contemporary attractions. Currently the Square does not identify the cultural amenities the area has to offer.

#### **Recommendations:**

- Define the cultural venues in the Square by incorporating elements that announce the artistic and historical aspects of the area into the streetscape enhancements to help to shape the image of cultural richness and diversity of the area
- Create a guided tour system through the Square that brings visitors and the greater community to the actual venues on a regular basis to define paths to the cultural points and promote the venues the area has to offer



**Pros:** Identifying the cultural aspects of the Square and promoting access to them will allow a celebration of the character of the area and provide access to these important artistic and historic amenities for the general public.

**Cons:** None

**(16) Create a Trolley Tour Loop through the Dudley Square Area that Brings Tourists and the General Public through the Area Noting Points of Interest**

**Issue:** The Dudley Square area is home to many cultural and historic entities. Although well promoted and accessible, these venues are dispersed throughout the area. Tourists and members of the general public interested in Roxbury's history and the areas cultural venues do not have a central point to start from that guides people to the many important locations in the area.

**Recommendation:**

- Create a central tourist/educational point within the Dudley Square area that people could gather to learn about the area's attractions and provide a Trolley Tour system that brings people to the points of interest. This Trolley Tour would occur several times a day on designated days each week. The Tour would provide those unfamiliar to the area an introduction to Roxbury and its many cultural/historic attractions. An example of the potential length of the Trolley Loop and the location of stops is illustrated on the map provided in the previous recommendation.

**Pros:** A greater awareness of the many points of interests within the Dudley Square area and a greater level of promotion of Roxbury's cultural and historical venues could be achieved through this Trolley Tour system. Tourists would be provided with an easily used system to visit the area and its attractions.

**Cons:** Finding a Trolley vehicle for the tours and a facility to act as the starting point and to house the Trolley is critical to the implementation of this recommendation.

## **CHAPTER 7: CONCLUSIONS & NEXT STEPS**

The goal of this Study is to ensure that Dudley Square remains a place where people want to live, work, shop and conduct the business of their lives in a healthy environment. Without each individual recommendation striving to reach this goal, the efforts of all those who have participated and guided the Study are minimized. The recommendations provided are designed to provide positive changes for the future of Dudley Square; changes so that Dudley Square:

- Is accessible by all modes of transportation and is a key link in Boston's transit system, with improved access to downtown and the various subway, bus and commuter rail lines
- Has an enhanced urban environment for residents, businesses and visitors
- Is a vibrant residential and commercial hub
- Has healthy air quality

The Dudley Square Transportation & Air Quality Study presents detailed existing conditions and potential future impacts of development on Dudley Square. The analysis explores the potential impacts of development as a whole on the transportation network, environment and quality of life in Dudley Square.

Through a community process, a set of implementable recommendations has been developed. These recommendations are not provided as a general wish list, but rather as specific options supported by community input, detailed analysis and applicable data.

A major objective of the Study was to present these recommendations *before* the anticipated developments occur in Dudley Square. Some of the recommendations such as parking strategies are already being carried out. Other recommendations are currently being planned. The Municipal Center Planning Study, to be released in December of 2001, for example, incorporates potential development options based on work completed in this Study (see Draft Options in the Appendix). Future developers and planners will have this set of Transportation & Air Quality recommendations as a guide to how the community expects future development in Dudley Square to occur.

## Appendix I

### Air Quality Information

- Evaluation Of Existing Air Quality in Dudley Square by Tech Environmental, Inc., November 2001
- Roxbury Air Quality Fact Sheet by ACE's Roxbury Environmental Empowerment Project, 2001 **(NOT CURRENTLY AVAILABLE ON BRA WEB SITE)**
- Levy, JI, EA Houseman, JD Spengler, P Loh, and L Ryan. "Fine Particulate Matter and Polycyclic Aromatic Hydrocarbon Concentration Patterns in Roxbury, Massachusetts: A Community-Based GIS Analysis," Environmental Health Perspectives, vol 109, no 4, April 2001, pp 341-347 **(NOT CURRENTLY AVAILABLE ON BRA WEB SITE)**

**EVALUATION OF  
EXISTING AIR QUALITY  
IN DUDLEY SQUARE**

*Prepared for:*

The Boston Redevelopment Authority  
One City Hall Square  
Boston, MA 02201

and

Bruce Campbell & Associates, Inc.  
38 Chauncy Street  
Boston, MA 02111

*Prepared by:*

Tech Environmental, Inc.  
1601 Trapelo Road  
Waltham, Massachusetts 02451  
(781) 890-2220

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## **1.0 EXECUTIVE SUMMARY**

Expected future reductions in motor vehicle air pollutant emission factors will help improve the air quality in the coming years. However, increases in traffic and traffic delays, resulting from future development and general population growth, are expected to negate the expected reductions in motor vehicle emissions factors to some degree. Many of the recommendations provided in this report will help mitigate the potential increase in motor vehicle traffic and traffic delays in Dudley Square.

## **2.0 AIR POLLUTANTS STUDIED AND HEALTH EFFECTS CRITERIA**

This air quality analysis focuses on mobile sources of air pollution. The analysis focuses on 11 air pollutants that have a significant contribution from mobile sources. These air pollutants have two classifications: criteria air pollutants and air toxics. Air toxics are also known as hazardous air pollutants (HAPs)

### **2.1 Criteria Air Pollutants**

The US EPA has identified six “criteria” air pollutants that may endanger public health or welfare. National Ambient Air Quality Standards (NAAQS) have been established for these six air pollutants to protect the public health and welfare with an adequate margin for safety (see Table 1). The Commonwealth of Massachusetts has adopted these same air quality standards. NAAQS have been established for ozone, lead, carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), particulate matter, and sulfur dioxide (SO<sub>2</sub>). Since 1987, particulate matter has been regulated as particles with a diameter of 10 micrometers (one-millionth of a meter) or less. In 1999, the EPA established a NAAQS for fine particulate matter with a diameter of 2.5 micrometers or less (PM<sub>2.5</sub>) and a new 8-hour average NAAQS for ozone. Implementation of these new NAAQS have been held up by litigation. The US Supreme Court recently upheld the constitutionality of the new PM<sub>2.5</sub> standard as well as a new eight-hour ozone standard. The EPA is in the process of determining the approach and schedule for implementing the new ozone standard. The PM<sub>2.5</sub> standard will be implemented after three years of monitoring data are available to allow designation of attainment/nonattainment areas.<sup>e</sup>

Five criteria air pollutants are included in this study: CO, NO<sub>2</sub>, SO<sub>2</sub>, PM<sub>10</sub>, and PM<sub>2.5</sub>. Each pollutant is described below.<sup>f</sup>

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<sup>e</sup> US EPA, “Press Release: Supreme Court Upholds EPA Position on Smog, Particulate Rules,” February 27, 2001.

<sup>f</sup> US EPA, “Criteria Pollutants”, [www.epa.gov/oar/oaqps/greenbk/o3co.html](http://www.epa.gov/oar/oaqps/greenbk/o3co.html).

## **Carbon Monoxide (CO)**

CO is a colorless odorless gas that is produced by the incomplete burning of carbon molecules in different fuels (e.g. coal, natural gas, oil). Exposure to elevated CO concentrations interferes with the blood's ability to delivery of oxygen to the body's organs and tissues. The NAAQS for CO are shown in Table 1. An area is allowed up to one exceedance of the CO NAAQS each year to maintain attainment of the NAAQS. Motor vehicles are the largest contributors to nationwide CO emissions.

## **Nitrogen Dioxide (NO<sub>2</sub>)**

NO<sub>2</sub> is a brownish, highly reactive gas formed during combustion processes at high temperatures. NO<sub>2</sub> can irritate the lungs and is an important ingredient in the complex photochemistry that causes ground-level ozone. Motor vehicles and power plants are the major sources of NO<sub>2</sub> emissions. The NAAQS for NO<sub>2</sub> is an annual average shown in Table 1.

## **Sulfur Dioxide (SO<sub>2</sub>)**

SO<sub>2</sub> is formed during the combustion of fuels that contain traces of sulfur (e.g. coal and oil). SO<sub>2</sub> is a primary contributor to acid rain. The NAAQS for SO<sub>2</sub> include 3-hour, 24-hour and annual average standards shown in Table 1. Motor vehicles are minor sources of SO<sub>2</sub>, with diesel engines contributing the majority of the motor vehicle emissions of this pollutant.

## **Particulate Matter (PM<sub>10</sub> and PM<sub>2.5</sub>)**

Particulate Matter consists of both particles with diameters at or less than 10 micrometers (PM<sub>10</sub>) and fine particulates with diameters at or less than 2.5 micrometers (PM<sub>2.5</sub>). Particulates include dust, dirt, soot and may be emitted directly to the atmosphere or formed in the atmosphere from other pollutants. Particulates may affect the respiratory and cardiovascular systems. PM<sub>10</sub> has been regulated since 1987. Standards for PM<sub>2.5</sub> were proposed in 1999, since this pollutant is likely to be responsible for adverse health affects because the smaller size of the particles allows them to reach further into the respiratory system. The NAAQS for PM<sub>10</sub> and PM<sub>2.5</sub> include 24-

hour and annual average standards shown in Table 1. The EPA is in the process of implementing the new PM<sub>2.5</sub> standards. Motor vehicles are not a major source of particulates, with diesel engines contributing the majority of the motor vehicle emissions of this pollutant.

## **2.2 Air Toxics**

The EPA has recently identified 21 compounds emitted from motor vehicles that are considered to be hazardous air pollutants. These compounds have been designated as Mobile Source Air Toxics (MSATs). In general air toxics are compounds that are known to be hazardous to human health for various reasons (e.g. they may cause cancer or other serious health problems).

The Massachusetts DEP has established air concentration limits for certain air toxics. These concentration limits are annual averaged Allowable Ambient Limits (AALs) and 24-hour averaged Threshold Effects Exposure Limits (TELEs). The AALs are based on concentrations that research has indicated may be responsible for causing a lifetime cancer risk of in one person in a million. The TELEs are based on concentrations that research has indicated may be responsible for non-cancer risks. AALs and TELEs are not really air quality concentration standards, but were developed as guidelines for permitting certain new air pollution sources. The prevailing theory regarding exposure to air pollutants and cancer regards all exposures as contributing to a lifetime cancer risk, rather than that exposures below a certain concentration (threshold) have no effect.

The EPA has developed reference concentrations for chronic inhalation exposure (RfCs) to which daily exposure for a lifetime, including sensitive populations, is likely to be free of adverse health effects.<sup>8</sup> The EPA has also established unit risk estimates (UREs) that estimate the number of people per million who risk developing cancer if exposed to a 1 :g/m<sup>3</sup> concentration of an air toxic for a lifetime. Table 2 lists all available information on the air toxics included in this study.

UREs are expressed as the maximum cancer risk estimated to results from a 70-year lifetime of continuous exposure to the air toxic at a concentration of 1 :g/m<sup>3</sup>. The URE is meant to represent the additional lifetime risk of cancer, beyond that due to other factors. Estimates of

risk are expressed as a probability as the chance in a million people. For example, the URE for 1,3-butadiene is estimated to be 10 in a million; that is, for people exposed to a concentration of 1,3-butadiene of 1 :g/m<sup>3</sup> for a lifetime, 10 out of a million people may develop cancer from the exposure to the chemical. It should be noted that there is a considerable amount of uncertainty associated with UREs. For higher (lower) concentrations, the cancer risk is proportionally higher (lower); for example exposure to a 1,3-butadiene concentration of 2 :g/m<sup>3</sup> for lifetime may result in 20 additional people with cancer in a population of a million people.

RfCs is an estimate of the concentration of an air toxic that people (including sensitive people) could be exposed to continuously without an appreciable risk of adverse health effects during a lifetime. There is considerable uncertainty in the RfC values. The EPA is in the process of developing RfCs for benzene, 1,3-butadiene, formaldehyde, and xylenes. However, the air toxics assessment uses equivalent criteria that have been established by the US Department of Health and Human Services Agency for Toxic Substances and Disease Registry's (ATSDR) Minimal Risk Levels (MRLs) and the California Environmental Protection Agency's (CalEPA) chronic inhalation Reference Exposure Levels (RELs).

Six toxic air pollutants are included in this study: benzene, 1,3-butadiene, formaldehyde, toluene, and xylenes. Each pollutant is described below.<sup>h,i,j,k</sup>

## **Benzene**

Benzene is a colorless aromatic volatile organic hydrocarbon that is emitted from motor vehicles. Benzene is a component of gasoline and is present in both the vehicle exhaust and from fuel evaporation emissions. Motor vehicles were estimated to account for approximately 76% of the national benzene emissions in 1996. In the US, roughly half of the benzene exposure is related to cigarette smoking. For nonsmokers, most benzene exposure is from motor vehicle emissions. Short-term exposure to elevated benzene concentrations may cause drowsiness, dizziness, and

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<sup>g</sup> MA DEP, "Indoor Air Sampling and Evaluation Guide," Office of Research and Standards, February 1, 2001.

<sup>h</sup> US EPA, "Motor Vehicle-Related Air Toxics Study", Office of Mobile Sources, April 1993.

<sup>i</sup> US EPA, Unified Air Toxics Website (UATW), [www.epa.gov/ttn/uatw](http://www.epa.gov/ttn/uatw)

<sup>j</sup> National Institutes of health, National Library of Medicine, Toxicology Data Network (TOXNET), Hazardous Substances Data Bank.

headaches. The EPA has classified benzene as a known human carcinogen (cause of cancer) of medium hazard.

### **1,3-Butadiene**

1,3-Butadiene is a colorless gas that is highly reactive. This air toxic is formed in motor vehicle exhaust from the incomplete combustion of fuel. The EPA estimates that in 1996 approximately 60% of the national emissions of 1,3-butadiene were associated with motor vehicles. Because of its high reactivity, this pollutant will only exist in the atmosphere for about one hour in the summertime; therefore, it will be found in its highest concentrations in the immediate vicinity of motor vehicles. Short-term exposure to this pollutant may cause irritation of the eyes, nasal passages, throat, and lungs, and may cause blurred vision, fatigue, and headaches. The EPA has classified 1,3-butadiene as a probable human carcinogen of medium hazard.

### **Formaldehyde**

Formaldehyde is a colorless volatile organic compound (VOC) that is formed in the exhaust of gasoline and diesel-fueled vehicles, through incomplete combustion of the fuel, and by the photo oxidation of other VOCs in the atmosphere. Other significant sources of this air toxic include cigarette smoking, manufacturing processes, and resin treated fabrics, rugs, and other building materials. The EPA estimates that approximately 49% of the formaldehyde in outdoor air is attributable to motor vehicles. Short-term and long-term exposure to elevated levels of formaldehyde can result in eye, nose, and throat irritation. The EPA has classified formaldehyde as a probable human carcinogen of medium hazard. The highest levels of airborne formaldehyde have been detected indoors.

### **Toluene**

Toluene is a colorless VOC that is a component of gasoline and is present in both the vehicle exhaust and from fuel evaporation emissions. Toluene is also widely used in coatings (e.g. paints), adhesives (e.g. glues), cleaning agents (e.g. paint thinners), and manufacturing. The EPA estimates that in 1996 approximately 74% of the national emissions of toluene are

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<sup>k</sup> Federal Register, "Control of Emissions of Hazardous Air Pollutants from Mobile Sources, Final Rule," Vol. 66, No. 61, March 29, 2001.

attributable to motor vehicles. Symptoms of exposure to elevated levels of toluene can include fatigue, headaches, and nausea. The EPA has determined that toluene is not classifiable with regard to human carcinogenicity. The highest concentrations of toluene usually occur indoors from exposure to paints, paint thinners, adhesives, and cigarette smoke.

### **Xylenes**

Xylenes are colorless VOC that are a component of gasoline and are present in both the vehicle exhaust and from fuel evaporation emissions. Mixed xylenes are also widely used in coatings, solvents, and manufacturing. The EPA estimates that in 1996 approximately 79% of the national emissions of xylenes are attributable to motor vehicles. Symptoms of exposure to elevated levels of xylenes can include irritation of the nose and throat, dizziness, nausea, and vomiting. The EPA has determined that xylenes are not classifiable with regard to human carcinogenicity.

## **2.3 Air Quality Indexes**

### **Criteria Air Pollutants**

The EPA has established an air quality index (AQI) as a way to present concentrations of criteria air pollutants in an easy to understand manner. Index values range from 0 to 500. A value of 100 represents air quality equal to the NAAQS; therefore, index values less than 100 represent air quality that is classified as good or moderate. Index values greater than 100 represent air quality that is unhealthy to a degree that increases as the index value increases.

### **Air Toxics**

The EPA has defined a hazard quotient (HQ) for air toxics that is equal to the air toxic concentration divided by the RfC or a similar health criteria concentration. A HQ value less than 100 is associated with exposures to a chemical that are not likely to be harmful. HQ values increasingly greater than 100 have the increasing potential for adverse health effects.<sup>1</sup>

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<sup>1</sup> EPA, "National-Scale Air Toxics Assessment for 1996, "(Draft for EPA Science Advisory Board Review), EPA-453/R-01-003, Office of Air Quality and Standards, January 2001.

### **3.0 EXISTING AIR QUALITY**

The existing air quality in the Dudley Square area has been estimated based on a number of different resources. Ideally, the existing air quality in Dudley Square should be established by air monitoring data over at least a three-year period in Dudley Square. Unfortunately, these data are not available for most air pollutants of concern. In lieu of data monitored at Dudley Square, data from the closest most representative air monitors in Boston have been used to establish the existing air quality conditions in Dudley Square.

The air quality in the Dudley Square area is a result of impacts from a variety of sources. These sources include mobile sources (e.g. on-road and off-road motor vehicles), stationary sources (e.g. power plants, manufacturing), and natural sources (e.g. vegetation, soils). This report focuses on the impacts of mobile sources.

The existing air quality concentrations presented in this report represent outdoor conditions. People typically spend more time indoors than outside. Concentrations of criteria air pollutants are generally lower indoors than outdoors. It is generally believed that exposure to air toxics is greater indoors than outdoors because concentrations of toxic air pollutants are not reduced greatly when outdoor air enters a building, and because there may be sources of toxic air pollutants inside buildings (e.g. pesticides, cleaners, paints). Several studies have shown higher concentrations of air toxics indoors than outdoors. One study concluded that concentrations of benzene, toluene, and xylenes are typically 2 to 5 times larger indoors than outdoors and may be up to 10 times larger indoors for formaldehyde (note: 1,3-butadiene was not included in the study).<sup>m</sup>

#### **3.1 Criteria Air Pollutants**

Various sources of air monitoring data were used to establish the existing background concentrations of the criteria air pollutants in Dudley Square. Ideally, at least three years of continuous monitoring data from the Massachusetts Department of Environmental Protection

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<sup>m</sup> US EPA, "A Comparison of Indoor and Outdoor Concentrations of Hazardous Air Pollutants," EPA/600/N-98-002, Inside IAQ, Spring/Summer 1998.

(DEP) monitor in Dudley Square would be used to establish the background concentration for all pollutants; however, this is not possible since only a few of the pollutants are monitored in Dudley Square and monitoring for most of the pollutants has only been occurring for two full years (1999 and 2000). Air monitoring of criteria air pollutants at the Dudley Square monitoring site started in 1999 for PM<sub>2.5</sub> and ozone. In the summer of 2000, monitoring at Dudley Square for SO<sub>2</sub> and NO<sub>2</sub> was started. The representative background data shown in Table 3 included as much monitoring data from Dudley Square as was possible.

For the pollutants that have not been monitored at Dudley Square we must substitute data from a location that is believed to be representative of Dudley Square (i.e. has similar air pollutant emissions from motor vehicles and stationary sources). The US Environmental Protection Agency (EPA) classifies air monitors for criteria air pollutants with regard to land use and location type. The Dudley Square air monitors are classified by the EPA as having a commercial land use and an urban/center city location type. Monitoring locations with these classifications were used to help establish the background air quality in Dudley Square.

The Massachusetts DEP operates a number of air quality monitors at locations throughout the commonwealth. The classification of different areas with regard to the NAAQS are based on data collected from the DEP air monitors. These air quality data are sent to the EPA and added to a nationwide database named the Aerometric Information Reporting System (AIRS). EPA's AIRData internet site contains a subset of the AIRS data and allows viewing of criteria air monitoring data from Massachusetts ([www.epa.gov/air/data](http://www.epa.gov/air/data)). It typically takes three months before air monitoring data are available in the AIRS or AIRData system.

Table 3 shows a summary of existing, representative criteria air pollutants concentrations in Dudley Square. Table 3 also shows the AQI for each pollutant. The AQIs shown in Table 3 indicate that the existing air quality in Dudley Square is good to moderate, with all AQIs less than 100.

### 3.2 Air Toxics

In October 1999 a program to take canister samples of air toxics on a six-day cycle began at the Dudley Square monitoring site. These weekly samples are shipped to the Rhode Island State Department of Health laboratory for gas chromatography/mass spectrometry (GC/MS) analysis according to EPA method T0-15. EPA method T0-15 determines the concentration of a number of target air toxics VOCs in outdoor air samples. These target VOCs include benzene, 1,3-butadiene, toluene, and xylenes.

Formaldehyde is monitored at Massachusetts DEP's Photochemical Assessment Monitoring Stations (PAMS) sites. PAMS monitoring stations are designed to monitor pollutants and meteorological data related to the formation of ground-level ozone and other photochemical oxidants during the summer months.

Table 4 lists representative background concentrations for the five air toxics and total nonmethane VOC (NMVOC) for the Dudley Square area. A hazard quotient value is shown in Table 4 that is the 24-hour concentration divided by the RfC (or equivalent) for the air toxic. Data shown in Table 4 indicate that the background air quality is not unhealthful with respect to noncancer effects with regards to the five air toxics included in this study, as all HQs are less than 100. A HQ for cancer affects was not determined, as the UREs for cancer impacts are not expressed as a concentration.

EPA's Cumulative Exposure Project estimated outdoor concentrations of air toxics across the US for the year 1990. More recently, the EPA has performed a national-scale assessment to estimate exposure to air toxics across the US for the year 1996. The 1996 analysis uses a much improved inventory of air toxics emissions. This report is presently available as a draft document.<sup>n</sup> The EPA plans to update this study again in 2004, using emissions data from 1999. This study included benzene, 1,3-butadiene, and formaldehyde. Predicted annual formaldehyde impacts for Suffolk County are included in Table 4, since no monitoring data for this pollutants are available for Dudley Square.

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<sup>n</sup> EPA, "National-Scale Air Toxics Assessment for 1996, "(Draft for EPA Science Advisory Board Review), EPA-453/R-01-003, Office of Air Quality and Standards, January 2001.

### **3.3 Air Quality Trends**

Over the past three decades outdoor air pollutant levels have generally decreased as a response to regulatory-mandated emission controls for mobile and stationary sources.

#### **Criteria Air Pollutants**

Air monitoring data indicate that background concentrations of criteria air pollutants have been decreasing in Massachusetts and throughout the United States.<sup>o,p</sup> This improvement in air quality is a result of regulatory practices that have required decreases in emissions from mobile and stationary sources.

#### **Air Toxics**

Data from Massachusetts DEP monitors indicates that background concentrations of benzene in the Commonwealth have been decreasing in recent years.<sup>11</sup> This decrease is attributable to the EPA's reformulated gas program which has attempted to control the benzene content in gasoline. The EPA has also implemented many other programs that are expected to contribute to decreases in air toxics emissions from motor vehicles in the coming years. These programs include: the a national low emissions vehicle (LEV) program, Tier 2 motor vehicle emissions standards, reductions in gasoline sulfur content, heavy-duty engine and vehicle standards and diesel fuel sulfur reductions. Additionally, the Toxics Use Reduction Act (TURA) was signed into law in 1989 to help reduce emissions of toxic pollutants from stationary sources in Massachusetts.

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<sup>o</sup> Massachusetts DEP, "1999 Air Quality Report," Air Assessment Branch.

<sup>p</sup> US EPA, "National Air Quality and Emissions Trends Report, 1999," EPA 454/R-01-004, Office of Air Quality Planning and Standards, March 2001.

**TABLE 1**

**MASSACHUSETTS AND NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)  
FOR CRITERIA AIR POLLUTANTS**

<b>Pollutant</b>	<b>Averaging Time</b>	<b>NAAQS (<math>\mu\text{g}/\text{m}^3</math>)</b>
SO <sub>2</sub>	3-hour <sup>S</sup>	1300 <sup>a</sup>
	24-hour <sup>P</sup>	365 <sup>a</sup>
	Annual <sup>P</sup> (Arithmetic Mean)	80
CO	1-hour <sup>P/S</sup>	40,000 <sup>a</sup>
	8-hour <sup>P/S</sup>	10,000 <sup>a</sup>
NO <sub>2</sub>	Annual <sup>P/S</sup> (Arithmetic Mean)	100
PM <sub>10</sub>	24-hour <sup>P/S</sup>	150 <sup>b</sup>
	Annual <sup>P/S</sup> (Arithmetic Mean)	50
PM <sub>2.5</sub>	24-hour <sup>P/S</sup>	65 <sup>b</sup>
	Annual <sup>P/S</sup> (Arithmetic Mean)	15 <sup>c</sup>
O <sub>3</sub>	1-hour <sup>P/S</sup>	235 <sup>a</sup>
	8-hour <sup>P/S</sup>	157 <sup>d</sup>
Pb	Calendar Quarter Arithmetic Mean	1.5

P = primary standard; S = secondary standard.

<sup>a</sup> One exceedance per year is allowed.

<sup>b</sup> 98th percentile (PM<sub>2.5</sub>) (99th percentile PM<sub>10</sub>) 24-hour concentrations in a year (average over three years).

<sup>c</sup> Three-year average of annual arithmetic means.

<sup>d</sup> Three-year average of the annual 4<sup>th</sup>-highest daily maximum 8-hour ozone concentration.

Note: The 8-hour ozone standard and the PM<sub>2.5</sub> standards have not been implemented at this time.

**TABLE 2**  
**AIR QUALITY CRITERIA FOR AIR TOXICS**

<i>Air Toxic</i>	<i>TEL</i> (:g/m <sup>3</sup> )	<i>AAL</i> (:g/m <sup>3</sup> )	<i>RfC</i> <i>Equivalent</i> (:g/m <sup>3</sup> )	<i>or</i>	<i>Unit Risk</i> <i>Estimate</i> (per million)
<i>Benzene</i>	<i>1.74</i>	<i>0.12</i>	<i>60</i>		<i>7.8</i>
<i>1,3-Butadiene</i>	<i>1.2</i>	<i>0.003</i>	<i>8</i>		<i>10</i>
<i>Formaldehyde</i>	<i>0.33</i>	<i>0.08</i>	<i>9.8</i>		<i>13</i>
<i>Toluene</i>	<i>80</i>	<i>20</i>	<i>400</i>		<i>Non</i> <i>Carcinogenic</i>
<i>Xylenes</i>	<i>11.8</i>	<i>11.8</i>	<i>700</i>		<i>Non</i> <i>Carcinogenic</i>

Unit Risk Estimate = possible number of additional people with cancer caused by a lifetime exposure to a concentration of 1 :g/m<sup>3</sup>.

RfC = the concentration that a person maybe exposed for a lifetime without causing any excess noncancer health effects.

*Sources of data:*

*AALs/TELS – Massachusetts DEP, Office of Research and Standards*

*Unit Risk estimates (UREs)/RfCs or equivalents – EPA National–Scale Air Toxics Assessment for 1996 (Draft), January 2001*

*RfC equivalent for xylenes is from CalEPA’s Reference Exposure Level (REL)*

**TABLE 3**  
**REPRESENTATIVE EXISTING AIR QUALITY IN DUDLEY SQUARE**  
**FOR CRITERIA AIR POLLUTANTS WITH A COMPARISON TO THE NAAQS**

<b>Pollutant, Averaging Period</b>	<b><u>Monitor Location</u></b>	<b>Representative Value (:g/m<sup>3</sup>)</b>	<b>NAAQS (:g/m<sup>3</sup>)</b>	<b>Air Quality Index (Value-Category)</b>
CO, 1-hour	Kenmore Square	5,520	40,000	40-Good
CO, 8-hour	Kenmore Square	4,140	10,000	
NO <sub>2</sub> , Annual	Kenmore Square	58.3	100	58-Moderate
Ozone, 1-hour	Dudley Square	152.9	235	65-Moderate
Ozone, 8-hour	Dudley Square	125.4	157	60-Moderate
PM <sub>10</sub> , 24-hour	200 Columbus Avenue	57.0	150	54-Moderate
PM <sub>10</sub> , Annual	200 Columbus Avenue	25.4	50	
PM <sub>2.5</sub> , 24-hour	Dudley Square	37.9	65	96-Moderate
PM <sub>2.5</sub> , Annual	Dudley Square	11.5	15	
Lead, Quarterly	Kenmore Square	0.03	1.5	2-Good
SO <sub>2</sub> , 3-hour	Kenmore Square	131.0	1,300	48-Good
SO <sub>2</sub> , 24-hour	Kenmore Square	76.0	365	
SO <sub>2</sub> , Annual	Kenmore Square	23.6	80	

Sources: US EPA Internet AIRData site ([www.epa.gov/air/data](http://www.epa.gov/air/data)) and Massachusetts Department of Environmental Protection's (DEP's) Air Assessment Branch in Lawrence.

Notes: Annual averages are highest measured during the most recent complete three-year period for which data are available (1998 - 2000). Values for periods of 24-hours or less are highest, second-highest measured over the three-year period. Exceptions are noted below.

The DEP started monitoring for PM<sub>2.5</sub> in Dudley Square in 1999; therefore, only two years of data are available for this pollutant. The standards for PM<sub>2.5</sub> are based on three-year averages of the measurements.

Ozone data represent only two years of data: 1999 and 2000. The Dudley Square ozone monitor did not commence operation until 1999.

NO<sub>2</sub> and SO<sub>2</sub> monitoring started at Dudley Square in June of 2000. The data shown in the table for these two pollutants for the year 2000 include information from the Dudley Square monitor.

The EPA has not established an air quality index (AQI) for NO<sub>2</sub> or lead. The AQIs shown for these pollutants are equal to the concentration divided by the NAAQS.

**TABLE 4**  
**REPRESENTATIVE EXISTING AIR QUALITY IN DUDLEY SQUARE**  
**FOR AIR TOXICS WITH A COMPARISON TO REFERENCE CONCENTRATIONS (RfCs)**  
**OR EQUIVALENTS**

<b>Pollutant, Averaging Period</b>	<b>Monitor Location</b>	<b>Representative Value (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>RfC or Equivalent (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>Hazard Quotient (HQ) (Value-Category)</b>
Benzene, 24-hour	Dudley Square	5.9	60	10 - Not Unhealthy
Benzene, Annual	Dudley Square	1.6		
1,3 Butadiene, 24-hour	Dudley Square	0.36	8	5 - Not Unhealthy
1,3 Butadiene, Annual	Dudley Square	0.05		
Formaldehyde, 24-Hour	N/A	N/A	9.8	25 - Not Unhealthy
Formaldehyde, Annual	Suffolk County	2.43		
Toluene, 24-Hour	Dudley Square	46.9	400	12 - Not Unhealthy
Toluene, Annual	Dudley Square	5.4		
Xylenes, 24-Hour	Dudley Square	10.2	700	1 - Not Unhealthy
Xylenes, Annual	Dudley Square	2.7		
NM VOC, 24-Hour	Dudley Square	327.3	N/A	N/A
NM VOC, Annual	Dudley Square	83.0		

Sources: Air sampling conducted by the Massachusetts Department of Environmental Protection (DEP) and modeling from the US EPA National-Scale Air Toxics Assessment for 1996.

Notes: The annual average formaldehyde concentration is a modeled value that is representative of Suffolk County for 1996, obtained from the US EPA Cumulative Exposure Project. A representative 24-hour average for formaldehyde is not available (N/A).

Twenty-four hour averages at Dudley Square are from air sampling conducted by the Massachusetts DEP on a six-day schedule. These data represent the maximum measured 24-hour concentration from 68 24-hour canister samples taken during the period: October 9, 1999 – January 1, 2001. Annual averages are estimated by the average of the 24-hour samples over the period.

RfC is the concentration that a person maybe exposed for a lifetime without causing any excess noncancer health effects.

The Hazard Quotient is equal to the 24-hour concentration divided by the RfC value and multiplied by 100. A HQ value less than 100 is considered not unhealthy and a value greater than 100 is classified as unhealthy.

NM VOC represents total non-methane VOC. There are no RfCs for total NM VOC.

**Appendix II**

**Department of Neighborhood Development**

**Dudley Square Municipal Center Study**

**Draft Development Options**

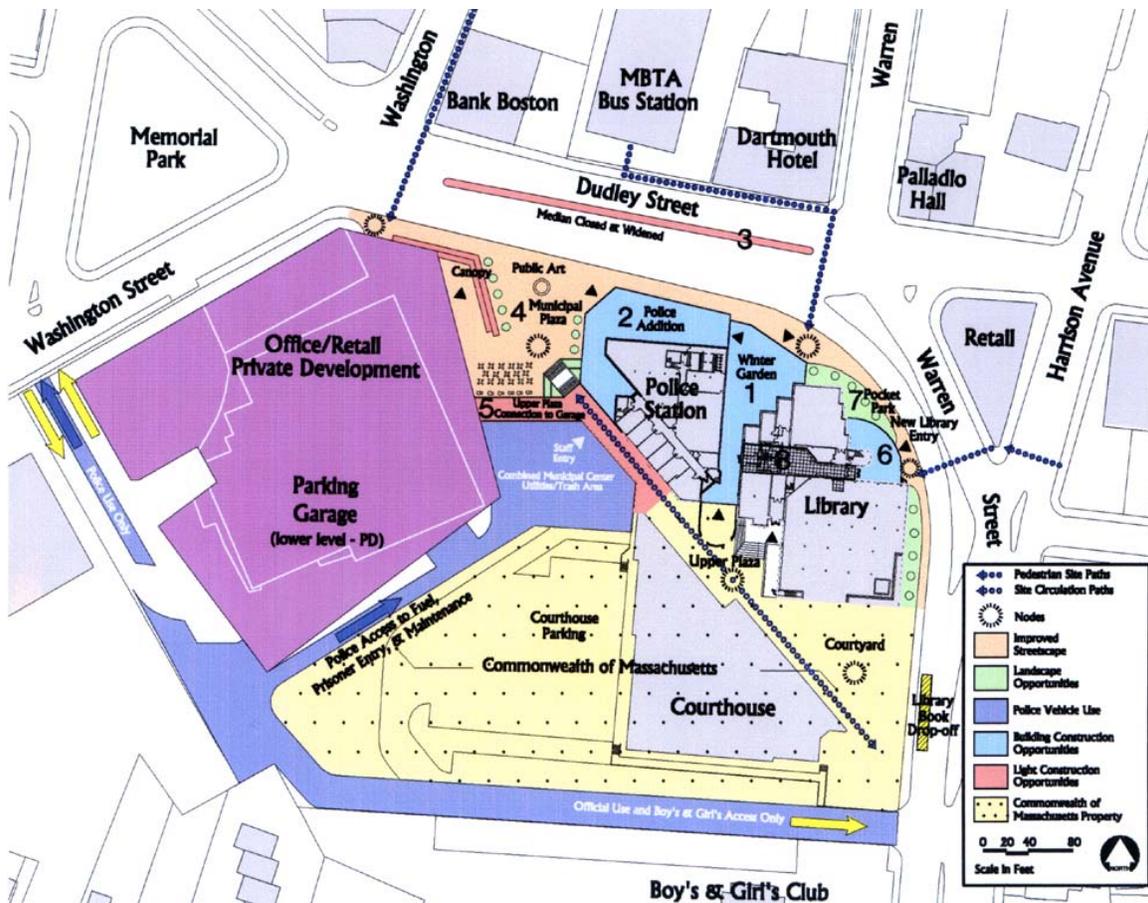
**Note:** The four draft development options presented will depend on the availability of City funding and the final development plans for the Modern Electroplating project.

**Department of Neighborhood Development  
 Dudley Square Municipal Center Study  
 Draft Options**

The Dudley Square Municipal Center Study will be released in December 2001. The Study provides Master Plan options for the Dudley Square Municipal Center including detailed development options and cost analysis. Below are brief summaries of the four draft options proposed.

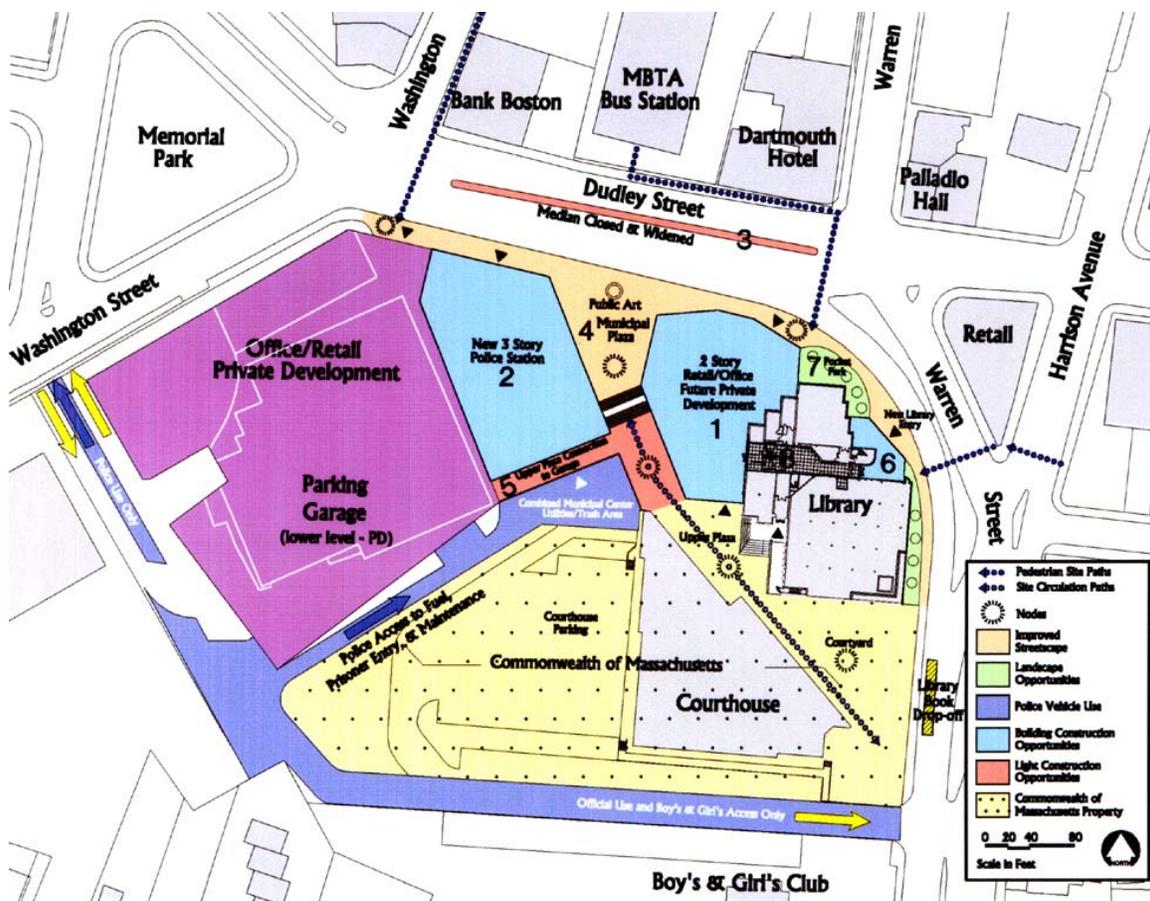
**Draft Option A**

Option A enhances existing elements within the Municipal Center with renovations and building additions. A Winter Garden (1 on map below) is proposed between the Library and Police Station with additional improvements to the streetscape and plaza spaces. Challenges include renovating the existing Police Station (2) that is a cast in place concrete structure. This complete renovation would require Police functions to be relocated for at least 18 months.



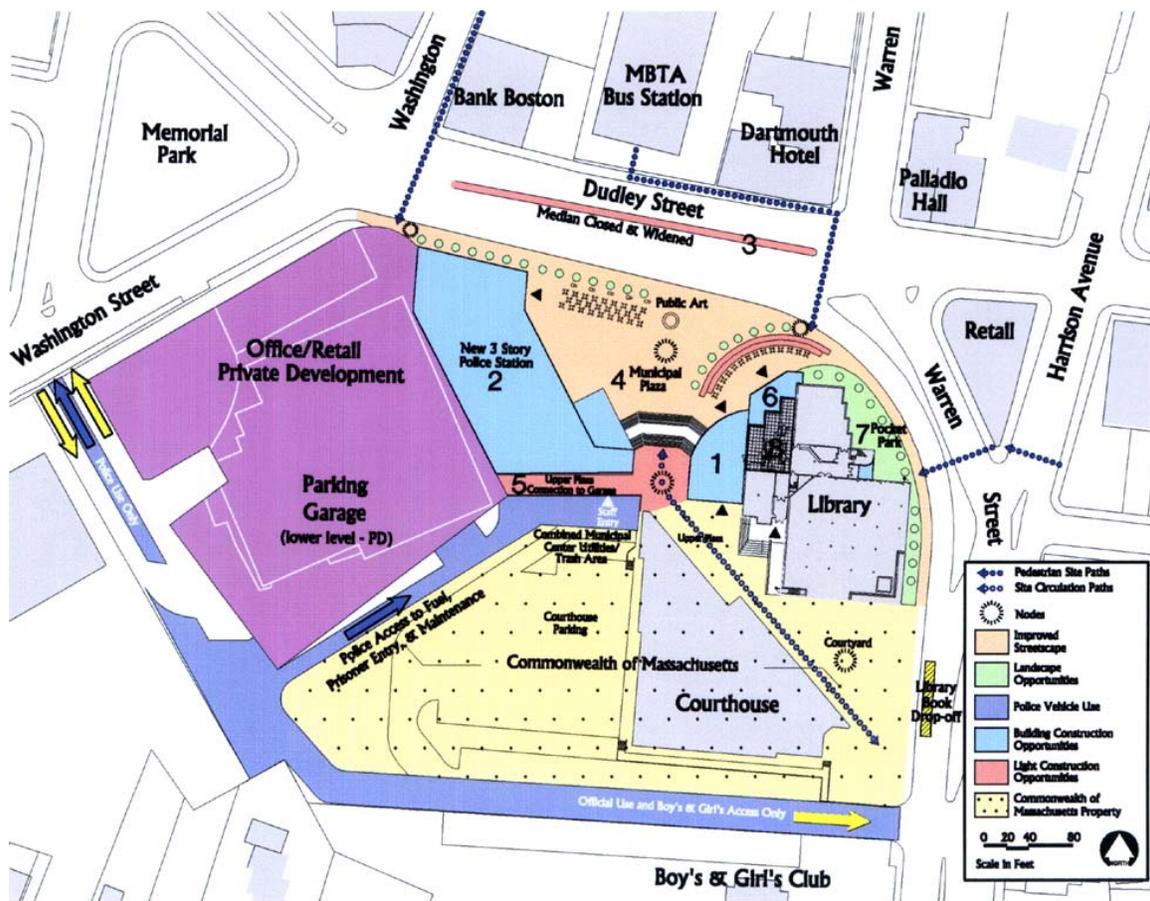
## Draft Option B

Option B creates new economic development opportunities within the Municipal Center. Option B significantly alters the existing site by removing the existing Police Station. A new Police Station is proposed (3) adjacent to the Modern Electroplating Development creating the opportunity for office/retail development at the former Police Station Site. The streetscape and plaza enhancements are similar to those proposed in Option A.



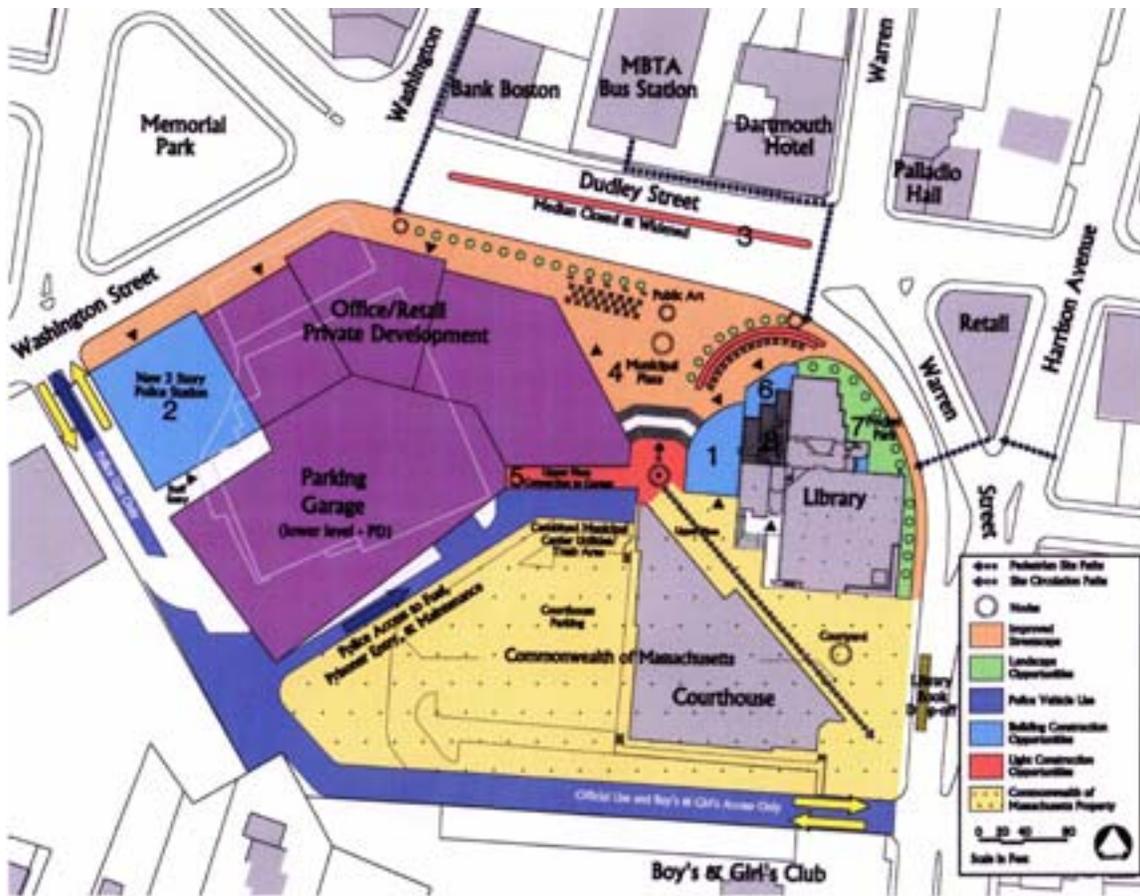
## Draft Option C

Option C increases the amount of open space within the Site. Streetscape and plaza enhancements are more extensive than in Options A and B. The proposed construction of a new Police Station is similar to Option B. Option C includes greater enhancements to the Library.



## Draft Option D

Option D relocates a newly constructed Police Station to the opposite side of the Modern Electroplating Development (2) versus Options B and C. This would allow additional retail and office space to “wrap around” the corner of Washington and Dudley Street, thereby screening the proposed parking structure.



**Appendix III**

**Meeting Minutes  
&  
Issue Identification**

**Dudley Square Transportation & Air Quality Study**  
**First Community Meeting**  
**November 28, 2000**  
**Dudley Square Library, 5:30 – 7:30pm**

Minutes

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Noah Luskin, Boston Redevelopment Authority (BRA) welcomed the attendants. Discussed the history of the project evolving from the Dudley Square Parking Task Force and the Modern Electroplating Redevelopment process. From these processes, it was apparent that with several new developments proposed in Dudley Square, the overall transportation and air quality effects needed to be examined. In response to a community request, the BRA agreed to conduct this study. A request for proposals was issued in February 2000 and Bruce Campbell & Associates was selected as the consultant in September 2000. Bruce Campbell & Associates will examine transportation issues, Primary Group will look at urban design and Tech Environmental will conduct the air quality analysis.

The consultant has begun the first phase of the study; existing conditions. The study will hold public meetings to update and receive input from the community. The community input from these public meetings will be compiled into a set of Community Recommendations that will be given to developers, City and State agencies. These specific development recommendations will outline how new development will occur in Dudley Square so that (1) transportation is improved, and (2) the public health of residents is protected.

Ralph DeNisco, Boston Transportation Department (BTD) discussed the overall scope of the study. Recommendations for Dudley Square will be focused on the following five categories:

- Air Quality
- Parking & Loading
- Pedestrian & Bicycle Issues
- Public Transportation
- Traffic Management

There is already a significant amount of existing data from similar studies including the Dudley Square Municipal Study Center being conducted by the Department of Neighborhood Development. This study is examining specific design issues related to the Municipal Block containing the Police Station, Library and Courthouse. The Transportation & Air Quality Study will coordinate its information with the Municipal Buildings Study and the Modern Electroplating Redevelopment in order to achieve a coordinated recommendation to the squares' needs.

The following are comments from meeting attendees:

Jean Morgan, Roxbury Neighborhood Council (RNC) commented that a significant number of bus depots are located near Dudley Square and that their long term existence in the area should be examined. Mr. DeNisco responded that these type of recommendations will be developed under the "Air Quality" category.

Pen Loh, Alternatives for Community and the Environment (ACE) asked if the study will look at the potential of combined impacts from development as well as future build out scenarios. Mr. DeNisco

responded that a goal of the study was to predict combined impacts from future projects and to develop strategies on how to deal with these impacts.

Jim Hill, Department of Public Health (DPH) discussed the public transportation goals for the DPH projects proposed for the Ferdinand Building site. John Rumpler, (ACE) commented that it will be particularly important to convince DPH employees used to taking public transit to work that an additional transfer will be easy.

Bonnie Polin, Bruce Campbell & Associates presented the existing transportation conditions that exist in the study area. It was recommended that abutting residential areas be looked at for parking and traffic management.

Kirk Sykes, Primary Group, reviewed the latest finding of the Dudley Square Municipal Center Study. Kirk then asked for comments on the main categories of the study; Air Quality, Parking & Loading, Pedestrian & Bicycle Issues, Public Transportation & Traffic Management.

**Dudley Square Transportation & Air Quality Study**  
**Second Community Meeting**  
**January 30, 2001**  
**Dudley Square Library, 5:30 – 7:30pm**

Minutes

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Noah Luskin, Boston Redevelopment Authority (BRA) welcomed the attendants and discussed overall scope of the study as well as the five focus categories:

- Air Quality
- Parking & Loading
- Pedestrian & Bicycle Issues
- Public Transportation
- Traffic Management

David Noiles and Stanley Wiggins from Alternatives for Community and Environment's Roxbury Environmental Empowerment Program (REEP) presented their findings of air quality in Dudley Square. They discussed causes of air pollution, health effects, sources as well as specific air quality conditions in Dudley Square. The Particulate Matter air quality in Roxbury is at the EPA standard. The Environmental Protection Agency translates these standards into an Air Quality Index. According to this index (which ranges from unhealthy to moderate to good) air quality in the Dudley Square area was good for less than 60% of the time. In addition, air quality pollutants in Dudley Square (particulate matter and carbon levels) are 15-30% higher than at the Harvard School of Public Health on Huntington Avenue. See attached handout for detailed statistics. It was stated that it would be important to get more baseline data to better understand how Dudley compares to other areas in the city as well as the air quality of the baseline data.

Bonnie Polin, Bruce Campbell & Associates presented detailed existing transportation conditions that exist in the study area. This information included predominate traffic flows as well as the existing

parking situation and MBTA bus data with regards to on time performance. It was recommended that enforcement of parking regulations be examined as a recommendation.

In addition, it was recommended that the design of Dudley Station be revised as the existing bus routes cause chaotic situations within Dudley Square. Representatives from the MBTA stated they are anxious to see the recommendations of this study so that bus routes can be improved. The proposed silver line plans will be included in the study analysis to more accurately forecast conditions before making recommendations. The speed of the buses was also raised as an issue to examine. Ms. Polin then discussed the definite and potential future development projects that will be looked at. While the potential developments are not yet known, the guidelines produced from this study will apply to all new developments in Dudley Square.

Kirk Sykes and Mathew Bluette, Primary Group, presented a comparative analysis of other urban centers. Community decisions on density, for example, will need to be explored to determine the types of retail that can come into Dudley Square. The question of whether to attempt to divert MBTA traffic out of Dudley Square should be studied. This could, however, lessen the level of service that Dudley Square currently has. Dudley Square is unique in that its transit center is located in the center of the square versus other urban centers where transit hubs are located on the periphery.

It was recommended that for the next public meeting, community residents think about what characteristics of urban areas they would like to see in Dudley Square and what types of environments they would like to avoid. For example, Harvard Square has a good mix of retail shops but is that an environment residents would like to see in Dudley (such as hours of use, etc.)? It was stated that it would be critical to keep Dudley unique as the center of Roxbury.

At the next public meeting, the consultants will look at baseline characteristics of urban centers to better determine what could occur in Dudley. In addition, the air quality scope of work will be discussed. The next public meeting will be held on February 27, 2001 at the Dudley Square Library at 5:30pm.

## **Dudley Square Transportation & Air Quality Study**

### **Third Community Meeting**

**February 27, 2001**

**Dudley Square Library, 5:30 – 7:30pm**

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The consultants presented a variety of urban design and streetscapes from recognizable areas to allow the community an opportunity to analyze comparable urban environments. The areas chosen were comparable in size, transportation infrastructure and traffic volumes to Dudley Square. The images and urban environments provided guidance and lessons to be duplicated or avoided. Broadly defined transportation recommendations were developed based on community process to date. Through community discussion, alternative recommendations were narrowed down for further evaluation.

**Dudley Square Transportation & Air Quality Study**  
**Fourth Community Meeting**  
**June 6, 2001**  
**Dudley Square Library, 5:30 – 7:30pm**

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The consultants presented a preliminary series of Draft Recommendations. Each draft recommendation was presented in the context of the community concerns that it addressed. Recommendations were shown as the outgrowth of the preferred alternative strategy agreed to at the previous meeting. Each recommendation was developed, tested and analyzed based upon the data collected and how it met the Study's objectives. Comparative elements from other urban areas were presented to demonstrate how the recommendations would materialize in Dudley Square. Community input was noted for each recommendation. Donna Smallwood from Caravan for Communities, presented information on Transportation Demand Management (TDM) programs and how other communities have established Transportation Management Associations (TMA's) to increase non-auto travel in their districts.

**Dudley Square Transportation & Air Quality Study**  
**Fifth Community Meeting**  
**July 11, 2001**  
**Dudley Square Library, 5:30 – 7:30pm**

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The detailed recommendations of the Study were presented at the final public meeting. The recommendations were refined based on community input at the previous public meeting. The consultants presented timelines and responsibility for implementation of the recommendations. A discussion on how these recommendations would be incorporated into the Dudley Square Municipal Center Study detailed the coordination of these two planning efforts. Updates on the Department of Public Health and Modern Electroplating projects were also given.

## **Dudley Square Transportation & Air Quality Study**

### **Categories of Focus: Issue Identification**

This will be an ongoing list of community issues that will be discussed and revised as needed at each Public Meeting

#### **1. AIR QUALITY**

- Bus depot locations a problem
- Idling issues
- Air quality a function of parking, public traffic, bike rack/transit
- Cars, density, buses/ “the Dudley environment”
- Explore garage venting scenarios

#### **2. PARKING AND LOADING**

- Tractor trailer trucks and Woolworth’s parking is used as maneuvering space, not parking/public lot will be used by city workers
- Businesses need vehicular support
- Parking is about safety and convenience/conflict avoidance by double parking
- Need for on street parking (Orchard Gardens) Shawmut Avenue

#### **3. PEDESTRIAN AND BIKE ISSUES**

- Dudley Street too wide to cross without a signal light
- General street crossing issues
- Bike racks should be everywhere for bike storage
- Modern Garage should have bike storage
- No smooth bicycle ride from Dudley to Downtown
- Bike lane-Washington Street and everywhere
- Bikes are major mode of transport
- Pedestrian streetscape should be generally improved
- Accessibility provisions required
- Bike riders must signal or get fined
- Sidewalk plowing required
- Triangle park restoration

#### **4. PUBLIC TRANSPORTATION**

- T-Pass subsidy good/negotiable state number
- There should be light on Washington Street
- Shuttle from Dudley to RCC or Ruggles (Orange Line)
- A Dudley “coop” shuttle
- Light rail should go up (Harrison) and down (Washington) different streets to reduce traffic conflicts
- Light rail should be considered if no buildings need to be taken
- Urban ring bus should stop in Dudley
- Bus schedule confusing/no visible schedule
- MBTA must help solve the problem
- Alternative fuel buses
- Too many out of service buses
- Reduce “dead-head” trips
- Buses are noisy

#### **5. TRAFFIC MANAGEMENT**

- Signalization phasing and coordination problems
- Grid lock at Washington & Dudley and Shawmut & Dudley
- Signals poorly located/not visible
- No pedestrian signals
- Can we separate buses & cars/create dedicated lanes
- Dudley Station traffic poorly managed/pedestrian conflicts
- Preferred signalization on street for buses
- Washington/Warren (Melnea Cass& Dudley)
- Pedestrian only environment such as Downtown crossing streetscape
- Silverline has no dedicated lane from Melnea Cass to Dudley
- All pedestrian environment is not convenient/not safe
- Emergency vehicle lanes for police and fire
- Church overflow parking
- Police enforcement difficult
- Double parking a problem-safety a reason
- Access to proposed Modern Electroplating garage
- Residential traffic conflicts/shortcut Moreland Street
- Shawmut Avenue too fast/one lane/need traffic calming
- Insufficient street markings
- Eliminate cars from Dudley Square
- Beginning of Roxbury Street should reverse direction of traffic

## **Appendix IV**

### **Transportation Data**

The traffic data gathered by the Bruce Campbell & Associates is available under separate cover.