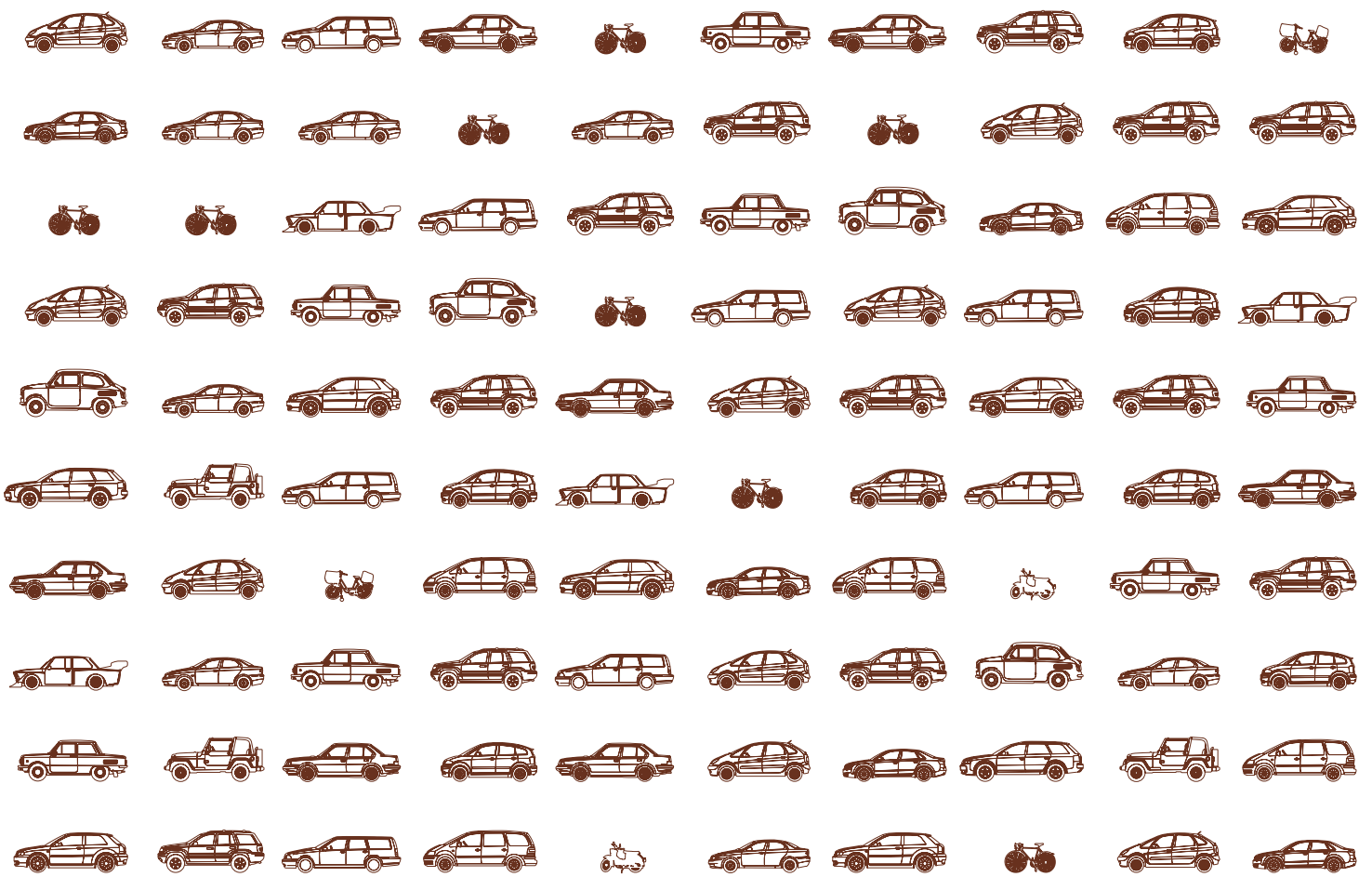
Medford Square Garage
Feasibility Study

MassDevelopment
Utile, Inc.
Nelson\Nygaard Consulting Associates
for the City of Medford



Final Report — October 15, 2010

Prepared for

The City of Medford
Mayor Michael J. McGlynn

In cooperation with

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I.
Introduction

Executive Summary

The goal of the Medford Garage Feasibility Study was to a) identify the best site, parking capacity, and layout of a new public parking garage, b) propose options for design approaches to the garage, and c) embed the logic of a new parking garage within an overall parking management strategy for the Medford Square downtown core. To arrive at the most informed and compelling recommendations, MassDevelopment and the planning team—Utile, Inc., and Nelson\Nygaard Consulting Associates—worked closely with Lauren DiLorenzo, Director of the City of Medford Office of Community Development, and sought the feedback of Mayor Michael J. McGlynn, City staff, and Medford community members at several stages during the iterative planning process. Public input was generated through two public meetings and written surveys.

The Feasibility Study resulted in five important recommendations:

1. Build a Garage to Accommodate Future Development

A four-and-a-half-story parking garage with 178 vehicular spaces and 22 bike spaces should be built on the existing lot between Governors Avenue and Bradlee Road, replacing the 163-space municipal garage formerly on the site. This garage is adequate to meet the future economic development of Medford Square if the garage is part of a larger parking management plan for the Downtown area. The garage will provide parking for existing businesses, for future retail and restaurant establishments, as well as the patrons of the nearby Chevalier Theatre.

2. Forward a Sustainable Agenda in Planning and Design

The garage should be a high-quality and architecturally distinctive building that can be considered a contributing visual asset to the Square. The design should be driven by a sustainable agenda and include photovoltaic (solar) panels, adequate natural ventilation and daylighting, bicycle parking, accommodations for electric and shared cars, innovative storm water management, and other sustainable features to make the garage a Zero Net Energy demonstration project in the Commonwealth.

3. Initiate a Comprehensive Parking Management Strategy

New parking supply in the western half of the Square, as provided by a new garage, will not alleviate the on-street parking situation, especially if there is a fee to park at the garage. Improved parking management practices are necessary to moderate heavily utilized prime parking areas and incentivize the use of a new garage. A comprehensive parking management strategy for the Downtown area will include tiered pricing for both metered spaces and permits (business and residential), a relaxation of parking time limits, and adequate enforcement.

4. Institute a Pricing Program

A demand-responsive priced parking management system in the Square can equitably assure available parking spaces for all user groups, including long-term spaces for employees and convenient front-door spaces for customers. Financing the recommended garage is made much more feasible if such pricing is successfully instituted, providing the City with new sources of revenue.

5. Improve Main Traffic Intersection

The five-legged intersection at High, Forest, Salem, Riverside, and Main streets is currently an impediment to pedestrian movement between the east and west halves of Medford Square, effectively splitting the Square's parking supply. With some traffic and public space improvements at this intersection, the overall vehicular level of service would not be negatively impacted, and a civic space could be created at the very heart of the Square.

The analysis conducted and recommendations proposed in this Feasibility Study are intended to arm the City of Medford, and the design team they ultimately choose, with the regulatory and technical information necessary to move the design and construction of a new municipal garage forward. The comprehensive appendix to this report is comprised of memos from a host of subconsultants that outline the potential permits that may be required for the garage, environmental conditions on the site, structural implications of various systems, specifications for photovoltaic panel systems, conceptual cost estimates, construction and maintenance financing implications, relevant building code provisions, and an overview of modular construction options. In total, the report provides the future design team with vetted conceptual options for the garage, and the means to engage the project quickly, with City and public support.

Study Area

The specific area chosen for the urban design portion of this study constitutes the core of Medford Square's retail and commercial center. It is bounded on the east by Interstate 93, on the south by Route 16, on the west by Powderhouse Road, and on the north by Hall Avenue.

Analysis of vehicular activity in the Square focused more tightly on the public (nonresidential) core of the Square in which the majority of through-traffic and public parking occurs. An illustration of both study areas is shown here.


URBAN DESIGN STUDY AREA
Chevalier Theatre
Proposed Garage Site
Post Office
City Hall
TRAFFIC AND PARKING STUDY AREA
93

Methodology

Urban Design and Garage Study

Utile, Inc., the lead urban design consultant, devised a planning approach that analyzed garage location and layout options at the same time that Nelson\Nygaard, Utile's transportation planning sub-consultant, conducted a comprehensive analysis of the quantities and utilization rates of the existing parking supply. As a result, the planning team was able to dovetail existing site opportunities with a rigorous analysis of future needs. This report describes the role analysis played in determining the location and appropriate scale of the garage. Broad understanding of the existing conditions also helped to frame a specific set of recommendations for a Downtown-wide parking management approach.

The planning began by a test of four discrete sites in the Square as possible locations for a municipal parking garage (see Section III: Garage Site Selection). Drafted plans revealed the most efficient parking garage configuration and the specific number of spaces that could be generated on each site. In addition, the overall merits of each site and potential garage were assessed, to allow the client team to select a preferred site on which the team would focus for the remainder of the Feasibility Study.

Of the four potential sites assessed, the Governors Avenue parking lot site was selected by the client team. Utile tested two plan options for the site—a zero-lot-line option, and a slightly smaller option—and two facade strategies. These facade strategies were kept purposely divergent, to provide the City with two different but equally feasible options for future design. Conceptual cost estimates were developed for both options.



LEFT: The proposed garage site is between Governors Avenue and Bradlee Road, just off High Street.

Traffic and Parking Study

Recognizing the likely interaction that a new garage would have with the existing Medford Square parking system, Nelson\Nygaard developed a methodology that considered current parking supplies, their utilization, and how they are regulated. This included detailed inventories, parking activity observations, user surveys, and a Parking Open House workshop.

The Parking Open House was conducted to help identify successes and needs in the existing parking management system. Participants provided input on parking needs and potential improvements through hands-on mapping and voting exercises. This exercise was supplemented by a survey distributed at local businesses and advertised online through the City's web page.

In order to accurately assess the number of spaces required for a parking garage in Medford Square, the team completed a detailed parking utilization study. Rather than rely on national averages to develop demand estimates, this approach measures the real demand for parking within a reasonable walking distance of the target garage site(s). Nelson\Nygaard created a detailed parking inventory for all publicly accessible parking spaces, and conducted counts throughout an entire day to determine how the spaces were utilized. This led directly to an estimate of the existing demand and the need for additional supply.

Nelson\Nygaard then conducted an evaluation of walking conditions in the Square, and their impact on the ability of motorists to access destinations on foot once parked. Using a 5-minute maximum walk time, and assuming various future walking improvements, they determined the catchment area for the target site(s).

Finally, projected garage traffic was assigned to local streets to assess the impact on vehicular safety and local congestion at nearby intersections.

Public Participation

To help identify needs in and potential improvements to Medford Square's parking system, the team and City held a Parking Open House workshop on March 31, 2010, at Medford City Hall. The open public forum was designed to allow all participants to help identify areas of concern regarding parking in the Square, and to offer suggestions on how to improve the current parking conditions. The Open House included a voting exercise to elicit general parking preferences and small group discussions where comments were made and recorded directly onto large tabletop maps of the Square's parking inventory. The Open House was well-attended by the local business community and nearby residents. All map comments were transferred to illustrations included in this report (see pp. 30–31), and all voting results are summarized in the accompanying pie charts (see facing page and p. 29). In addition, a broad public survey was distributed in paper and online that resulted in more than one hundred responses. The workshop and survey results helped target the team's recommendations and provided a valuable users' perspective on parking operations.

Finally, a Public Meeting was held June 16, 2010, during which the consultant team shared the preliminary analysis and recommendations for parking management strategies, siting and sizing of a municipal parking garage, and conceptual studies for a garage on the Governors Avenue site. The public was invited to comment after the presentation. Some of the public recommendations and suggestions are reflected in this report.



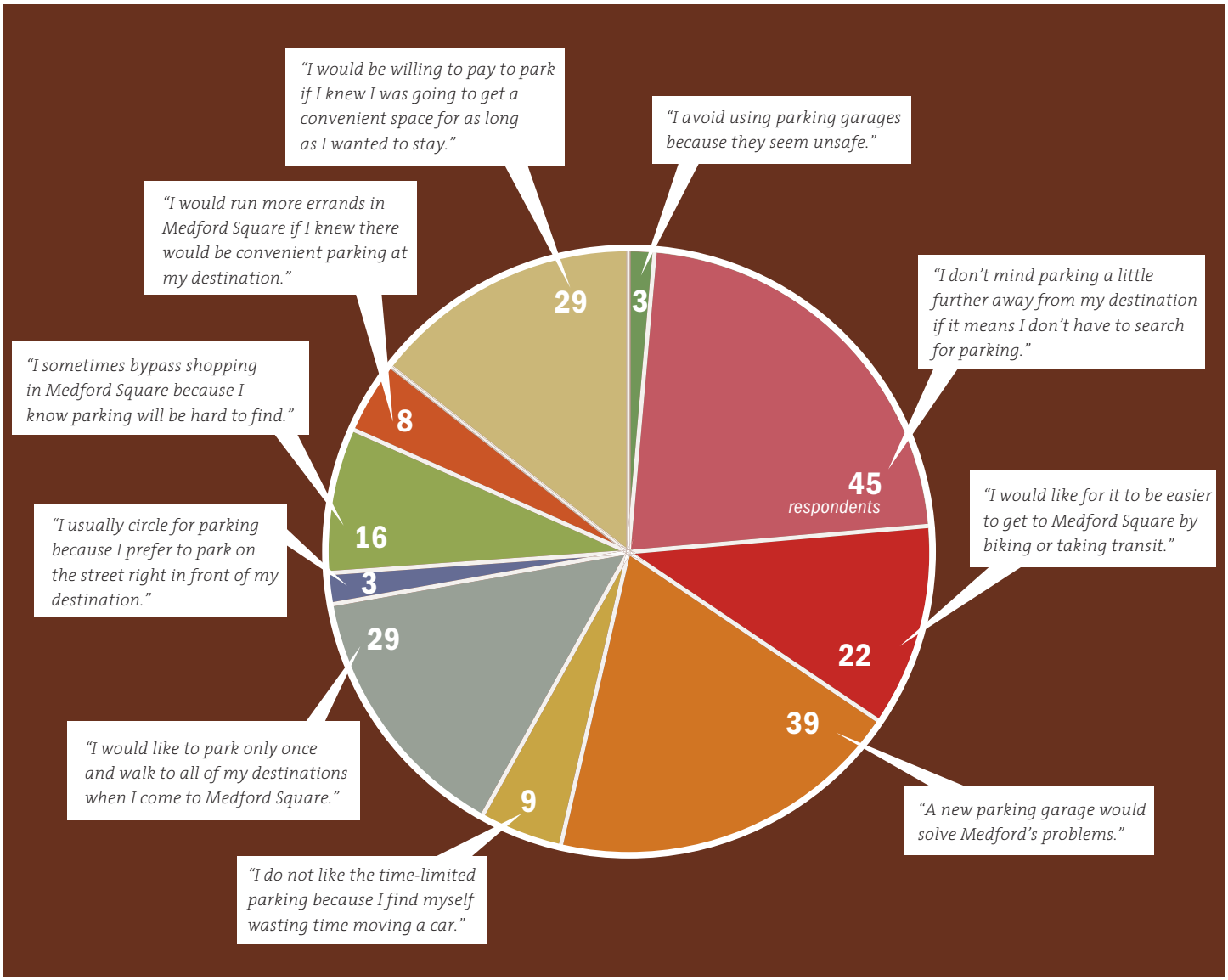




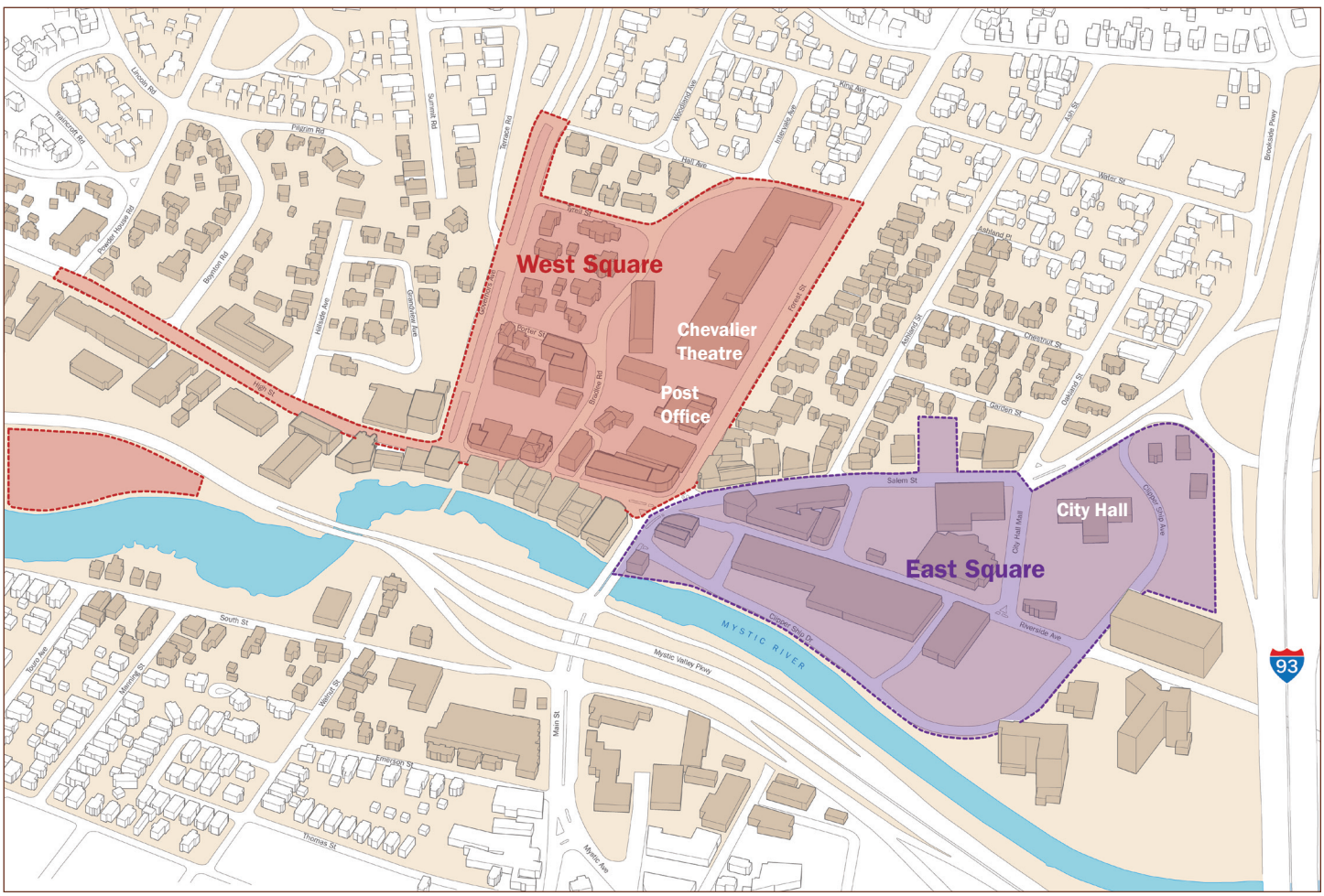


RIGHT: Community members at the Public Meeting on June 16, 2010.

FACING PAGE: Comments from workshop and survey respondents.


"I would be willing to pay to park if I knew I was going to get a convenient space for as long as I wanted to stay."
"I avoid using parking garages because they seem unsafe."
"I would run more errands in Medford Square if I knew there would be convenient parking at my destination."
"I don't mind parking a little further away from my destination if it means I don't have to search for parking."
"I sometimes bypass shopping in Medford Square because I know parking will be hard to find."
"I would like for it to be easier to get to Medford Square by biking or taking transit."
"I usually circle for parking because I prefer to park on the street right in front of my destination."
"I would like to park only once and walk to all of my destinations when I come to Medford Square."
"A new parking garage would solve Medford's problems."
"I do not like the time-limited parking because I find myself wasting time moving a car."
29
3
45
respondents
8
16
3
29
22
39
9

II. Existing Conditions



ABOVE: Medford Square with the East and West Squares highlighted.

Urban Design Issues

East vs. West Square

Medford Square centers on the five-legged intersection at High, Forest, Salem, Riverside, and Main streets. While this crossroads once served as a node for pedestrian activity and exchange, the intersection is now dominated by constant vehicular traffic, which effectively divides the square in two halves, the East and West Squares. Currently, the configuration and character of Medford Square, and the area that surrounds it, is defined by the needs of the large number of vehicles that pass through the Square every day. As a result, dedicated turn lanes, smooth turning radii to maximize traffic speed, and a street layout that maximizes the number of vehicular movements from any intersection, has reduced the pedestrian realm to narrow sidewalks and pedestrian islands marooned in the middle of traffic.

The **East Square** is populated by a collection of small retail storefronts that line both Salem Street and Riverside Avenue. This commercial fabric quickly terminates at River Street, where City Hall and its grounds mark a change in density and streetscape character. Surface parking lots, both municipal and private, surround City Hall grounds, extending south to Clippership Drive and east to I-93.

The **West Square** is more densely inhabited, and is characterized by a collection of small retail storefronts, low-rise office buildings, and medical office buildings lining High Street. Above High Street, the fabric quickly transforms into a residential neighborhood comprised primarily of single-family housing stock. West Square also contains several historic structures.

Pedestrian Experience

In addition to the parking supply issues that influenced the recommendations of the report, the team also weighed several urban design issues including pedestrian walkability, architectural character, and placemaking opportunities. Both sides of the Square have pleasant architectural and streetscape character, but there is a notable lack of pedestrian gathering spaces that would contribute a vibrant walking quality to the Square. The most obvious location for public gathering should be at the center of the Square, currently the most pedestrian-challenged location.

A thorough assessment of walking conditions in Medford Square was conducted to evaluate the potential market for a new garage within a 5-minute walk of the target site(s). A number of walking issues were identified and mapped by the consultant team, including obstructions, missing signing and crosswalks, poor sidewalk conditions, difficult sight lines, and areas of higher traffic speeds.

As part of the walking inventory, the intersections of High and Main Streets, and High Street and Governors Avenue were determined to be notable barriers to walking in the Square—particularly between the East Square and West Square.





FACING PAGE, TOP: Pedestrians near the Salem / Forest intersection with High Street.

FACING PAGE, BOTTOM LEFT: Colleen's on High Street, at the intersection of Governors Avenue in the West Square, is a popular ice cream and sandwich shop.

FACING PAGE, BOTTOM RIGHT: The five-legged intersection of High Street, Forest Street, Salem Street, Riverside Avenue, and Main Street.

LEFT: Pedestrians in the East Square.


TOW AWAY ZONE
Memorial Hospital
SALEM ST
ANDREW REALTY
FOREST
thephoenix
STUFF

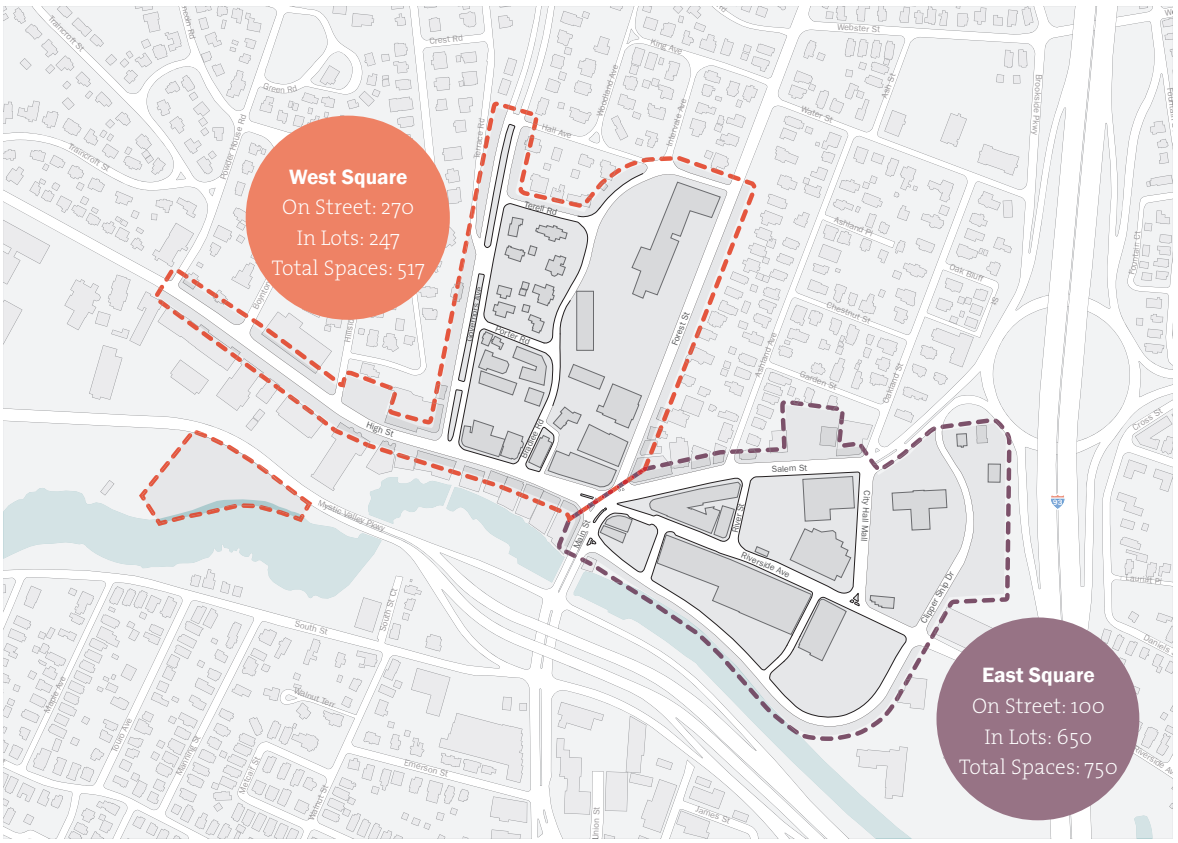

Colleen's
61 HIGH STREET
DESSERTS • SANDWICHES

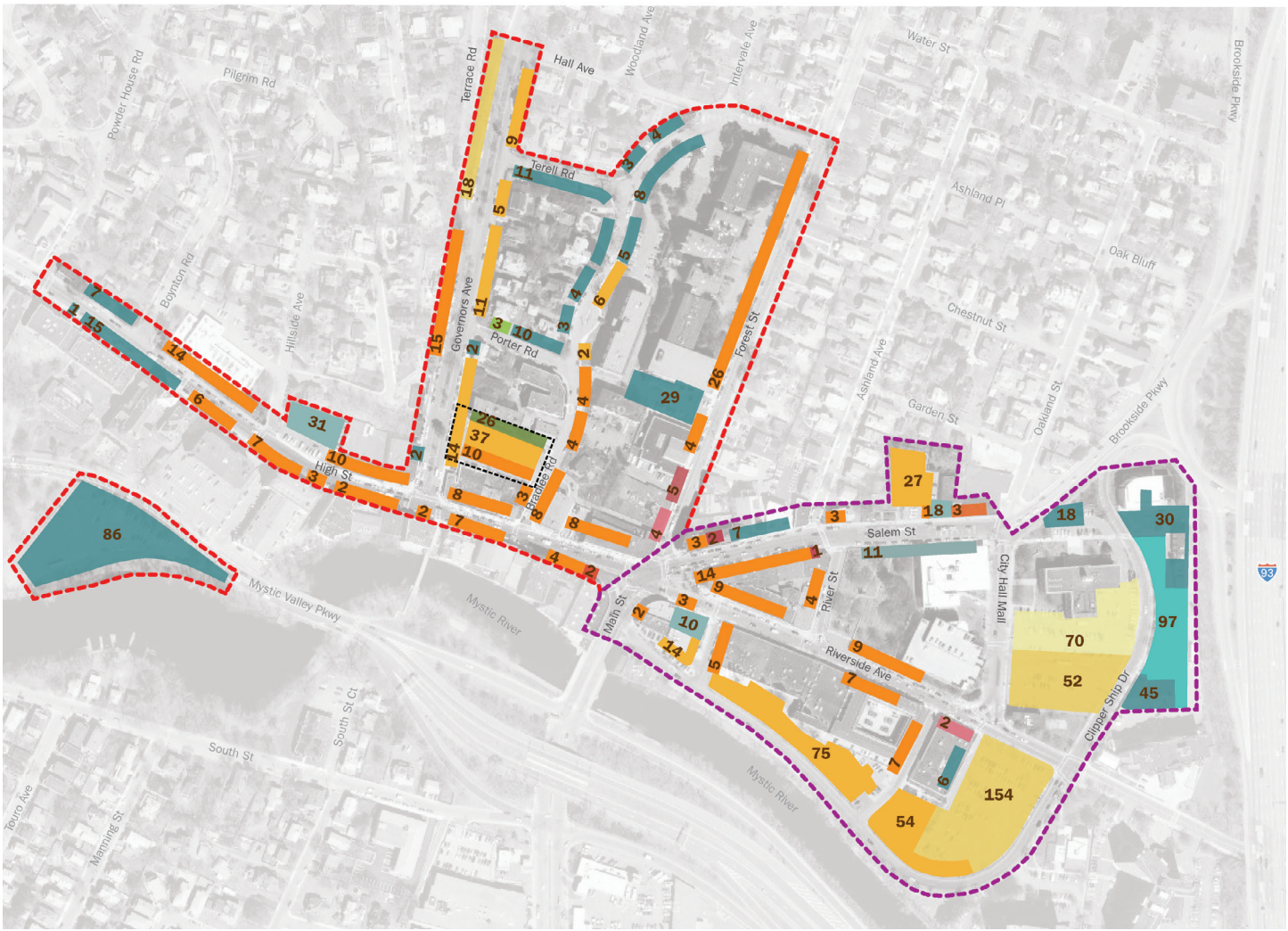

DETOUR

Existing Parking Issues

Current Inventory Analysis

Medford Square contains several parking regulations for its public on- and off-street spaces. In general, the regulations are heavily oriented to short-term turnover with the vast majority of spaces posted with a 2-hour or less time limit. Only the Department of Conservation and Recreation (DCR) lot, commuter permit spaces, business permit spaces, and some unregulated spaces provide long-term parking, which comprises less than 10 percent of the Square's public parking supply. As a result, employees without access to private off-street parking completely fill the limited quantity of business permit spaces and are regularly observed in time-limited spaces as well. More importantly, the Square appears unaccommodating to any customers seeking to stay for more than 2 hours, as the remaining long-term spaces are not signed and not close to businesses.





- 10 Minute
- 15 Minute
- 15 Minute Loading
- 30 Minute
- 1 Hour
- 2 Hours
- 2 Hour Business Permit
- 2 Hour Municipal Employee
- Private Residential
- Business Parking
- Unregulated
- Customer Parking
- Commuter Lot

Existing Parking Types

There is very little long-term parking for customers in either half of Medford Square. Spare capacity exists, but not in the most desirable locations. A garage may be necessary if upper floor vacancies are filled, though it does not need to be a large garage. Without a parking management system in place, a new parking structure alone will not solve the problem of a paucity of prime spaces.

- West Square
- East Square
- Proposed Garage Site
- # Existing Parking Spaces

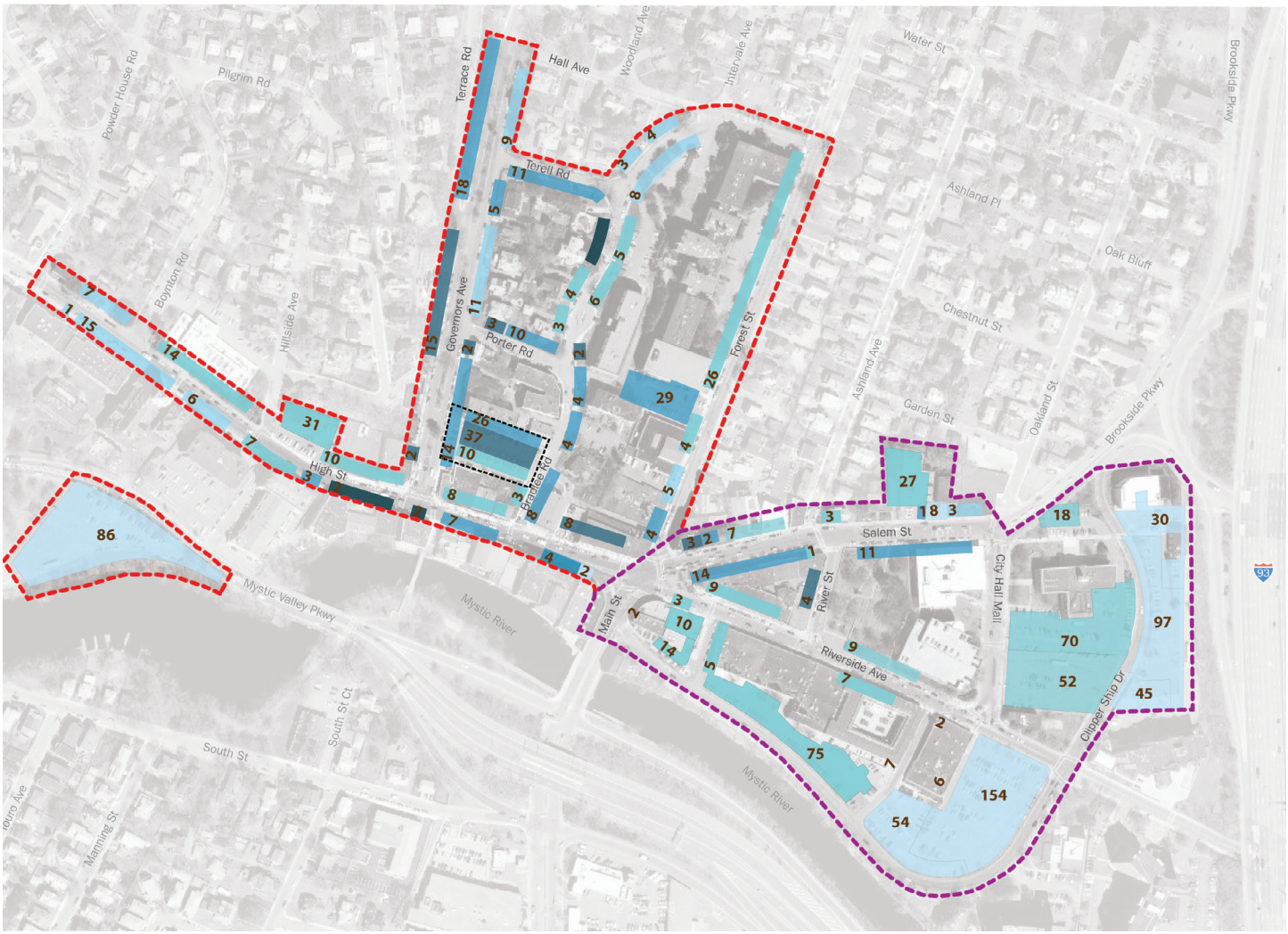
Parking Utilization

Parking utilization counts revealed a significant amount of vacant parking spaces in the Square during the busiest time of parking demand. A utilization rate of 85 percent is considered ideal, and should be the goal of the parking management plan in the Square. In its current state, of the more than 1,300 public spaces in the Square, nearly 500 are vacant at the peak hour of 11AM, resulting in less than 65 percent utilization. Parking on the east side of the square is under 55 percent utilized with more than 300 vacant spaces at peak 11AM accumulation. Parking on the west side of the square is better utilized at 76 percent, but nearly 140 spaces still remain vacant in this area.

Unfortunately, the vacant spaces in the Square are in the most remote locations. Key commercial streets are almost entirely full of cars for much of the workday—particularly High Street, Salem Street, and Riverside Avenue. Governors Avenue is also nearly full during the workday. Similarly, the Governors Avenue surface lot is heavily utilized all day, whereas lots in the eastern half of the Square rarely reach 50 percent occupancy. The commuter lot adjacent to I-93 rarely has cars in it.

Spatial analysis of parking patterns throughout the day reveals that most business permit spaces are full before 9AM. Nearly all prime customer-friendly front-door spaces on High, Salem, and Riverside fill up shortly after 9AM. Participants in the Parking Open House (March 31, 2010) indicated that a lot of long-term employee parking occurs at these prime spaces, and the online survey revealed that the vast majority of the Square's employees park in the western half of the square where parking is constrained, while nearly three-quarters of customers only find parking in the eastern half of the Square. It is likely that the customers are forced to park in more distant locations while employees occupy prime spaces.

The spatial analysis directly contributed to the demand estimation for a new parking garage. By assessing the utilization rate of parking within the immediate 5-minute walking distance of the target site(s), Nelson\Nygaard evaluated whether demand exceeded available supply sufficiently to warrant new supply in the western half of the Square. For the Governors Avenue site, this assessment revealed an 85 percent utilization rate, which is considered ideal. No new parking is necessary currently, but will be imminently, with the introduction of new businesses along High Street. Given this site's existing high demand for parking, it is a valuable location for a garage, but parking management techniques would need to be implemented within the 5-minute walking distance to ensure it is utilized.



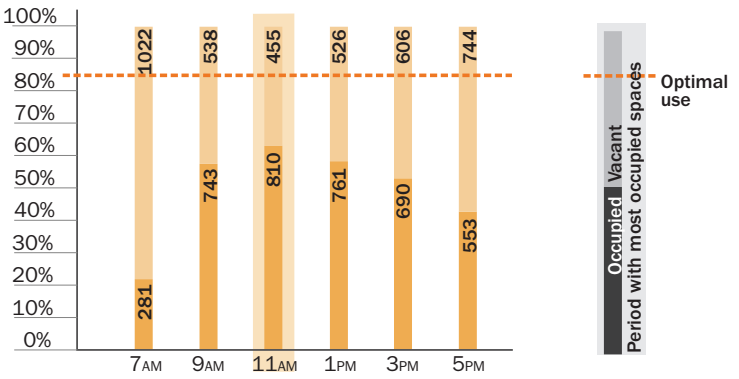
Parking Utilization

The above map shows the average utilization over the course of one weekday, based on data collected by Nelson\Nygaard in April 2010. In total, Medford Square parking (1,300 spaces total) is under 65 percent utilized. Only the Governors Avenue Lot, lower Governors Avenue, and portions of High, Salem, and Riverside streets exceed the desired 85 percent utilization at certain times of day.

- 0-50%
- 50-75%
- 75-85%
- 85-100%
- 100%
- West Square
- East Square
- Proposed Garage Site
- # Existing Parking Spaces

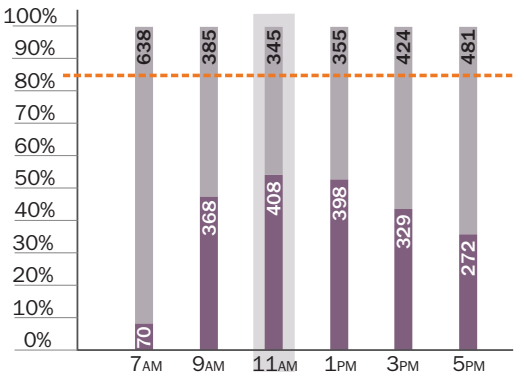
Medford Square

1,320 Parking Spaces



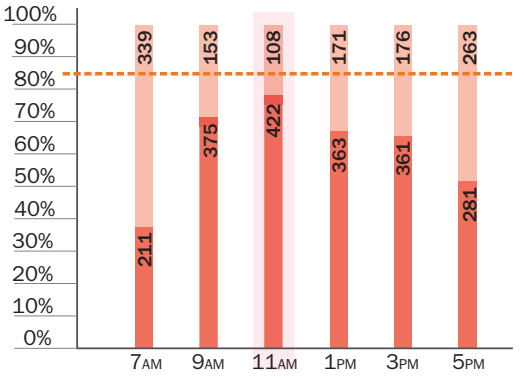
East Square

750 Parking Spaces



West Square

517 Parking Spaces



Parking Occupancies

The above tables demonstrate that parking demand in the East Square is significantly lower throughout the day than demand for parking spaces in the West Square. Midday parking occupancy in West Square approaches 85 percent use, while occupancy in East Square never exceeds 55 percent.

Parking Management

Parking management in the Square today is almost nonexistent. The City has no dedicated enforcement personnel, and the Police Department has public safety duties that limit its ability to enforce parking regulations in the Square. The department dispatches safety personnel to write tickets in the Square only intermittently, and typically in response to complaints. Given the high labor cost associated with enforcing time limits, it is not surprising that many violations are unenforced.

Parking Open House participants who work in the Square were aware that violations are rare, and many regular business customers are reported to take advantage of limited enforcement as well. Unfortunately, occasional customers and any new or pass-by customers assume that they can only stay for the posted time limits or risk a parking ticket.

BELOW LEFT AND RIGHT: Existing on-street parking and signage in the West (left) and East (right) Squares.





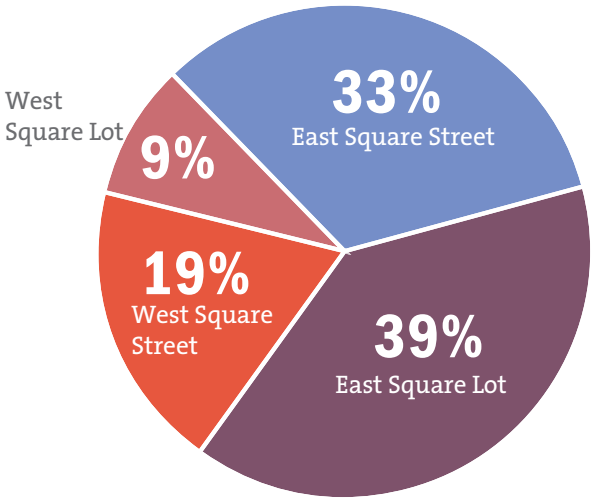
Community Feedback and Analysis

General community feedback was provided at both the March 31, 2010 Parking Open House workshop and in a survey distributed to area businesses, customers and residents both online and in paper form. This public input elucidated for the project team current patterns of parking use in Medford Square. Specifically, the feedback identified a preference among Medford Square employees for both lot and street parking in the West Square, which affects availability of parking for West Square business patrons. According to community observation and input, a majority of customers park in the East Square because availability in the West Square is quite limited during business hours.

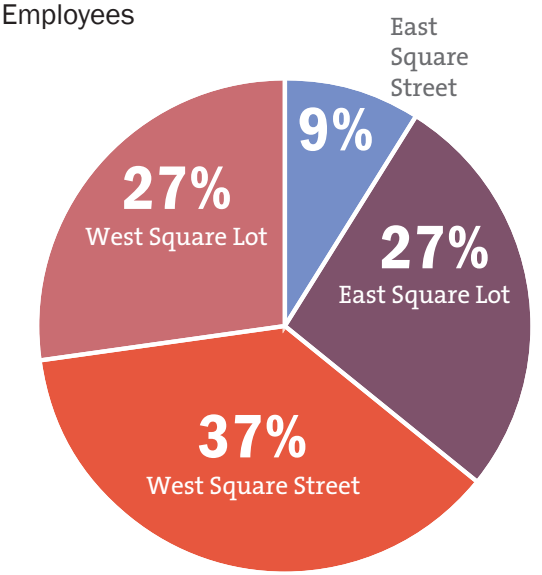
Feedback gathered at the Parking Open House also helped the team understand the primary vehicular and pedestrian challenges and opportunities in Medford Square for the community. Leading concerns include confusing traffic rules and the lack of adequate parking for senior citizens. Principal suggestions for improving parking access in Medford Square include making use of currently unused streetfront parking zones and implementing a signage strategy to better identify parking opportunities.

Preferred Parking Locations

Customers

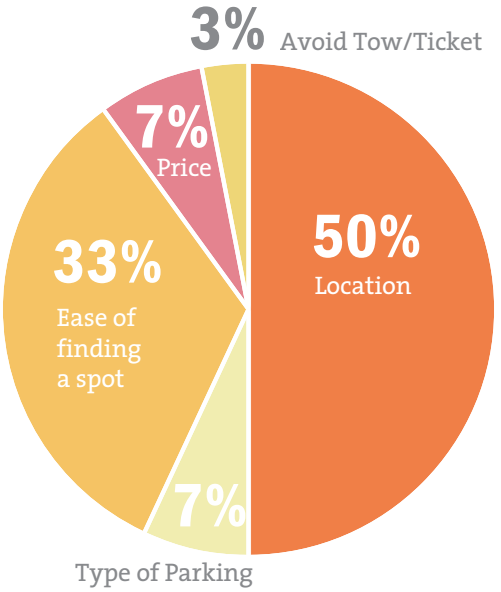


Employees

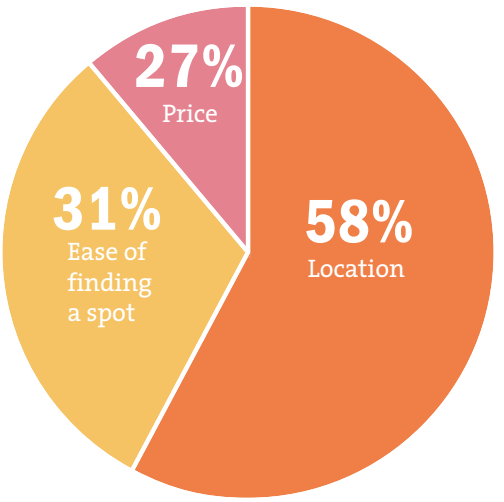


Primary Considerations for Parking Choice

Customers



Employees



The graphics shown above summarize results gathered from the March 31, 2010, Parking Open House and the paper and online survey distributed to area businesses, customers, and residents.

Parking Open House

General Issues and Problems

At the March 31, 2010 Parking Open House, general community concerns emerged. Leading concerns include the confusing traffic rules and the lack of adequate parking for senior citizens.

A. High Street: Church demand for parking
B. Armory/Medical offices use parking lot
C. CVS is generator of walking traffic for other businesses
D. No way to get to High Street from Main North; will not cross on foot; bus backs up traffic
E. Easy-to-find parking

Specific Problems Identified

a. No handicapped parking
b. "Too far": Difficult to enter in morning and exit in evening during peak times; bad in winter
c. Overflow onto residential streets: People park all day (in order to take bus to Boston)
d. Western High Street: Funerals and wakes can cause traffic back-ups; lack of available spaces on High Street west of Forest Street; too narrow
e. Lack of enforcement in Business Permit Section
f. Limited ticketing on Bradlee Road
g. Concern about signage for visitors of Chevalier Theatre
h. No way to get to High Street from Main Street going north; will not cross on foot; bus backs up traffic
i. No handicapped parking

Suggestions from the Community

Through the public process some general recommendations emerged: customer parking needs flex time periods; businesses at Main and High Streets are not attracting pedestrians; and the area needs galleries, bookstores, cafes, and pubs.

1. Good for all-day parking; should be business parking; needs shuttle and lighting
2. Three cars can park in front of Armory if lines are painted
3. Three cars can park in front of Roland's if lines are repainted and 1 hydrant is removed (2 hydrants within 15 feet)
4. Two cars can park in front of Historical Society
5. Path should be lit and maintained for safety
6. Lot/Garage should be for high turnover; needs to be large; connect garage to Chevalier Theatre
7. Zone for nonrush hour parking
8. Traffic calming zone
9. 80 to 100 feet for buses—could this space be better utilized?
10. Lot needs better signage
11. Place signage for nearby parking
12. Good parking supply—Don't take away these lots

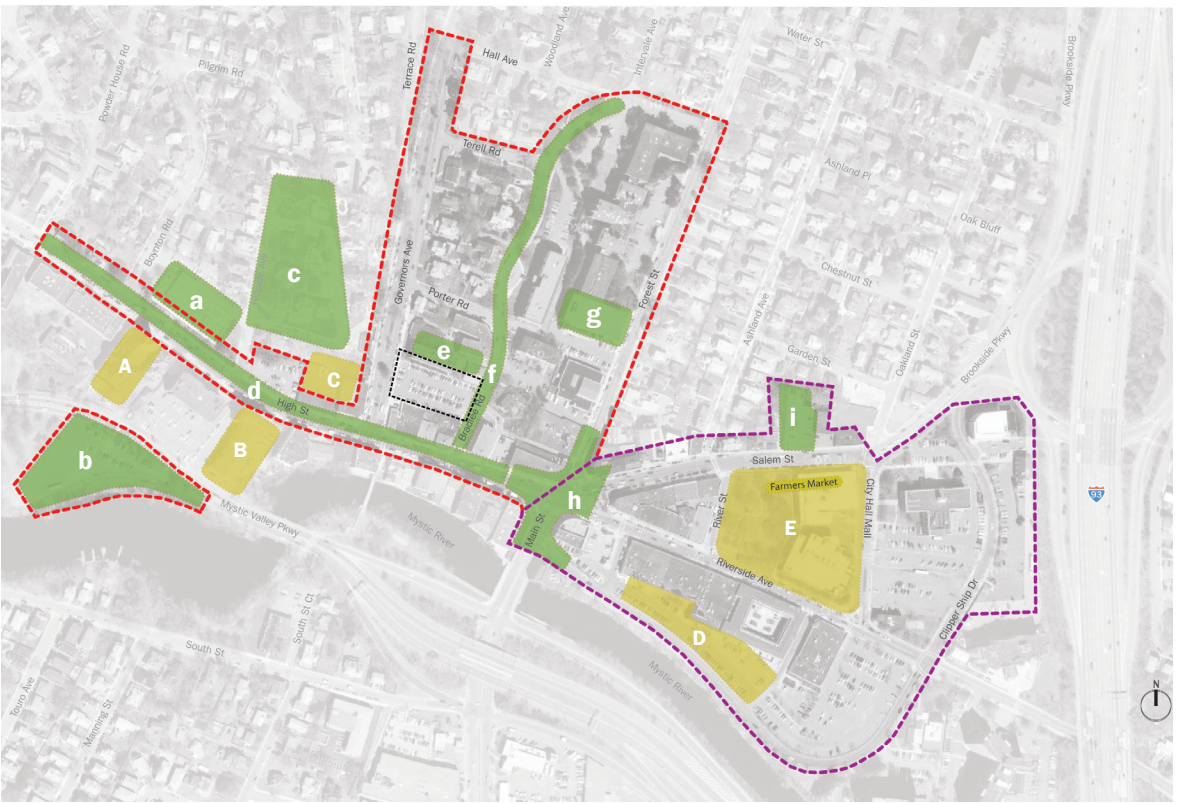
West Square

East Square

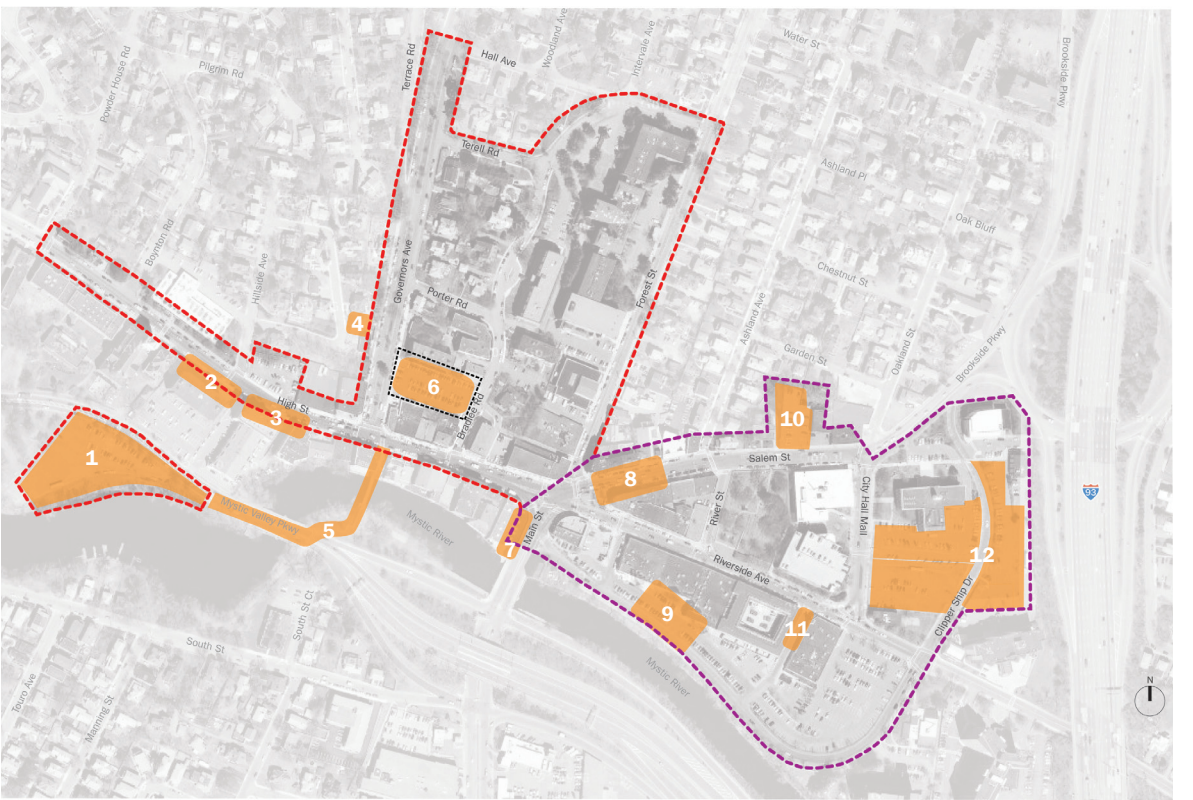
Proposed Garage Site

Sources:
May 15, 2009, Medford Police Parking inventory; MassGIS; Nelson\Nygaard; March 31, 2010 Parking Open House

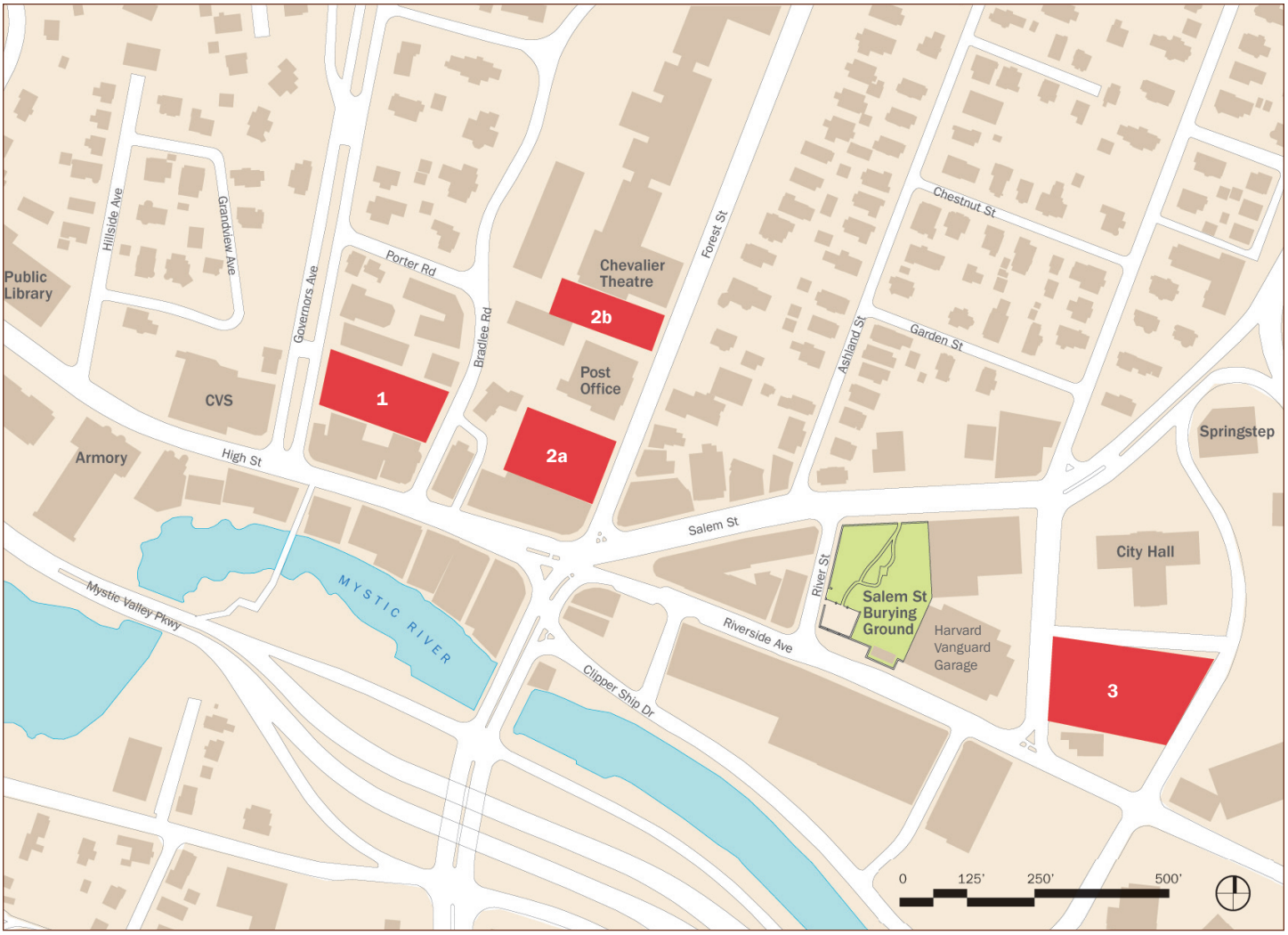
General Issues and Concerns from the Community



Suggestions from the Community



III.
Garage Site Selection



1 Governors Avenue Site

Pros

- Historically well-used
- Off High Street (back a layer)
- Two means of entry/exit
- On "mental map" of parking options
- Adjacent to new restaurant / retail
- Close to Medford Square Medical Nexus

Cons

- Narrow site
- Adjacent to existing residential

2a Forest Street Site

Pros

- Near Chevalier Theatre
- Close to center of Square
- Two means of entry/exit

Cons

- Property acquisition and demolition

2b Chevalier Site

Pros

- Adjacent to Chevalier Theatre

Cons

- Small, awkward site
- Adjacent to existing residential

3 City Hall Site

Pros

- Ease of access off I-93
- Ample lot for efficient parking
- Parking surplus for future development

Cons

- Relatively far from center of Square
- Traffic would need to be re-routed
- Possibly redundant to Harvard Vanguard Garage

Sites Under Consideration

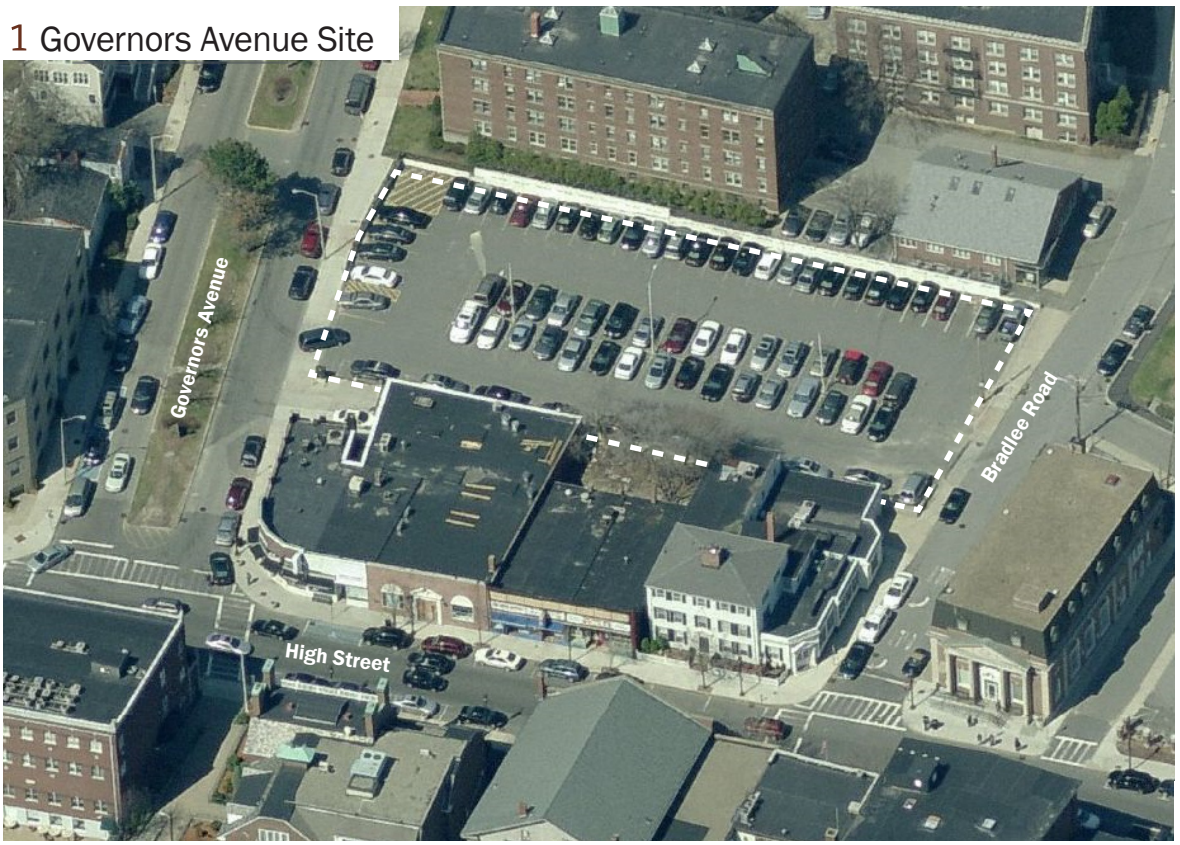
Four locations in Medford Square were considered as potential sites for the future garage. Of the sites studied, three are located in the West Square, a decision driven by Nelson\Nygaard's assessment that the West is closer to reaching the need for extra supply (see pp. 24–25 for a more extensive discussion of existing parking utilization rates).

Although the project team initially considered the possibility of an underground garage on each of the four sites, preliminary cost estimate studies revealed that subterranean garage construction costs would total, by conservative measures, at least twice as much as equivalent above-grade garage construction. The economic feasibility of an underground garage on any of the considered sites seemed unrealistic based on high projected costs and modest revenue projections. Further study thus focused on above-ground garage options for all four sites.

Each site was subject to a rigorous planning assessment; the surrounding building context and the possible entry and exit conditions were considered carefully before a maximum build-out scenario was drafted. This first assessment led to a concise pros and cons list for all four sites, information that ultimately assisted the client and project team in selecting the preferred site for further study.

The drafted plans demonstrate a feasible structured parking solution for each parcel under consideration. While only one site—the Governors Avenue Site—was developed further, the other three options should be considered viable solutions for future study, should additional structured parking become necessary in the Square.

1 Governors Avenue Site



2a Forest Street Site



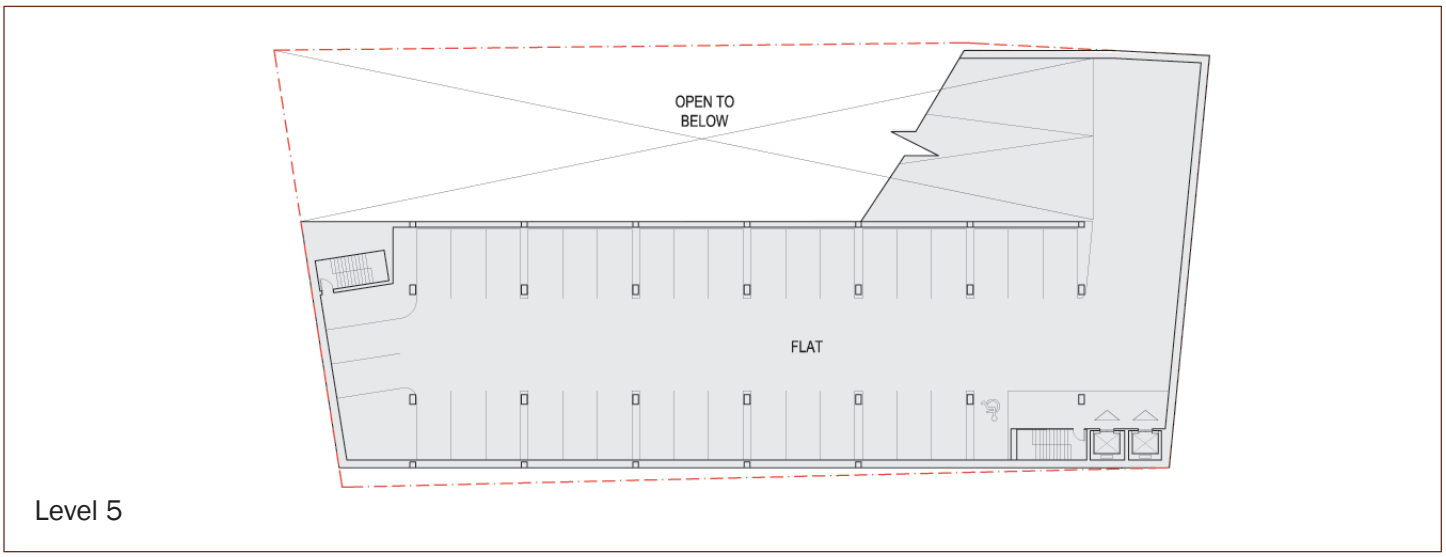
2b Chevalier Site

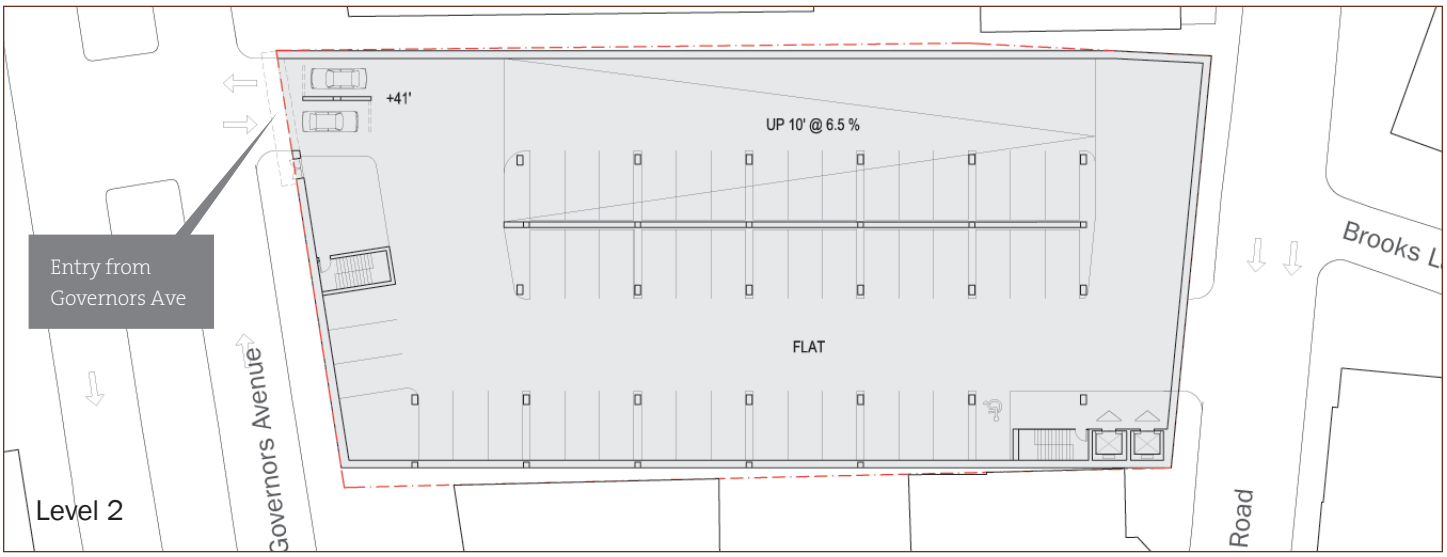


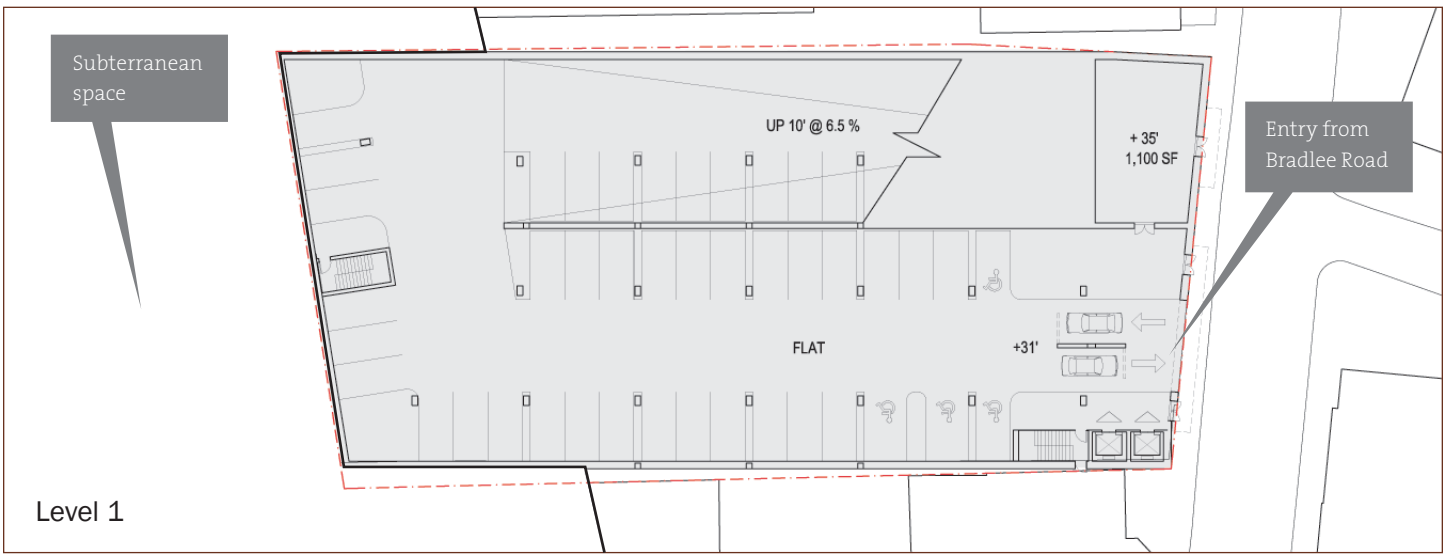
3 City Hall Site



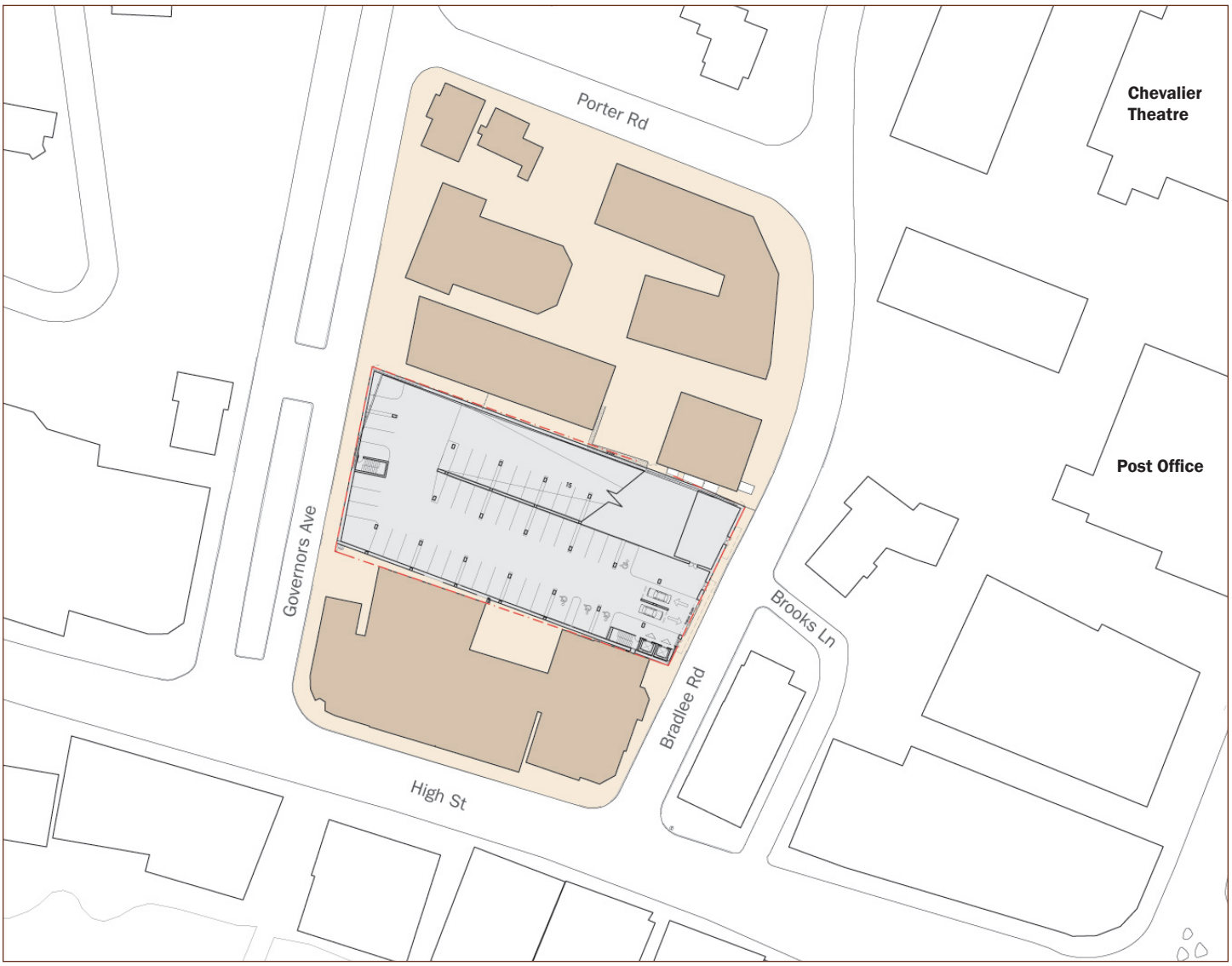
Views are at different scales.


OPEN TO
BELOW
FLAT
Level 5


+41'
UP 10' @ 6.5 %
Entry from
Governors Ave
FLAT
Governors Avenue
Brooks L
Road
Level 2


Subterranean
space
UP 10' @ 6.5 %
+ 35'
1,100 SF
Entry from
Bradlee Road
FLAT
+31'
Level 1


0
25'
50'
100'

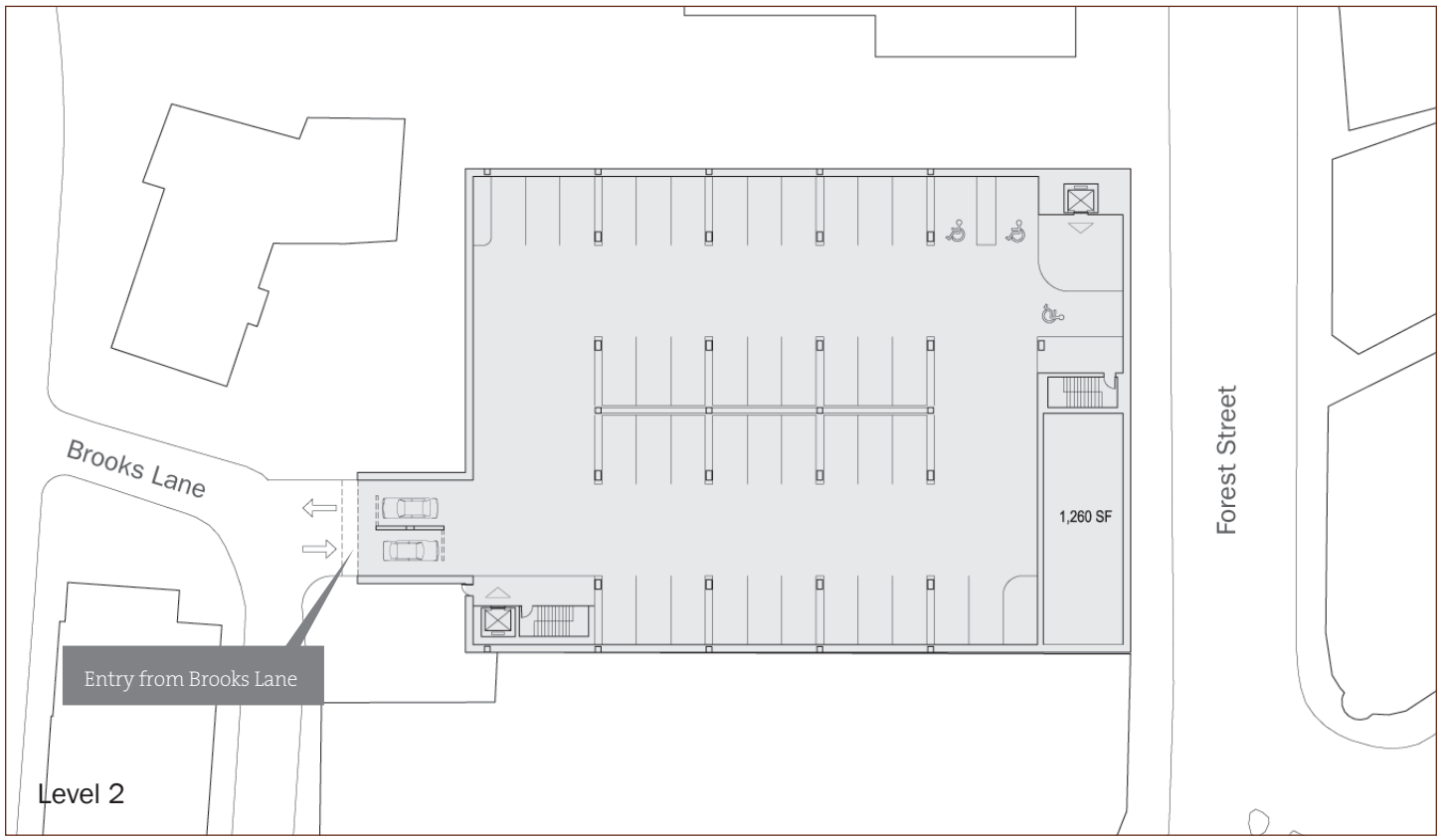


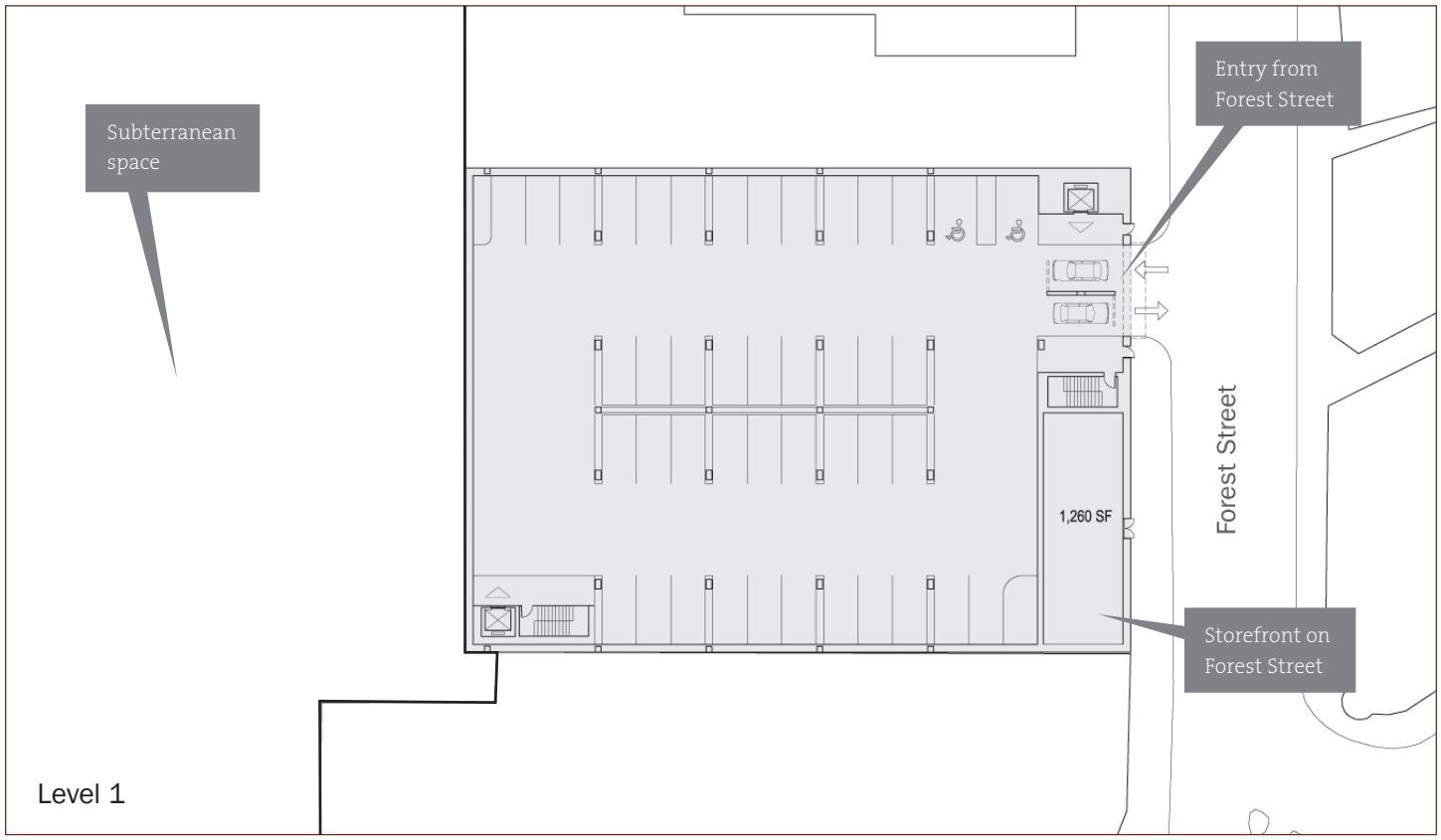
0 50' 100' 200'

178–238 spaces

Governors Avenue Site

The Governors Avenue Site was selected as a candidate for the potential garage for a host of reasons. It was the site of the previous garage (which collapsed in 2005; see pp. 70–71), and continues to be a heavily used parking option for employees and customers of the West Square. In this first iteration, later refined, the garage was planned to maximize the site, in a zero-lot-line configuration. This and later options used the 10-foot topographical rise across the site to make use of two entrances, one at Bradlee Road (on the lowest portion of the site), and one at Governors Avenue (at the highest grade). Given the narrow width of the site and changes in the Massachusetts building code, it is impossible to fit an efficient two-bay double-loaded plan. As a result, the four-and-a-half-floor garage yields 178 to 238 parking spaces, depending on its configuration on the site.


Brooks Lane
Forest Street
1,260 SF
Entry from Brooks Lane
Level 2


Subterranean space
Entry from Forest Street
Forest Street
1,260 SF
Storefront on Forest Street
Level 1

0 25' 50' 100'

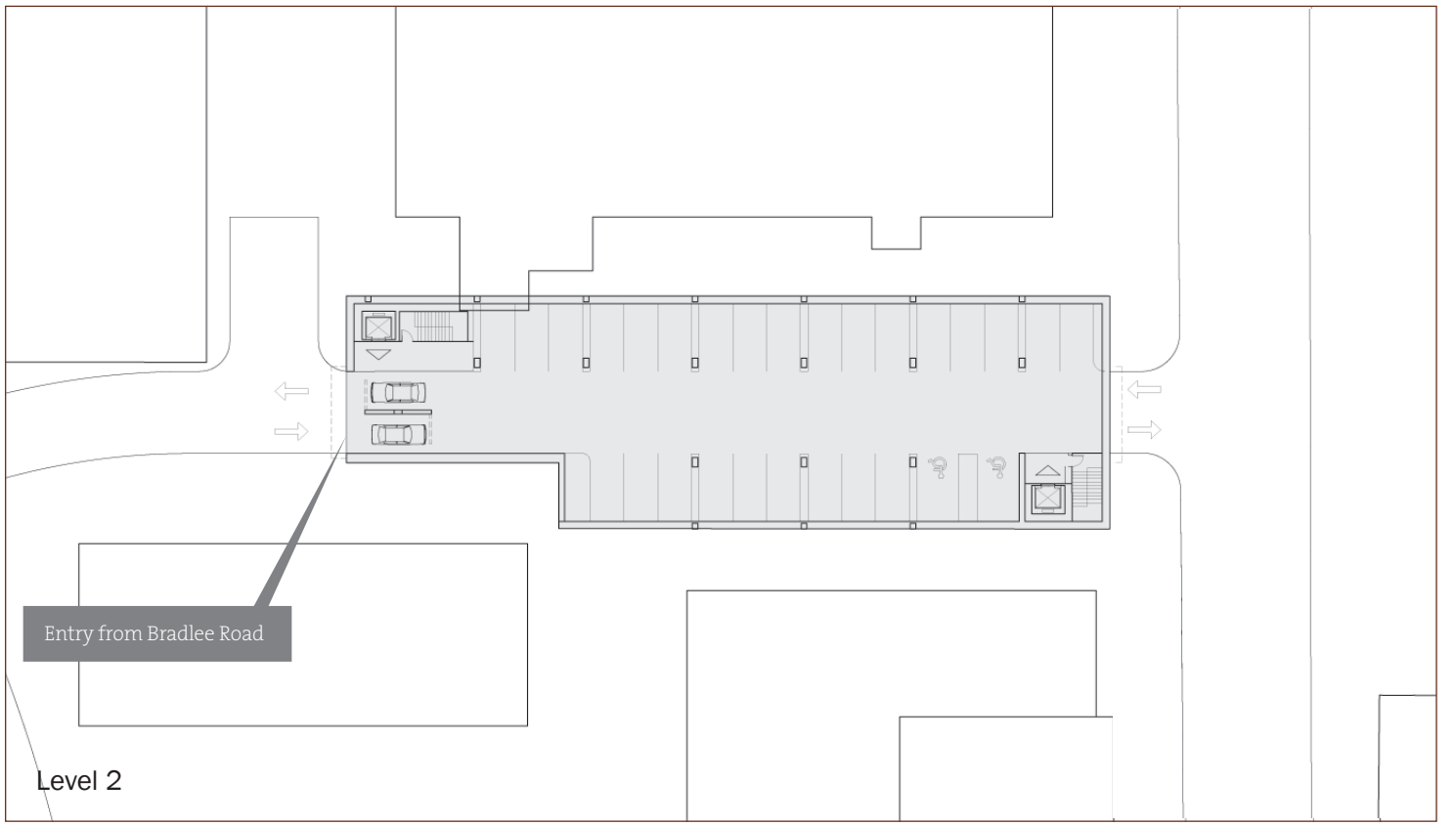


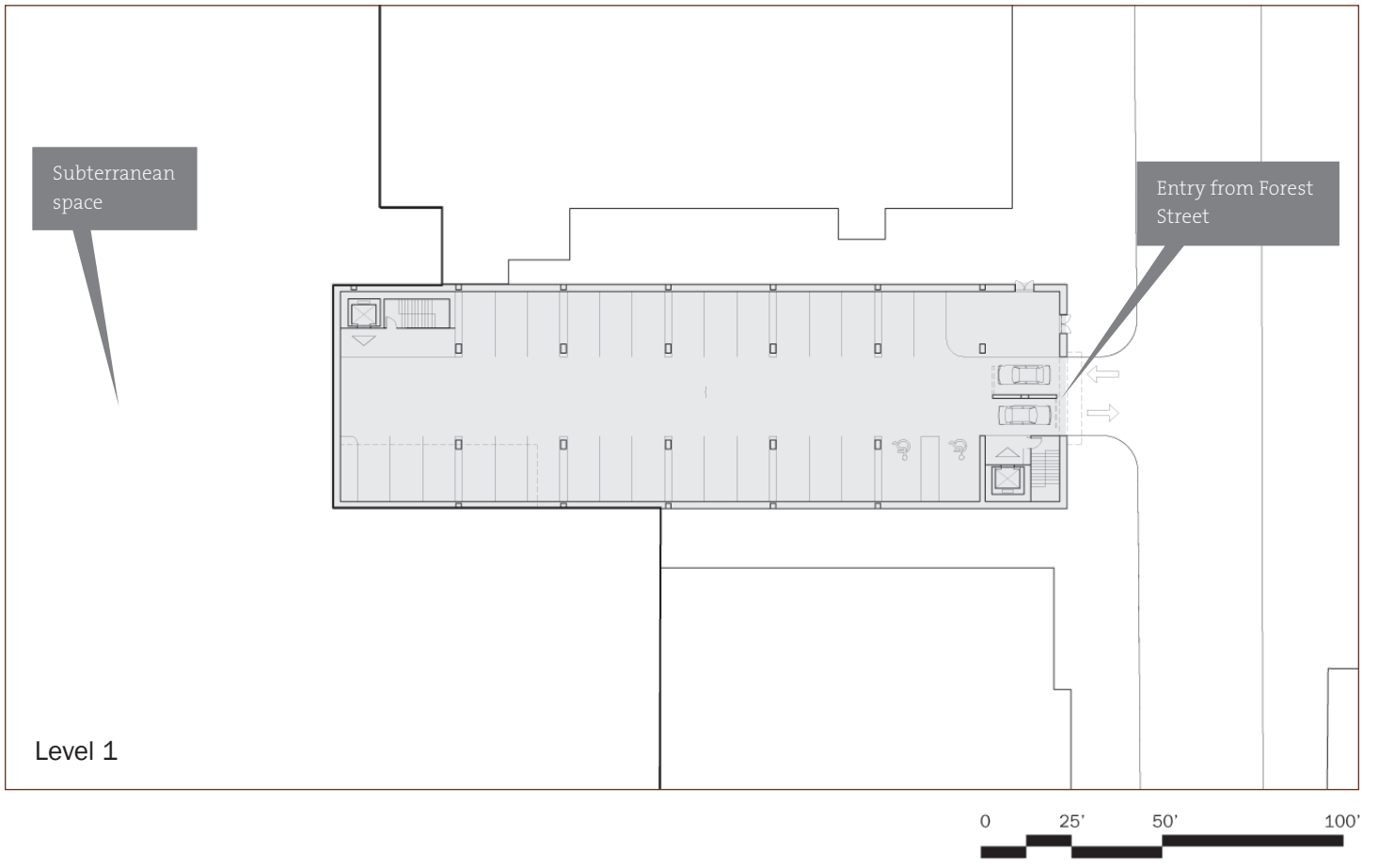
0 50' 100' 200'

Forest Street Site

87 spaces

The Forest Street Site currently hosts a vacant one-story commercial building that would be demolished to accommodate a future garage. Because of considerable grade change across the site (rising from Forest Street to Brooks Lane), this garage has two entrances, one into each level of the garage, and no internal ramping. The main entrance from Forest Street sits as far away from the Salem Street intersection as is possible, and allows for a shallow storefront buffer along the south end of the building. The ground floor is a flat plate of parking that would require minor excavation into the back of the site. The back entrance, accessed from Brooks Lane, leads to another flat plate of parking. The overall benefit of this scheme is its simplicity; also beneficial is its proximity to the Post Office and the Chevalier Theatre.


Entry from Bradlee Road
Level 2


Subterranean space
Entry from Forest Street
Level 1
0
25'
50'
100'

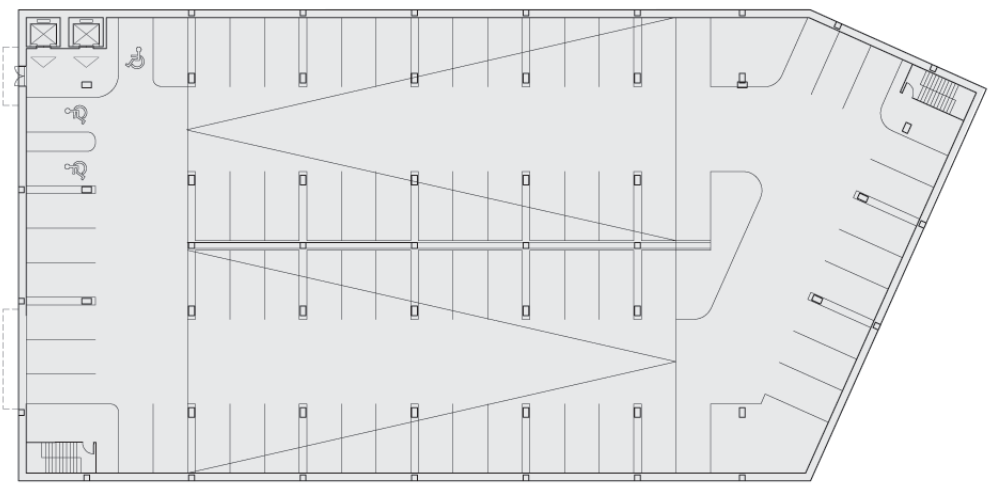


0 50' 100' 200'

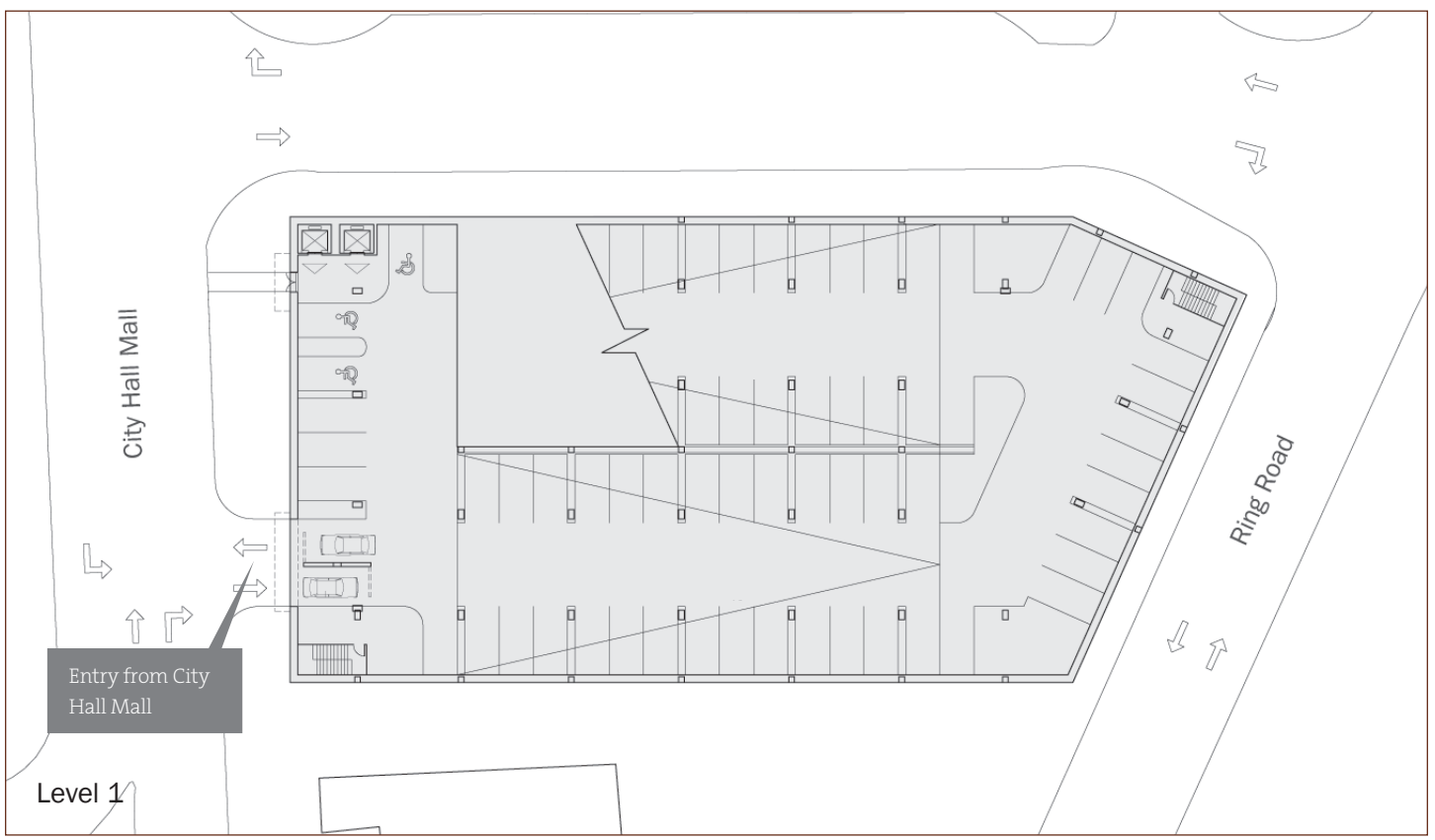
59 spaces

Chevalier Site

While the Chevalier site does not immediately seem a viable location for a parking structure, two significant characteristics of the site caused it to be included in the study. Like the Forest Street site, its proximity to the under-parked Chevalier Theatre (in this case immediate adjacency), was its primary asset. Additionally, the extreme natural grade rising from Forest Street to Bradlee Road allows for a simple two-plate solution without a costly internal ramping system. Currently, the site is a surface parking lot, fully utilized throughout the day by Post Office employees and visitors to the Square. The main entrance to the ground floor is on Forest Street, and a back entrance to the upper level can be accessed from Bradlee Road. This scheme effectively doubles the number of spaces that can be accommodated on the site.

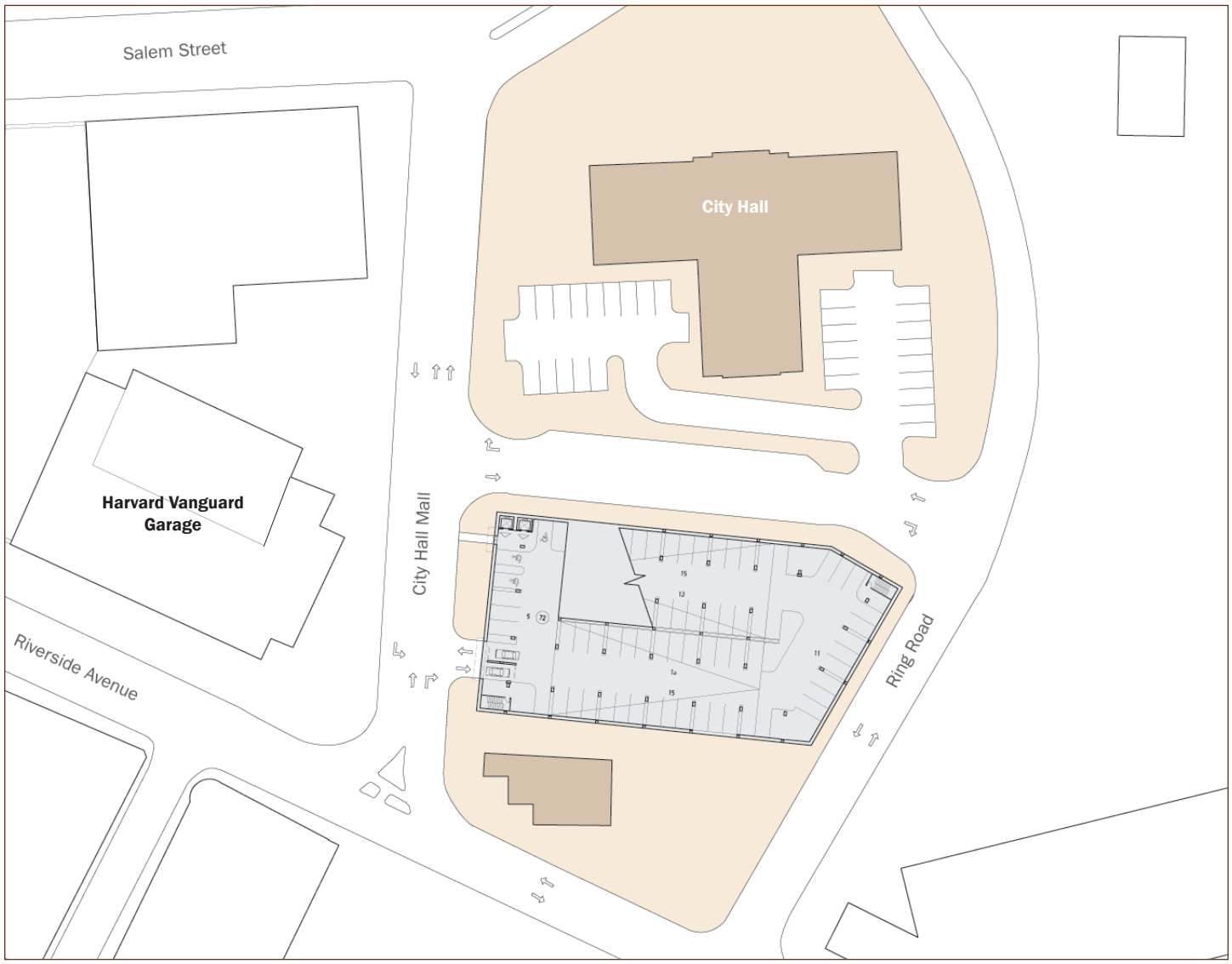


Levels 2-5



Level 1

0 25’ 50’ 100’



0 50' 100' 200'

376 spaces

City Hall Site

This parcel (located behind Medford City Hall) is the only site of the four considered located in the East Square. It was included in this study because it was identified in the 2005 *Medford Square Master Plan* as a preferred future garage site. Of all of the sites considered, it is the most unhampered by surrounding context; there are no immediately adjacent buildings, and the site itself is ample enough to hold a large, efficient two-bay double-loaded garage. This five-story scheme has one entrance accessed from City Hall Mall. In order to make vehicular access most convenient, City Hall Mall should be re-routed to become a two-way street, which could also allow easier access to the adjacent Harvard Vanguard Garage. Although there is no current need for extra parking supply in this section of the Square, such a garage could be built as a parking bank to encourage future development on nearby underutilized sites.

IV. Parking Management Plan and Recommendations











TOP: The intersection of High Street, Forest Street, Main Street, Riverside Avenue, and Salem Street.

FAR LEFT: Signage on High Street at the intersection with Governors Avenue directs drivers to the existing surface parking lot at the proposed garage site.

LEFT, TOP AND BOTTOM, AND ABOVE: Signage in Medford Square.

Parking Management Plan and Recommendations

The parking study revealed significant supplies of vacant parking in the Square, but a lack of fees or fines results in the prime spaces becoming fully occupied early in the day because they are closer and more convenient to the Square's destinations. Unfortunately, this characteristic of the Square will not change with the introduction of more parking supply at the target site(s). Furthermore, if a fee for parking is introduced at a new garage, it will become the least desirable place to park given the number of unpriced vacant spaces within a 5-minute walk. Therefore, the team recognized that a number of parking management strategies would be necessary throughout the Square in order to balance demand and support the financing of a new garage.

Supply Enhancement

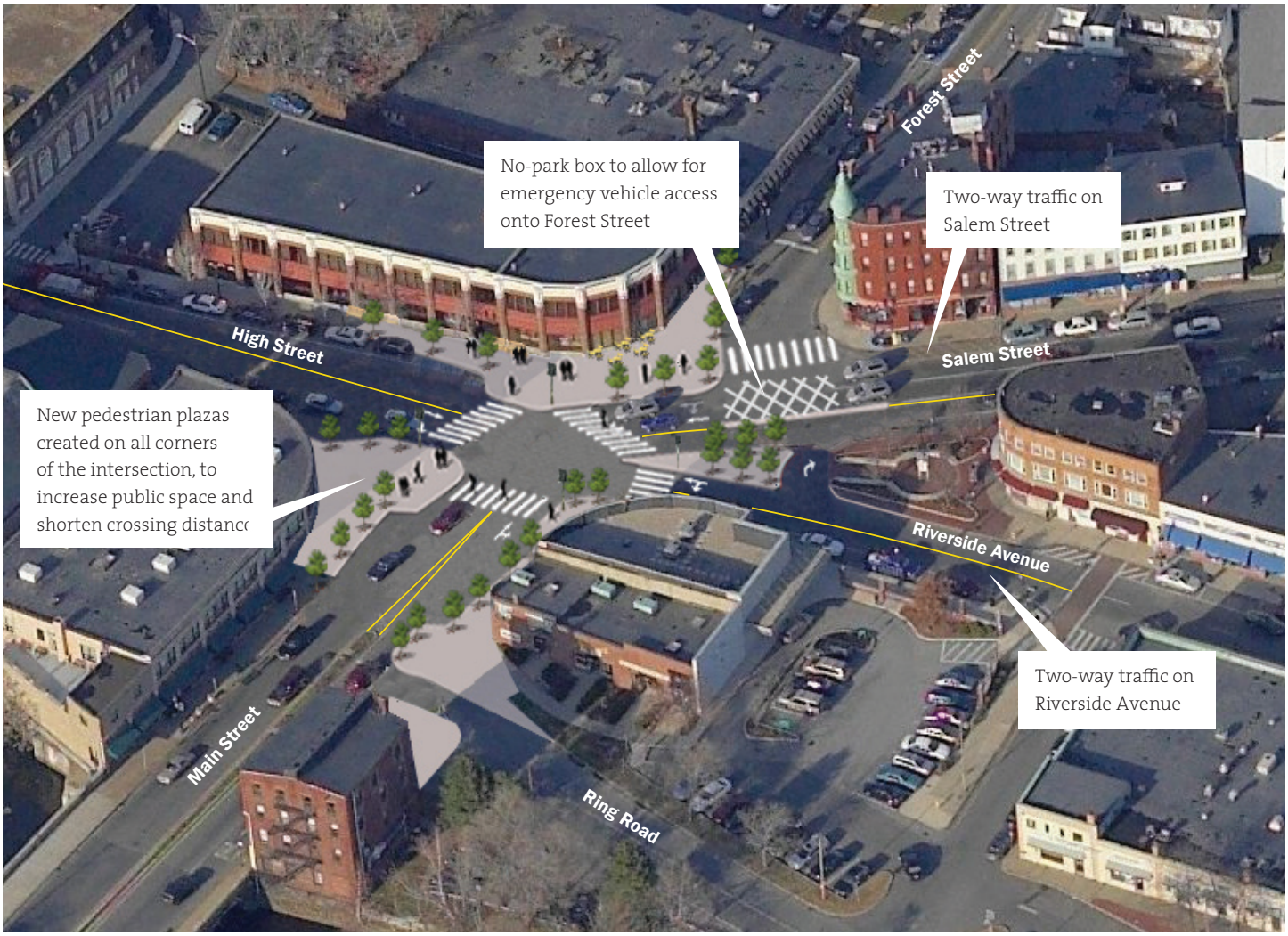
In the course of collecting parking inventory information and observing walking conditions, the consultant team observed a number of locations where additional on-street parking could be added. Several locations were already used for parking, even though signs in these locations indicated “No Parking.” Overall, nearly 80 such spaces were identified—mostly in the eastern half of the Square. With the planned re-alignment of Clippership Drive resulting in a net loss of 10 spaces, on-street additions elsewhere will see a net gain of approximately 30 spaces in the Square—simply through the use of paint and signs.

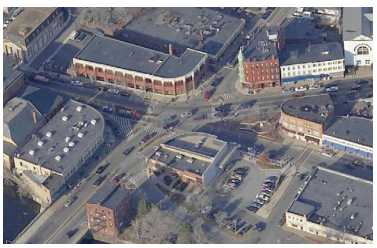


Parking: Additional Spaces

Current redevelopment along Clippership Drive will add 30 parking spaces in this stretch of Clippership, and take away 40 off-street spaces, for a net loss of 10 spaces. Paint and signage alone could offset this deficit and add an additional 40 (+/-) spaces in the Square, for a net gain of approximately 30 spaces.

- West Square
- East Square
- Proposed Garage Site
- # Existing Parking Spaces
- Parking Expansion
- Parking Loss
- 10 Minute
- 15 Minute
- 15 Minute Loading
- 30 Minute
- 1 Hour
- 2 Hours
- 2 Hour Business Permit
- 2 Hour Municipal Employee
- Private Residential
- Business Parking
- Unregulated
- Customer Parking
- Commuter Lot







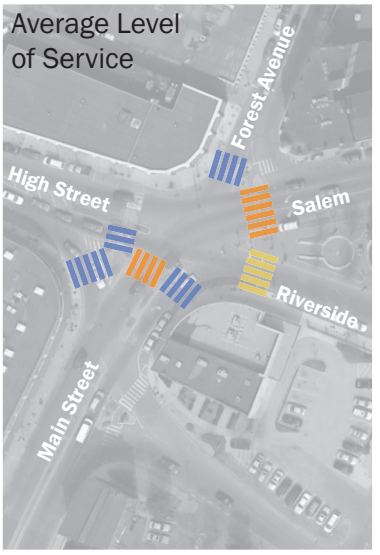
ABOVE: Reconfiguration of the main intersection would greatly improve the pedestrian experience in the Square by shortening the crossing distance and delay, and would also effectively free up additional parking spaces on the East Square to patrons of the West Square.

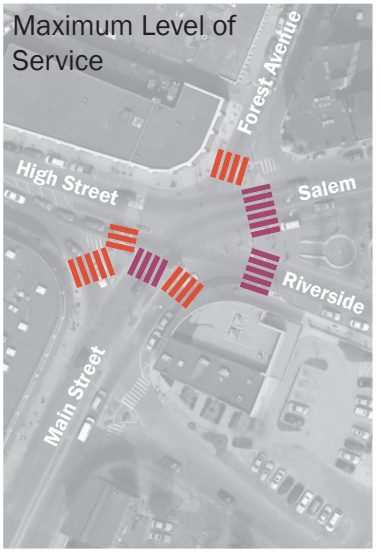
LEFT: Existing condition at the intersection of High Street, Forest Street, Main Street, Riverside Avenue, and Salem Street.

FACING PAGE: The existing Level of Service of the intersection informed the above recommendations.

Improved Walking Access

Level of Service	Delay Time	Likelihood of Pedestrian Noncompliance
F	> 60 seconds	Very High
E	41 to 60 seconds	High
D	31 to 40 seconds	Moderate-High
C	21 to 30 seconds	Moderate
B	10 to 20 seconds	Moderate-Low
A	<10 seconds	Low



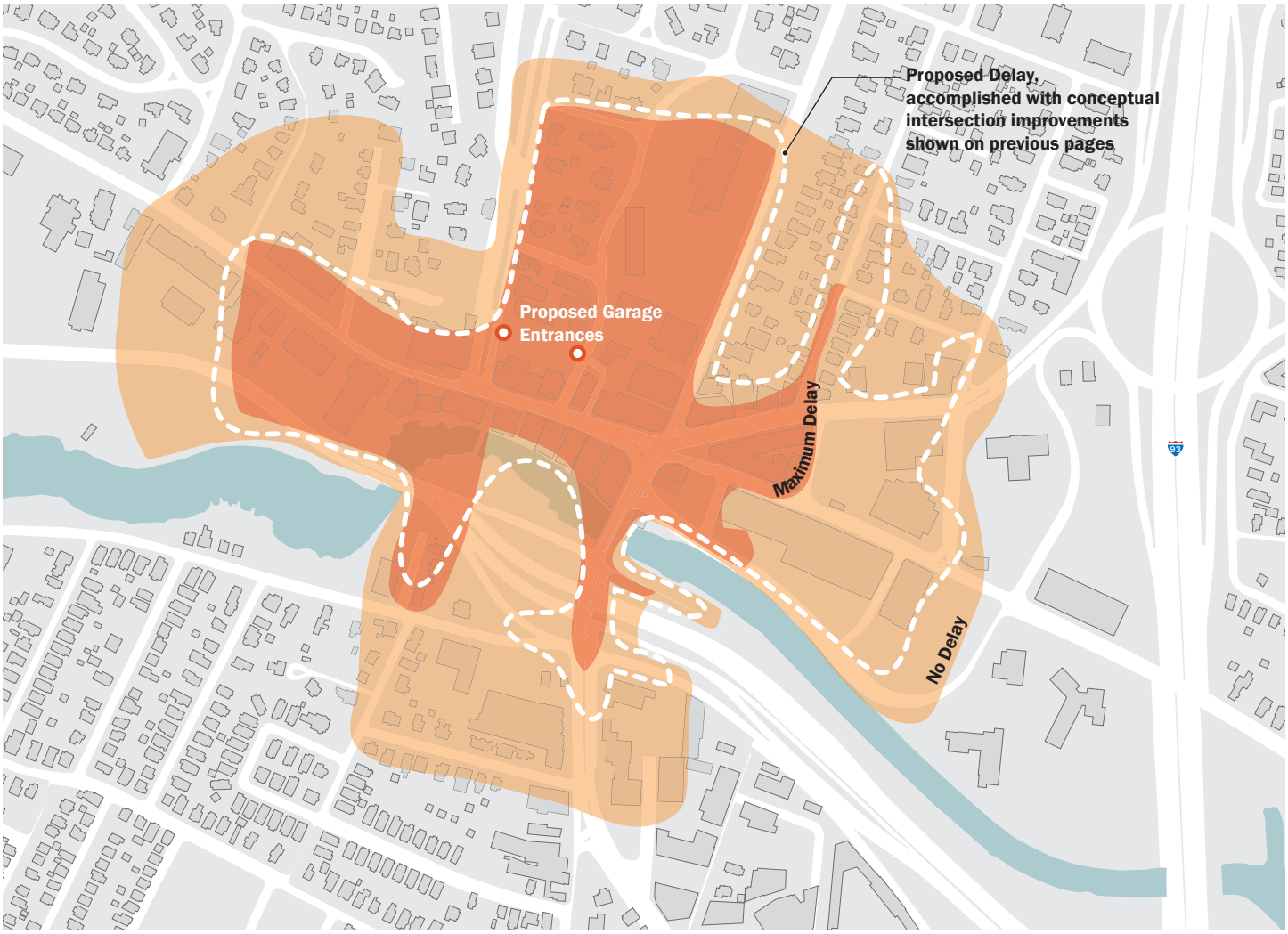


High and Main streets intersect with Salem Street, Forest Street, and Riverside Avenue at the core of Medford Square. This five-legged intersection includes medians and islands on two crosswalks, breaking up the pedestrian crossing experience. The intersection's signal was timed by the consultant team to calculate average pedestrian delay. While the average amount of pedestrian delay is low (good pedestrian level-of-service) for each individual crosswalk, the cumulative effect of needing to cross as many as three smaller crosswalks to get across the intersection—plus the fact that the maximum delay on each crosswalk is poor—results in a significant barrier to circulation between the east and west sides of the square. Whereas no signal delay would enable the customers of businesses near High Street and Governors Avenue to access the underutilized parking spaces near City Hall with a 5-minute walk, the current signal operation means that a parker near City Hall cannot get across the main intersection in 5 minutes on foot.

Given the high pedestrian crossing delay observed at the intersection of High and Main streets, Nelson\Nygaard began to test intersection improvements that would reduce crossing delays while preserving the vehicular capacity of the intersection. It was determined that re-orienting the Forest Street approach to intersect only with Salem Street could preserve all operations and levels of service while converting the intersection to a standard four-way with shorter crossings and no medians. The solution warrants more detailed evaluation, but models show little change in vehicular delay and notable improvements to pedestrian delay, enabling many more parking spaces that are vacant today to be accessed from Square businesses within a 5-minute walk.

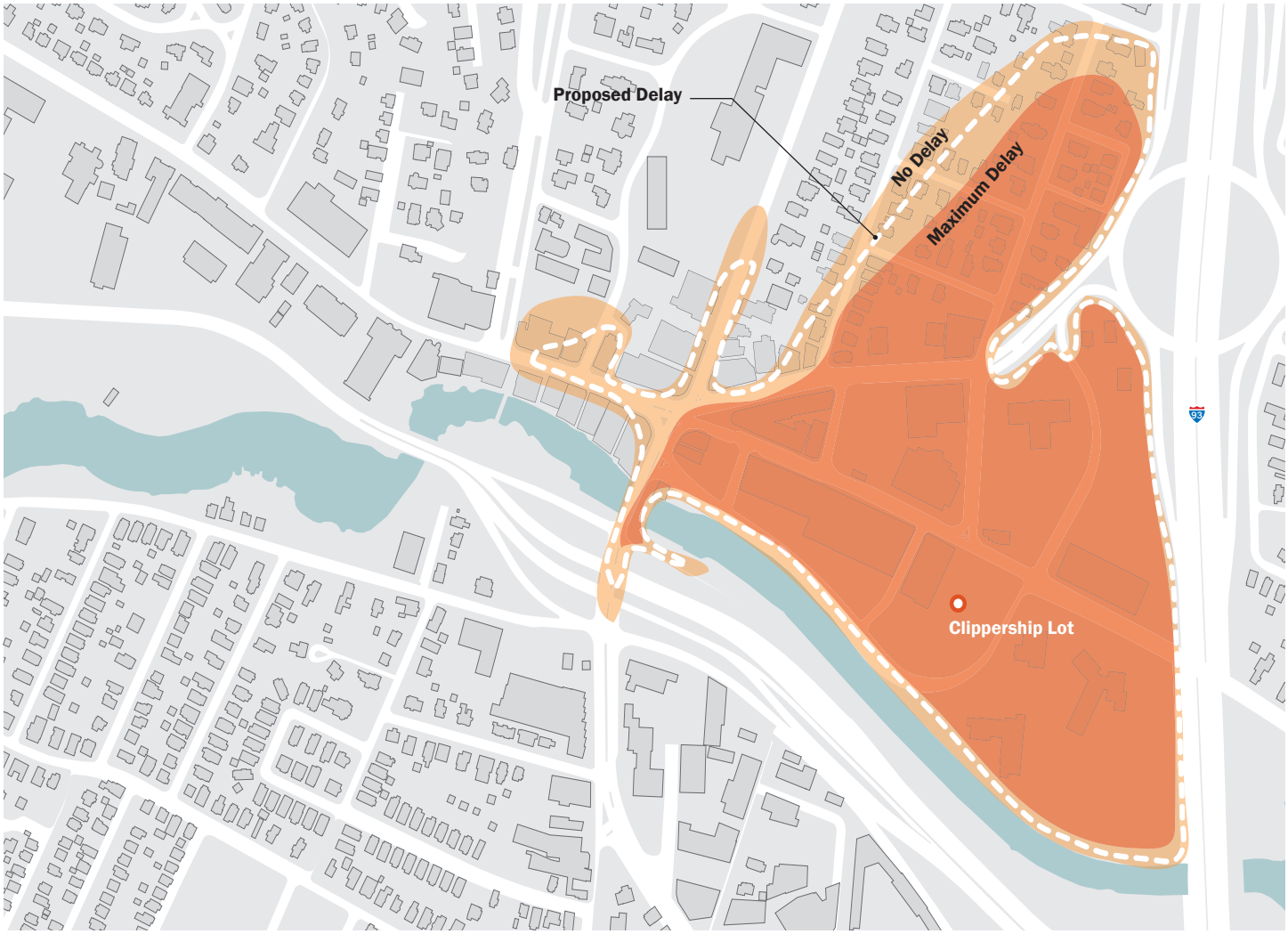
High Street and Governors Avenue safety conditions and crossing delays were also evaluated by the consultant. Simple curb extensions at this location would have a significant safety advantage while noticeably reducing the crossing distance. This would result in lower crossing delays and more parking supply within a short walk.

By making improvements to these two intersections, the consultant determined that 208 vacant parking spaces would become accessible within a 5-minute walk of the Governors Avenue lot, allowing nearly 90 more cars to be parked nearby before reaching the ideal 85 percent utilization rate.



Governors Avenue Five-Minute Walking Area

The walking distance with No Delay, shown above in the lighter orange tone, represents a theoretical scenario in which a pedestrian would not be required to wait for a signal change to get across the five-legged intersection at the center of Medford Square, nor a passing car at unsignalized crossings. Without any delay, a pedestrian originating at either of the proposed garage entrances at the Governors Avenue site could reasonably walk to the outer edges of the light orange area in 5 minutes walking time. In reality, pedestrians in Medford Square often face significant delays when crossing these intersections. In the worst case scenario, a pedestrian complying with traffic signals spends more than 2 minutes navigating two or three crosswalks at Main and High Streets before reaching the other side of the intersection. This Maximum Delay, represented by the darker orange tone in the diagram, results in a significantly smaller area accessible within 5 minutes walking time, and renders many East Square businesses inaccessible in a 5-minute walk from the Governors Avenue site. A Proposed Delay, which could be accomplished by reconfiguring the intersection (as shown in the conceptual rendering on p. 52), would facilitate better access between the east and west sectors of the Square even during times of peak vehicular traffic.



Clippership Lot Five-Minute Walking Area

The consultant team also calculated the 5-minute walking area from a more remote origin in an underutilized parking lot near City Hall. The lighter orange shape above depicts the area accessible to a pedestrian beginning a 5-minute walk from the center of the public lot south of Riverside Avenue with no crossings delay. In this No Delay case, a pedestrian is able to access a significant portion of the West Square's shops and restaurants along High Street. However, complying with the current crossing indications at High and Main Streets with maximum signal delay assumed would delay the same pedestrian by over 2 minutes, effectively limiting pedestrian access to West Square businesses altogether. The Proposed Delay accomplished by reconfiguring the intersection would reconnect the east and west halves of the square.

1 Create order



3 Create crossings



5 Complete sidewalk



6 Improve sidewalk slope



7 Add curb ramp



8 Remove poles



14 Remove fencing

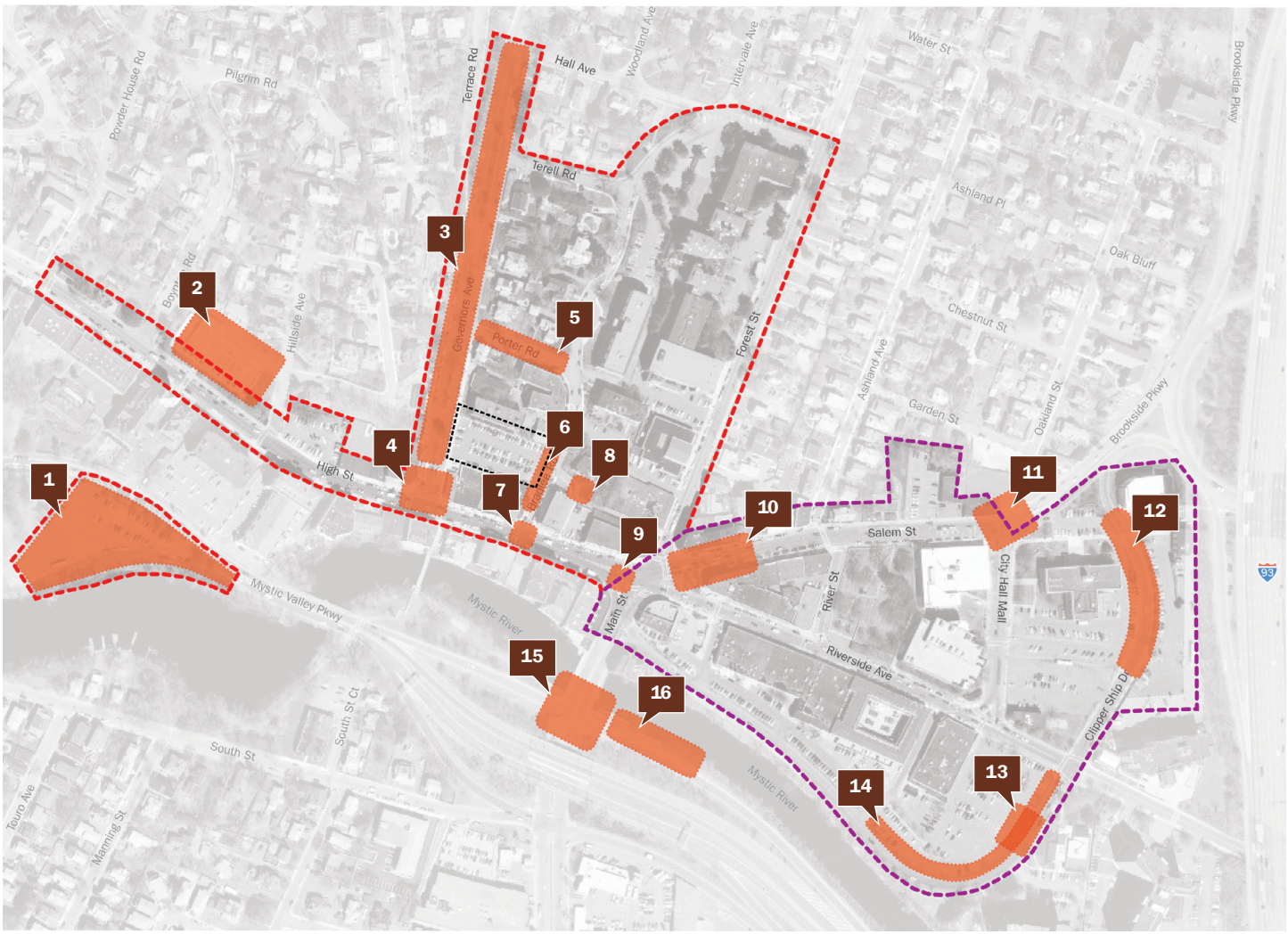


15 Widen median protection



16 Reconstruct curb and walkway





West Square

East Square

Proposed Garage Site

Recommendations for Pedestrian Improvements

These are observations and recommendations from Nelson\Nygaard for immediate pedestrian improvements.

1. Create order
2. Add wayfinding signage
3. Create crossings
4. Improve sight lines
5. Complete sidewalk
6. Improve sidewalk slope
7. Add curb ramp
8. Remove poles
9. Make "No Right on Red"
10. Reduce speeds
11. Reduce speeds
12. Reduce speeds
13. Create crossings
14. Remove fencing
15. Widen median protection; repaint crossings; reconstruct curb and walkway
16. Reconstruct curb and walkway

Parking Zoning and Management Program

Absent incentives to utilize vacant spaces in the Square, parking will continue to be heavily utilized and difficult to find in the most desirable parts of Medford Square. A new parking garage alone will not alleviate this problem. Furthermore, the need to collect parking fees at a garage (in order to pay for its construction and maintenance) while surrounding streets remain free will likely see the garage become the parking destination of last resort, which typically leads to disinvestment. Given this well-documented condition in downtowns throughout the United States, the consultant team recommends a parking management program that helps shift long-term parkers (such as employees) to more underutilized remote spaces while freeing up prime spaces for visitors and customers.



ABOVE: A multi-space meter.

The City is encouraged to implement a demand-responsive parking management approach that has proven successful in numerous cities in the United States. By implementing on-street pricing that is higher where demand is highest and lower (or free) where demand is lowest, the City can ensure availability for customers, guaranteed parking for employees without the fear of ticketing, protection of residential neighborhoods from spillover parking, and sufficient utilization of a new parking garage. Fair pricing strategies will also help cover the cost of operating and maintaining the garage and other parking assets.

Four key elements comprise the recommended parking management approach to support the optimal utilization of the garage while improving the availability of parking in the Square:

Implement Market Rate Pricing Recognizing that parkers respond to pricing, a minimum of three pricing tiers are suggested that correspond with local market prices. If implemented in response to utilization patterns, availability can increase throughout the Square while allowing patrons to pay according to the desirability of the parking spaces.

Eliminate Time Limits The current time limits are only appropriate for a limited number of parkers in the Square. If demand-responsive pricing is in place, time limits are unnecessary as cost will encourage turnover in time intervals that better match the real needs of those working, visiting, or residing in the Square.

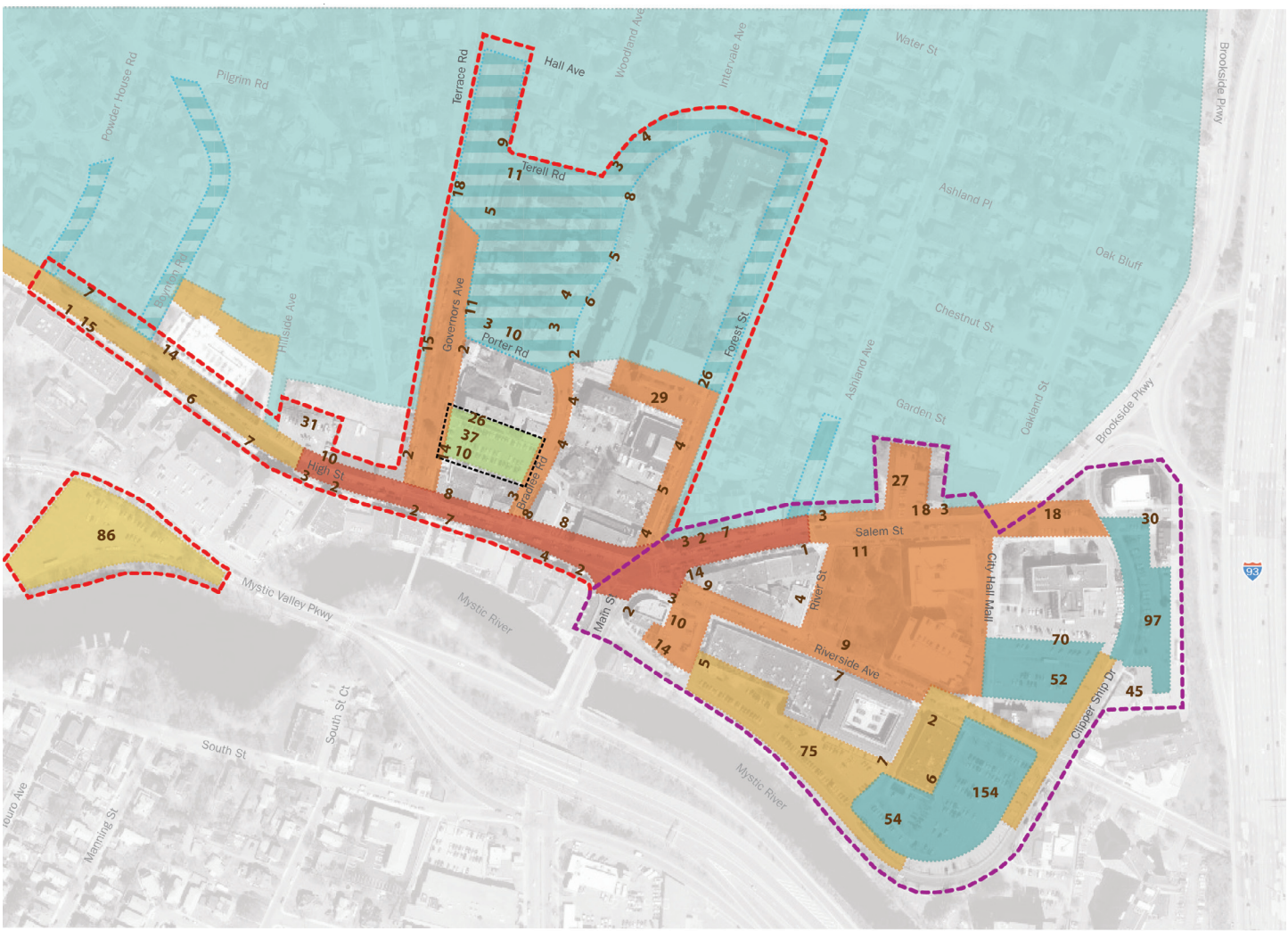
Use Multi-Space Meters New payment technologies have dramatically improved the ease of payment, enforcement, and revenue collection for paid parking spaces. Multi-space meters have significantly fewer streetscape impacts, as one unit can serve many spaces. They offer features such as credit card payment, payment by cell phone, remote recharging from different points in the Square, and transmission of space availability information to mobile devices and the internet. A pay-by-space system is recommended with space numbers posted on buildings or curbside.

Expand Parking Permit Program Utilizing the same demand-responsive approach that should be implemented for public parking, employees, commuters, and residents should have different tiers of long-term monthly parking available for purchase on a monthly basis.

Financial Impact

Utilizing the modeled pricing structure, Nelson\Nygaard estimated that surplus annual funds could be generated for the City that would be best directed to improvements in the Square, such as signing, landscaping, and pedestrian or bicycle amenities. Local management of the parking system would result in greater surpluses versus contracting with a private vendor for operations and enforcement.

Scenario A



Hourly Parking

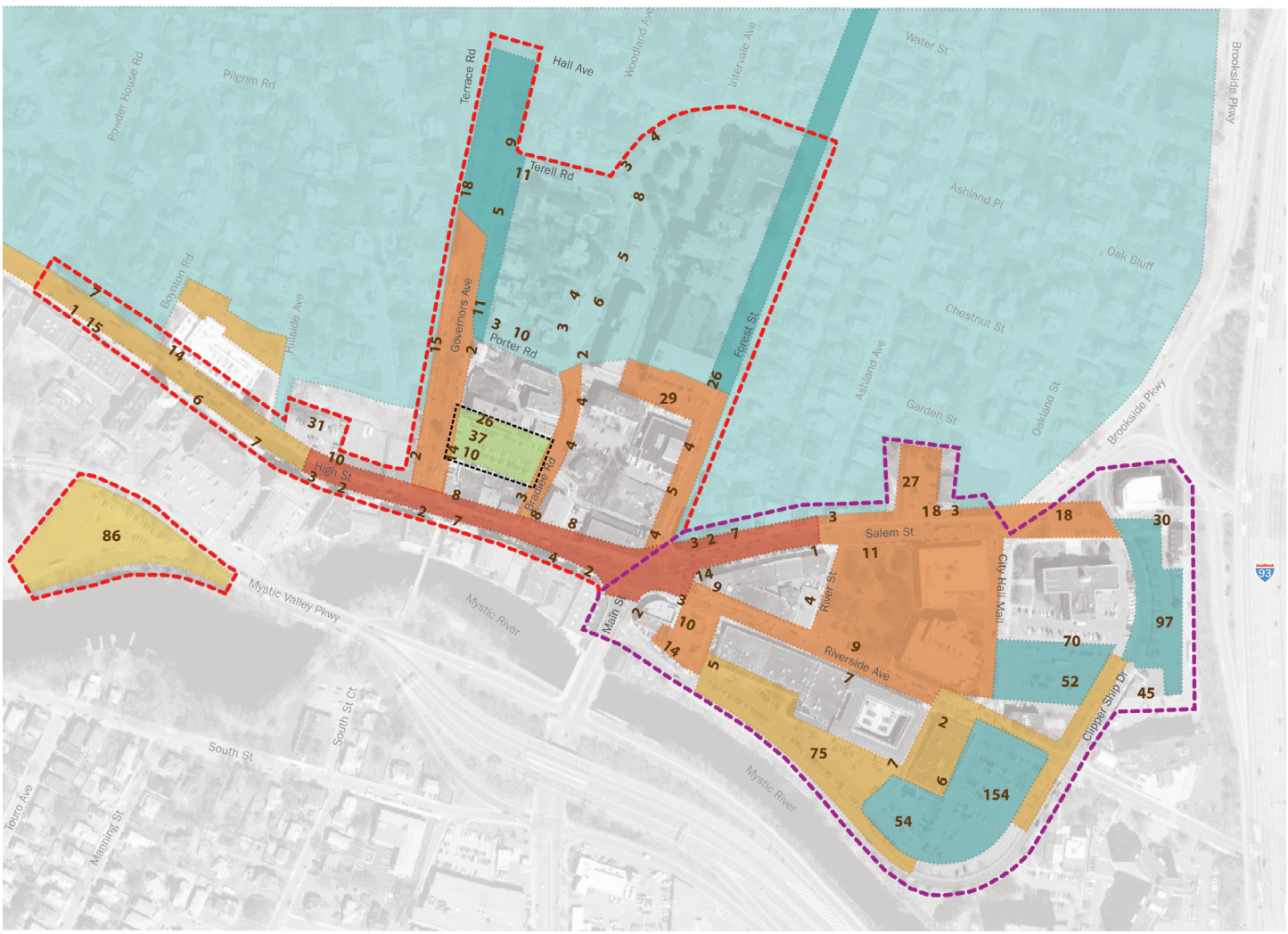
- High-demand Parking $$$
- Moderate-demand Parking $$
- Long-term Parking $
- Free Parking

Permit Parking

- Garage Parking $
- Employee Parking $$
- Residential Parking $
- Residential Parking 5PM-8AM weekdays and weekends
  Employee Parking 8AM-5PM weekdays
  $

- West Square
- East Square
- Proposed Garage Site
- # Existing Parking Spaces

Scenario B



Parking: Proposed Pricing Zones

Two scenarios are shown here, in which parking for the Square would be divided into pricing zones. As the key (see facing page) describes, on-street pricing is higher where demand is highest and lower (or free) where demand is lowest. Using such a strategy, the City can ensure that the most convenient on-street spaces in the center of the Square will either turn over quickly or generate decent revenue. The lowest priced, or free, spaces are located at the periphery where demand is lower, and those willing to walk can be guaranteed the least-expensive parking options. The difference between the two scenarios is simply the allocation of employee parking areas. In Scenario A (facing page), employees and residents share spaces during the working hours. In Scenario B (above), employees are restricted to nonresidential streets.

Pricing Revenues & Costs

The draft pricing structure is based upon conservative estimates of supportable pricing in the Medford Square marketplace. While these prices might be a good starting place, the City should carefully observe actual utilization patterns and be prepared to adjust prices up or down depending on how close parking utilization is to 85 percent of capacity on any block face or in any off-street facility.

Applying these conservative rates to the observed utilization rates in each hourly pricing zone, over $600,000 of annual revenues can be expected, given the recommended hours of operation that reflect daily demand patterns. Similarly, tiered monthly permit prices would conservatively generate another $185,000 per year, for a total revenue stream exceeding $1,000,000 annually. Utilizing this approach to pricing will generate most of the revenue to cover parking system expenses from on-street spaces, but not a new garage. This recognizes the value that prime spaces have over garage spaces, which are not as convenient.

By implementing this approach throughout the Square and eliminating time limits, net revenue can be made available for local improvements if the City chooses to self-finance the new multi-space meters. Assuming that annual debt service on an installation of 30 units will be no more than $30,000, on-call maintenance and service costs would require up to an additional $75,000 per year. Two full-time personnel with benefits are estimated to cost $250,000 per year for dedicated enforcement and maintenance.

Alternately, many municipalities choose to have their entire system run privately. While a precise estimate is not possible, given typical ratios observed in other cities, Nelson\Nygaard estimates that as much as three-quarters of the total system revenues would be lost to the private entity.

On-Street Fee Structure	
High-Demand Spaces	82
Hours of Operation	9AM to 7PM
Hourly Fee	$1.00
Moderate-Demand Spaces	265
Hours of Operation	9AM to 5PM
Hourly Fee	$0.75
Long-Term Spaces (inc. garage)	310
Hours of Operation	10AM to 4PM
Hourly Fee	$0.50
Annual Revenue by Hourly Paid Space	
Total Annual Revenue per High-Demand Space	$2,606
Total Annual Revenue per Moderate-Demand Space	$1,564
Total Annual Revenue per Long-Term Space	$1,043
Revenue at Existing Utilization Rates	
Total Annual High-Demand Parking (77% utilized)	$165,000
Total Annual Visitor Parking (66% utilized)	$274,000
Total Annual General Parking (51% utilized)	$165,000
Total Annual Hourly Paid Parking Revenue	**$603,000**
Revenue at Target Utilization Rate (85%)	
Total Annual Customer Parking	$182,000
Total Annual Visitor Parking	$352,000
Total Annual General Parking	$275,000
Total Annual Hourly Paid Parking Revenue	**$809,000**

Monthly Permit Fee Structure	
Garage Permits (75% of Probable Capacity)	135
Hours of Operation	9AM to 5PM
Monthly Fee	$60
Employee Permits	525
Hours of Operation	9AM to 5:30PM
Monthly Fee	$15
Residential Permits	N/A
Hours of Operation	5:30PM to 9AM
First Permit (Annually)	$10
Second Permit (Annually)	$30
Third & Each Additional Permit (Annually)	$100
Annual Revenue by Permit	
Total Annual Revenue per Garage Permit	$720
Total Annual Revenue per Employee Permit	$180
Total Annual Revenue per Residential Permit	$10; $30; $100
Annual Permit Revenue	
Garage Permit Revenue (180 spaces)	$90,720
Employee Permit Revenue (525 permits)	$94,500
Total Annual Permit Revenue	**$185,220**

Annual Parking System Revenues	
Paid Parking Revenue	$603,000
Permit Revenue (Optimal Garage Capacity)	$185,000
Enforcement Revenue (Est.)	$250,000
Total	**$1,038,000**

Annual Parking System Costs (self-financed)	
Equipment Service, Maintenance (30 pay stations)	$75,000
Personnel	$250,000
Total after Maintenance and Operations	**$713,000**

Annual Parking System Costs (privately-financed)*	
Service Contract Estimate	$800,000
Personnel	$65,000
Total after Maintenance and Operations	**$173,000**

* The privately financed option is based upon an assumption that private vendors typically offer an annual payment to the municipality in exchange for collecting and retaining all enforcement revenues. The scenario above assumes an annual payment of approximately $250,000 to the municipality ($1,038,000 in revenues, minus this $250,000 payment, reveals the Service Contract Estimate of approximately $800,000). One City staffer at half-time would still be required to manage the relationship with the vendor.

Signing Plan

Transitioning from a time-limited enforcement system to a pay-as-you-go unlimited parking system can be very simple to describe to the traveling public. Other than special regulations for buses, loading, or safety clearances, all existing parking regulatory signs can be removed. Simple “pay for parking” signs can be placed at entry points to each pricing zone, with the only additional signs at the multi-space meters themselves. Adhesive stickers indicating the hourly charge can be placed on signs within certain zones. Such stickers can be replaced easily if the pricing structure changes. Similar barrier signs can be used on residential streets and along streets used for low-rate monthly paid parking.











Best Practices Signage

A. Boulder, Colorado
B. Palm Beach, Florida
C. Denver, Colorado
D. Salem, Massachusetts
E. Salem, Massachusetts

V.
Proposed Garage Site



The Governors Avenue site is currently a 70-space municipal parking lot. As the images suggest, it is almost always filled to capacity.



Site Description

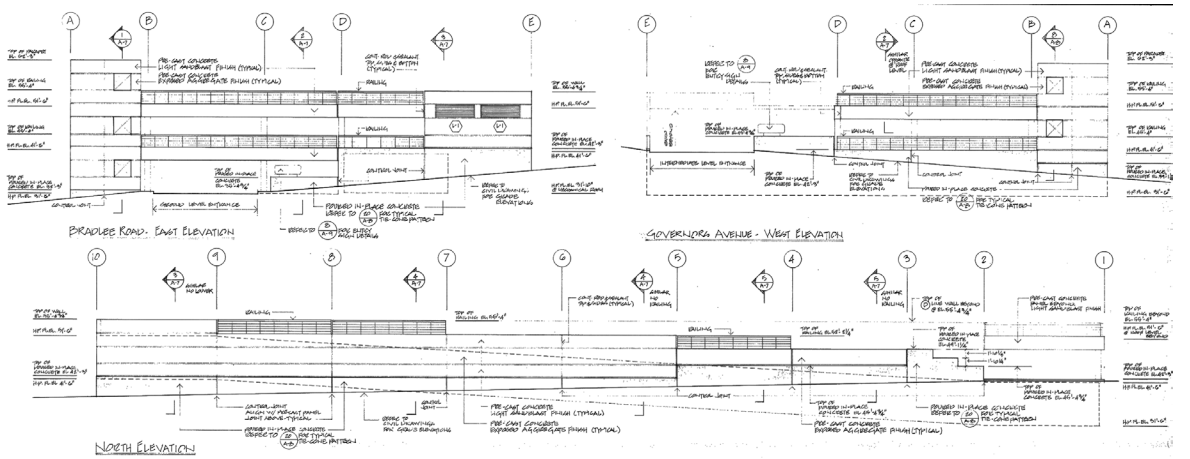
The Governors Avenue parking lot, the preferred site for further study, is located immediately adjacent to the center of activity in the west half of Medford Square. The edge dimensions of the trapezoidal parcel are approximately 244 feet to the north, 108 feet to the east, 215 feet to the south, and 115 to the west, resulting in an overall site area of 25,848 square feet.

The site is bounded on the east by Bradlee Road and on the west by Governors Avenue. To the immediate north of site, sitting above significant retaining walls, is a five-story brick residential building and a small office building. The southernmost quadrant of the block, facing High Street, is occupied by several retail and restaurant storefronts.

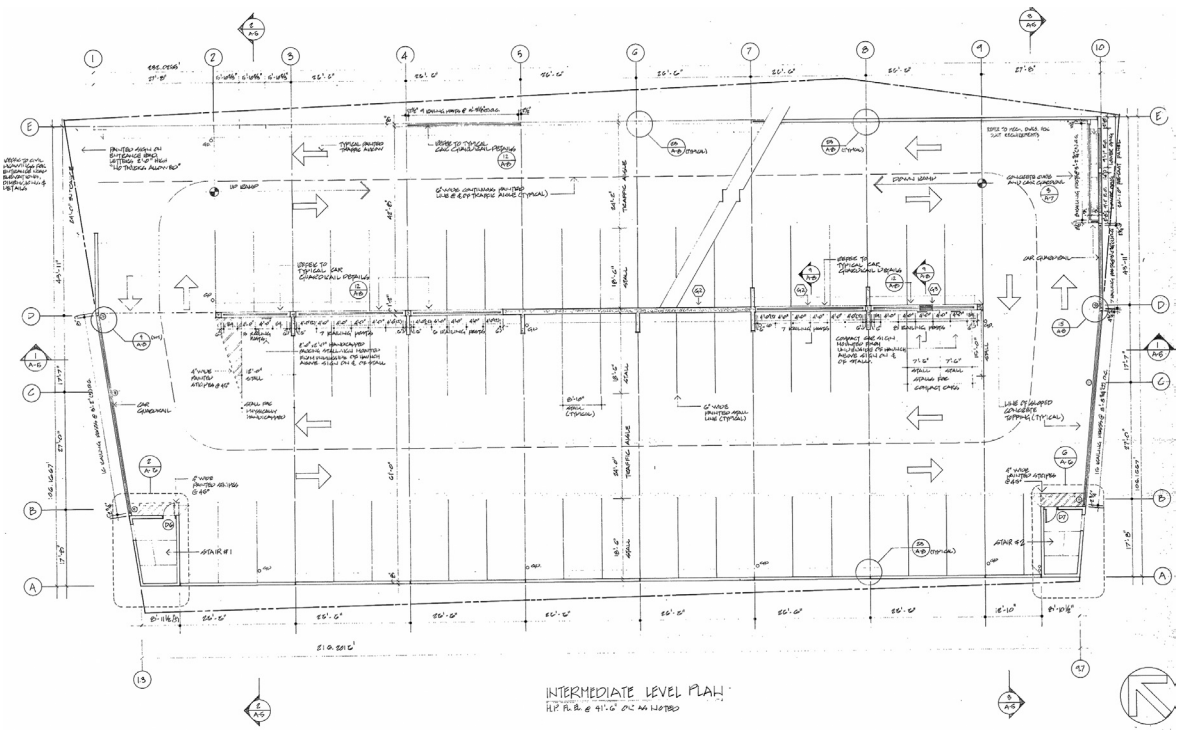
Currently, the site is occupied by a sloping 70-space surface parking lot. The topography on the site is notable. From its highest point at the northwest corner of the lot (facing Governors Avenue) to its lowest elevation at its southeast corner (facing Bradlee Road), the site drops approximately 10 feet. The abutting retail storefronts that face onto High Street are all single-story structures, with the exception of Gaffey Funeral Services.

The highest point of the site is on the northwest corner, where the lot meets the residential building. Retaining walls, remnants of the foundation of the previous garage, define this corner.





Elevations



Typical Plan

ABOVE: Drawings of the previous garage, which was demolished in 2005.

In discussions with the City and the public during the Parking Open House, the team noted generally negative public perception of the previous garage's appearance. With a heavy, opaque concrete enclosure, and little natural light or transparency, the design of the garage limited visual connection between inside and outside, and this lack of visibility contributed to a reduced sense of security among many parkers.

Previous Garage

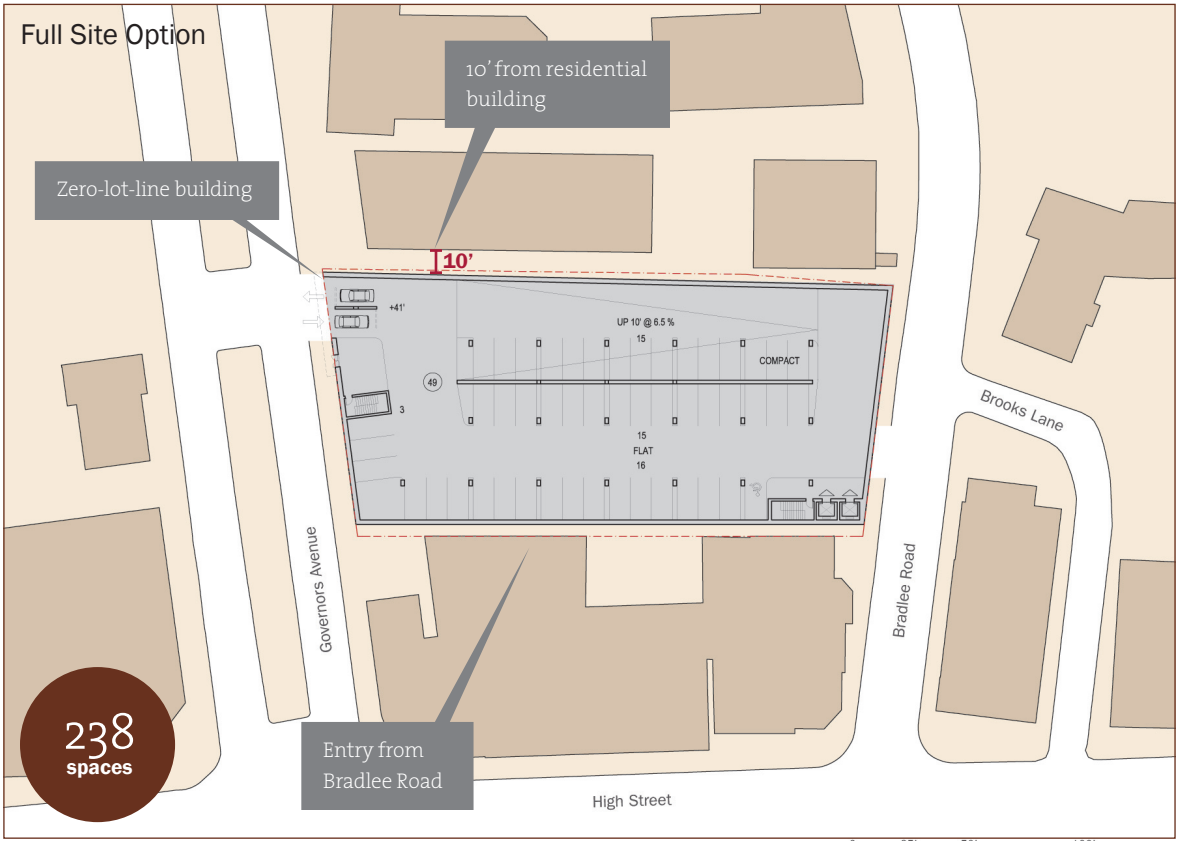
From 1983 to 2005, a 164-space, two-and-a-half-level garage existed on the Governors Avenue site. Building and zoning codes in effect during the construction of this garage allowed for much denser occupation of the site than could be achieved in the current regulatory climate. The width of parking stalls was then much narrower than current building code allows, and drive aisles were similarly less generous. Additionally, the garage presented significant barriers to handicapped accessibility: it lacked an elevator to connect all three parking levels, and offered too few designated accessible parking stalls. It is important to note that any contemporary garage on this site would thus not achieve the same density.

According to the 2005 *Medford Square Master Plan*, occupancy of the previous garage was consistently high, reaching 84 percent occupancy in the morning hours and more than 90 percent occupancy in the afternoon hours. In their recent analysis of the site, Nelson\Nygaard observed similarly high occupancy in the current surface lot, which houses approximately 70 cars.

The previous garage was demolished in the spring of 2005, after the top floor collapsed.

The previous garage occupied virtually the entire footprint of the site. It was a two-and-a-half-story concrete building with very few openings to allow for ventilation and daylighting.




Full Site Option
10' from residential building
Zero-lot-line building
10'
UP 10' @ 6.5 %
COMPACT
15
FLAT
16
Governors Avenue
Bradlee Road
Brooks Lane
238 spaces
Entry from Bradlee Road
High Street

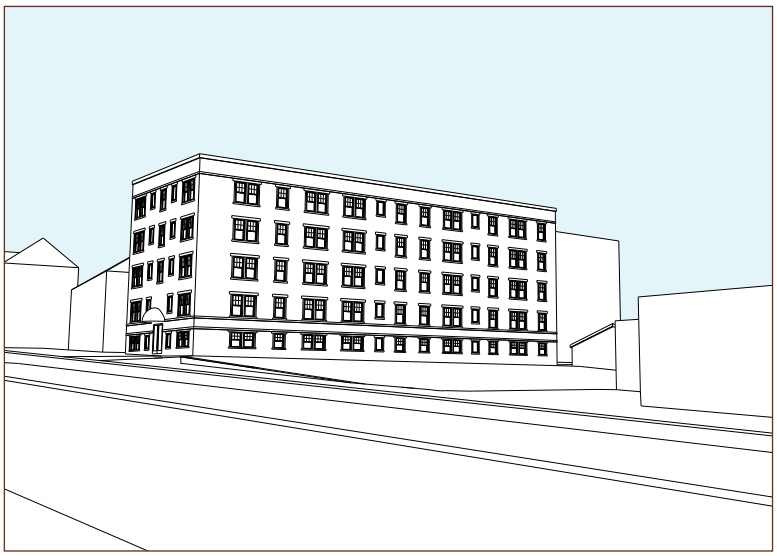

Partial Site Option
One-story entry pavilion from Governors Avenue
10'
15'
30'
15'
UP 10' @ 12 %
Governors Avenue
Bradlee Road
Brooks Lane
178 spaces
High Street
0
25'
50'
100'

Visual Impact of New Garage

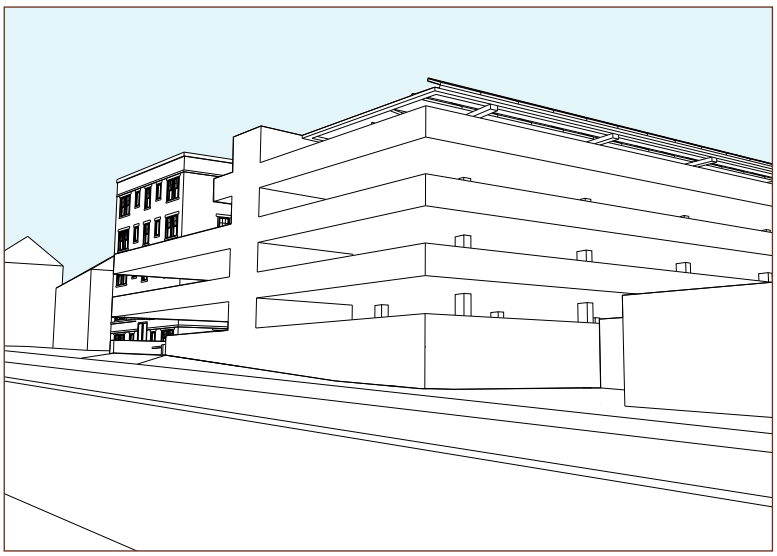
In order to understand the capacity of the site, and the parking configurations the parcel could hold, the design team tried two primary planning options.

Full Site Option This maximum option was studied purely to understand the number of parking spaces that could be generated on the site, devoid of other considerations. This full site plan yields 238 vehicular spaces. The considerable downside to this option is its relationship to the buildings to the north: it is a mere 10 feet from the existing residential and office buildings. As street-level perspectives demonstrated, this garage is not responsive to concerns that it "fit" into the context.

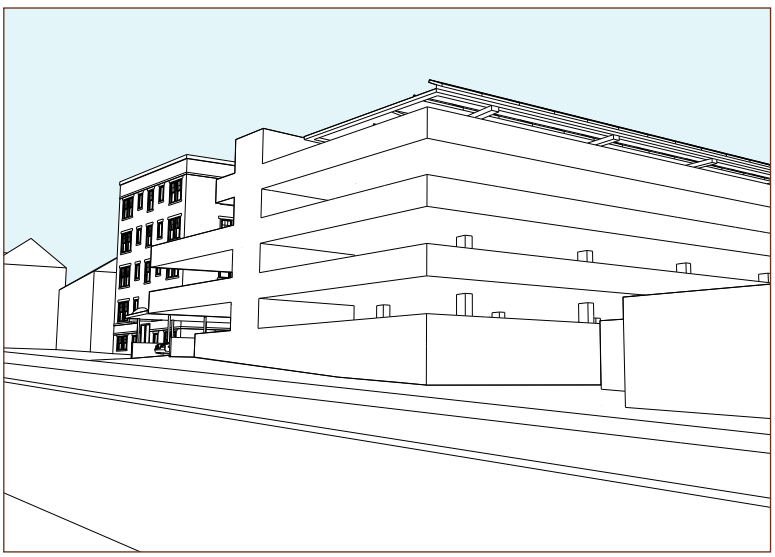
Partial Site Option The second option attempted pulls the building back slightly from the northern lot line, to allow for a 30-foot setback from the adjacent buildings. An entry pavilion at the Governors Avenue entrance is still required in order to take advantage of the natural high point of the grade, but this entry is a small single-story appendage, set back 15 feet from the lowest floor only. Shade-tolerant trees and a bioswale could be inserted in the resultant gap between the garage and the buildings to the north to create a visual buffer and to help deal naturally with storm water runoff. This option yields 178 vehicular spaces and a minimum of 22 bicycle spaces.



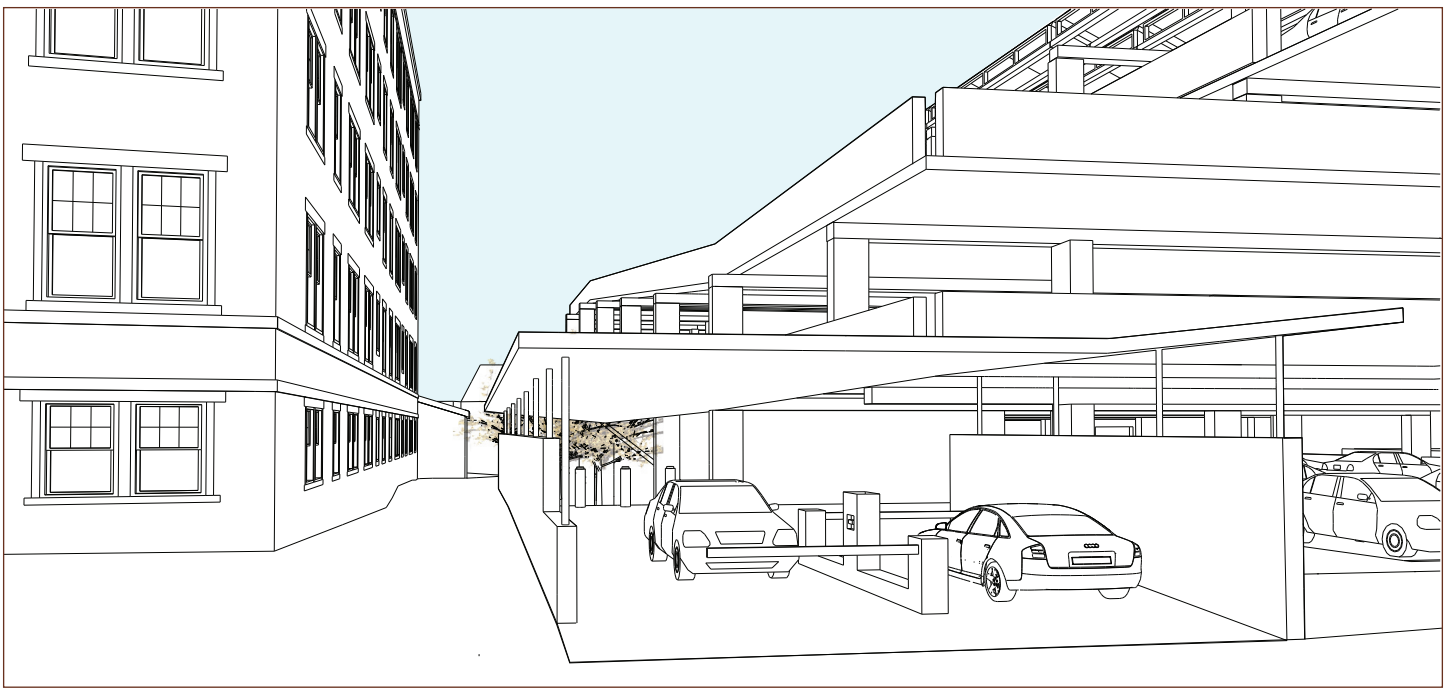
Existing Conditions:
Surface parking lot



Full Site Garage

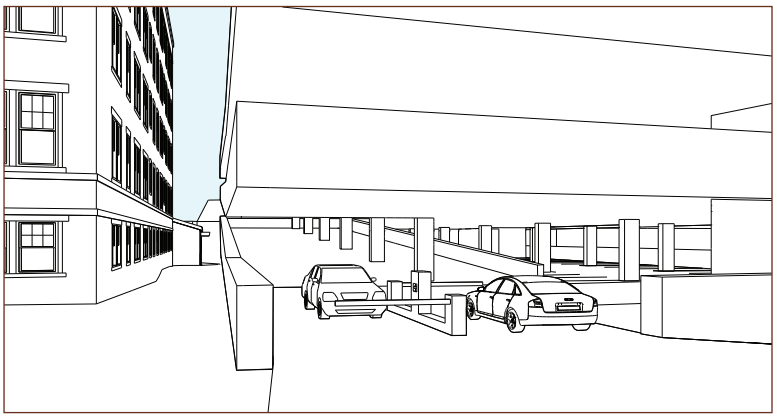


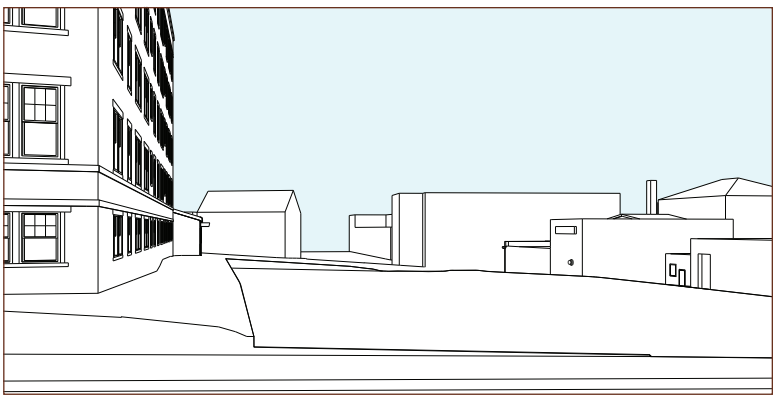
Partial Site Garage



Once the plans were in place, simple digital massing models of both options were built to test the visual impact of the garage on the site from various perspectives. These perspectives helped the client and design team to arrive at a decision to forward the Partial Site option, as the Full Site Garage was too massive and intrusive in the context.

Ultimately, the conceptual design was a refinement of the Partial Site option. In the refined scheme, seen in Section VI of this report, the architecture and massing were adjusted to break down the bulk of the building while maintaining the maximum number of parking spaces.





TOP: Entry to the Partial Site Garage from Governors Avenue.

MIDDLE: The Full Site Garage from Governors Avenue.

RIGHT: The existing surface lot.

Site Impacts

Given that a garage previously occupied the site, and that the site currently hosts a well-used surface lot, it can be inferred that a parking use is compatible with this location. Numerous business owners and customers of the West Square who attended both the Parking Open House and the Public Meeting expressed support for a new garage on this site, for the relief it will offer to the perceived parking deficit in this half of the Square. Among those most likely to utilize the garage are patients and visitors to the nearby medical offices, employees and customers of High Street businesses, and evening patrons of the Chevalier Theatre.

Although the Governors Avenue site is zoned as a zero-lot-line parcel, the options forwarded in this study acknowledge the contextual and functional need for setbacks on the southern and northern edges of the site. While the adjacent businesses to the south use their High Street addresses as the primary means of entry and access, these businesses also have secondary or service entries currently accessed from a narrow passageway to the rear of their buildings, directly off of the current parking lot.

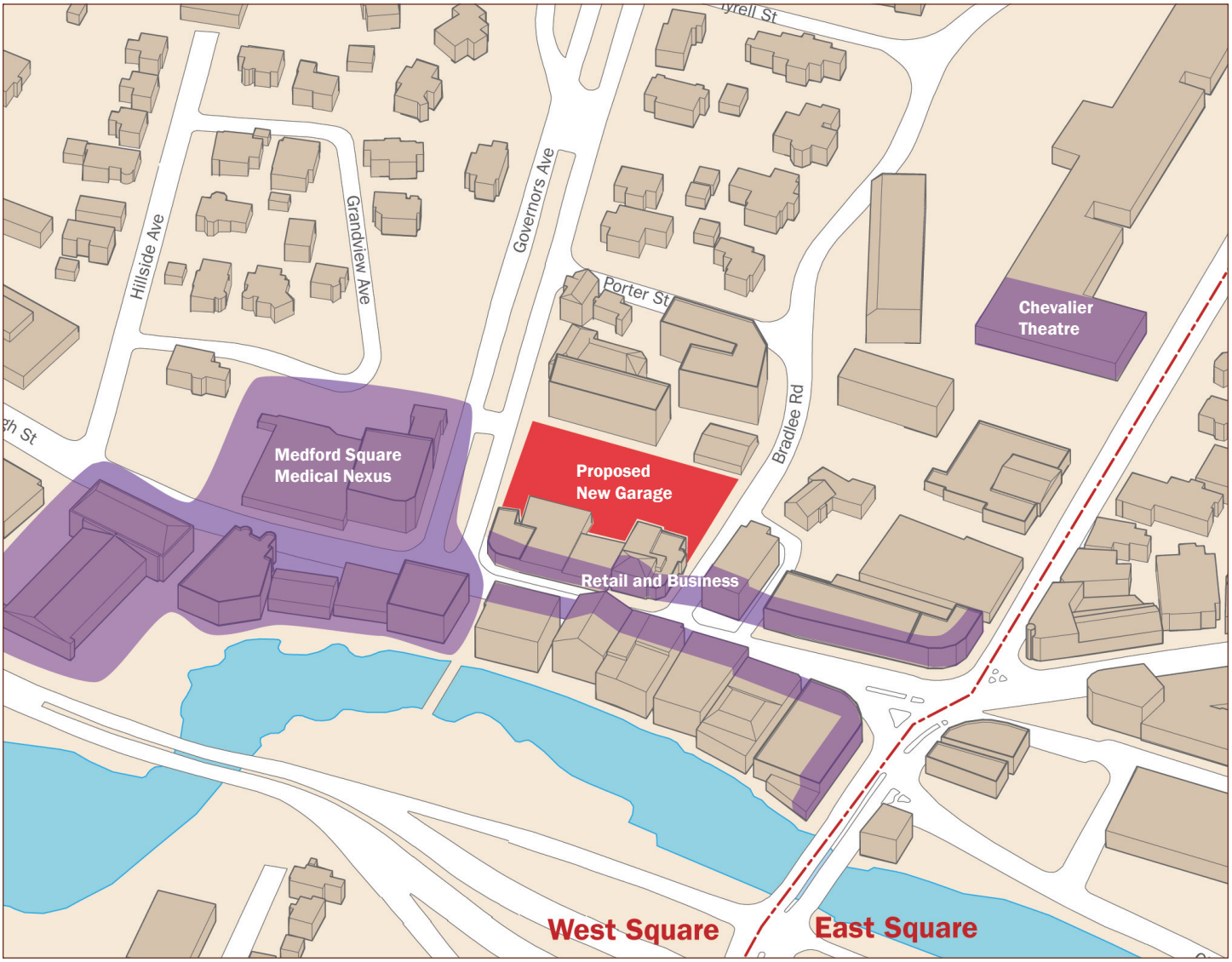
In addition, the team looked at both the vehicular and visual impact of a new garage on the surrounding streets and buildings. The existing residential and office buildings to the north, which sit very close to the lot line, were carefully considered in the garage massing strategies.





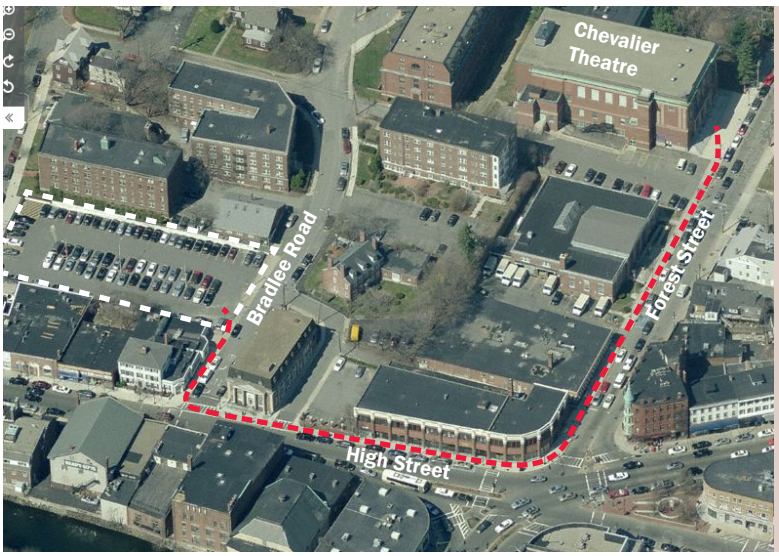


LEFT AND MIDDLE: Local businesses in Medford Square.
ABOVE: A medical office building at the corner of High Street and Governors Avenue.



Positive Impacts on the Surrounding Uses

There are a number of local constituencies in the western half of Medford Square that will benefit from a new garage on the Governors Avenue site. Among those constituencies are the visitors and patients of the various medical offices to the west of Governors Avenue, the retail and business customers of the High Street businesses, and patrons of the Chevalier Theatre on Forest Street. Providing a safe, enjoyable, and accessible route between the garage and the Theatre will be crucial to forging a programmatic connection between the two buildings.



1
High/Forest Path

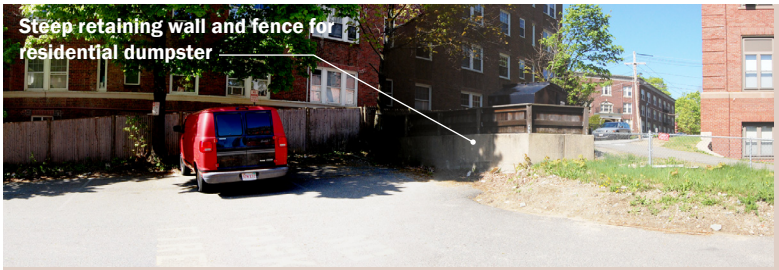
This pathway takes advantage of the already-extant City sidewalks and the pleasant atmosphere of the Square, ultimately offering the most potential activity to the center of the Square. Although it is a few steps longer than the other options, it requires virtually no capital improvements. Wayfinding signage between the garage and Chevalier to highlight this route is the only suggested improvement. This is the recommended pathway.

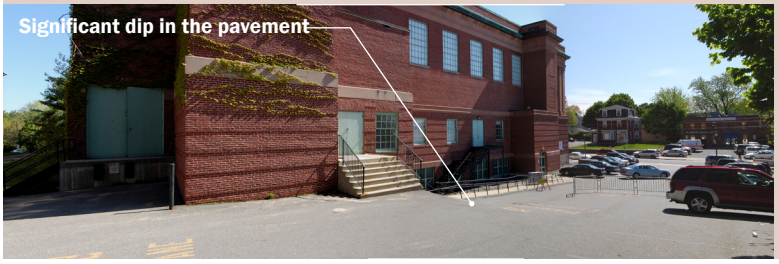




2
Brooks Lane Path

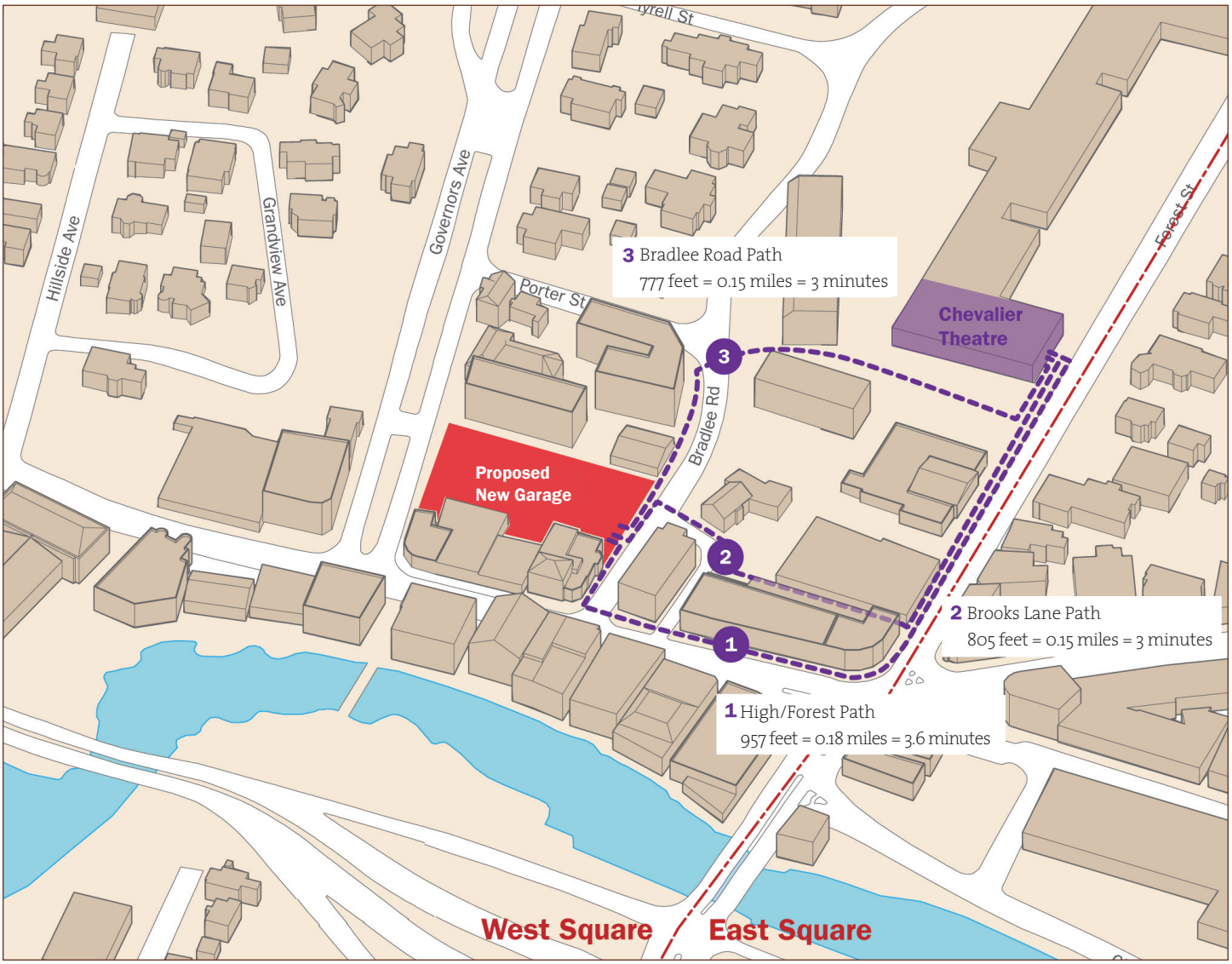
This pathway would send pedestrians across Bradlee Road, and down through an existing alleyway between two privately owned buildings. This space is currently used for private parking, and would require the City partnering with the private owners to conduct the requisite capital improvements (lighting, paving, signage) to make this a feasible pedestrian option.





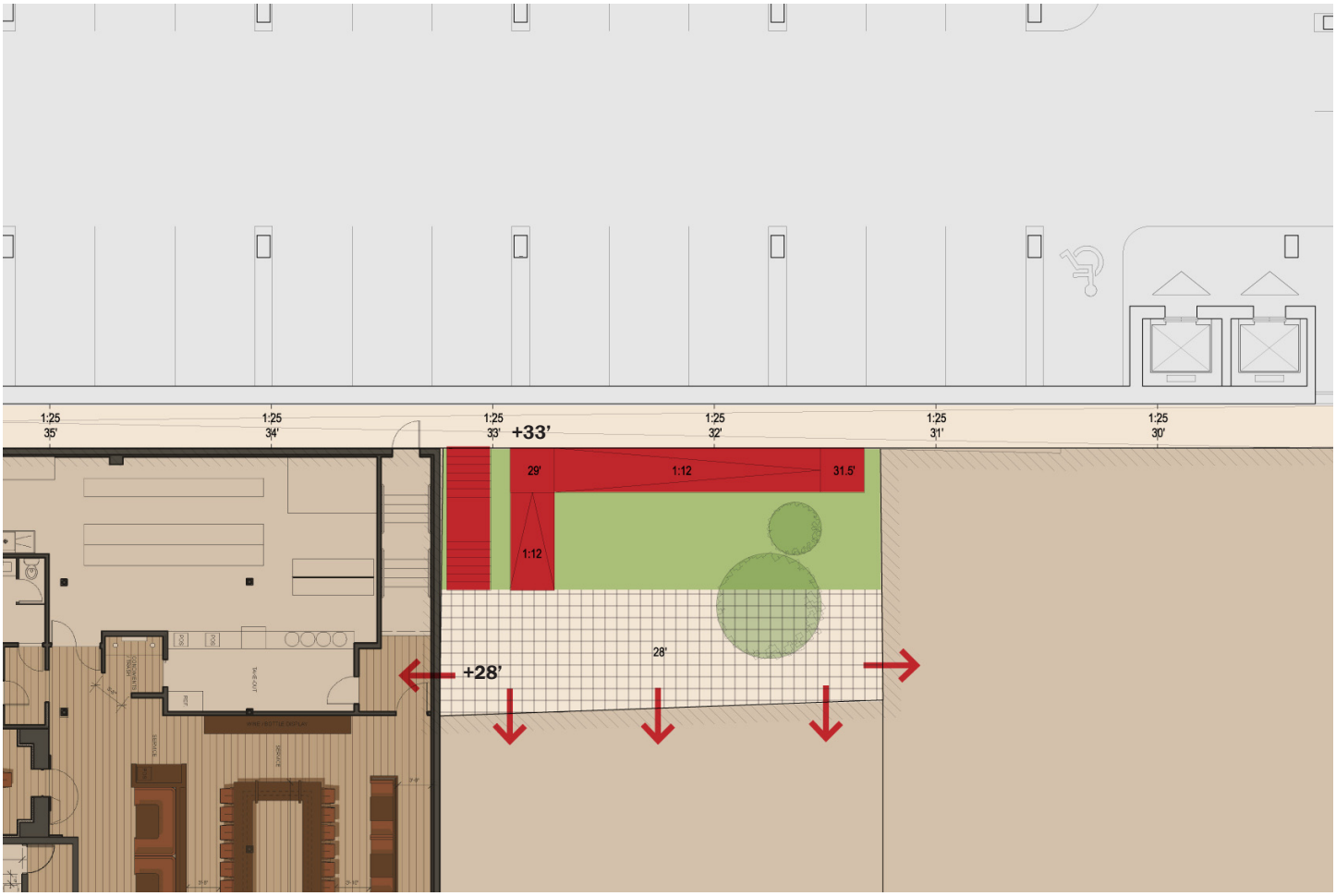
3
Bradlee Road Path

There are several major disadvantages to this pathway. First, patrons would have to climb the steep grade of upper Bradlee Road, a grade that may not meet accessibility standards. Once the pedestrian reaches the top, he/she must slip between two residential buildings (the current site of the residential dumpsters), and a new stair/ramp would need to be inserted. The remaining sloping grade down the Chevalier parking lot would also require regrading.



Pedestrian Impacts

The design team initially considered several possible routes between the Governors Avenue site and Chevalier Theatre that prioritized, to varying degrees, the shortest route between the two structures, the most visually interesting route, and the path with the least topographic change (and thus the least costly intervention). In order to optimize all of these concerns, the project team arrived at the conclusion that the pedestrian route along High Street and up Forest Avenue maximized efficiency and pedestrian experience while minimizing costs.



To navigate the 5-foot difference in grade between the back passageway (33-foot elevation) and the building interiors (28-foot elevation), the existing courtyard space would be re-graded to the 28-foot level, and a stair and accessible ramp would be inserted.

BELOW, LEFT: The rear exit to a local restaurant faces the Governors Avenue site.

BELOW, RIGHT: The existing underutilized pocket of space.





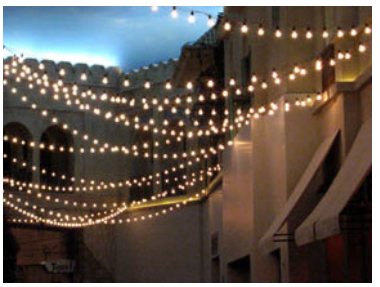
Impacts to Access

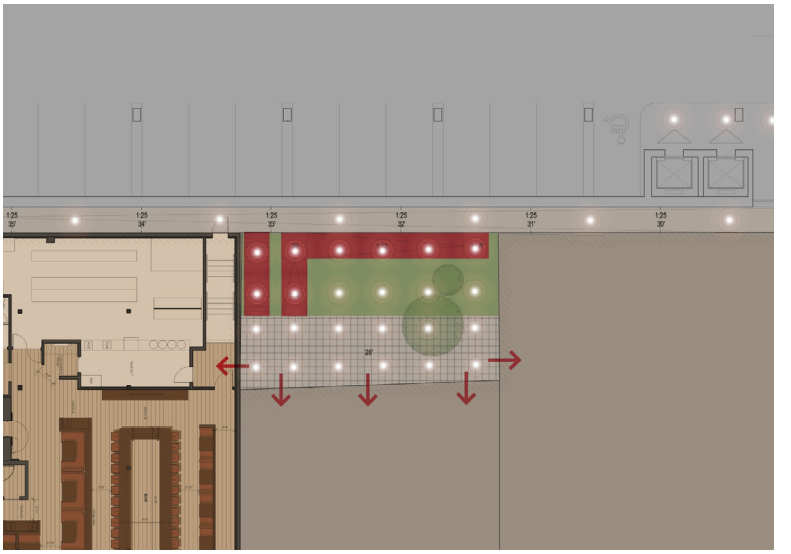
High Street Buildings: Back Entrance

The retail buildings on High Street that back up to the potential garage site are zero-lot-line buildings: they sit exactly on the parcel line. The previous garage on this site was set back approximately three feet to allow for a service passageway between the garage and these buildings. In the massing schemes for the future garage, the new building allows for a more generous five-foot passageway between the garage and the retail buildings. The slope along the passageway length rises gradually from Bradlee Road to Governors Avenue, and with slight grading adjustments, can be fashioned into a handicapped-accessible route from the garage to the rear of the High Street buildings. An existing, underutilized pocket of space in the center of this block can be re-graded to match the floor level of the retail buildings, and a stair and accessible ramp inserted to create a pleasant entry space to access all abutting buildings.

In addition to making the passageway wood-clad (a boardwalk), building-mounted lighting along the passageway and suspended lighting above the new entry space could create a pleasant evening experience for patrons of future restaurants housed in these buildings. Exterior seating could also be considered for this space.







Vehicular Impacts

A new parking garage in Medford Square of approximately 180 vehicular spaces, and a minimum of 22 bike spaces, can be expected to see a worst-case volume of 110 entering cars in the morning peak hour and 110 existing in the evening peak hour. Utilizing census data and existing vehicle turning movement counts at the intersections of High and Main streets, and High Street and Governors Avenue, the consultant team distributed potential garage traffic through these intersections in each peak hour.

The High Street and Main Street intersection processes a significant volume of traffic in each peak hour—approximately 3,000 cars—and would be almost entirely unaffected by a new garage adding less than 100 new vehicles in either peak hour to the intersection's least congested movements.

The High Street and Governors Avenue intersection processes 1,100 cars in the morning peak with a 7-car queue on stop-controlled Governors Avenue, which contributes to a Level of Service (LOS) E. However, the garage would be served by an entrance off of Governors Avenue north of High Street, resulting in no impact to this intersection in the morning. In the evening, the Governors Avenue queue today is only 3 cars on average, but the exiting garage will add up to another 6 cars to this queue. The intersection would drop from a LOS D to LOS E with a 9-car queue extending up Governors Avenue near the garage exit. While a traffic signal at Governors Avenue and High Street would solve this situation, the delay is acceptable for a stop-controlled minor street. It is advisable to observe actual conditions before proceeding with new traffic controls.

Nonetheless, this intersection would benefit from improved geometry that would increase driver sight lines compromised today

Level of Service

C 21-30 Second Delay

D 31-40 Second Delay

E 41-50 Second Delay

% Of the cars moving through this intersection, this percent leaves in this direction

Illegal turn

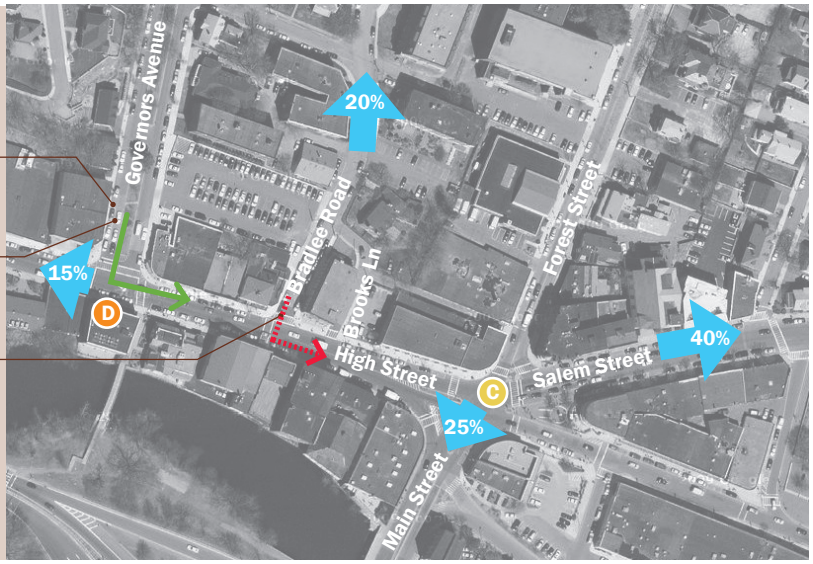
Existing Operations

PM Peak (All Traffic)

On average, 3-car queue in the PM peak hours.

Nelson\Nygaard observed 57 cars turning left onto High Street from Governors Avenue.

Currently, illegal left turns from Bradlee Road onto High Street cause delays.



by cars parked in and close to the intersection. Simple curb extensions clearing cars back as little as ten feet at the corners and removing parked cars from the intersection would allow Governors Avenue motorists to merge into High Street traffic more safely, reducing perceived delay. Furthermore, the curb extensions would greatly improve pedestrian safety and reduce crossing delays, capturing more existing parking spaces within a short walk of the Square's businesses.

Traffic Circulation Changes

The threat of illegal left turns out of Bradlee Road onto High Street increases given the possibility of long queues on Governors Avenue at High Street during the PM peak hour as the garage empties. This maneuver is already observed by the consultant team and many workshop participants. While a new median break at the Governors Avenue garage exit would enable better access to eastbound High Street for garage users, the queue for left turns onto High Street might discourage this route and preserve the appeal of exiting at Bradlee Road. Therefore, the team recommends reversing the direction of Bradlee Road for the one block south of Porter Road, possibly supported by a new median break at Porter Road on Governors Avenue. This treatment enables new access to the garage from High Street without using Brooks Lane, eliminates the risk of left turns from Bradlee Street onto High Street, helps discourage cut-through traffic on Bradlee Road into the Square, and preserves easy access to all properties on Bradlee Road. Vehicles heading west on High Street can easily bypass the left-turn queue.

Recommendations

With the addition of a 180-space garage in this area of Medford Square, Nelson\Nygaard recommends the following actions to alleviate the traffic impacts listed below:

1. Reversal of Bradlee Road direction in this block will eliminate the threat of illegal left turns.
2. Installation of curb extensions will aid sight lines and reduce crossing delays.

180-space Garage

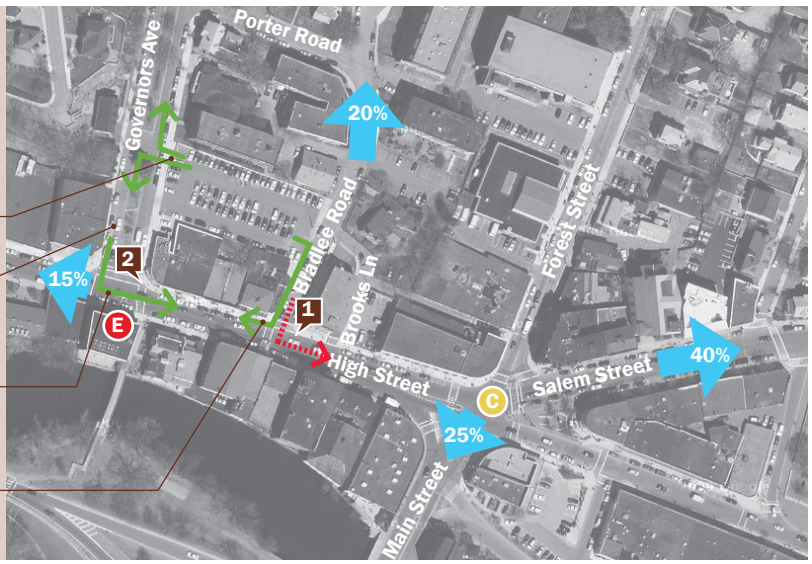
PM Peak (All Traffic)

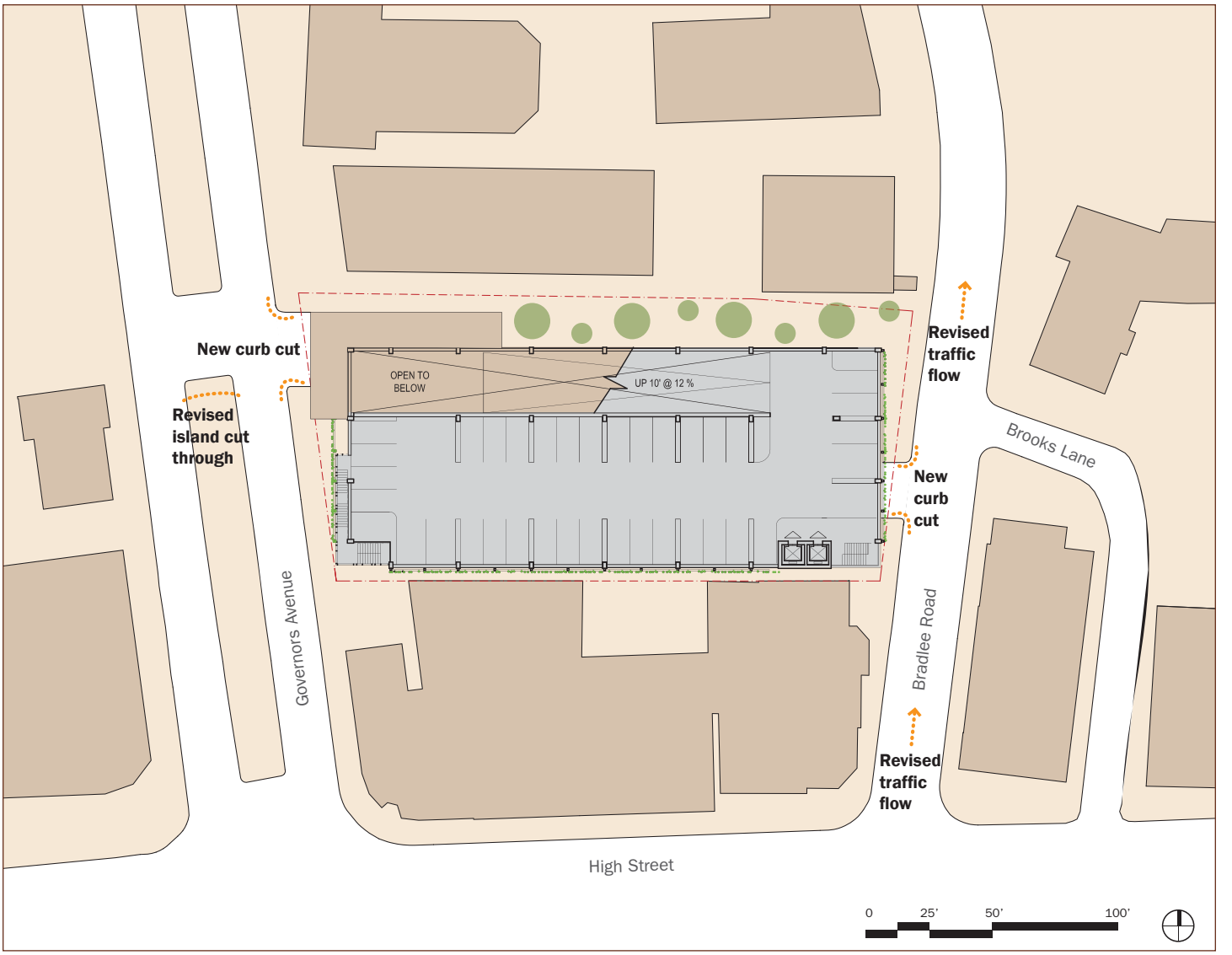
Of the cars pulling out of the garage, it is estimated that 22 would turn right, and 71 would turn left.

On average, 7-car queue in the PM peak hours.

Nelson\Nygaard estimates 99 cars would turn left onto High Street from Governors Avenue.

Of cars leaving the garage on Bradlee Road, an estimated 17 would turn right onto High Street.





Proposed Traffic and Roadway Impacts

A new parking structure on the Governors Avenue site will require several changes to the roads and sidewalks immediately adjacent to the site to permit safe and easy access to and from the garage. Curb cuts along Governors Avenue and Bradlee Road will be relocated to permit vehicular access to the main entries of the structure. Additionally, a cut through the median that separates opposing traffic along Governors Avenue may be required to allow for southbound traffic to enter into and exit from the garage. One-way traffic flow along Bradlee Road will likely need to be reversed so that vehicles travel northward only along this stretch of Bradlee Road until its intersection with Porter Street. As part of this strategy, Brooks Lane would remain a southbound one-way route to allow easy access to the funeral home in particular. (See Section IV: Parking Management Plan and Recommendation, pp. 46–65, for further information about roadway impacts.)

FACING PAGE, TOP LEFT: On-street parking along Governors Avenue.

TOP RIGHT: View looking west at the north side of High Street.

MIDDLE LEFT: View looking west at the south side of High Street.

MIDDLE RIGHT: View looking east at the south side of High Street.

BOTTOM LEFT: Parking on the north side of High Street.

BOTTOM RIGHT: A car turning onto Governors Avenue from High Street.




FedEx






GIFTS
Collectibles
58K M08



VI.
Garage Studies

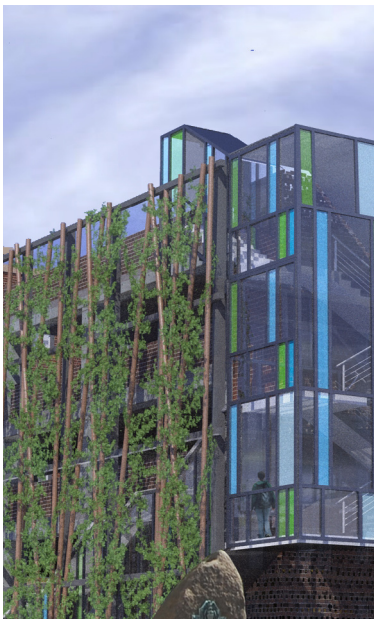
Design Approaches

Two options for the design approach to the garage were tested to provide two price models and an opportunity for the community to weigh in on two compelling but strongly differentiated approaches.



The **Brick Garage** is modeled on early twentieth-century commercial and mill buildings typical to Massachusetts cities and towns. Each structural module is subdivided into two bays defined by thick pilasters that stretch between the base and the top of the wall. A brick corbel above the upper window head helps make this transition between the pilasters and the upper zone of the facade. Brick spandrels of a slightly darker color define the parapet at each parking level. The brick of the base, pilasters, and top of the wall should closely match that of the neighboring apartment building. The garage option is meant to be timeless in style and look like "it was always there." As a result, the building will not call attention to itself, despite its relatively large size.

The Brick Garage is supported by a cast-in-place system of concrete columns and beams, and its structure is concealed behind the pilasters and recessed spandrel panels described above. This specific structural system was selected in order to minimize the height of the spandrel condition, thereby allowing the tallest opening possible at each level to support natural ventilation. Specifically, the state building code mandates that 40 percent of the garage's total facade area remain free and open in order to avoid the requirement for a costly mechanical ventilation system in the structure. (See the Appendix for relevant excerpts of the Massachusetts State Building Code that define this condition.)



The second garage option, the **Green Garage**, uses natural vegetation rather than a masonry skin to give character and distinction to the garage. To avoid the need for difficult-to-maintain irrigation, the vegetation is planted in the ground around the perimeter of the building—including a vine pocket along the alley on the south side of the garage. Since it will take several years for the ivies to cover the garage, the supporting trellis is intended to be visually interesting in its own right; the slightly canted poles are meant to represent the view through a dense forest. In contrast to the vegetated walls, glass stair lanterns are proposed in the two corners closest to High Street. A mix of glass colors will create a memorable evening landmark as it welcomes visitors to the restaurants in the Medford Square.

Because the entire facade is porous and open, the Green Garage meets the Massachusetts Building Code's 40 percent open facade area requirement without having to limit itself to a specific structural logic. The Green Garage employs a different structural strategy than its brick counterpart; this option employs a slender steel frame of columns and girders to support precast concrete double-tee beams. The Green Garage exposes its structure, offering glimpses of itself through the vegetated walls. Such a hybrid structural system is often less expensive than a cast-in-place equivalent, and in many cases can be erected faster since it requires no formwork and is not dependent on favorable weather conditions.

Having considered many structural strategies, the design team ultimately chose to pair the two garage schemes with specific structural systems that meet the respective functional and aesthetic goals of each. In forwarding a distinct structural strategy for each scheme, the team was able to explore two varied structural strategies that are conceivably interchangeable. (Please refer to the Appendix for more detailed structural and cost estimating information.)

Brick Garage







Brick Building Precedents in the Boston Area

THIS PAGE: A brick building on Melcher Street, in the Fort Point neighborhood of Boston. The brick corbeling detail at the top of the final full-height window was a detail that was utilized in the Brick Garage option.

FACING PAGE: This commercial building on the corner of High and Forest streets in Medford Square is an excellent example of early twentieth-century commercial architecture. The strong vertical pilasters and recessed spandrel panels create depth and visual interest on the facade.





Brick Garage Precedents

In the interest of forwarding one scheme that looked like it "fit right into" the surrounding context, the design team found inspiration in some exemplary local masonry precedents. A variety of locally mined details were used in the ultimate concept for the Brick Garage, shown on the following pages. On both of the precedents used here, brick piers offer strong vertical expression, made more pronounced by inset spandrels. While these buildings are also quite simple, careful details, such as the stepped-brick head to the uppermost window (corbeling), on the Fort Point precedent, provide some additional visual interest.


Governors Avenue
High Street
Bradlee Road





Brick Garage Views

Since many of the surrounding buildings are brick-faced, the massing and facade study for the Brick Garage borrows the language of local masonry buildings, seen on the preceding pages. A number of design decisions were made to try to reduce the overall mass of the garage from the two primary vantage points: the Governors Avenue view (above), and the Bradlee Road view (see p. 97). For Governors Avenue, the corner closest to High Street was cut back to make room for plantings (here, a tree) and lessen the expanse of both short and long facades. Steel mullions were inserted in each bay to bring a human scale to the large openings. Cast stone lintels and sills were also placed at each opening to provide some visual relief to the otherwise entirely brick structure. The entries on both sides of the garage are indicated by a steel canopy that hangs over the sidewalk.

TOP: Brick Garage entry at Governors Avenue.

ABOVE LEFT: Brick corbeling detail at uppermost window.

FACING PAGE: Aerial view of Brick Garage.






The Lighthouse
BREAKFAST
LUNCH




Colleen's
SALADS • SOUPS
SPECIALS
OPEN





Brick Garage at Night

In response to nighttime security concerns the team heard from the client group and the public, it is recommended that a lighting designer be engaged on the future design team to ensure that the nighttime environment within and around the garage is safe and welcoming. As is shown in the above rendering, both the interior and exterior of the building should be lit, while remaining sensitive to light spill toward the adjacent neighbors. All lighting should be LED, for maximum energy efficiency and to limit the amount of maintenance and bulb replacement costs.

FACING PAGE: Brick buildings in the Medford Square area.



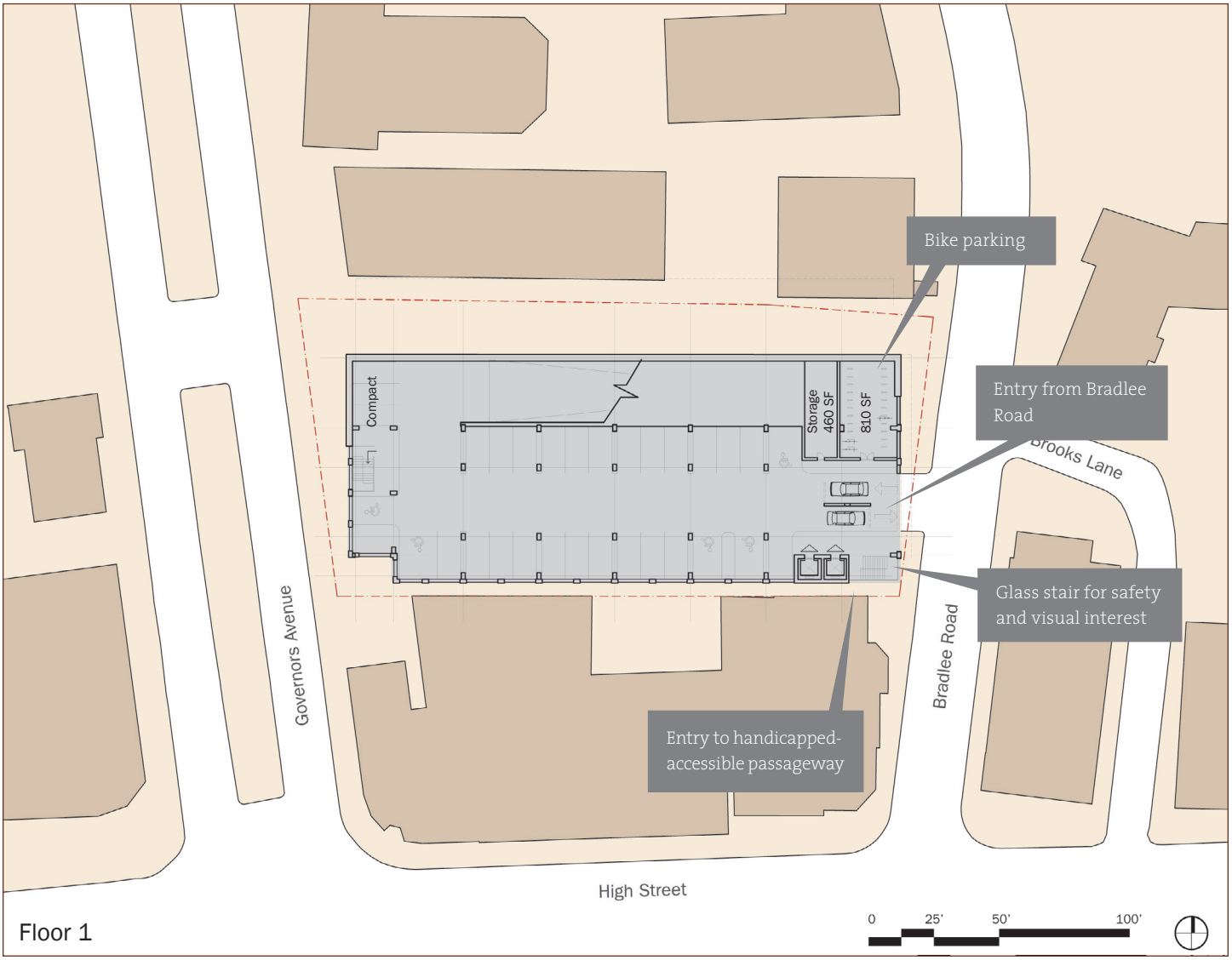


Brick Garage Entry Conditions

On the Bradlee Road side of the garage, a steel canopy marks vehicular entry. A glassy stair holds the corner, to allow for day and nighttime visibility into and out of the garage. Evergreen ivy could be allowed to climb a pre-installed trellis on the elevator tower, to soften the amount of brick on the south facade. The Governors Avenue entry (facing page), also has a steel canopy that covers both the vehicular and pedestrian entry to the garage. The 30-foot gap between the garage and the buildings to the north is shown planted with shade-tolerant trees to provide a visual buffer between the buildings. Sustainable storm water management strategies, such as a bioswale, could also be pursued in this gap.

ABOVE: Brick Garage entry at Bradlee Road entrance.

FACING PAGE: Brick Garage entry at Governors Avenue entrance.



Brick Garage Plans

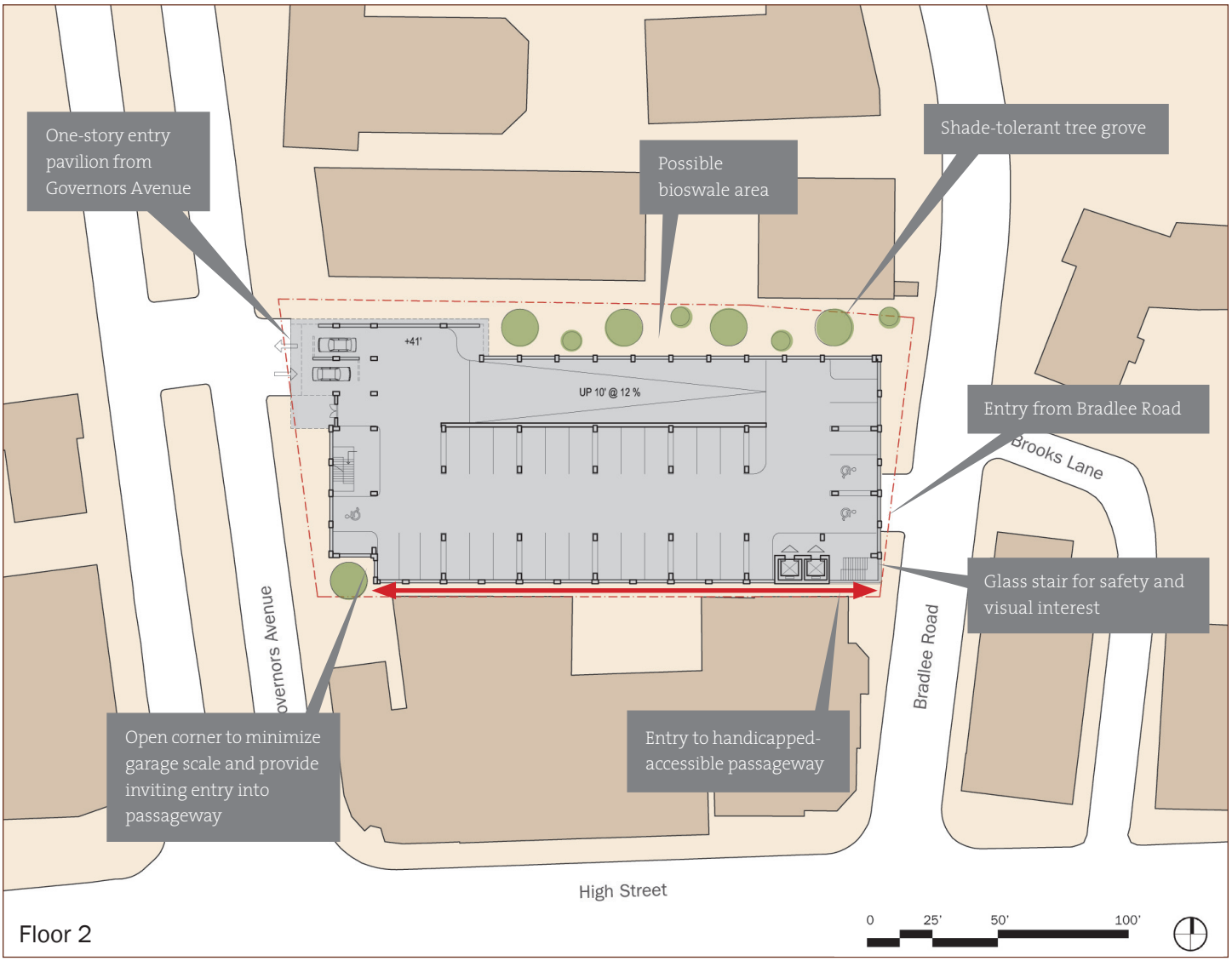
Because of the 10-foot grade difference between Bradlee Road and Governors Avenue, the first floor of the garage has an entrance from Bradlee Road, and the second floor has an entrance from Governors Avenue.

ABOVE: Entry from Bradlee Road.

FACING PAGE: Entry from Governors Avenue.

178 cars

22+ bikes


One-story entry pavilion from Governors Avenue
Possible bioswale area
Shade-tolerant tree grove
Entry from Bradlee Road
Glass stair for safety and visual interest
Open corner to minimize garage scale and provide inviting entry into passageway
Entry to handicapped-accessible passageway
+41'
UP 10' @ 12 %
Brooks Lane
Bradlee Road
High Street
0 25' 50' 100'
Floor 2


OPEN TO BELOW
Brooks Lane
Governors Avenue
Bradlee Road
High Street
Floor 5


UP 10' @ 12 %
Brooks Lane
Governors Avenue
Bradlee Road
High Street
Floor 4


UP 10' @ 12 %
Brooks Lane
Governors Avenue
Bradlee Road
High Street
Floor 3


0
25'
50'
100'

Brick Garage
Conceptual Construction Cost Estimate Summary

ITEM	TOTAL	$/SF
Sitework and Utilities	$84,000	n/a
Demolition	$14,450	n/a
Foundations	$446,480	$5.51
Superstructure (Cast-in-Place Concrete)	$1,884,620	$23.27
Exterior Envelope	$1,288,660	$15.91
Interior Finishes	$433,510	$5.35
Equipment/Specialties	$31,060	$0.38
Elevator	$257,200	$3.18
Sprinkler	$264,300	$3.26
Plumbing	$136,150	$1.68
HVAC	$1,500	$0.02
Electrical and Photovoltaics	$1,084,900	$13.39
Subtotal	$5,926,830	$71.96
General Conditions (8%)	$474,146	$5.76
Subtotal	$6,400,976	$77.71
Contractor Fee (3%)	$192,029	$2.33
Subtotal	$6,593,006	$80.04
General Contractor Bond (1%)	$65,930	$.80
Subtotal	$6,658,936	$80.84
Design/Estimating Contingency (10%)	$665,894	$8.08
Subtotal	$7,324,829	$88.93
Cost Escalation	Not Included	n/a
PROJECT TOTAL	$7,324,829	$88.93
	Cost/Parking Space	**$41,150.73**

See Appendix for expanded cost estimate.
Cost estimates prepared by KVAssociates, Inc.

Note: Mechanical ventilation costs are not included in the cost estimate for the Brick Garage because it qualifies as an Open Garage per State Building Code and thus can be naturally ventilated. Please see Relevant Building Code Excerpts in the Appendix for further explanation.

Green Garage









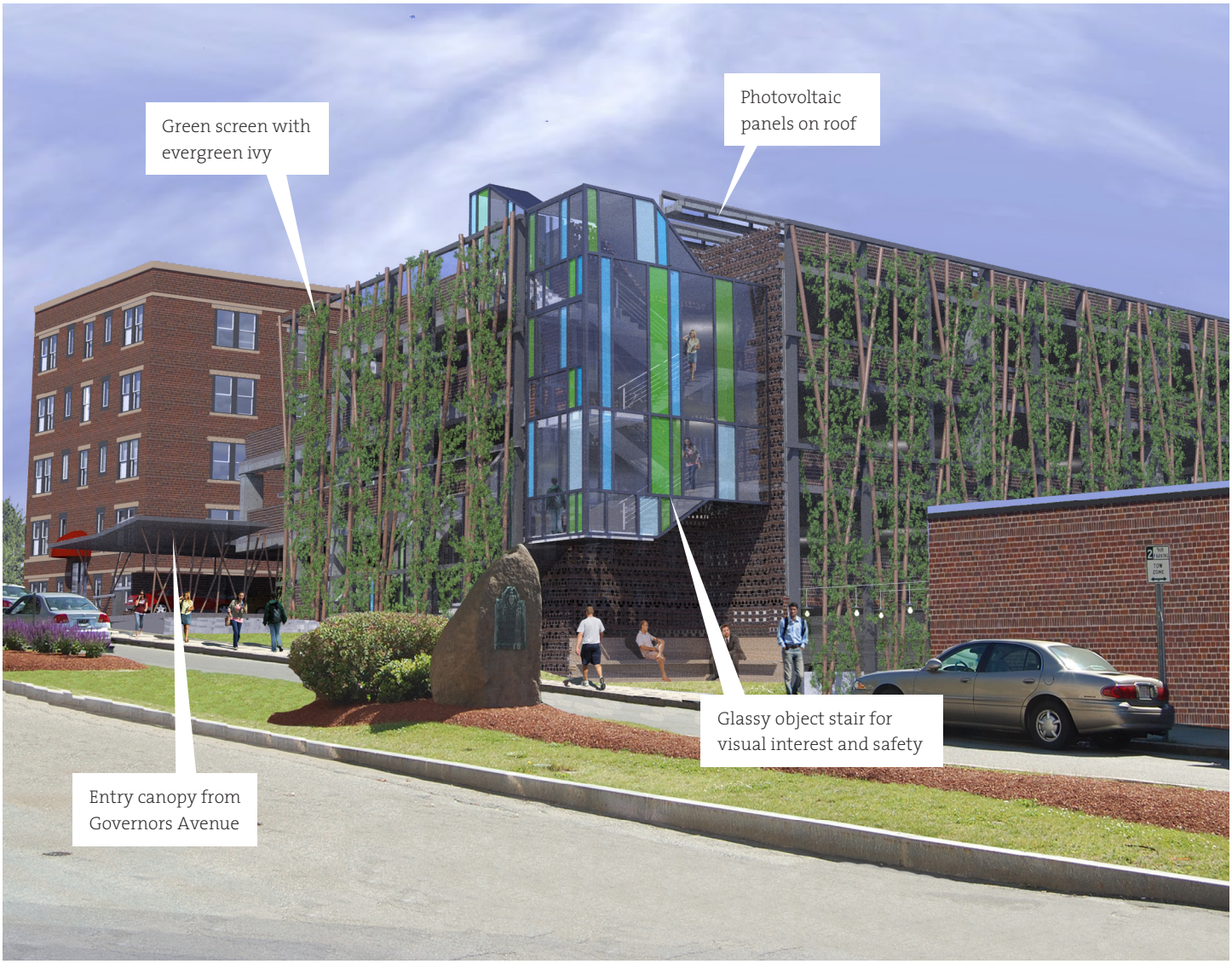
Green Garage Precedents

The second option the design team pursued—the Green Garage—was made purposely different from the more traditional brick option to offer the City divergent facade options and pricing scenarios. The strategy to clothe a garage in living plants is an increasingly popular one; precedents that inspired the team were found from Boston to Florida to California. In most contemporary versions of this building type, a cable or rod system is attached to the structure that then is the growing platform for the plant media. In Medford's climate, an evergreen plant, such as English Ivy, would be the best solution, to ensure a vibrant facade during all seasons.

FACING PAGE, TOP, BOTTOM RIGHT, AND ABOVE: These green facades feature ivy that is gradually growing upward over a simple stainless steel cable system.

FACING PAGE, BOTTOM LEFT: Closer to our Medford Garage site, this parking garage near the Longwood Medical Campus in Boston has a rich red Boston ivy over a concrete facade.


Governors Avenue
High Street
Bradlee Road



Green Garage Views

The Green Garage is intended to portray a forward-thinking image for the City of Medford, a vision of sustainability that is supported by true "green" features, such as photovoltaic panels on the roof, natural ventilation and daylighting, LED lighting at night, electric car recharging stations, and bike parking. The structure of the garage is comprised of steel columns and precast-tee concrete beams, to make the base building as light as possible. Attached to the structure are light steel pillars, canted for visual interest. Evergreen ivy is planted in soil pockets at the base of the garage, and will slowly grow up the pillars and steel cables to cover the primary facades. The ivy allows light to penetrate the deep interior of the garage, while maintaining a lush green facade for passersby, residents of the apartment building to the north of the site, and visitors and tenants of the retail and restaurant spaces on High Street. A colorful glass stair holds the corner.

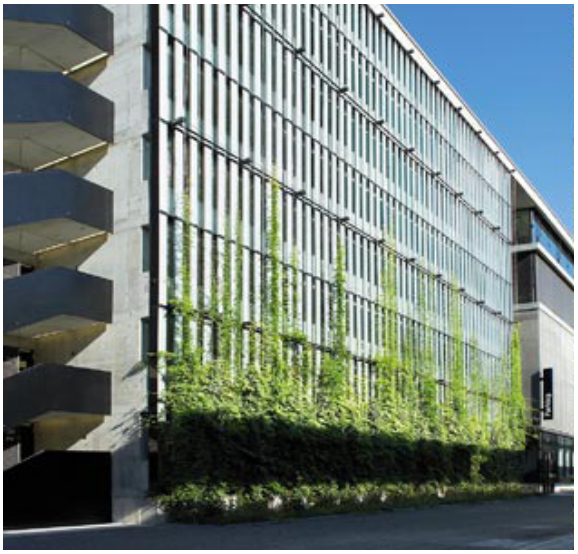
ABOVE: Green Garage entry at Governors Avenue.

FACING PAGE: Aerial view of Green Garage.









Green Wall and Lighting Examples

TOP, LEFT: The Santa Monica Civic Center Garage features a colorful lit facade that enlivens the downtown.

TOP, RIGHT: the parking garage of Miami's Bentley Bay development by Arquitectonica has a green facade and a top level pool surrounded by lush greenery.

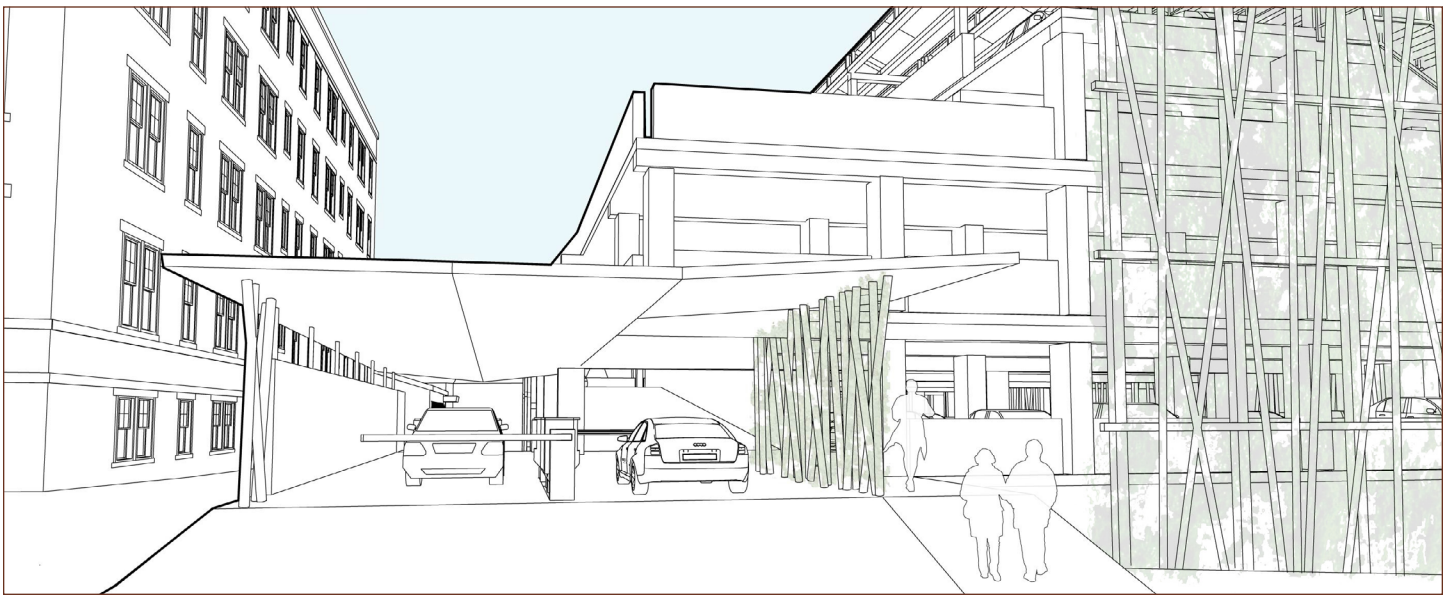
ABOVE, LEFT: A recent student thesis project at MIT, by Ethan Lacy, explored the potential of green walls and was inspired by Patrick Blanc's vertical gardens.

ABOVE, RIGHT: Another vegetated facade, the Sihl City Shopping Centre in Zurich, offers a more subtle approach to "greening" a wall.



Green Garage at Night

As was highlighted in the Brick Garage options, the team considers artful and safety-conscious nighttime lighting to be a crucial component to the future success of this municipal garage. In the case of the Green Garage, lighting is focused not only on interior spaces, but also on the colorful glass stair at the corner, which can act as a beacon from High Street. As was also true of the previous scheme, the lighting shown in the above rendering must be sensitive to light spill toward the adjacent neighbors. All lighting should be LED, for maximum energy efficiency and to limit the amount of maintenance and bulb replacement costs.



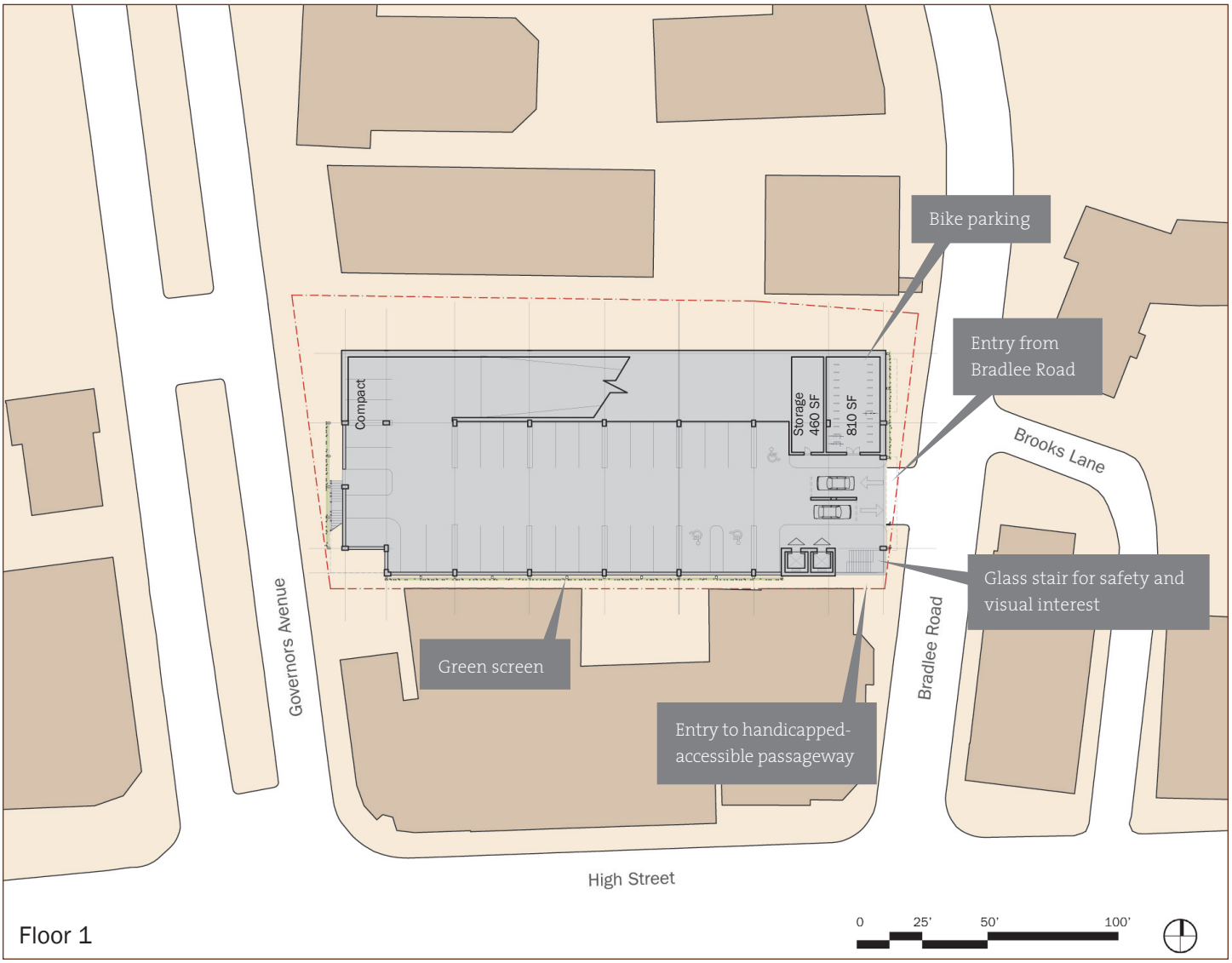
Green Garage Entry Conditions

The Governors Avenue entry is indicated by a one-story entry pavilion, held up by canted steel columns. These slightly canted poles support the green growth and provide visual interest that signals entry and exit for the garage. On the Bradlee Road side, an opening in the green screen marks the vehicular entry. A glassy stair holds the corner closest to High Street, to allow for day and night-time visibility into and out of the garage.

ABOVE: Green Garage entry at Governors Avenue Entrance.

FACING PAGE: Green Garage entry at Bradlee Road, where the brightly colored glass stair will help visitors and parkers find the garage.





Green Garage Plans

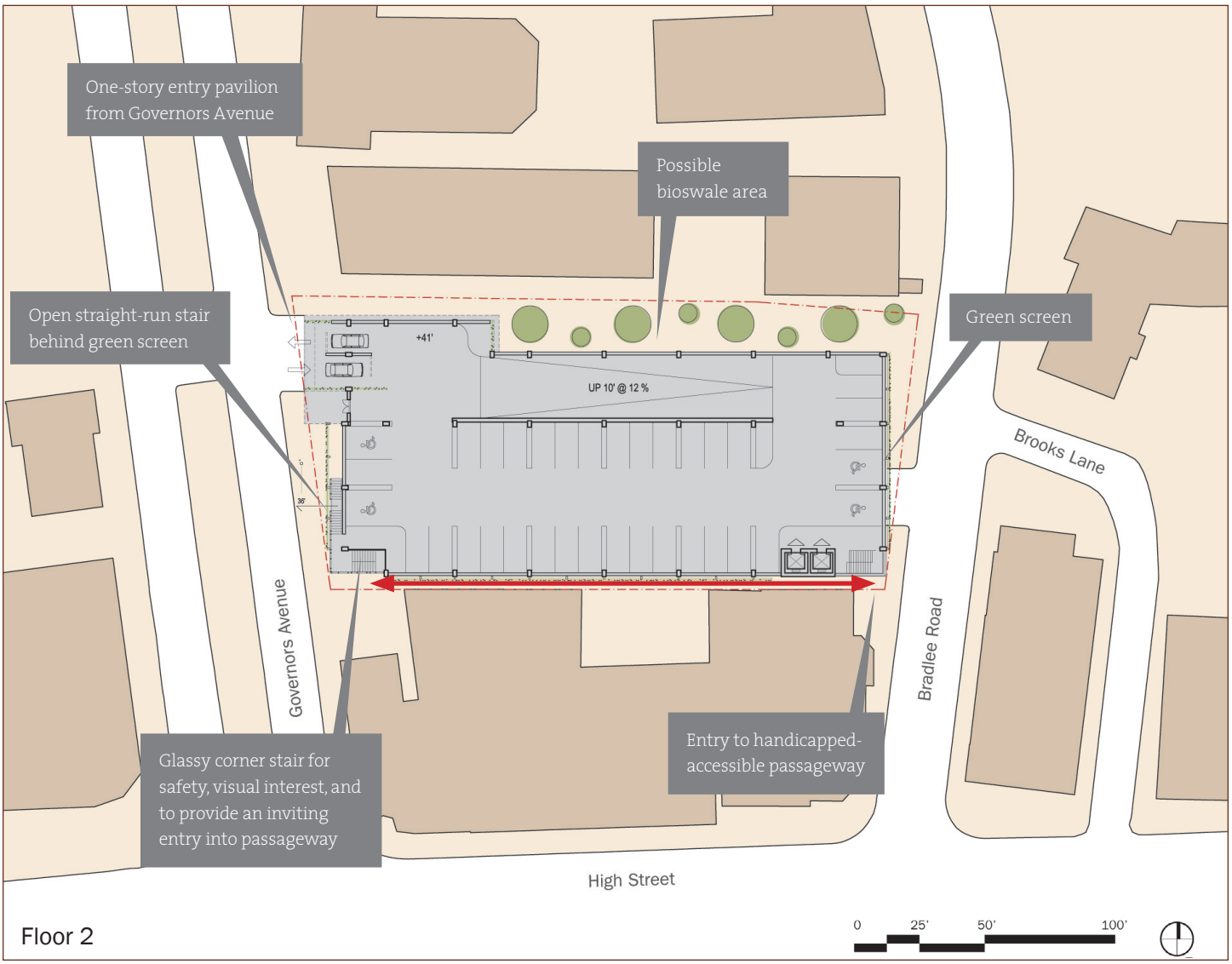
Due to the 10-foot grade difference between Bradlee Road and Governors Avenue, the first floor of the garage has an entrance from Bradlee Road, and the second floor has an entrance from Governors Avenue.

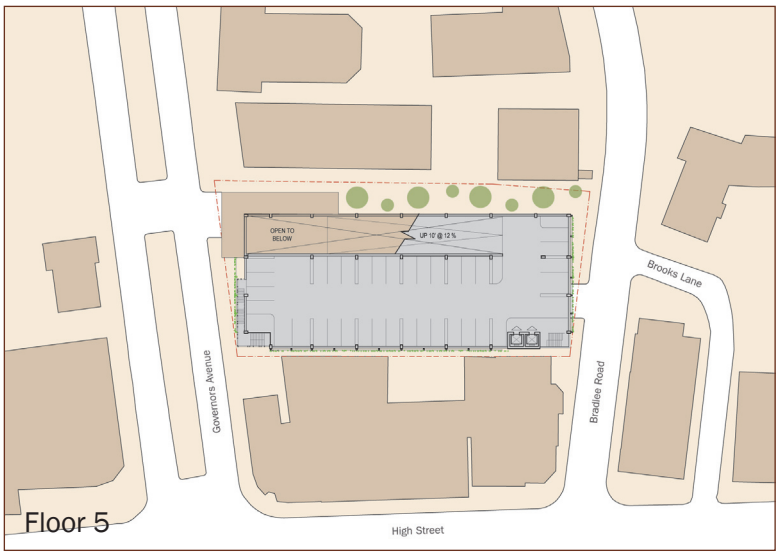
ABOVE: Entry from Bradlee Road.

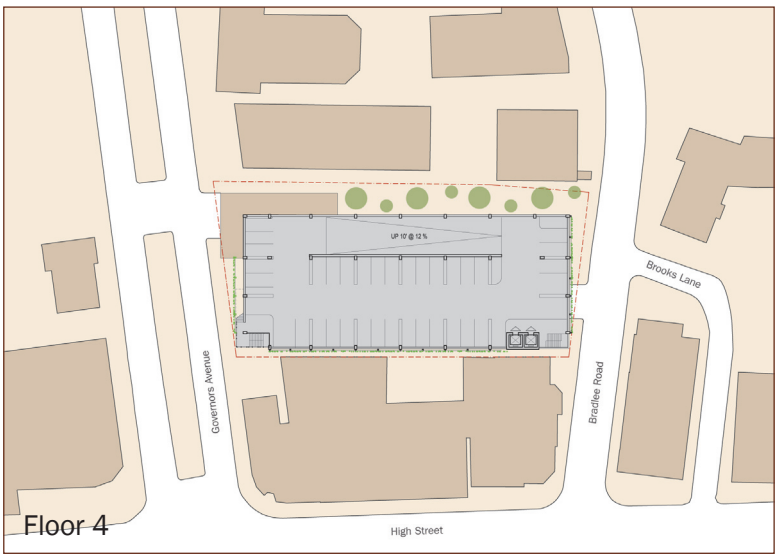
FACING PAGE: Entry from Governors Avenue.

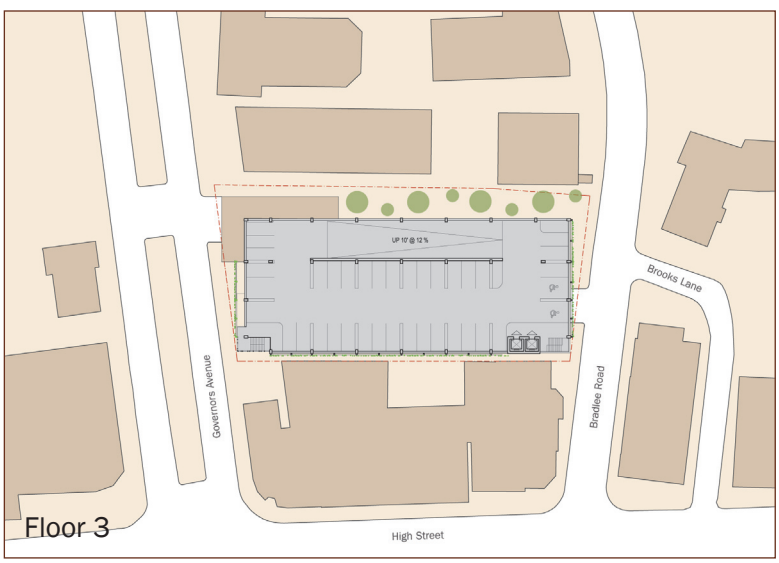
180 **cars**

22+ **bikes**


One-story entry pavilion from Governors Avenue
Possible bioswale area
Open straight-run stair behind green screen
Green screen
Glassy corner stair for safety, visual interest, and to provide an inviting entry into passageway
Entry to handicapped-accessible passageway
Governors Avenue
Bradlee Road
Brooks Lane
High Street
+41'
UP 10' @ 12 %
36'
Floor 2
0
25'
50'
100'


OPEN TO BELOW
UP 10' @ 12 %
Brooks Lane
Governors Avenue
Bradlee Road
High Street
Floor 5


UP 10' @ 12 %
Brooks Lane
Governors Avenue
Bradlee Road
High Street
Floor 4


UP 10' @ 12 %
Brooks Lane
Governors Avenue
Bradlee Road
High Street
Floor 3


0
25'
50'
100'

Green Garage
Conceptual Construction Cost
Estimate Summary

ITEM	TOTAL	$/SF
Sitework and Utilities	$84,000	n/a
Demolition	$14,450	n/a
Foundations	$431,980	$5.27
Superstructure (Steel with Precast Double-Tees)	$1,684,850	$20.55
Exterior Envelope	$1,246,730	$15.20
Interior Finishes	$537,700	$6.56
Equipment/Specialties	$31,100	$0.38
Elevator	$257,200	$3.14
Sprinkler	$268,300	$3.27
Plumbing	$137,650	$1.68
HVAC	$1,500	$0.02
Electrical and Photovoltaics	$1,088,400	$13.27
Subtotal	$5,783,860	$69.33
General Conditions (8%)	$462,709	$5.55
Subtotal	$6,246,569	$74.88
Contractor Fee (3%)	$187,397	$2.25
Subtotal	$6,433,966	$77.13
General Contractor Bond (1%)	$63,941	$0.77
Subtotal	$6,498,306	$77.90
Design/Estimating Contingency (10%)	$649,831	$7.79
Subtotal	$7,148,136	$85.69
Cost Escalation	Not Included	n/a
PROJECT TOTAL	$7,148,136	$85.69
	Cost/Parking Space	**$39,711.87**

See Appendix for expanded cost estimate.
Cost estimates prepared by KVAssociates, Inc.

Note: Mechanical ventilation costs are not included in the cost estimate for the Green Garage because it qualifies as an Open Garage per State Building Code and thus can be naturally ventilated. Please see Relevant Building Code Excerpts in the Appendix for further explanation.

VII.
Conclusions

Garage

Build Garage to Accommodate Future Development

A new parking garage in Medford Square is needed to accommodate future development and occupancy of existing vacant space in the western half of the Square, where parking utilization rates within a short walk are already at 85 percent. The eastern half of the Square has hundreds of vacant spaces already.

Locate in the West Square

A four-and-a-half-story municipal parking garage should be built on the existing surface parking lot located between Governors Avenue and Bradlee Road. Given the narrowness of the site, this garage will have a capacity of 178 parking spaces and a minimum of 22 bike spaces. This capacity is adequate to meet the future economic development of Medford Square if the garage is part of a larger parking management plan for the Downtown area.

Demand Distinctive Architecture

This new garage should be architecturally distinctive, so that it can contribute positively to the ongoing success of Medford Square. Solar panels and other sustainable features should be included in the ultimate design to elevate the garage to ground-breaking status within the Commonwealth.

Parking and Traffic

Improve Parking Management

New supply in the western half of the Square will not alone alleviate the on-street parking situation, especially if there is a fee to park at a garage. Improved parking management practices are necessary to moderate heavily utilized prime parking areas and incentivize the use of a new garage.

Improve Five-legged Intersection in Medford Square

With simple intersection improvements that reduce existing walking delays, the potential to access up to 90 additional vacant spaces exists today, without exceeding 85 percent utilization.

Institute Pricing Program

A demand-responsive priced parking management system in the Square can equitably assure available parking spaces for all user groups, including assuring long-term spaces for employees and convenient front-door spaces for customers.



Bioswale

Willamette River Park, Portland, Oregon

Bioswales are landscape elements that remove silt and pollution from surface runoff water. Built in 1996, this bioswale in Portland, Oregon, captures pollutant runoff and prevents it from entering the Willamette River.



Photovoltaic Trellis

Arizona State University Stadium Parking Structure, Mesa, Arizona

This solar panel trellis on top of a stadium parking lot produces approximately 1,425 megawatt hours per year. In addition to producing clean energy, the trellis provides shading for cars on the top level of the garage, and reduces the heat island effect of the structure.



Bicycle Parking

Forest Hills T Station, Boston, Massachusetts

In September 2009, a covered bicycle cage opened at the Forest Hills T Station in Boston's Jamaica Plain neighborhood. The bike cage has space for 100 bikes, it is enclosed by a chain-link fence, lit at night, and is equipped with security cameras.

Sustainability

To promote the image of the **City of Medford as a forward-thinking municipality**, and to capture additional (and varying) funding, it is recommended that the City maximize the number of sustainable features in the new garage. Both garage options include photovoltaic (solar) panels held above the top parking level on a lightweight steel trellis. In an initial analysis of quantities of photovoltaic panels and likely electric load, **the garage can strive to be a Zero Net Energy garage—the first of its kind in the Commonwealth of Massachusetts.** The solar-collecting structure has been located and dimensioned to be visible from the street, but set back enough from the upper parapet so that it does not dominate the visual image of the garage.

In addition to the solar panels, the design team for the garage should also look for sustainable approaches to storm water management and the specification of building systems. Both conceptual plans assumed at least 40 percent openings on the exterior envelope, to ensure that mechanical ventilation will not be necessary, and that daylighting will better contribute to the garage's illumination. The parcel's open space to the north of the garage structure may be a suitable location for a bioswale and/or a rain garden that can slow the rate of runoff entering the City's storm water sewer system. If the structure is branded as the "Green Garage," **it will be a groundbreaking project, bringing positive attention to the City.**

Recommended Sustainable Features

- **Bicycle parking** Bike parking is an important component of a municipal garage in Medford Square. The presence of secure public bike storage in the garage encourages community members to limit vehicular traffic and emissions impacts in Downtown Medford. The proposed garage plan includes a minimum of 22 spaces for covered and enclosed bicycle parking accessible from the Bradlee Road entrance.
- **Car-sharing spaces** Car-sharing services are widespread in the Boston area and their use is growing rapidly. Car-sharing spaces in the garage will provide local residents and businesses with an affordable and convenient mode of transportation. Increased use of car sharing services correlates to fewer cars owned and thus fewer cars parked on streets, less traffic congestion., and fewer emissions.
- **Electric car recharging stations** Fast-charging plugs for electric cars will support those community members who choose to drive emissions-free vehicles.
- **Bioswale in the gap between garage and northern neighbors** Providing a bioswale along the north edge of the garage will help mitigate the effects of storm water runoff from the garage. Soil and plants in this zone will filter pollutants out of the effluent before it returns to the groundwater supply. Additionally, storm water runoff will also provide any necessary irrigation to the shade-tolerant tree grove in this area.
- **LED lighting** LED light bulbs are long-lasting, durable, mercury-free, extremely energy efficient, cost-effective, and do no cause heat build-up.
- **Photovoltaic panels on roof** Photovoltaic panels supported on a steel trellis above the uppermost level of parking will supply the garage with the electricity it needs to light the structure at night and power the parking meter system. Because the garage will supply its own electrical needs through the rooftop solar collection system alone, the structure can strive to become Massachusetts's first Zero Net Energy garage.
- **40 percent minimum exterior openings on facades** Openings on the facade will allow daylight and natural ventilation in the garage. According to the Massachusetts building code, the garage will not require mechanical ventilation if at least 40 percent of the exterior is left open, thus greatly lowering the overall energy use of the structure.
- **Plantings** Plants provide shade and visual interest. The Green Garage's evergreen ivy screen will enliven Downtown Medford and provide a visual barrier between the residential building to the north and the garage. Evergreen ivy could also feature on the portion of the Brick Garage's solid facade that faces High Street. A grove of shade-tolerant trees lining the area between the garage and neighboring residential building will provide a visual and acoustic buffer.



1 Bicycle parking



2 Car-sharing spaces



3 Electric car recharging stations



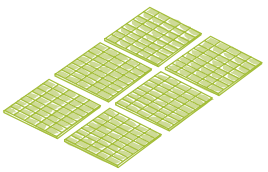
4 Bioswale



5 LED lighting



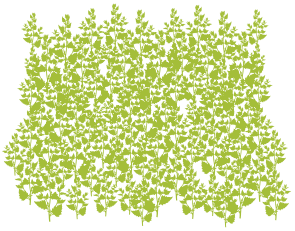
6 Photovoltaic panels



7 40 percent+ exterior openings on facade



8 Green screen



VIII.
Appendix

Bibliography

Previous Studies

***City of Medford, MA, Parking Advisory Committee Report*,** prepared by City of Medford Parking Advisory Committee and presented to Mayor Michael J. McGlynn, September 30, 2009.

***Medford Square Master Plan*,** prepared by Sasaki Associates, Inc., Abramson & Associates, Howard/Stein-Hudson Associates, Inc., and Todreas Hanley Associates, Inc., November 2005.

***Medford Square and the Mystic River: Reconnection, Revitalization, Redevelopment*,** prepared by Massachusetts Institute of Technology Department of Urban Studies and Planning, Community Growth and Land Use Planning, Fall 2006.

"Appendices," ***Medford Square and the Mystic River: Reconnection, Revitalization, Redevelopment*,** prepared by Massachusetts Institute of Technology Department of Urban Studies and Planning, Community Growth and Land Use Planning, Fall 2006.

"Parking Space Count," memo prepared by Sergeant Carroll, Medford Police Department, May 15, 2009.



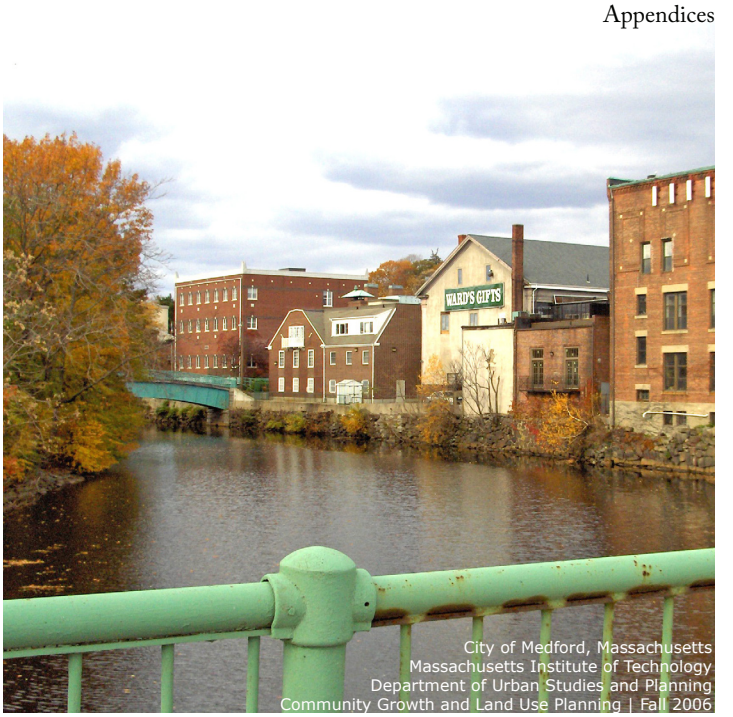
City of Medford, MA
PARKING ADVISORY COMMITTEE

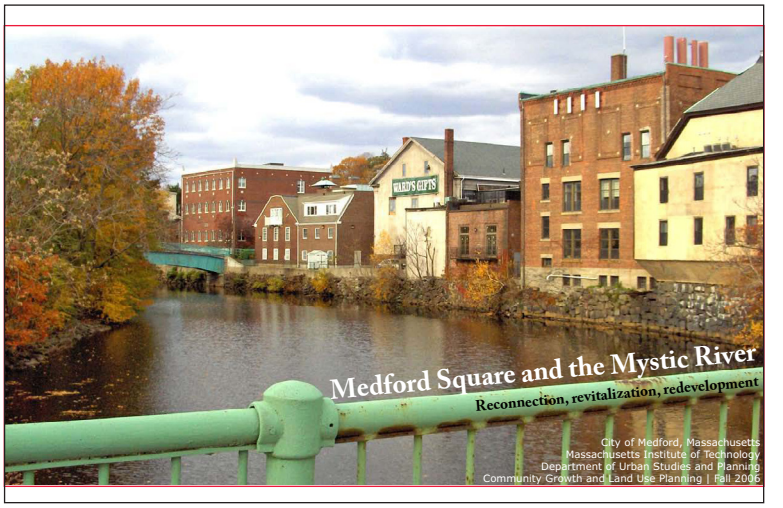
Report to Mayor Michael J. McGlynn

September 30, 2009

Medford Square and the Mystic River
Reconnection, revitalization, redevelopment

Appendices





Property Title Search

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crainen@rainenlaw.com

June 10, 2010

Attorney Lee S. Smith
MassDevelopment
33 Andrews Parkway
Devens, MA 01434

Re: 1 Governor's Avenue, Medford
Our File No. 40032

Dear Attorney Smith:

I have caused the title to the above-cited parcel of land to be examined at the Middlesex County Southern District Registry of Deeds from April 1, 1948 through the close of business on June 2, 2010. The Undersigned hereby certifies, based solely on an examination of said public record, that the Owners indicated below have a good, clear, and marketable fee simple title, of record, to said premises for the period of time in our examination, free from all encumbrances which would materially affect the title, subject to the matters indicated below. The title examination shows the following:

OWNERS:

City of Medford, by virtue of a Deed from Agamemnon Sophios recorded with said Registry of Deeds in Book 7267, Page 48.
Sheet 3

DESCRIPTION:

See Exhibit "A", annexed hereto and incorporated herein.
Sheet 3, 4, 5

June 10, 2010 Page 2
Attorney Smith
Re: 1 Governor's Avenue, Medford
Our File No. 40032

SAID ESTATE SUBJECT TO:

1. None.

REMARKS:

1. We performed title examinations on all of the abutting parcels, ran the plan indices and grantored the streets.

This Certificate of Title is based upon a title examination covering a period of time of at least fifty (50) years with the earliest instrument a Warranty or Quitclaim Deed which does not on its face suggest a defect in title, except as otherwise noted herein. The period of title search and this Certificate are based upon, and consistent with, the Title Standards promulgated by Real Estate Bar Association for Massachusetts.

This Certificate of Title shall be limited in its use to the addressee, for the immediate transaction contemplated hereunder, and does not extend to any subsequent conveyance, mortgage or other transaction, and is intended to be a privileged communication from Counsel.

Please note: We have not run any of the Lienholders in the public records for assignments or discharges which may not be marginally referenced. We do not search bankruptcies (except upon separate request for a PACER search) since those indices are no longer maintained at the Registries of Deeds.

Very truly yours,

RAINEN LAW OFFICE, P.C.

By:_____
SBR/kmr
encl.
crt40032

June 10, 2010
Attorney Smith
Re: 1 Governor's Avenue, Medford
Our File No. 40032

Exhibit "A"

The land in Medford, Middlesex County, Massachusetts:

Beginning at a point on the easterly sideline of Governors Avenue ninety-six and 49/100 (96.49) feet northerly from the intersection of said easterly sideline of Governors Avenue with the northerly sideline of High Street; thence

NORTHERLY	along said easterly sideline of Governors Avenue one hundred fifteen and 3/10 (115.3) feet to its intersection with the southerly location line of Lot A1 premises #15 Governors Avenue; thence
EASTERLY	along said last mentioned southerly location line and its extension easterly one hundred seventy-nine (179) feet more or less to an angle point; thence
SOUTHEASTERLY	sixty-three and 5/10 (63.5) feet more or less to a point on the westerly sideline of Bradlee Road; thence
SOUTHERLY	along said westerly sideline of Bradlee Road one hundred eight (108) feet to its intersection with the northerly location line of Lot C containing one thousand eight (1,008) square feet; thence
WESTERLY	by the above mentioned northerly location line of Lot C and two other lots containing four thousand six hundred eleven (4,611) square feet and eight thousand four hundred fifty-one (8,451) square feet being premises 47-53 inclusive and 55-61 inclusive High Street respectively a distance of two hundred fourteen and 87/100 (214.87) feet to the point of beginning.

The above described area includes Lot A2 containing eight thousand seven hundred twenty-three (8,723) square feet, Lot A3 containing eight thousand one hundred thirteen (8,113) square feet and the southerly portion of Lot A4 containing nine thousand twelve (9,012) square feet and is more particularly shown and described on Plan #16620 dated March 26, 1948 and signed by H.J. Nicholson, City Engineer, recorded with the Middlesex South Registry of Deeds as Plan No. 615 of 1948 in Book 7267, Page 48.

Said premises are also shown as New Lot A-5 on Plan recorded with said Registry of Deeds as Plan No. 412 of 1982 in Book 14601, Page End.

1

7267

46

3

Agamemnon Sophios

of Medford, Middlesex County, Massachusetts,
being unmarried, for consideration paid, grant to City of Medford

of Medford, Middlesex County, Massachusetts with quitclaim covenants

the land in Medford aforesaid

Beginning at a point on the easterly sideline of Governors Ave. ninety-six and forty-nine one-hundredths (96.49) feet northerly from the intersection of said easterly sideline of Governors Ave. with the northerly sideline of High Street; thence

NORTHERLY along said easterly sideline of Governors Ave. one hundred fifteen and thirty one-hundredths (115.30) feet to its intersection with the southerly location line of Lot A1 premises #15 Governors Avenue; thence

EASTERLY along said last mentioned southerly location line and its extension easterly one hundred seventy-nine (179) feet more or less to an angle point; thence

SOUTHEASTERLY sixty-three and five tenths (63.5) feet more or less to a point on the westerly sideline of Bradlee Road; thence

SOUTHERLY along said westerly sideline of Bradlee Road one hundred eight (108) feet to its intersection with the northerly location line of Lot C containing one thousand eight (1,008) square feet; thence

WESTERLY by the above mentioned northerly location line of Lot C and two other lots containing four thousand six hundred eleven (4,611) square feet and eight thousand four hundred fifty-one (8,451) square feet being premises 47-53 inclusive and 55-61 inclusive High Street respectively a distance of two hundred fourteen and eighty-seven one-hundredths (214.87) feet to the point of beginning.

The above described area includes Lot A2 containing eight thousand seven hundred twenty-three (8,723) square feet, Lot A3 containing eight thousand one hundred thirteen (8,113) square feet and the southerly portion of Lot A4 containing nine thousand twelve (9,012) square feet and is more particularly shown and described on Plan #16620 dated March 26,1948 and signed by H.J.Nicholson. City Engineer, to be recorded.

Said premises are also shown as New Lot A-5 on plan in Bk 14601 Page End.

Witness my hand and seal this 1st day of April 19 48.

Agamemnon Sophios

The Commonwealth of Massachusetts

Middlesex, ss. Medford, Mass., April 1st 19 48.

Then personally appeared the above named Agamemnon Sophios

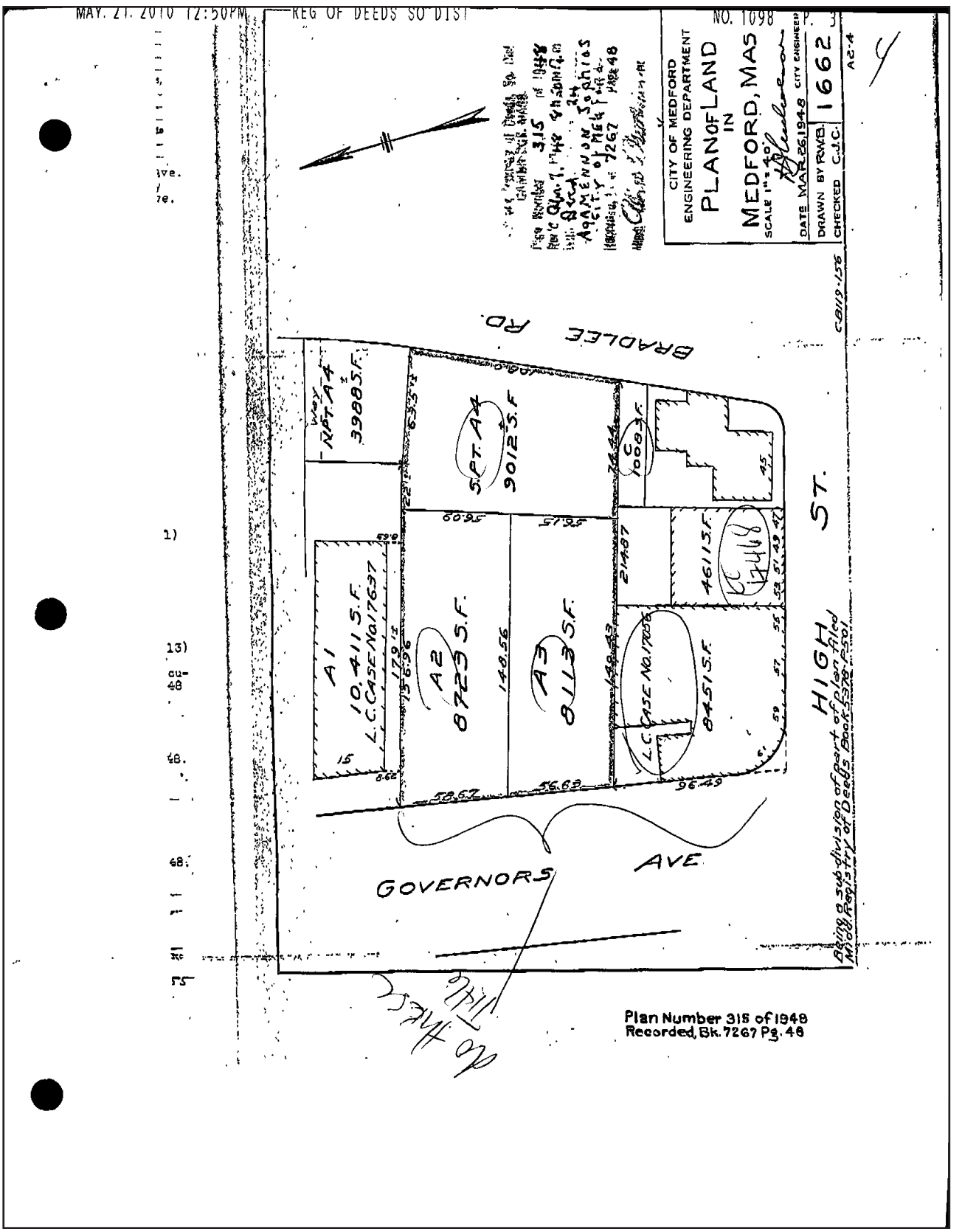
and acknowledged the foregoing instrument to be his free act and deed, before me,

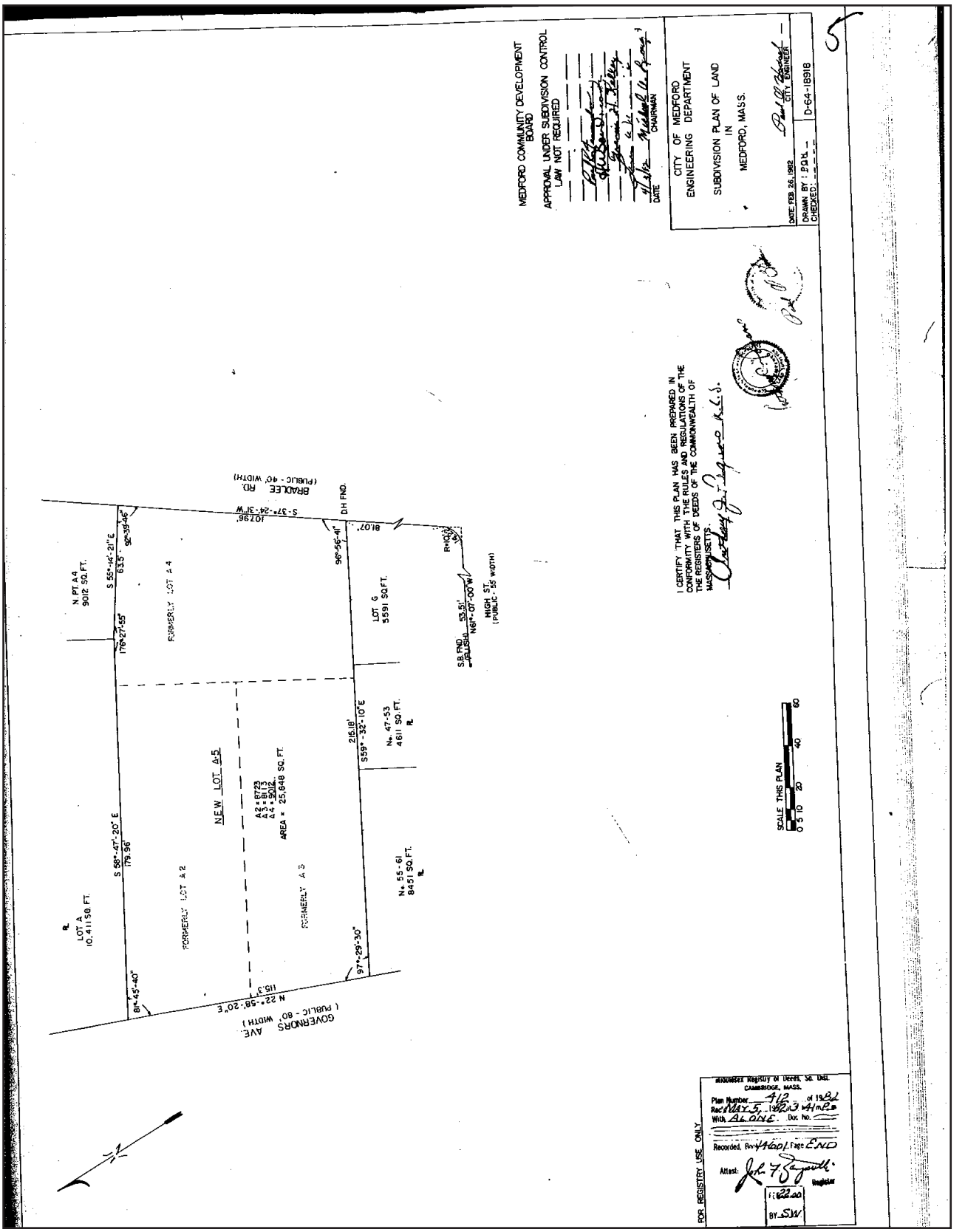
James W. Norton
Notary Public — Justice of the Peace

James W.Norton

My commission expires March 8 — 1955

Rec'd & entered for record April 7, 1948 at 8h. 56m. A.M. #24


MAY. 21. 2010 12:50PM REG OF DEEDS SO DIST NO. 1098
CITY OF MEDFORD
ENGINEERING DEPARTMENT
PLAN OF LAND
IN
MEDFORD, MASS
SCALE 1"=40'
DATE MAR. 26, 1948
DRAWN BY RWB
CHECKED C.J.C.
1662
BRADLEE RD.
PT. A4
9012 S.F.
A1
10,411 S.F.
L.C. CASE No. 17637
A2
8723 S.F.
A3
8113 S.F.
L.C. CASE No. 17638
8451 S.F.
4611 S.F.
HIGH ST.
GOVERNORS AVE
Plan Number 315 of 1948
Recorded, Bk. 7267 Pg. 48


MEDFORD COMMUNITY DEVELOPMENT BOARD
APPROVAL UNDER SUBDIVISION CONTROL LAW NOT REQUIRED
DATE
CHAIRMAN
CITY OF MEDFORD
ENGINEERING DEPARTMENT
SUBDIVISION PLAN OF LAND
IN
MEDFORD, MASS.
DATE: FEB. 26, 1982
DRAWN BY : PDL
CHECKED:
CITY ENGINEER
D-64-18918
I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.
SCALE THIS PLAN
0 5 10 20 40 60
FOR REGISTRY USE ONLY
Middlesex Registry of Deeds, So. Dist.
CAMBRIDGE, MASS.
Plan Number 412 of 1982
Rec'd MAY 5, 1982 3:41 P.M.
With ALONE Doc. No.
Recorded, Bk. 14601 Page END
Attest:
Register
11:22.00
BY SW
N. PT A4
9012 SQ. FT.
LOT A
10,411.50 FT.
LOT G
5591 SQ.FT.
NEW LOT A-5
AREA = 25,848 SQ. FT.
No. 47-53
4611 SQ. FT.
No. 55-61
8451 SQ. FT.
FORMERLY LOT A 4
FORMERLY LOT A 2
FORMERLY A 3
BRADLEE RD. (PUBLIC - 40' WIDTH)
GOVERNORS AVE (PUBLIC - 80' WIDTH)
HIGH ST. (PUBLIC - 66' WIDTH)
D.H. FND.
S.B. FND.
RHOAD
S 37°-24'-37" W 107.96'
S 55°-46'-21" E 63.5'
S 58°-47'-20" E 179.96'
N 22°-58'-20" E 115.31'
N 59°-32'-10" E 215.18'
N 68°-07'-00" W 53.51'
96°-56'-41"
97°-29'-30"
88°-45'-40"
92°-39'-46"
179.27'55"

Memorandum

Possible Permits Required

Medford Garage Feasibility Study

This list of possible permits for the Medford Garage includes all conceivable permits, although it is probable that some of those listed below will not be required.

Local Permits

- Site Plan Review/Approval: Medford Community Development Board
- Special Permit/Variance: Medford Board of Appeals
- Building Permit: Medford Building Department *
- Dewatering Permit: Medford Engineering Department or MWRA (Massachusetts Water Resources Authority) *
- Planning Board and/or ZBA approval
- Sign Design Certificate, Office of Community Development
- Application to Dig Permit, Public Works Commission
- Driveway Opening Application, Public Works Commission

Massachusetts Historical Commission

- Section 106 review, Determination of effect on Historical properties under MGL Ch9, S.26027C amended by Ch.254 (950CMR 71).

Massachusetts Water Resources Authority

- Construction Dewatering and Sewage Discharge Permits

MEPA

- ENF: Environmental Notification Form
- EIR: Environmental Impact Report

NEPA

» EIS: Environmental Impact Statement **

DEP

» Oil and Water Separator Permit
» Underground Storage Tank (UST) Permit (if there is to be any fuel on site)
» Surface Water and Groundwater Discharge Permits
» Approval of Plans and Specs pursuant to Federal and State Clean Air Acts (CH. 111) – Fuel Utilization Facility Approval (Limited Plan)
» Notice of Construction or Demolition
» Sewer Extension/Connection Permit
» Cross-connection Permit

State Department of Public Safety

» Flammable Storage License

If there is to be more than 1 acre of disturbance:

» EPA
» NPDES SWPPP (National Pollutant Discharge Elimination System / Storm Water Pollution Prevention Plan) *

* Construction Phase Permit, to be obtained by General Contractor of project

** May be required if Federal funds are used to finance the garage construction

Memo prepared by Utile,
in collaboration with
MassDevelopment and Samiotes
Consultants, Inc.

MEPA Threshold Review

MEMORANDUM

Re: Governors Ave. Garage / Medford SCI File # 10013.00

To: Utile, Inc.

From: Stephen Garvin, PE, LEED AP June 17, 2010

This memorandum is to apprise you of potential thresholds that may be exceeded for the above-mentioned project requiring a Massachusetts Environmental Policy Act (MEPA) filing. Some of these assumptions regarding the project thresholds are based on plans and data provided by the City of Medford, Utile, Inc, Nelson/Nygaard Consulting Associates and McPhail Associates.

MEPA review is not a permitting process. MEPA requires public study, disclosure, and development of feasible mitigation for a proposed project. It does not pass judgment on whether a project is environmentally beneficial, or whether a project can or should receive a particular permit. Those decisions are left to the permitting agencies. MEPA review occurs before permitting agencies act, to ensure that the agencies know the environmental consequences of their actions.

MEPA provides the mechanism through which this information collection and mitigation mandate is executed. The primary mechanism is known as an Environmental Impact Report – EIR, a lower threshold filing is an Environmental Notification Form (ENF). MEPA empowers the Secretary of Environmental Affairs to oversee the review process. The process is public and encourages comments from the public and from state, regional and local agencies.

301 CMR 11.00 establishes review thresholds that identify categories of Projects or aspects thereof of a nature, size or location that are likely, directly or indirectly, to cause damage to the Environment. Except when the Secretary requires fail-safe review, the review thresholds determine whether MEPA review is required. MEPA review is required when one or more review thresholds are met or exceeded and the subject matter of at least one review threshold is within MEPA jurisdiction.

MEPA filing deadlines are the 15th and last day of each month to make publication in the next *Environmental Monitor*.

The following summarizes the thresholds (pertinent to the project) required for MEPA review:

1) Land

a) ENF and Mandatory EIR

1. Direct alteration of 50 or more acres of land, unless the Project is consistent with an approved conservation farm plan or forest cutting plan or other similar generally accepted agricultural or forestry practices.
2. Creation of ten or more acres of impervious area.

The project is well under the EIR thresholds for Land.

Samiotes Consultants, Inc.
Civil Engineers + Land Surveyors

20 A Street
Framingham, MA 01701-4102

T 508.877.6688
F 508.877.8349

www.samiotes.com

b) ENF and Other MEPA Review if the Secretary So Requires

1. Direct alteration of 25 or more acres of land, unless the Project is consistent with an approved conservation farm plan or forest cutting plan or other similar generally accepted agricultural or forestry practices.
2. Creation of five or more acres of impervious area.
3. Conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth to any purpose not in accordance with Article 97.
4. Conversion of land in active agricultural use to nonagricultural use, provided the land includes soils classified as prime, state-important or unique by the United States Department of Agriculture, unless the Project is accessory to active agricultural use or consists solely of one single family dwelling.
5. Release of an interest in land held for conservation, preservation or agricultural or watershed preservation purposes.
6. Approval in accordance with M.G.L. c. 121A of a New urban redevelopment project or a fundamental change in an approved urban redevelopment project, provided that the Project consists of 100 or more dwelling units or 50,000 or more sf of non-residential space.
7. Approval in accordance with M.G.L. c. 121B of a New urban renewal plan or a major modification of an existing urban renewal plan.

The project is under the ENF threshold for Land.

2) Rare Species

a) ENF and Mandatory EIR. None

b) ENF and Other MEPA Review if the Secretary So Requires

1. Alteration of designated significant habitat.
2. Greater than two acres of disturbance of designated priority habitat, as defined in 321 CMR 10.02, that results in a take of a state-listed endangered or threatened species or species of special concern.

The project site is not within a designated significant habitat or a Priority Site of Rare Species Habitats according to the latest Natural Heritage Map.

3) Wetlands, Waterways and Tidelands

a) ENF and Mandatory EIR

1. Provided that a Permit is required:
   a. alteration of one or more acres of salt marsh or bordering vegetating wetlands; or
   b. alteration of ten or more acres of any other wetlands.
2. Alteration requiring a variance in accordance with the Wetlands Protection Act.
3. Construction of a New dam.
4. Structural alteration of an existing dam that causes an Expansion of 20% or any decrease in impoundment Capacity.
5. Provided that a Chapter 91 License is required, New non-water dependent use or Expansion of an existing non-water dependent structure, provided the use or structure occupies one or more acres of waterways or tidelands.

The project does not meet the EIR thresholds for Wetlands, Waterways and Tidelands

b) ENF and Other MEPA Review if the Secretary So Requires

1. Provided that a Permit is required:

a. alteration of coastal dune, barrier beach or coastal bank;
b. alteration of 500 or more linear feet of bank along a fish run or inland bank;
c. alteration of 1,000 or more sf of salt marsh or outstanding resource waters;
d. alteration of 5,000 or more sf of bordering or isolated vegetated wetlands;
e. New fill or structure or Expansion of existing fill or structure, except a pile-supported structure, in a velocity zone or regulatory floodway; or
f. alteration of one half or more acres of any other wetlands.

2. Construction of a New roadway or bridge providing access to a barrier beach or a New utility line providing service to a structure on a barrier beach.
3. Dredging of 10,000 or more cy of material.
4. Disposal of 10,000 or more cy of dredged material, unless at a designated in-water disposal site.
5. Provided that a Chapter 91 License is required, New or existing unlicensed non-water dependent use of waterways or tidelands, unless the Project is an overhead utility line, a structure of 1,000 or less sf base area accessory to a single family dwelling, a temporary use in a designated port area, or an existing unlicensed structure in use prior to January 1, 1984.
6. Construction, reconstruction or Expansion of an existing solid fill structure of 1,000 or more sf base area or of a pile-supported or bottom-anchored structure of 2,000 or more
sf base area, except a seasonal, pile-held or bottom-anchored float, provided the structure occupies flowed tidelands or other waterways.

The project is under the ENF threshold for Wetlands, Waterways, and Tidelands. The work proposed is not in a Velocity Zone or Regulatory Floodway according to the latest FEMA maps.

4) Water

a) ENF and Mandatory EIR

1. New withdrawal or Expansion in withdrawal of:
a. 2,500,000 or more gpd from a surface water source; or
b. 1,500,000 or more gpd from a groundwater source.
2. New interbasin transfer of water of 1,000,000 or more gpd or any amount determined significant by the Water Resources Commission.
3. Construction of one or more New water mains ten or more miles in length.
4. Provided that the Project is undertaken by an Agency, New water service to a municipality or water district across a municipal boundary through New or existing pipelines, unless a disruption of service emergency is declared in accordance with applicable statutes and regulations.

The project is well under the EIR thresholds for Water.

b) ENF and Other MEPA Review if the Secretary So Requires

1. New withdrawal or Expansion in withdrawal of 100,000 or more gpd from a water source that requires New construction for the withdrawal.
2. New withdrawal or Expansion in withdrawal of 500,000 or more gpd from a water supply system above the lesser of current system-wide authorized withdrawal volume or three-years' average system-wide actual withdrawal volume.
3. Construction of one or more New water mains five or more miles in length.
4. Construction of a New drinking water treatment plant with a Capacity of 1,000,000 or more gpd.
5. Expansion of an existing drinking water treatment plant by the greater of 1,000,000 gpd or 10% of existing Capacity.
6. Alteration requiring a variance in accordance with the Watershed Protection Act, unless the Project consists solely of one single family dwelling.

7. Non-bridged stream crossing 1,000 or less feet upstream of a public surface drinking water supply for purpose of forest harvesting activities.

The project is well under the ENF thresholds for Water.

5) Wastewater

a) ENF and Mandatory EIR

1. Construction of a new wastewater treatment and/or disposal facility with a Capacity of 2,500,000 or more gpd.
2. New interbasin transfer of wastewater of 1,000,000 or more gpd or any amount determined significant by the Water Resource Commission.
3. Construction of one or more new sewer mains ten or more miles in length.
4. Provided that the Project is undertaken by an Agency, New sewer service to a municipality or sewer district across a municipal boundary through New or existing pipelines, unless an emergency is declared in accordance with applicable statutes and regulations.
5. New discharge or Expansion in discharge of any amount of sewage, industrial waste water or untreated stormwater directly to an outstanding resource water.
6. New Capacity or Expansion in Capacity for storage, treatment, processing, combustion or disposal of 150 or more wet tpd of sewage sludge, sludge ash, grit, screenings, or other sewage sludge residual materials, unless the Project is an Expansion of an existing facility within an area that has already been sited for the proposed use in accordance with M.G.L. c. 21 or M.G.L. c. 83, section 6.

The project is well under the EIR thresholds for Wastewater.

b) ENF and Other MEPA Review if the Secretary So Requires

1. Construction of a New wastewater treatment and/or disposal facility with a Capacity of 100,000 or more gpd.
2. Expansion of an existing wastewater treatment and/or disposal facility by the greater of 100,000 gpd or 10% of existing Capacity.
3. Construction of one or more New sewer mains: a. that will result in an Expansion in the flow to a wastewater treatment and/or disposal facility by 10% of existing Capacity; b. five or more miles in length; or c. 1/2 or more miles in length, provided the sewer mains are not located in the right of way of existing roadways.
4. New discharges or Expansion in discharge:
   a. to a sewer system of 100,000 or more gpd of sewage, industrial waste water or untreated stormwater;
   b. to a surface water of:
      i. 100,000 or more gpd of sewage;
      ii. 20,000 or more gpd of industrial waste water; or
      iii. any amount of sewage, industrial waste water or untreated stormwater requiring a variance from applicable water quality regulations; or
   c. to groundwater of:
      i. 10,000 or more gpd of sewage within an area, zone or district established, delineated or identified as necessary or appropriate to protect a public drinking water supply, an area established to protect a nitrogen sensitive embayment, an area within 200 feet of a tributary to a public surface drinking water supply, or an area within 400 feet of a public surface drinking water supply;
      ii. 50,000 or more gpd of sewage within any other area;
      iii. 20,000 or more gpd of industrial waste water; or iv. any amount of sewage, industrial waste water or untreated stormwater requiring approval by the Department of Environmental Protection of a variance from Title 5 of the State Environmental Code for New construction.
5. New Capacity or Expansion in Capacity for: a. combustion or disposal of any amount of sewage sludge, sludge ash, grit, screenings, or other sewage sludge residual materials; or b. storage, treatment, or processing of 50 or more wet tpd of sewage sludge or sewage sludge residual materials.

The project is well under the ENF thresholds for Wastewater.

6) Transportation

a) ENF and Mandatory EIR

1. Unless the Project consists solely of an internal or on-site roadway or is located entirely on the site of a non-roadway Project: a. construction of a New roadway two or more miles in length; or b. widening of an existing roadway by one or more travel lanes for two or more miles.
2. New interchange on a completed limited access highway.
3. Construction of a new airport.
4. Construction of a new runway or terminal at an existing airport.
5. Construction of a new rail or rapid transit line along a New, unused or abandoned right-of-way for transportation of passengers or freight (not including sidings, spurs or other lines not leading to an ultimate destination).
6. Generation of 3,000 or more new adt (Average Daily Flow) on roadways providing access to a single location.
7. Construction of 1,000 or more new parking spaces at a single location.

The project does not meet the EIR thresholds for Traffic.

b) ENF and Other MEPA Review if the Secretary So Requires

1. Unless the Project consists solely of an internal or on-site roadway or is located entirely on the site of a non-roadway Project:
   a. construction of a New roadway one-quarter or more miles in length; or
   b. widening of an existing roadway by four or more feet for one-half or more miles.
2. Construction, widening or maintenance of a roadway or its right-of-way that will:
   a. alter the bank or terrain located ten more feet from the existing roadway for one-half or more miles, unless necessary to install a structure or equipment;
   b. cut five or more living public shade trees of 14 or more inches in diameter at breast height; or
   c. eliminate 300 or more feet of stone wall.
3. Expansion of an existing runway at an airport.
4. Construction of a New taxiway at an airport.
5. Expansion of an existing taxiway at Logan Airport.
6. Expansion of an existing terminal at Logan Airport by 100,000 or more sf.
7. Expansion of an existing terminal at any other airport by 25,000 or more sf.
8. Construction of New or Expansion of existing air cargo buildings at an airport by 100,000 or more sf.
9. Conversion of a military airport to a non-military airport.
10. Construction of a New rail or rapid transit line for transportation of passengers or freight.
11. Discontinuation of passenger or freight service along a rail or rapid transit line.
12. Abandonment of a substantially intact rail or rapid transit right-of-way.
13. Generation of 2,000 or more New adt on roadways providing access to a single location.
14. Generation of 1,000 or more New adt on roadways providing access to a single location and construction of 150 or more new parking spaces at a single location.
15. Construction of 300 or more new parking spaces at a single location.

The proposed project at this stage does not appear to meet the traffic threshold. The proposed parking garage will provide approximately 110 additional parking spaces (existing 70 spaces / proposed 180 spaces) to the site. According to Nelson/Nygaard (the traffic consultant for the study) by assuming a rough worst case scenario where 60% of the traffic arrives during peak hours, we can estimate an average daily trip. By assuming a typical value; where 10% of the "average daily trips" contributes to the peak traffic flow, they estimated the increase in "average

*daily trips" to be **660**. Since this estimate only amounts to 2/3rds the required threshold, it appears that the project will fall under the filing threshold.*

Once again – based upon the traffic consultants input, a key point in this preliminary estimate is that parking garages don't create trips, their surrounding land uses do. Real numbers would need full 48-hr tube counts at the driveways, plus an inflation factor for the new garage, backed up by real land use data. The surrounding buildings will govern the daily trips for the proposed parking garage.

Additional investigation with actual 48-hour parking counts may be needed to determine a more conclusive judgment. Existing and proposed parking summaries are included in the Parking Management Plan / Recommendations section of the Feasibility Study Report.

7) Energy

a) ENF and Mandatory EIR

1. Construction of a New electric generating facility with a Capacity of 100 or more MW.
2. Expansion of an existing electric generating facility by 100 or more MW.
3. Construction of a New fuel pipeline ten or more miles in length.
4. Construction of electric transmission lines with a Capacity of 230 or more kv, provided the transmission lines are five or more miles in length along New, unused or abandoned right of way.

This project will not be exceeding any of these thresholds.

b) ENF and Other MEPA Review if the Secretary So Requires

1. Construction of a New electric generating facility with a Capacity of 25 or more MW.
2. Expansion of an existing electric generating facility by 25 or more MW.
3. Construction of a New fuel pipeline five or more miles in length.
4. Construction of electric transmission lines with a Capacity of 69 or more kv, provided the transmission lines are one or more miles in length along New, unused or abandoned right of way.

This project will not be exceeding any of these thresholds.

8) Air

a) ENF and Mandatory EIR

Construction of a New major stationary source with federal potential emissions, after construction and the imposition of required controls, of: 250 tpy of any criteria air pollutant; 40 tpy of any HAP; or 100 tpy of any combination of HAPs.

This project will not be exceeding any of these thresholds.

b) ENF and Other MEPA Review if the Secretary So Requires

1. Construction of a New major stationary source with federal potential emissions, after construction and the imposition of required controls, of: 100 tpy of PM as PM10, CO, lead or SO2; 50 tpy of VOC or NOx; 10 tpy of any HAP; or 25 tpy of any combination of HAPs.
2. Modification of an existing major stationary source resulting in a "significant net increase" in actual emissions, provided that the stationary source or facility is major for the pollutant, emission of which is increased by: 15 tpy of PM as PM10; 100 tpy of CO; 40 tpy of SO2; 25 tpy of VOC or NOx; 0.6 tpy of lead.

We do not believe that the project will exceed these thresholds.

9) Solid and Hazardous Waste

a) ENF and Mandatory EIR.

New Capacity or Expansion in Capacity of 150 or more tpd for storage, treatment, processing, combustion or disposal of solid waste, unless the Project is a transfer station, is an Expansion of an existing facility within a validly site assigned area for the proposed use, or is exempt from site assignment requirements.

b) ENF and Other MEPA Review if the Secretary So Require.

1. New Capacity or Expansion in Capacity for combustion or disposal of any quantity of solid waste, or storage, treatment or processing of 50 or more tpd of solid waste, unless the Project is exempt from site assignment requirements.
2. Provided that a Permit is required in accordance with M.G.L. c. 21D, New Capacity or Expansion in Capacity for the storage, recycling, treatment or disposal of hazardous waste.

A parking garage should not be generating solid waste anywhere near the thresholds.

10) Historical and Archaeological Resources

a) ENF and Mandatory EIR. None

b) ENF and Other MEPA Review if the Secretary So Requires

Unless the Project is subject to a Determination of No Adverse Effect by the Massachusetts Historical Commission or is consistent with a Memorandum of Agreement with the Massachusetts Historical Commission that has been the subject of public notice and comment:
1. demolition of all or any exterior part of any Historic Structure listed in or located in any Historic District listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth; or
2. destruction of all or any part of any Archaeological Site listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth.

We do not believe that this project meets any of these thresholds.

11) Areas of Critical Environmental Concern

a) ENF and Mandatory EIR. None

b) ENF and Other MEPA Review if the Secretary So Requires

Any Project within a designated ACEC, unless the Project consists solely of one single family dwelling.

The project site is not within an Area of Critical Environmental Concern.

12) Regulations

a) ENF and Mandatory EIR. None

b) ENF and Other MEPA Review if the Secretary So Requires

Promulgation of New or revised regulations, of which a primary purpose is protecting against Damage to the Environment, that significantly reduce:

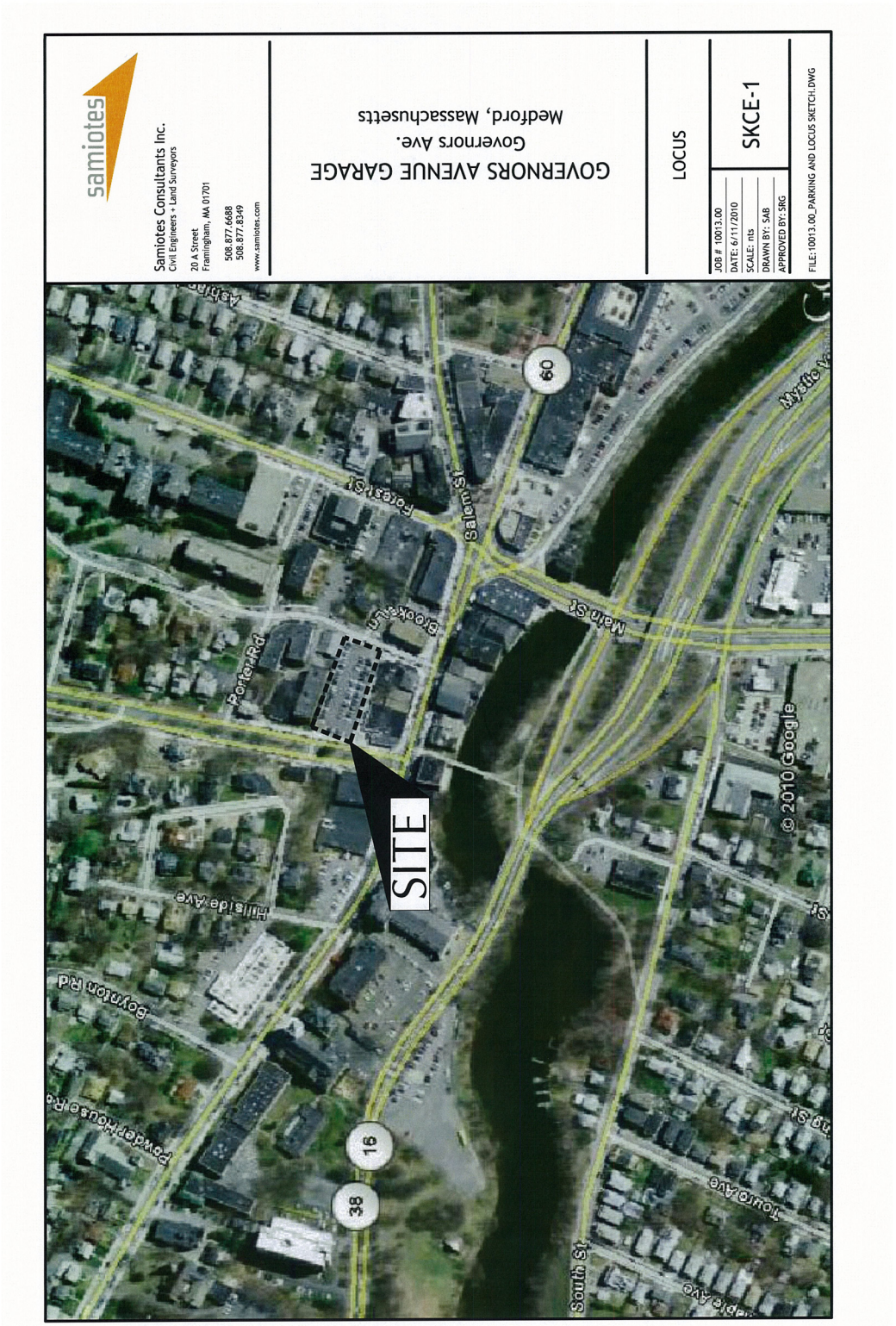
1. standards for environmental protection;
2. opportunities for public participation in permitting or other review processes; or
3. public access to information generated or provided in accordance with the regulations.

We hope these responses will allow you to narrow your preliminary MEPA review of this project. If there are other thresholds that are tripped, this would require State agencies to review the filing if a permit were being applied for (for example if a curb cut permit from MassHighway was required). If you have any comments or questions regarding this memo, please do not hesitate to call either Steven Buff (ext 16) or myself at (508) 877-6688 ext. 13.

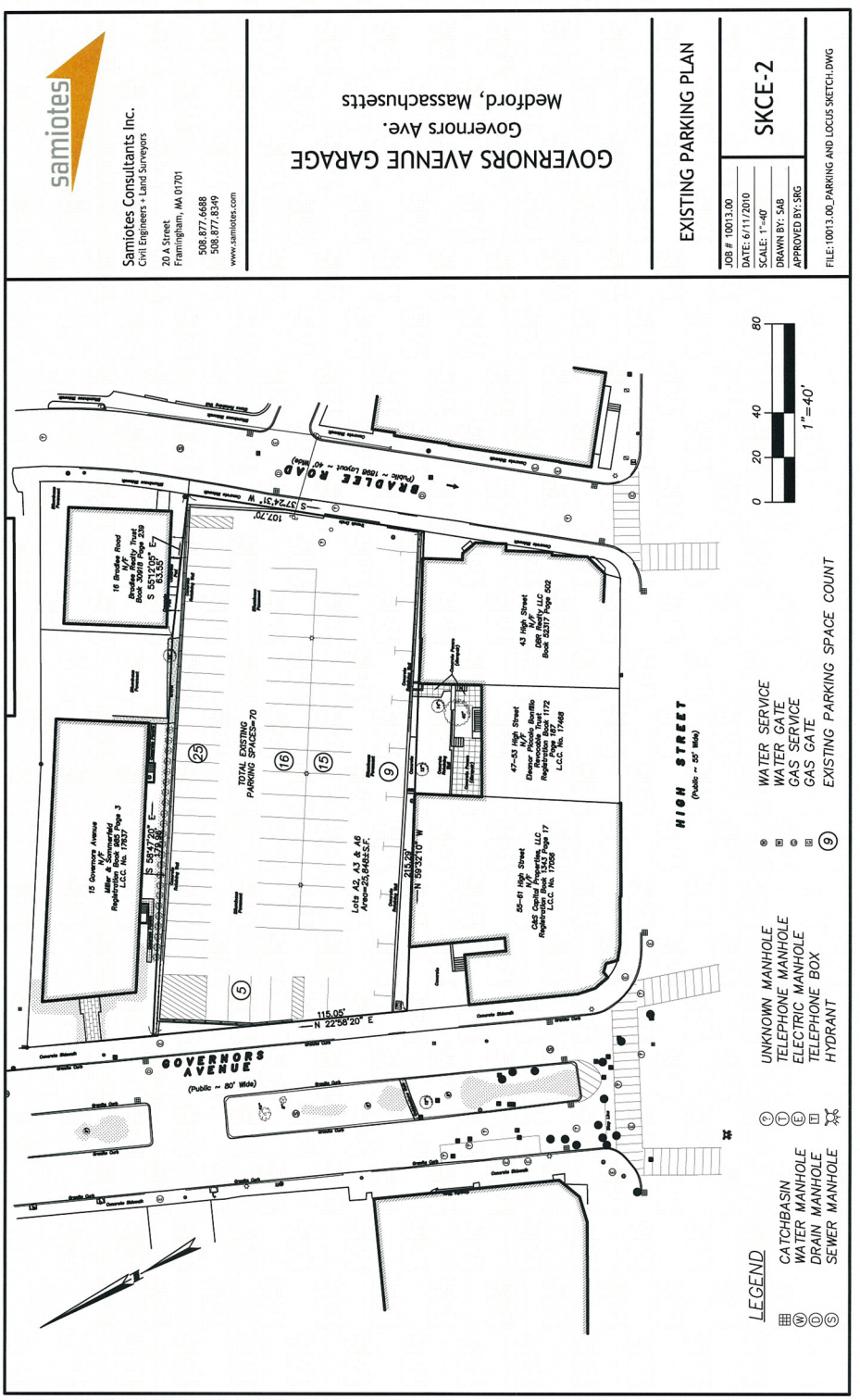
Enc.

srg: P:\Projects\2010\10013.00 Governors Ave Garage Medford\Documents\10013.00 MEPA Threshold Review Memo.doc

MEPA Review Sketches at 50% of original scale



MEPA Review Sketches at 50% of original scale



Environmental Report Overview

The complete environmental report can be found on the CD enclosed in this final report.

McPHAIL ASSOCIATES, INC

Geotechnical Engineers

April 23, 2010

Samiotes Consultants, Inc.
20 A Street
Framingham, MA 01701-4102

Attention: Mr. Stephen R. Garvin, P.E.

Reference: Proposed Medford Square Garage; Medford, Massachusetts
Phase I/II Environmental Site Assessment

Ladies and Gentlemen:

Enclosed herewith is our Phase I/II Environmental Site Assessment Report prepared for the property identified as the Proposed Medford Square Garage to be located off Governors Avenue in the Medford Square section of Medford, Massachusetts. The general site locus is shown on the enclosed **Figure 1,** and the boundaries of the subject site are shown on the enclosed **Figure 2.**

This report was prepared by McPhail Associates, Inc. in accordance with our proposal dated March 22, 2010 and the subsequent authorization of Samiotes Consultants, Inc., and is subject to the limitations contained in **Appendix A.**

This environmental site assessment was conducted in general accordance to the provisions contained in the following: (1) Massachusetts Oil and Hazardous Materials (OHM) Release Prevention and Response Act (MGL Chapter 21E); (2) Massachusetts Contingency Plan (MCP) 310 CMR 40.0000; and (3) ASTM E 1527-05 Standard Guide for Environmental Site Assessment: Phase I Environmental Site Assessment Process, as referred to in 40 CFR Part 312 (the All Appropriate Inquiries Rule).

The objective of the environmental investigation was to identify the potential presence of Recognized Environmental Conditions (RECs), as defined by ASTM, at the subject site or on nearby property that may pose a threat to the subject site. The objective of the Phase II portion of this environmental assessment was to assess the potential impacts to soil and groundwater due to the current and former presence of undertakers located adjacent to the southeastern portion of the subject site.

Our scope of work included the following: (i) a review of previous reports; (ii) a visual inspection of the subject site and reconnaissance of the surrounding area; (iii) a review of readily available information regarding the subject site history and usage; (iv) a review of readily available municipal, state and federal databases and records; (v) a subsurface investigation consisting of the performance of borings and the installation of a groundwater monitoring well; (vi) chemical analysis of selected soil samples obtained from our recent subsurface investigation; and (vii) chemical analysis of a groundwater sample obtained from a newly installed monitoring well. The conclusions presented herein and our professional opinions are based solely on the scope of work conducted. The scope of our Phase I/II Environmental Site Assessment did not include an investigation of the property for the presence of mold, urea formaldehyde foam insulation (UFFI), or other naturally occurring substances. Further, we did not perform a title or environmental lien search.

The subject site has a footprint of approximately 25,850 square feet and currently consists of an existing asphalt paved parking lot that is located between Governors Avenue to the west and Bradlee Road to the east. The southern side of the parking lot is bounded by the rear of commercial buildings that front onto High Street. The north end of the site is bordered by properties that contain a 5-story brick residential structure and a 1-story brick commercial structure.

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McPHAIL ASSOCIATES, INC
Geotechnical Engineers

A site reconnaissance of the subject site was performed by a representative of McPhail Associates, Inc. on April 9, 2010. Surficial observations of readily observable portions of the subject site did not identify RECs. Surficial observations of readily observable portions of nearby properties also did not identify RECs with respect to the subject site.

A review of historical records indicated that the subject site had been utilized for parking or occupied by vacant land since at least 1887. The historical records reviewed further indicated that the surrounding properties had been occupied by residential structures and commercial structures including undertakers since at least 1887. RECs were not identified during our review of historical records of the subject site and surrounding properties. However, as part of the Phase II portion of this environmental assessment, soil samples and a groundwater sample obtained from the recently conducted subsurface investigation were submitted fro chemical analysis to assess potential impacts to soil and groundwater due to the current and former presence of undertakers located in the vicinity of the subject site.

A search for records pertaining to the storage of oil and hazardous materials at the subject site and surrounding properties was conducted at the City of Medford municipal offices. The City of Medford Assessors' Office, City of Medford Engineering Office, City of Medford Building Department, City of Medford Board of Health, the City of Medford Fire Department Fire Prevention Bureau, and the Massachusetts Fire Marshall's on-line database did not contain records for the subject site or surrounding properties which would indicate the presence of an REC.

A review of local, state and federal databases searched by EDR of Milford, CT indicated that the subject site is not a DEP listed release site. Further, a review of the information provided in the available databases searched by EDR indicated that the majority of the properties located in the vicinity of the subject site do not pose a threat of impact to the subject site and are not considered RECs. However, the files for one (1) DEP listed release site located within 0.25 miles of the subject site were reviewed on the DEP's on-line database to assess if it posed a potential threat of impact to the subject site. Based on our review of readily available information, the release site reviewed is not considered likely to pose a threat of impact to the subject site and therefore is not considered an REC.

As indicated above, to further assess impacts to soil and groundwater due to the current and former presence of undertakers located to the southeast and downgradient of the subject site, soil samples obtained from our recently conducted subsurface investigation were submitted for chemical analysis for the presence of total metals and volatile organic compounds (VOCs) and a groundwater sample obtained from the newly installed monitoring well was submitted for chemical analysis for the presence of dissolved metals and VOCs. The results of the chemical analysis did not detect the presence of the above mentioned contaminants of concern at concentrations above the applicable MCP reporting thresholds. Therefore, based on these results, the current and former presence of undertakers located in the vicinity of the subject site is not considered an REC.

In conclusion, we have performed an Environmental Site Assessment in general conformance with the scope and limitations of ASTM E-1527-05 for the property identified as the Proposed Medford Square Garage to be located off Governors Avenue in the Medford Square section of Medford, Massachusetts. Any exceptions to, or deletions from this practice are described in the Data Gap section of this report. This assessment has revealed no evidence of a Recognized Environmental Condition in connection with the subject site.

McPHAIL ASSOCIATES, INC

Geotechnical Engineers

We trust that the above is sufficient for your present requirements. Should you have any questions concerning this report, please do not hesitate to call us.

Very truly yours,

McPHAIL ASSOCIATES, INC.

Amy M. Falconeiri

Thomas J. Fennick, P.E., L.S.P.

Enclosures
COVERS\5082\ Phase I ESA Ltr
AMF/tjf

Structural Review

SIMPSON GUMPERTZ & HEGER
Engineering of Structures and Building Enclosures

11 June 2010

Ms. Alyson Tanguay
Utile, Inc.
50 Summer Street
Boston, MA 02210

Project 100520 – Governors Avenue Garage, Medford, MA

1. BACKGROUND

You asked Simpson Gumpertz & Heger Inc. (SGH) to meet to review a proposed parking garage at the above-noted location and to provide a narrative on structural system and durability options for the proposed garage.

This letter is a summary of parking garage durability considerations, structural options for the garage, a recommended structural system, and recommended durability options.

2. DURABILITY OF PARKING STRUCTURES

Parking deck slabs in cold climates are exposed to significant quantities of deicing salts brought into the garage by vehicles. Salt-laden water from melting snow and ice permeates the top surface of the slab. Cracks allow salt-laden water to permeate the slab more quickly. Open joints and through-slab cracks allow salt-laden water to flow through the slab where it then permeates the underside of the slab and substructure elements in the vicinity of the leaking cracks and joints.

The alkalinity and high electrical resistivity of concrete normally provide excellent protection against reinforcing bar corrosion. However, chlorides from salts break down this protection and establish electrical potentials which result in corrosion of the reinforcing steel. The corrosion produces corrosion products (rust) which have a much greater volume that the original, stable metal. This expansion of the rust produces bursting tensile stresses within the concrete, causing delamination and eventually spalling of the concrete over the reinforcing steel.

In parking structures exposed to deicing salts, the chloride concentration at the depth of the reinforcing steel increases with time. There exists a threshold chloride level above which corrosion begins in the presence of oxygen and moisture, and with further ingress of chlorides and moisture, the corrosion continues an ever-increasing rate. The permeability of the concrete, the amount of concrete cover the reinforcing steel, and the presence or absence of other durability measures can greatly affect the time for the initiation of corrosion.

Scaling, which is the disintegration of the mortar portion of the concrete due to freezing and thawing while critically saturated, is another common problem in parking structures. Scaling eventually results in exposure of the coarse aggregate and pitting of the slab surface. Standing

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water and the associated use of deicing salts exacerbate scaling damage by increasing the rate of freeze-thaw cycling. A well-distributed system of entrained air voids maximizes concrete's resistance to freeze-thaw damage. Entrained air voids can prevent or reduce damage to concrete by providing expansion space for free water in the concrete as it expands upon cooling and freezing.

2.1 Minimum Durability Features Recommended by ACI

ACI 362.1R-97 – Guide for the Design of Durable Parking Structures – gives recommendations for the minimum level of corrosion protection for parking structures. ACI 362 defines five exposure zones representing different conditions of exposure to freezing water and salts: three general exposures and two coastal exposures. The general exposures are defined as follows:

- Zone I: Mild exposure where freezing is rare and salt is not used.
- Zone II: Moderate exposure areas where freezing occurs but deicer salts are rarely or never used.
- Zone III: Severe exposure areas that are commonly exposed to freezing and deicer salts.

The Governors Avenue garage is located in Zone III. For cast-in-place, non-prestressed/post-tensioned concrete structures with Zone III exposure, ACI 362 recommends the following minimum durability measures:

- 2 in. of clear cover over the reinforcing steel in the top of the slab (reducible to 1-1/2 in. if corrosion inhibitor or epoxy coated reinforcement is used).
- A maximum water-cement ratio of 0.40.
- Application of vehicular-traffic-bearing waterproofing.

Adequate drainage is also a necessary feature for durability. There must be an appropriate number of drains and a minimum slope to drain of 1/4 in./ft. Drains should be located at anticipated areas of maximum vertical displacement of the slab.

2.2 Durability Features for the Governors Avenue Garage

Since the parking decks of the garage are intended to serve a diverse population and are located in a densely populated area, major structural repairs involving removal and replacement of large portions of the decks will be not only an operational hardship but also very costly. Therefore, it is sensible to maximize the time to major structural repairs by including other corrosion protection measures in addition to the minimum durability requirements recommended by ACI 362.

We suggest the consideration of the following corrosion protection alternates, listed in order of increasing protection:

- Alternate 1 – 2 in. of cover over top reinforcement, maximum water/cement ratio of 0.40, epoxy coated reinforcement in the top of the slab (including beam top steel and stirrups), and vehicular-traffic-bearing membrane.

- Alternate 2 – 2 in. of cover over top reinforcement, maximum water/cement ratio of 0.40, epoxy coated reinforcement in the top of the slab (including beam top steel and stirrups) ,and corrosion inhibitor.

- Alternate 3 – 2 in. of cover over top reinforcement, maximum water/cement ratio of 0.40, all reinforcement epoxy coated, and corrosion inhibitor.

All of the alternates include 2 in. cover over top reinforcement, maximum water/cement ratio of 0.40, and epoxy coated top reinforcement, which together should provide excellent long-term protection to the top reinforcement.

The intent of the vehicular-traffic-bearing waterproofing in Alternate 1 is to control leakage, which is a nuisance (stained cars) and can cause corrosion of the reinforcement in the bottom of slabs, and beams and in the columns in the vicinity of the leaking cracks and joints.

The corrosion inhibitor in Alternate 2 is intended to provide additional protection to the epoxy coated steel at defects in the coating and to provide protection to the non-epoxy coated reinforcement at leaking cracks and joints.

The epoxy coating on the bottom reinforcement in Alternate 3 is intended to provide additional protection to that reinforcement at leaking cracks and joints.

Because vehicular-traffic-bearing membrane is prone to wear and to leakage at cracks and joints that reflect through the membrane, they can require frequent and costly maintenance. Consequently, we exclude the membrane from Alternates 2 and 3, which have other measures for protecting the bottom reinforcement at cracks and joints. Without membrane waterproofing, control of nuisance leakage will require diligent maintenance of sealant in cracks and joints. Membrane waterproofing can always be installed in the future if maintenance of sealant becomes intolerable.

We do not consider a roof over the garage to be a cost-effective measure to protect the garage from the effects of weather. The cost associated with the additional structure necessary is generally better expended on durability measures in the initial construction and ongoing maintenance.

3. STRUCTURAL SYSTEMS

3.1 Background

Structural systems commonly used for parking garages fall into the three general categories:

- Cast-in-place, non-prestressed/non-post-tensioned concrete. These structures are usually either entirely cast-in-place structures or cast-in-place concrete slabs on steel frames.

- Precast prestressed concrete. These structures are usually precast prestressed double tees on either concrete or steel frames. The flanges of the tees can serve as the riding surface (pretopped) or can be covered with a cast-in-place concrete topping.

- Cast-in-place, post-tensioned concrete. These structures are usually one-way post-tensioned slabs spanning between post-tensioned beams supported on cast-in-place concrete columns. Two-way systems without beams are also possible.

Each system category has general advantages and/or disadvantages in terms of both structural function and durability as described below:

- Cast-in-place, non-prestressed/non-post-tensioned concrete structures:

    - In the Boston construction market, this is the most typical type of concrete construction.
    - Cast-in-place slabs can be combined with a structural steel frame.
    - More capable than precast systems at accommodating unique geometry.
    - Not as capable as the other systems of accommodating the large span-to-depth ratios that are usually desirable in parking structures.
    - These structures are prone to cracking which results in leakage and deterioration of both the deck and substructure elements.

- Precast prestressed concrete double tees:

    - More capable of accommodating large span-to-depth ratios.
    - Since it is cast in a plant, precast concrete is usually of better quality (durability) than cast-in-place concrete; this is less of an advantage for systems that include a cast-in-place concrete topping.
    - Both the topped and pretopped systems rely on sealant joints between tees and elsewhere to control leakage and therefore can be prone to leakage and deterioration unless the joints are diligently maintained.
    - The depth of double tees usually prohibits their use in depth-constrained applications. Double tees are at least twice as deep as cast-in-place garage systems.
    - Double tees can span significantly longer distances than cast-in-place concrete systems. For this particular project, the spans of precast double tees would afford the designer the option of eliminating interior columns.
    - The range of enclosure options is limited; precast facade panels are the most typical enclosure/facade.

- Cast-in-place post-tensioned concrete:

    - Can accommodate larger span-to-depth ratios.
    - Slabs are typically thinner than conventionally cast-in-place concrete.
    - Post-tensioning minimizes cracking and thereby controls leakage and related deterioration.
    - Post-tensioning effects are reduced by the restraint provided by shear walls.

- End anchorages in post-tensioned concrete systems require special detailing and coordination for facade connections.

Each system category generally has advantages and/or disadvantages in terms of constructability as described below:

- Cast-in-place concrete:
  - Requires formwork, shoring, and reshoring.
  - Cast-in-place slabs on steel frames require much less, if any (metal from deck), formwork.
- Precast prestressed double tees:
  - Eliminates shoring and formwork.
  - Eliminates on-site concrete placement for pretopped systems.
- Post-tensioned concrete:
  - Requires formwork.
  - Monitoring of the concrete strength for readiness for stressing is critical.
  - The stressing operation.

3.2 Structural System Recommendations for the Governors Avenue Garage

The cast-in-place concrete, two-way structural system is the most appropriate choice for the following reasons.

- The disadvantages of post-tensioning – extra construction activity (post-tensioning), special detailing requirements, restraint of creep shortening, and the potential vulnerability of the post-tensioning anchorages in the foundation walls – far outweigh the advantage of improved crack control.
- The pretopped double tee system can not resist the high diaphragm forces and will be prone to leakage due to reliance on the large length of sealant joints for leakage control.
- The topped double tee system will require a thick and highly reinforced concrete topping to resist diaphragm forces and will be prone to leakage due to reliance on the large length of sealant joints for leakage control.
- The double tee system will be too deep a structural system.
- Cast-in-place concrete slabs on steel framing may require fireproofing and special corrosion protection of the steel such as galvanizing.

The current architectural plans for the garage indicate the following:

- Ramp
    - 27 ft single span between columns transverse to the direction of travel.
    - 29 ft continuous spans between columns parallel to the direction of travel.
    - Approximate slope of 12%.

During final design, it is reasonable to expect these spans to increase/decrease between 1 and 3 ft. The proposed slab geometry listed below can accommodate this range of spans for cast-in-place concrete flat plate construction.

- Parking deck:
    - 15 ft – 26 ft – 15 ft, three span condition between columns transverse to the direction of travel.
    - 29 ft continuous spans between columns parallel to the direction of travel.
    - This slab is presumed to be nominally flat with pitch of 1/4 in./ft (minimum) to drains.

Typical parking garage column bay spacing, without site or other constrictions, is typically in this range. During final design, it is reasonable to expect these spans to increase/decrease between 1 and 3 ft. The proposed slab geometry listed below can accommodate this range of spans for cast-in-place concrete flat plate construction.

Cost efficiency is developed by reducing floor-to-floor height. This reduces the required area of vertical formwork, reduces the area of facade, and reduces the lateral loads the structure must resist due to lower weight and lower height.

For planning, floor-to-floor height between 8.5 ft and 10ft should be considered for this garage. The final heights will depend on entry clear height requirements for emergency vehicles, type and size of signage, type and location of lighting, location and path of drain bodies and pipes, etc.

For the size and spans of the Governors Avenue garage, we recommend that the following member geometry be considered for any construction budget estimates.

- Cast-in-place concrete flat slabs:
    - 11 in. – 12 in. thick slabs
    - #6 steel reinforcing bars at 10 in. o/c, both ways, top and bottom.
    - Decon “stud rails” shear heads at columns.
- Typical column size:
    - 20 in. x 20 in. square columns.
    - Alternately, 14 in. x 32 in. rectangular columns.

- Lateral load resistance:
    - 10 in. thick, cast-in-place concrete shear walls.
    - 24 in. x 24 in. wall boundary elements (integral columns).
    - Assume three walls in each direction of the garage; final locations to be coordinated.

Sincerely yours,



Matthew H. Johnson
Associate Principal
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Preliminary Cost Estimating Overview

Prepared by KVAssociates, Inc.

MassDevelopment
Governors Avenue Parking Garage - Brick Garage Option
Conceptual Construction Cost Estimate Summary

	ITEM	TOTAL	$/SF FOR GARAGE
1	Sitework and Utilities	$84,000	n/a
2	Demolition	$14,450	n/a
3	Foundations	$446,480	$5.51
4	Superstructure (Cast-in-Place Concrete)	$1,884,620	$23.27
5	Exterior Envelope	$1,288,660	$15.91
6	Interior Finishes	$433,510	$5.35
7	Equipment/Specialties	$31,060	$0.38
8	Elevator	$257,200	$3.18
9	Sprinkler	$264,300	$3.26
10	Plumbing	$136,150	$1.68
11	HVAC	$1,500	$0.02
12	Electrical and Photovoltaics	$1,084,900	$13.39
13			
14	**Subtotal**	**$5,926,830**	**$71.96**
15			
16	General Conditions (8%)	$474,146	$5.76
17	**Subtotal**	**$6,400,976**	**$77.71**
18			
19	Contractor Fee (3%)	$192,029	$2.33
20	**Subtotal**	**$6,593,006**	**$80.04**
21			
22	General Contractor Bond (1%)	$65,930	$0.80
23	**Subtotal**	**$6,658,936**	**$80.84**
24			
25	Design/Estimating Contingency (10%)	$665,894	$8.08
26	**Subtotal**	**$7,324,829**	**$88.93**
27			
28	Cost Escalation	Not Included	n/a
29			
	PROJECT TOTAL	**$7,324,829**	**$88.93**
		Cost/Parking Space	**$41,150.73**

Estimate for: MassDevelopment

Governors Avenue Garage
Medford , MA
Brick Garage Option

6/14/10

Prepared by KVAssociates, Inc.

Ref Dwgs: Conceptual drawings by Utile Inc., undated
Gross Sq Ft: 81,000 SF

	ITEM	QUANTITY	UNIT	UNIT COST	TOTAL	NOTES (See Below)
1	**Sitework and Utilities:**					
2	Water Service	1	allow	$ 10,000.00	$ 10,000.00	
3	Storm Drain Tie-in	1	allow	$ 10,000.00	$ 10,000.00	
4	Electric Service Tie-in	1	allow	$ 10,000.00	$ 10,000.00	
5	Sidewalks at Perimeter Including Subbase	900	sf	$ 6.00	$ 5,400.00	
6	Wood Boardwalk with Footings	1,100	sf	$ 30.00	$ 33,000.00	
7	Reset Existing Curbs	400	lf	$ 14.00	$ 5,600.00	
8	Trees and Shrubs	1	allow	$ 10,000.00	$ 10,000.00	
9	Stormwater Retention System	Not Included				
10	Street Lighting	Excluded				
11						
12	**Subtotal**				**$ 84,000.00**	
13						
14	**Demolition:**	Not Included				
15	Strip Existing Parking Lot	2,700	sy	$ 3.50	$ 9,450.00	
16	Remove Existing Light Poles and Utility Poles	1	allow	$ 5,000.00	$ 5,000.00	
17						
18	**Subtotal**				**$ 14,450.00**	
19						
20	**Foundations:**					
21	General Excavation	4,100	cy	$ 6.00	$ 24,600.00	
22	Backfill - General	1,500	cy	$ 8.00	$ 12,000.00	
23	Gravel fill under slab (12")	680	cy	$ 30.00	$ 20,400.00	
24	Miscellaneous Trenching for Piping	400	lf	$ 15.00	$ 6,000.00	
25	Dispose of Overburden to Unlined Landfill	2,600	cy	$ 25.00	$ 65,000.00	
26	Miscellaneous Dewatering	1	allow	$ 10,000.00	$ 10,000.00	
27	Spread Footings and Strip Footings	80	cy	$ 460.00	$ 36,800.00	
28	Frost Wall	57	cy	$ 440.00	$ 25,080.00	
29	Perimeter Retaining Wall and Footing	290	cy	$ 520.00	$ 150,800.00	
30	Slab on Grade	14,300	sf	$ 6.00	$ 85,800.00	
31	Elevator Pit	1	allow	$ 10,000.00	$ 10,000.00	
32						
33	**Subtotal**				**$ 446,480.00**	
34						
35	**Superstructure:**					
36	**Concrete Formwork:**					
37	- Columns (18" x 24")	8,950	sf	8.00	$ 71,600.00	
38	- Shear Walls (12")	7,360	sf	12.00	$ 88,320.00	
39	- Flat Slabs (10")	65,200	sf	10.00	$ 652,000.00	
40	Ready Mix Material w/ Corrosion Inhibitor and Place	2,280	cy	190.00	$ 433,200.00	
41	**Rebar Furnish and Install:**					
42	- Columns (400#/ea)	35	tons	1,600.00	$ 56,000.00	
43	- Shear Walls (10#/sf)	19	tons	1,600.00	$ 29,600.00	
44	- Flat Slabs (7#/sf)	228	tons	1,600.00	$ 364,800.00	1
45	Concrete Slab Finishing	65,200	sf	$ 0.75	$ 48,900.00	

Estimate for: MassDevelopment

Governors Avenue Garage
Medford , MA
Brick Garage Option

6/14/10

Prepared by KVAssociates, Inc.

Ref Dwgs: Conceptual drawings by Utile Inc., undated
Gross Sq Ft: 81,000 SF

	ITEM	QUANTITY	UNIT	UNIT COST	TOTAL	NOTES (See Below)
46	Concrete Testing and Inspection	1	allow	$ 50,000.00	$ 50,000.00	
47	Steel Support (Galv.) for Photovoltaics (allow 6#/sf)	24	tons	$ 2,800.00	$ 67,200.00	
48	Elevator - Miscellaneous Metals	1	allow	$ 5,000.00	$ 5,000.00	
49	Concrete Landings at Elevator/Stairs	3,000	sf	$ 6.00	$ 18,000.00	
50						
51	**Subtotal**				**$ 1,884,620.00**	
52						
53	**Exterior Envelope:**					
54	Glass Curtainwall Stair Cladding	1,680	sf	$ 70.00	$ 117,600.00	
55	Relieving Angles	860	lf	$ 50.00	$ 43,000.00	
56	Loose Lintels at Corbelled Header	300	lf	$ 20.00	$ 6,000.00	
57	Precast Sills	1,340	lf	$ 70.00	$ 93,800.00	
58	Precast Headers	960	lf	$ 60.00	$ 57,600.00	
59	Precast Cap at Top Spandrel	430	lf	$ 70.00	$ 30,100.00	
60	Stainless Steel Metal Frames (at masonry openings)	97	ea	$ 900.00	$ 87,300.00	
61	Steel Railings at North Elevation - Painted	600	lf	$ 90.00	$ 54,000.00	
62	CMU False Columns	740	sf	$ 20.00	$ 14,800.00	
63	CMU Spandrel Back-up	5,400	sf	$ 18.00	$ 97,200.00	
64	CMU Elevator Hoistway	3,025	sf	$ 20.00	$ 60,500.00	
65	Waterproof CMU and Concrete at Brick and Stone	15,840	sf	$ 3.00	$ 47,520.00	
66	Brick Veneer	15,260	sf	$ 32.00	$ 488,320.00	
67	Stone Base (3 sides)	580	sf	$ 60.00	$ 34,800.00	
68	Canopy at Exits to Street (Glass and Steel)	720	sf	$ 60.00	$ 43,200.00	
69	Doors - Hollow Metal	2	pr	$ 2,500.00	$ 5,000.00	
70	Caulking and Flashings for Masonry	15,840	sf	$ 0.50	$ 7,920.00	
71						
72	**Subtotal**				**$ 1,288,660.00**	
73						
74	**Interior Finishes:**					
75	Stairs- Metal Pan with Concrete Fill	8	flgts	$ 6,000.00	$ 48,000.00	
76	Stair Railings	8	flgts	$ 6,000.00	$ 48,000.00	
77	Railings at Vehicle Ramps	500	lf	$ 80.00	$ 40,000.00	
78	Electric Room - CMU and Door	1	ea	$ 8,000.00	$ 8,000.00	
79	CMU Walls at Storage	620	sf	$ 18.00	$ 11,160.00	
80	Metal Door and Frame at Storage	1	pr	$ 1,800.00	$ 1,800.00	
81	Painting of Stair Pans and Stair Rails	8	flgts	$ 1,000.00	$ 8,000.00	
82	Traffic Deck Coating	73,700	sf	$ 3.50	$ 257,950.00	
83	Concrete Sealer	4,000	sf	$ 0.50	$ 2,000.00	
84	Paint Railings at Ramps	500	lf	$ 10.00	$ 5,000.00	
85	Paint CMU at Elevator Shaft	1,800	sf	$ 2.00	$ 3,600.00	
86						
87	**Subtotal**				**$ 433,510.00**	
88						
89	**Equipment/Specialties:**					
	Photovoltaic System Gutters		allow	$ 10,000.00	$ 10,000.00	

Estimate for: MassDevelopment

Governors Avenue Garage
Medford , MA
Brick Garage Option

6/14/10

Prepared by KVAssociates, Inc.

Ref Dwgs: Conceptual drawings by Utile Inc., undated
Gross Sq Ft: 81,000 SF

	ITEM	QUANTITY	UNIT	UNIT COST	TOTAL	NOTES (See Below)
90	Bike Racks		None			
91	Signage	1	allow	$ 15,000.00	$ 15,000.00	
92	Fire Extinguishers and Brackets	10	ea	$ 250.00	$ 2,500.00	
93	Parking Space Striping	178	spcs	$ 20.00	$ 3,560.00	
94	Parking Controls - Gates, Card Reader, Loop Detectors	Not Included				
95						
96	**Subtotal**				**$ 31,060.00**	
97	**Elevator:**					
98	5 - Stop Machine Roomless	2	ea	$ 125,000.00	$ 250,000.00	
99	12 Month Maintenance	12	mos	$ 600.00	$ 7,200.00	
100						
101	**Subtotal**				**$ 257,200.00**	
102						
103	**Sprinkler:**					
104	Main Service/Check Valve	1	allow	$ 7,500.00	$ 7,500.00	
105	Sprinkler Heads and Distribution	64,200	sf	$ 4.00	$ 256,800.00	
106	Fire Pump	Assume Not Needed				
107						
108	**Subtotal**				**$ 264,300.00**	
109						
110	**Plumbing:**					
111	Deck Drainage	66,700	sf	$ 1.50	$ 100,050.00	
112	Slab on Grade Drainage	14,300	sf	$ 2.00	$ 28,600.00	
113	Gas/Sand Seperator	1	allow	$ 7,500.00	$ 7,500.00	
114						
115	**Subtotal**				**$ 136,150.00**	
116						
117	**HVAC:**					
118	Storage Room - Unit Heater	1	ea	$ 1,500.00	$ 1,500.00	
119						
120	**Subtotal**				**$ 1,500.00**	
121						
122	**Electrical:**					
123	Main Electric Service	1	allow	$ 25,000.00	$ 25,000.00	
124	Lighting - Covered Levels	64,200	sf	$ 2.50	$ 160,500.00	
125	Lighting - Upper Level and Upper Ramp	16,800	sf	$ 3.00	$ 50,400.00	
126	Exterior Lighting	1	allow	$ 10,000.00	$ 10,000.00	
127	Miscellaneous Convenience Power	5	lvls	$ 2,500.00	$ 12,500.00	
128	Fire Alarm	81,000	sf	$ 1.00	$ 81,000.00	
129	Automatic Venting Damper for Elevator Hoistway	1	ea	$ 3,000.00	$ 3,000.00	
130	Emergency Battery Pack Lighting - Stairwells	10	lvls	$ 350.00	$ 3,500.00	
131	Power for Elevators	2	ea	$ 7,500.00	$ 15,000.00	
132	Power to Parking Controls	2	loc	$ 2,000.00	$ 4,000.00	
133	Security Systems		None			
134	Photovoltaic System	120,000	Watt	$ 6.00	$ 720,000.00	

Prepared by KVAssociates, Inc.

Estimate for: MassDevelopment
Governors Avenue Garage
Medford , MA
Brick Garage Option

6/14/10

Ref Dwgs: Conceptual drawings by Utile Inc., undated
Gross Sq Ft: 81,000 SF

	ITEM	QUANTITY	UNIT	UNIT COST	TOTAL	NOTES (See Below)
135						
136	**Subtotal**				**$ 1,084,900.00**	
137						

Note: Mechanical ventilation costs are not included in the cost estimate for the Brick Garage because it qualifies as as Open Garage per State Building Code and thus can be naturally ventilated. Please see Relevant Building Code Excerpts in the Appendix for further explanation.

KVAssociates, Inc.
303 Congress Street
Boston, MA 02210

Prepared by KVAssociates, Inc.

6/30/2010

MassDevelopment
Governors Avenue Parking Garage - Green Garage Option
Conceptual Construction Cost Estimate Summary

	ITEM	TOTAL	$/SF FOR GARAGE
1	Sitework and Utilities	$84,000	n/a
2	Demolition	$14,450	n/a
3	Foundations	$431,980	$5.27
4	Superstructure (Steel with Precast Double-Tees	$1,684,850	$20.55
5	Exterior Envelope	$1,246,730	$15.20
6	Interior Finishes	$537,700	$6.56
7	Equipment/Specialties	$31,100	$0.38
8	Elevator	$257,200	$3.14
9	Sprinkler	$268,300	$3.27
10	Plumbing	$137,650	$1.68
11	HVAC	$1,500	$0.02
12	Electrical and Photovoltaics	$1,088,400	$13.27
13			
14	**Subtotal**	**$5,783,860**	**$69.33**
15			
16	General Conditions (8%)	$462,709	$5.55
17	**Subtotal**	**$6,246,569**	**$74.88**
18			
19	Contractor Fee (3%)	$187,397	$2.25
20	**Subtotal**	**$6,433,966**	**$77.13**
21			
22	General Contractor Bond (1%)	$64,340	$0.77
23	**Subtotal**	**$6,498,306**	**$77.90**
24			
25	Design/Estimating Contingency (10%)	$649,831	$7.79
26	**Subtotal**	**$7,148,136**	**$85.69**
27			
28	Cost Escalation	Not Included	n/a
29			
	PROJECT TOTAL	**$7,148,136**	**$85.69**
		Cost/Parking Space	**$39,711.87**

Estimate for: MassDevelopment

Governors Avenue Garage
Medford , MA
Green Garage Option

6/14/10

Prepared by KVAssociates, Inc.

Ref Dwgs: Conceptual drawings by Utile Inc., undated
Gross Sq Ft: 82,000 SF

	ITEM	QUANTITY	UNIT	UNIT COST	TOTAL	NOTES (See Below)
1	**Sitework and Utilities:**					
2	Water Service	1	allow	$ 10,000.00	$ 10,000.00	
3	Storm Drain Tie-in	1	allow	$ 10,000.00	$ 10,000.00	
4	Electric Service Tie-in	1	allow	$ 10,000.00	$ 10,000.00	
5	Sidewalks at Perimeter Including Subbase	900	sf	$ 6.00	$ 5,400.00	
6	Wood Boardwalk with Footings	1,100	sf	$ 30.00	$ 33,000.00	
7	Reset Existing Curbs	400	lf	$ 14.00	$ 5,600.00	
8	Trees and Shrubs	1	allow	$ 10,000.00	$ 10,000.00	
9	Plantings for Green Screen	in Exterior Envelope				
10	Stormwater Retention System	Not Included				
11	Street Lighting	Excluded				
12						
13	**Subtotal**				**$ 84,000.00**	
14						
15	**Demolition:**	Not Included				
16	Strip Existing Parking Lot	2,700	sy	$ 3.50	$ 9,450.00	
17	Remove Existing Light Poles and Utility Poles	1	allow	$ 5,000.00	$ 5,000.00	
18						
19	**Subtotal**				**$ 14,450.00**	
20						
21	**Foundations:**					
22	General Excavation	4,100	cy	$ 6.00	$ 24,600.00	
23	Backfill - General	1,500	cy	$ 8.00	$ 12,000.00	
24	Gravel fill under slab (12")	680	cy	$ 30.00	$ 20,400.00	
25	Miscellaneous Trenching for Piping	400	lf	$ 15.00	$ 6,000.00	
26	Dispose of Overburden to Unlined Landfill	2,600	cy	$ 25.00	$ 65,000.00	
27	Miscellaneous Dewatering	1	allow	$ 10,000.00	$ 10,000.00	
28	Spread Footings and Strip Footings	80	cy	$ 460.00	$ 36,800.00	
29	Set Column Base Plates	28	ea	$ 200.00	$ 5,600.00	
30	Frost Wall	57	cy	$ 440.00	$ 25,080.00	
31	Perimeter Retaining Wall and Footing	290	cy	$ 500.00	$ 145,000.00	
32	Slab on Grade	14,300	sf	$ 5.00	$ 71,500.00	
33	Elevator Pit	1	allow	$ 10,000.00	$ 10,000.00	
34						
35	**Subtotal**				**$ 431,980.00**	
36						
37	**Superstructure:**					
38	Steel Columns and Girders (allow 9#/sf)	305	tons	$ 2,500.00	$ 762,500.00	
39	Precast Double Tee Decking - 60' Span	47,300	sf	$ 11.50	$ 543,950.00	
40	Precast Double Tee Decking - 26' Span	20,400	sf	$ 10.50	$ 214,200.00	
41	Caulking of Double-Tees	8,000	lf	$ 8.00	$ 64,000.00	

Estimate for: MassDevelopment

Governors Avenue Garage
Medford , MA
Green Garage Option

6/14/10

Prepared by KVAssociates, Inc.

Ref Dwgs: Conceptual drawings by Utile Inc., undated
Gross Sq Ft: 82,000 SF

	ITEM	QUANTITY	UNIT	UNIT COST	TOTAL	NOTES (See Below)
42	Precast Plant Testing and Inspection	1	allow	$ 10,000.00	$ 10,000.00	
43	Steel Support (Galv.) for Photovoltaics (allow 6#/sf)	24	tons	$ 2,800.00	$ 67,200.00	
44	Elevator - Miscellaneous Metals	1	allow	$ 5,000.00	$ 5,000.00	
45	Concrete Landings at Elevator/Stairs	3,000	sf	$ 6.00	$ 18,000.00	
46						
47	**Subtotal**				**$ 1,684,850.00**	
48						
49	**Exterior Envelope:**					
50	Glass Curtainwall Stair Cladding	3,520	sf	$ 70.00	$ 246,400.00	
51	Premium for Colored Glass (assume 50%)	1,760	sf	$ 10.00	$ 17,600.00	
52	Metal Soffiting at Curtainwall	360	sf	$ 50.00	$ 18,000.00	
53	Precast Spandrel Panels with Thin Brick Veneer/Precast C	4,870	sf	$ 30.00	$ 146,100.00	
54	Inserts and Attachments for Precast Panels to Structure	1	allow	$ 25,000.00	$ 25,000.00	
55	Railings at North Elevation - Painted	600	lf	$ 90.00	$ 54,000.00	
56	Green Screen Metal Grid System:					
57	- Galvanized Horizontal Tube Supports (assume 6x3x1/4)	23,000	lbs	$ 4.50	$ 103,500.00	
58	- Galvanized Outrigger Attachements for Vertical Membe	500	ea	$ 300.00	$ 150,000.00	
59	- Galvanized Vertical Pipe (assume 3" diameter)	46,000	lbs	$ 3.50	$ 161,000.00	
60	- Stainless Steel Mesh and Cables	15,000	sf	$ 8.00	$ 120,000.00	
61	- Installation of Mesh and Cables	15,000	sf	$ 2.50	$ 37,500.00	
62	- Misc touch up of galvy and re-tightening	1	allow	$ 10,000.00	$ 10,000.00	
63	Plantings for Green Screen	1	allow	$ 5,000.00	$ 5,000.00	
64	CMU at Elevator Hoistway	3,025	sf	$ 20.00	$ 60,500.00	
65	Waterproof CMU and Concrete at Brick and Stone	1,810	sf	$ 3.00	$ 5,430.00	
66	Brick Veneer at Elevator	1,230	sf	$ 32.00	$ 39,360.00	
67	Brick Base (3 sides)	580	sf	$ 30.00	$ 17,400.00	
68	Canopy at Exit to Street (Glass and Steel)	360	sf	$ 60.00	$ 21,600.00	
69	Doors - Hollow Metal	2	pr	$ 2,500.00	$ 5,000.00	
70	Caulking and Flashings for Masonry and Precast Panels	6,680	sf	$ 0.50	$ 3,340.00	
71						
72	**Subtotal**				**$ 1,246,730.00**	
73						
74	**Interior Finishes:**					
75	Stairs- Metal Pan with Concrete Fill	8	flgts	$ 6,000.00	$ 48,000.00	
76	Stair Railings	8	flgts	$ 6,000.00	$ 48,000.00	
77	Railings at Vehicle Ramps and North	1,120	lf	$ 80.00	$ 89,600.00	
78	Electric Room - CMU and Door	1	ea	$ 8,000.00	$ 8,000.00	
79	CMU Walls at Storage	620	sf	$ 18.00	$ 11,160.00	
80	Metal Door and Frame at Storage	1	pr	$ 1,800.00	$ 1,800.00	
81	Painting of Stair Pans and Stair Rails	8	flgts	$ 1,000.00	$ 8,000.00	
82	Paint Exposed Structural Steel	67,700	sf	$ 0.70	$ 47,390.00	
83	Traffic Deck Coating	73,700	sf	$ 3.50	$ 257,950.00	
84	Concrete Sealer	4,000	sf	$ 0.50	$ 2,000.00	
85	Paint Railings at Ramps	1,220	lf	$ 10.00	$ 12,200.00	
86	Paint CMU at Elevator Shaft	1,800	sf	$ 2.00	$ 3,600.00	

Estimate for: MassDevelopment

Governors Avenue Garage
Medford , MA
Green Garage Option

6/14/10

Prepared by KVAssociates, Inc.

Ref Dwgs: Conceptual drawings by Utile Inc., undated
Gross Sq Ft: 82,000 SF

	ITEM	QUANTITY	UNIT	UNIT COST	TOTAL	NOTES (See Below)
87						
88	**Subtotal**				**$ 537,700.00**	
89						
90	**Equipment/Specialties:**					
	Photovoltaic System Gutters		allow	$ 10,000.00	$ 10,000.00	
91	Bike Racks		None			
92	Signage	1	allow	$ 15,000.00	$ 15,000.00	
93	Fire Extinguishers and Brackets	10	ea	$ 250.00	$ 2,500.00	
94	Parking Space Striping	180	spcs	$ 20.00	$ 3,600.00	
95	Parking Controls - Gates, Card Reader, Loop Detectors	Not Included				
96						
97	**Subtotal**				**$ 31,100.00**	
98	**Elevator:**					
99	5 - Stop Machine Roomless	2	ea	$ 125,000.00	$ 250,000.00	
100	12 Month Maintenance	12	mos	$ 600.00	$ 7,200.00	
101						
102	**Subtotal**				**$ 257,200.00**	
103						
104	**Sprinkler:**					
105	Main Service/Check Valve	1	allow	$ 7,500.00	$ 7,500.00	
106	Sprinkler Heads and Distribution	65,200	sf	$ 4.00	$ 260,800.00	
107	Fire Pump	Assume Not Needed				
108						
109	**Subtotal**				**$ 268,300.00**	
110						
111	**Plumbing:**					
112	Deck Drainage	67,700	sf	$ 1.50	$ 101,550.00	
113	Slab on Grade Drainage	14,300	sf	$ 2.00	$ 28,600.00	
114	Gas/Sand Seperator	1	allow	$ 7,500.00	$ 7,500.00	
115						
116	**Subtotal**				**$ 137,650.00**	
117						
118	**HVAC:**					
119	Storage Room - Unit Heater	1	ea	$ 1,500.00	$ 1,500.00	
120						
121	**Subtotal**				**$ 1,500.00**	
122						
123	**Electrical:**					
124	Main Electric Service	1	allow	$ 25,000.00	$ 25,000.00	
125	Lighting - Covered Levels	65,200	sf	$ 2.50	$ 163,000.00	
126	Lighting - Upper Level and Upper Ramp	16,800	sf	$ 3.00	$ 50,400.00	
127	Exterior Lighting	1	allow	$ 10,000.00	$ 10,000.00	
128	Miscellaneous Convenience Power	5	lvls	$ 2,500.00	$ 12,500.00	
129	Fire Alarm	82,000	sf	$ 1.00	$ 82,000.00	
130	Automatic Venting Damper for Elevator Hoistway	1	ea	$ 3,000.00	$ 3,000.00	

Estimate for: MassDevelopment

Governors Avenue Garage
Medford , MA
Green Garage Option

6/14/10

Prepared by KVAssociates, Inc.

Ref Dwgs: Conceptual drawings by Utile Inc., undated
Gross Sq Ft: 82,000 SF

	ITEM	QUANTITY	UNIT	UNIT COST	TOTAL	NOTES (See Below)
131	Emergency Battery Pack Lighting - Stairwells	10	flgts	$ 350.00	$ 3,500.00	
132	Power for Elevators	2	ea	$ 7,500.00	$ 15,000.00	
133	Power to Parking Controls	2	loc	$ 2,000.00	$ 4,000.00	
134	Security Systems		None			
135	Photovoltaic System	120,000	Watt	$ 6.00	$ 720,000.00	
136						
137	**Subtotal**				**$ 1,088,400.00**	
138						

Note: Mechanical ventilation costs are not included in the cost estimate for the Green Garage because it qualifies as as Open Garage per State Building Code and thus can be naturally ventilated. Please see Relevant Building Code Excerpts in the Appendix for further explanation.

Memorandum

Photovoltaic Panel Specifications

solar design associates

Medford, MA – Governors Ave Parking Garage
Solar Photovoltaic Feasibility Study Summary

Project Description
The Parking Garage proposed for Medford center between Governors Avenue and Bradlee Road is expected to be optimally energy efficient and may provide its own power production through photovoltaics (PV) mounted on a trellis above the top floor parking deck. There appears to be sufficient area to provide a PV system that could offset the expected loads of the garage given a number of early stage assumptions.

The utility for the site is National Grid, and they have indicated that there should be no significant constraints to the interconnection of a 100-150kWdc PV system as part of this project. The energy produced on site will offset any that is consumed by the facility through the Massachusetts Net-Metering laws, which provide a one for one credit between utility provided electricity and renewable energy generated kilowatt hours.

Energy Budget
Parking garages of the type proposed, incorporating significant open air design for day-lighting and natural ventilation, should not require significant energy. Lighting loads are expected to be the major consumption, along with attendant kiosk heating and cooling, and minor loads due to elevator and other equipment. Given an area of roughly 82,000sf, and a rough energy load goal of less than 5kBtu/sf/yr, the garage is estimated to consume approximately 410,000kBtu/yr or **120,000kWh/yr**.

Design Considerations
To produce approximately 120,000kWh/yr, the PV system should be sized between 100 and 120kWdc, and oriented towards True south in a shade-free area. Depending upon the tilt angles and row spacing required, as well as the efficiency of the modules installed, the system will likely require between 8,000 and 15,000sf of roof area. Since only about 7,750sf of area is available, it is recommended that a low 5-20° slope system be installed. Using a low tilt angle will reduce production but increase available area (due to less row shading). Alternatively, a high tilt angle will increase production per panel installed, but take up more space. For the Medford Garage, it is recommended that a rain, ice and snow collection (roof or gutter) system be included under the PV system to avoid snow dropping onto cars and customers.

Cost of the System
The cost for construction of the PV equipment of an array is around $6-7/Watt fully installed. This does not include the supporting trellis proposed on the garage. This rate is considered reasonable for a system of this size, complexity, and aesthetic requirement. This amounts to approximately $6-700,000 total.

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solar design associates

Operations

The Department of Energy estimates that the annual maintenance costs for PV systems to range between $0.005 and $0.02 per kWh for a typical system. Inverter replacement is typically required every 10-12 years, and costs are currently about $0.40/W or $40,000 for a 100kW system.

Funding Opportunities

For a nonprofit or government agency, there are limited number of external funding options for renewable energy projects; 1) state production incentives, 2) grants loans and donations, and 3) private ownership arrangements. A comprehensive data base of state and federal incentives can be found at http://www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=MA .

1) For system owners, the primary financial incentive in MA is based upon production. Every megawatt-hour (MWh) of energy produced by the PV system can be sold, traded, or donated as a solar Renewable Energy Certificate or sREC, anticipated to be between $300 and $600/MWh. The Medford garage array will produce roughly 120 carbon-free MWh each year for the life of the system that can provide between $36,000 - $72,000/yr, as well as useful energy for the facility and city.

2) Grants for renewable energy are typically focused on disadvantaged areas. The current state grant program, the Green Communities Act from the MA DOER, is not currently accepting new applications (http://www.mass.gov/energy/greencommunities), but may consider special projects for urban developments in need. Alternatively, renewable energy loans or Clean Renewable Energy Bonds (CREBs) may also be available to help distribute the costs over time.

3) Medford may also consider a Power Purchase Agreement, or PPA with a 3rd party for-profit firm that can take advantage of federal and state tax incentives as well as production incentives. The 3rd party would then install, own and operate the PV system on the garage, and sell the clean energy at a rate discounted from the utility rates. Typically PPAs are aimed at large systems only, and 100kW may be below the current market threshold.

Recommended Consultants

For the design of the PV systems, it is recommended that the City of Medford engage an Electrical Engineering firm with a minimum of 5 years experience in photovoltaic system design and application.

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Memorandum

Financing the Construction and Operations and Maintenance of a New Garage in Medford Square

From MassDevelopment to City of Medford Office of Community Development

MEMORANDUM

To:	Lauren DiLorenzo
From:	Rhonda Spector and Robert Kaye
Cc:	Richard Henderson, Rebecca Sullivan, Ken Goode, and Ann Pierce
Subject:	Financing the Construction and Operations and Maintenance of a New Garage in Medford Square
Date:	September 20, 2010

The most likely option for financing the cost associated with the construction of a garage at Governors Avenue in Medford Square appears to be either a tax exempt revenue bond or general obligation bond issued by the City of Medford. There also may be opportunities for some small grants for the project, as well as the possibility of either grants or subsidies for photovoltaics for the project.

Revenue Bonds

The City of Medford has several borrowing options to finance a City garage. The first option would be to issue a tax exempt revenue bond backed by parking receipts. To do this type of financing, the City would need to commit garage and on-street parking revenues equal to a multiple of the projected debt service (multiple varies by project). Investors will look to a parking finance study to verify what revenues are projected to be available. It is possible that additional analysis may be required to verify potential revenue for a bond issuance. Interest rates are traditionally higher for a tax exempt revenue bond than a general obligation financing, but the City might have more flexibility in structuring the bond. The analysis provided indicates there may be insufficient revenue from parking to support a revenue bond issuance.

General Obligation Bonds

The second borrowing option would be to issue a tax exempt general obligation bond backed by the full faith and credit of the City. The City could issue in the traditional form of tax exempt bonds, issue a Build America Bond (taxable bond with subsidy from the Federal government) or apply for Recovery Zone Economic Development Bond (RZEDB) financing, which is a better version of Build America Bonds, with an increased subsidy of 45% vs. 35%. Tax exempt bonds or Build America Bonds can be issued without any state approvals. For a Recovery Zone Economic Development Bond allocation, the City would need to apply to the Executive Office of Housing and Economic Development (EOHED).

The best place to start exploring any bond related financing options would be with the City's financial advisor, First Southwest.

Grant Opportunities

In recent years, the only garages that have received grants have been on the State's Transportation Improvement Plan (TIP) and have been related to intermodal facilities. It is possible, however, that grants for economic development may be available for this project.

A summary of grant opportunities is presented here:

State

Growth District Initiative – City must be designated a growth district in order to be eligible

PWED – funds above-ground infrastructure improvements, not parking garages; $1- 2M maximum award; requires 2:1 private to public match ratio; **application is due June 30, 2010.**

CDAG – funds below-ground infrastructure improvements, not parking garages and there is a low-income/workforce affordable housing requirement; $1-2M maximum award; requires 2.5:1 private to public dollar and 2:1 CDAG to public dollar match ratios; rolling application, first submit Notice of Intent to Apply.

Federal

ARRA (Stimulus) – funds were applied to the statewide TIP for highway and bridge improvements; although some funds were applied to TIP-related/approved parking garage construction in cities where the garage supported a transit center or intermodal facility, generally, parking garages are an ineligible use of funds.

EDA – (Economic Development Administration) requires private investment/job creation; commercial/retail projects are not eligible; EDA is reluctant to support parking garage construction.

Photovoltaics

The attached financial analysis assumes the cost of photovoltaics is included in the total construction budget that would be paid for out of bond proceeds. The City could reduce the funds needed through grants available through the Massachusetts Clean Energy Center's Commonwealth Solar programs. www.commonwealthsolar.org Another alternative for funding photovoltaics would be a Power Purchase Agreement with a private firm. Under a Power Purchase Agreement, a private company would lease an area for photovoltaics on the garage. The private company will purchase, install and maintain the photovoltaics and provide energy to the public facility. If there is any electricity in excess of what is needed for the facility, that excess is sold to the local utility company. The private company benefits from any tax credits that are available for photovoltaics as well as from the sale of excess electricity. Initially, the City would receive a utility bill similar to one they would have had without the photovoltaics, and then, after the private firm makes back its investment and sees a return, for less or nothing depending upon the contract with the private company.

Potential Financing Scenarios

The attached potential financing scenarios use estimates for the cost of the garage and for photovoltaics as presented in the feasibility study. An estimated cost for on-street pay stations is added to come up with an overall parking capital requirement. This estimate does not include costs identified in the feasibility study for traffic circulation changes or improvements to the Forest/Salem/High/Riverside intersection identified in the study. A table of potential interest rates and debt service coverage is then provided to identify the range of revenue that could be needed to service the debt for associated with the capital costs. Debt service coverage is determined based on the level of certainty the bond issuer associates with the identified repayment revenue source. The estimates for on-street parking revenues in and around Medford Square, garage operations, maintenance and for revenue related employees are all based upon estimates derived from the feasibility study. The parking rates provided in the study have not been approved by the City and will require further policy study and feasibility confirmation before any parking rates are implemented.

The first scenario assumes a tax-exempt revenue bond at an interest rate of 4.5% and a debt service coverage ratio of 1.75. The estimated income is short of the coverage required. Coverage could be adequate if assumed staffing expenses are covered by other City revenues. Scenario 2 assumes a 20-year G.O Bond at 4.0%, with no debt service coverage needed as the full faith and credit of the city is behind the bond. The estimated revenue easily exceeds the debt service required.

Medford Parking Garage Financing Scenarios

Brick Version

Scenario 1: Revenue Bond

Estimated Garage Cost		$ 7,324,829	
Number of spaces	$ 178		
Total Per space construction	$ 41,151		
		-	
Garage cost		$ 7,324,829	
Plus Other Parking Equipment		$ 500,000	Pay Stations for street parking
Total Capital Requirement		**$ 7,824,829**	

Debt Capacity Analysis
Medford Parking Garage Bond Issuance

Bond Issue **7,824,829**
Debt Service **480,378**
(Assuming 4.50% non-subsidized Interest Rate with 30-Year Amortization)

Where the issuance falls in the range depends on type of bond and revenue source

Annual Revenue Sensitivities Table (assuming : 7,824,829 debt issuance)

Debt Service Coverage	Interest Rate Assumptions					
	3.50%	**4.00%**	**4.50%**	**4.75%**	**5.00%**	**5.50%**
1.50	638,170	678,766	720,567	741,905	763,525	807,586
1.75	744,531	791,894	840,662	865,556	890,779	942,183
2.00	850,893	905,021	960,757	989,206	1,018,033	1,076,781

Annual Income required for Bond Issue = $840,662 @ Debt Service Coverage = 1.75

If issued as a revenue bond, investors will generally require the higher debt service coverage shown.

Potential Cash Flow Available From All Parking in Medford Square

All estimates are preliminary and assume, among other things,
pricing in feasiblity study which has not been approved by the City

Paid parking Revenue	$ 603,000	
Permit Revenue	$ 185,000	
Enforcement Revenue	$ 250,000	
	$ 1,038,000	
Personnel*	$ 122,337	*subsidized from other sources
Operations and Maintenance	$ 75,000	
	$ 197,337	
Net Annual proceeds available for debt service and coverage requirements	$ 840,663	
Income required for debt service coverage	840,662	
Net	$ 1	

Scenario 2: General Obligation Bond

Estimated Garage Cost			$ 7,324,829	
Number of spaces	$	178		Plus 22 bike spaces
Total Per space construction	$	41,151		
Photovoltaics (assume 0% grant coverage)			$ -	
Federal Grant			$ -	
Garage Cost			$ 7,324,829	
Plus Other Parking Equipment			$ 500,000	Pay Stations for street parking
Total Capital Requirement			**$ 7,824,829**	

Debt Capacity Analysis
Medford Parking Garage Bond Issuance

Bond Issue	**7,824,829**
Debt Service	**575,765**

(Assuming 4.0% subsidized Interest Rate with 20-Year Amortization)

Potential Cash Flow Available From All Parking in Medford Square

All estimates are preliminary and assume, among other things,
pricing in feasiblity study which has not been approved by the City

Paid parking Revenue	$	603,000
Permit Revenue	$	185,000
Enforcement Revenue	$	250,000
	$	1,038,000
Personnel	$	250,000
Operations and Maintenance	$	75,000
	$	325,000
Net Annual proceeds available for debt service	$	713,000
Income required for debt service coverage		575,765
Net	$	137,235

Memorandum

Overview of Modular Construction Procurement

Memorandum prepared by MassDevelopment.

OVERVIEW OF MODULAR CONSTRUCTION PROCUREMENT

As the parking garage project moves forward into a preliminary design and cost estimating phase, one option is to consider potential savings in time and money that may be realized by utilizing modular construction.

Massachusetts General Laws chapter 149, sections 44A-M govern contracts for the construction of public buildings. Although the statutes do not define the term "building", court decisions have indicated that the word is to be taken in its common and ordinary sense. If a structure has walls and a roof and enclosed space that is to be used for some purpose, it is a building.[1]

While the proposed Medford Square municipal parking garage has yet to be designed, it is reasonable to anticipate that the structure will have walls, a roof (or lower levels with a ceiling or roof), enclosed spaces such as staircases, elevators, a storage room and/or retail space, electrical systems, and fire protection systems, etc., all to be used and occupied by people parking within it. Therefore, the proposed garage will likely be considered a "building".

The City may elect to follow chapter 149 procedures to deliver the project by using a design-bid-build process. However, M.G.L. chapter 149, s. 44E(4) permits a public agency to procure modular buildings by following an alternative procurement process. Using this alternative method of procurement may result in the delivery of a completed project while achieving significant savings in time and money.

A modular building is one which is predesigned or units of a predesigned building which are assembled and equipped with internal plumbing, electrical or similar systems prior to movement to the site where the units are attached to each other and the building is affixed to a foundation and connected to external utilities.

A parking garage that is predesigned and mostly manufactured off site (such as a concrete beam and slab design) and then delivered to the site for assembly would likely be considered a modular building, however, specific details of a proposed design would need to be reviewed and analyzed before a conclusion can be reached.

The modular procurement process varies from the design-bid-build process in several respects. Rather than competitively selecting a designer to prepare detailed plans and specifications for the construction, the awarding authority issues a request for proposals (RFP) for modular construction that describes the project requirements in detail. Respondents to the RFP submit proposals to provide a predesigned building meeting the requirements set forth in the RFP. Proposals are then evaluated according to a competitive evaluation process by individuals designated by the awarding authority.

Additional information regarding procuring modular construction can be found in M.G.L. chapter 149, s. 44E as well as in *Designing and Constructing Public Facilities*, Comm. of Mass. Office of the Inspector General, Section VIII. (Fall 2005.)

[1] See *Designing and Constructing Public Facilities*, Comm. of Mass. Office of the Inspector General, Section V. (Fall 2005.)

Relevant Building Code Excerpts

The excerpts of the Massachusetts State Building Code included on the following pages deal with the classification of parking garages and egress requirements for each garage type. Specifically, the excerpts highlight the relevant sections that define an “Open Garage,” a facility that does not require mechanical ventilation or enclosed egress stairs. Each scenario illustrated in this report can be classified as an Open Garage.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

406.1.4 Separation. Separations shall comply with the following:

1. The private garage shall be separated from the dwelling unit and its attic area by means of a minimum ½-inch (12.7 mm) gypsum board applied to the garage side. Garages beneath habitable rooms shall be separated from all habitable rooms above by not less than ⅝-inch Type X gypsum board or equivalent. Door openings between a private garage and the dwelling unit shall be equipped with either solid wood doors, or solid or honeycomb core steel doors not less than 1⅜ inches (34.9 mm) thick, or doors in compliance with 780 CMR 715.3.3. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted.
2. Ducts in a private garage and ducts penetrating the walls or ceilings separating the dwelling unit from the garage shall be constructed of a minimum 0.019-inch (0.48 mm) sheet steel and shall have no openings into the garage.
3. A separation is not required between a Group R-3 and U carport provided the carport is entirely open on two or more sides and there are not enclosed areas above.

406.2 Parking Garages.

406.2.1 Classification. Parking garages shall be classified as either open, as defined in 780 CMR 406.3, or enclosed and shall meet the appropriate criteria in 780 CMR 406.4. Also see 780 CMR 508.0 for special provisions for parking garages.

406.2.2 Clear Height. The clear height of each floor level in vehicle and pedestrian traffic areas shall not be less than seven feet (2134 mm). Vehicle and pedestrian areas accommodating van-accessible parking required by 780 CMR 11.00 shall conform to 521 CMR, as applicable.

406.2.3 Guards. Guards shall be provided in accordance with 780 CMR 1012 at exterior and interior vertical openings on floor and roof areas where vehicles are parked or moved and where the vertical distance to the ground or surface directly below exceeds 30 inches (762 mm).

406.2.4 Vehicle Barriers. Parking areas shall be provided with exterior or interior walls or vehicle barriers, except at pedestrian or vehicular accesses, designed in accordance with 780 CMR 1607.7. Vehicle barriers not less than two feet (607 mm) high shall be placed at the ends of drive lanes, at the end of parking spaces where the difference in adjacent floor elevation is greater than one foot (305 mm).

406.2.5 Ramps. Vehicle ramps shall not serve as an exit element.

406.2.6 Floor Surface. Parking surfaces shall be of concrete or similar noncombustible and nonabsorbent materials.

Exception. Asphalt parking surfaces are permitted at ground level.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

406.2.7 Mixed Separation. Parking garages shall be separated from other occupancies in accordance with 780 CMR 302.3.2.

406.2.8 Special Hazards. Connection of a parking garage with any room in which there is a fuel-fired appliance shall be by means of a vestibule providing a two-doorway separation.

Exception: A single door shall be allowed provided the sources of ignition in the appliance are at least 18 inches (457 mm) above the floor.

406.2.9 Attached to Rooms. Openings from a parking garage directly into a room used for sleeping purposes shall not be permitted.

406.3 Open Parking Garages.

406.3.1 Scope. Except where specific provisions are made in 780 CMR 406.3.2 through 406.3.13, other requirements of 780 CMR shall apply.

406.3.2 Definitions. The following words and terms shall, for the purposes of 780 CMR 4.00 and as used elsewhere in 780 CMR, have the meanings shown 780 CMR 406.3.2.

MECHANICAL-ACCESS OPEN PARKING GARAGES. Open parking garages employing parking machines, lifts, elevators or other mechanical devices for vehicles moving from and to street level and in which public occupancy is prohibited above the street level.

OPEN PARKING GARAGE. A structure or portion of a structure with the openings as described in 780 CMR 406.3.3.1 on two or more sides that is used for the parking or storage of private motor vehicles as described in 780 CMR 406.3.4.

RAMP-ACCESS OPEN PARKING GARAGES. Open parking garages employing a series of continuously rising floors or a series of interconnecting ramps between floors permitting the movement of vehicles under their own power from and to the street level.

406.3.3 Construction. Open parking garages shall be of Type I, II or IV construction. Open parking garages shall meet the design requirements of 780 CMR 16.00. For vehicle barriers, *see* 780 CMR 406.2.4.

406.3.3.1 Openings. For natural ventilation purposes, the exterior side of the structure shall have uniformly distributed openings on two or more sides. The area of such openings in exterior walls on a tier must be at least 20% of the total perimeter wall area of each tier. The aggregate length of the openings considered to be providing natural ventilation shall constitute a minimum of 40% of the perimeter of the tier. Interior walls shall be at least 20% open with uniformly distributed openings.

Exception: Openings are not required to be distributed over 40% of the building perimeter where the required openings are uniformly distributed over two opposing sides of the building.

406.3.4 Uses. Mixed uses shall be allowed in the same building as an open parking garage subject to the provisions of 780 CMR 302.3, 402.7.1, 406.3.13, 508.3.2, 508.3, 508.4 and 508.7.

406.3.5 Area and Height. Area and height of open parking garages shall be limited as set forth in 780 CMR 5.00 for Group S-2 occupancies and as further provided for in 780 CMR 302.3.

406.3.5.1 Single Use. When the open parking garage is used exclusively for the parking or storage of private motor vehicles, with no other uses in the building, the area and height shall be permitted to comply with Table 406.3.5, along with increases allowed by 780 CMR 406.3.6.

Exception. The grade-level tier is permitted to contain an office, waiting and toilet rooms having a total combined area of not more than 1,000 square feet (93 m^2). Such area need not be separated from the open parking garage.

In open parking garages having a spiral or sloping floor, the horizontal projection of the structure at any cross section shall not exceed the allowable area per parking tier. In the case of an open parking garage having a continuous spiral floor, each nine feet six inches (2896 mm) of height, or portion thereof, shall be considered a tier.

The clear height of a parking tier shall not be less than seven feet (2134 mm), except that a lower clear height is permitted in mechanical-access open parking garages where approved by the building official.

TABLE 406.3.5 OPEN PARKING GARAGES AREA AND HEIGHT

TYPE OF CONSTRUCTION	AREA PER TIER (square feet)	HEIGHT (in tiers)		
		Ramp access	Mechanical access	
			Automatic sprinkler system	
			No	Yes
IA	Unlimited	Unlimited	Unlimited	Unlimited
IB	Unlimited	12 tiers	12 tiers	18 tiers
IIA	50,000	10 tiers	10 tiers	15 tiers
IIB	50,000	8 tiers	8 tiers	12 tiers
IV	50,000	4 tiers	4 tiers	4 tiers

For SI: 1 square foot = 0.0929 m^2

from coming in contact with the ignition sources of the heating equipment.

An allowance is made if the heating equipment is located at least 18 inches (457 mm) above the floor of the separated room. In such a case, the vestibule/airlock arrangement with a double-door system is not required and can be done with just a single door. If this exception is used, care must be taken by the building and fire officials that these special stipulations and conditions are part of the certificate of occupancy.

406.2.9 Attached to rooms. Openings from a parking garage directly into a room used for sleeping purposes shall not be permitted.

❖ Just as a private garage cannot have openings into bedrooms (see Item 1 in Section 406.1.4), other parking garages are likewise limited. The risks of a fire quickly spreading into adjacent areas where occupants may be sleeping are too great.

406.3 Open parking garages.

406.3.1 Scope. Except where specific provisions are made in the following subsections, other requirements of this code shall apply.

❖ The code defines four types of garages: private, enclosed parking, repair garages and open parking. With the exception of private garages, all such structures are classified as Group S. Unlike other storage occupancies in which the fuel load is evenly distributed, garages represent a different fire hazard.

Because of the generally fast-burning upholstery and the gasoline or diesel fuel content, fires in individual vehicles can be quite extensive. Because of both the overall combustible loading within a parking garage, which yields a low combustible fuel load [approximately 2 pounds per square foot (psf) (9.8 kg/m^2)], and the considerable amount of metal in vehicles, which absorbs heat, the overall fire hazards are low. Section 406.3 provides requirements that are unique to open parking garages, while Section 406.1 addresses private garages and Section 406.4 addresses enclosed parking garages. Because of the permanently open exterior walls of open parking garages, which permit the dissipation of heated gases, special provisions are made for heights and areas of such structures.

Open parking garages are classified as Group S-2 and all of the provisions for this group are applicable except as modified herein.

406.3.2 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

❖ Definitions of terms that are associated with the content of this section are contained herein. These definitions can help in the understanding and application of the code requirements. It is important to emphasize that these terms are not exclusively related to this section but are applicable everywhere the term is used in the code. The purpose for including these definitions within this section is to provide more convenient access to them without having to refer back to Chapter 2.

For convenience, these terms are also listed in Chapter 2 with a cross reference to this section.

The use and application of all defined terms, including those defined herein, are set forth in Section 201.

MECHANICAL-ACCESS OPEN PARKING GARAGES. Open parking garages employing parking machines, lifts, elevators or other mechanical devices for vehicles moving from and to street level and in which public occupancy is prohibited above the street level.

❖ These types of garages are constructed with most of the same attributes as other garages. They have numerous parking levels that house the motor vehicles; however, public access to these upper levels is not permitted. Employees take control of the vehicles at the street level and drive into some sort of a vertical mechanical device, which conveys them to the upper parking levels. These structures are still provided with the required openings of Section 406.3.3.1.

OPEN PARKING GARAGE. A structure or portion of a structure with the openings as described in Section 406.3.3.1 on two or more sides that is used for the parking or storage of private motor vehicles as described in Section 406.3.4.

❖ Open parking garages are defined as having uniformly distributed openings on no less than two sides totaling no less than 40 percent of the building perimeter. The aggregate area of the openings is to be a minimum of 20 percent of the total wall area of all perimeter walls (see Figure 406.3.3.1).

RAMP-ACCESS OPEN PARKING GARAGES. Open parking garages employing a series of continuously rising floors or a series of interconnecting ramps between floors permitting the movement of vehicles under their own power from and to the street level.

❖ These types of garages employ vehicular ramps or sloped tiers that connect all of the levels of the structure. Whether the vehicles are self-parked or employee parked is immaterial.

406.3.3 Construction. Open parking garages shall be of Type I, II or IV construction. Open parking garages shall meet the design requirements of Chapter 16. For vehicle barriers, see Section 406.2.4.

❖ One of the basic premises of the provisions for open parking garages is that the overall fuel load is low and that the average fuel load per square foot is low. The construction of open parking garages, therefore, is restricted to Type I, II or IV, so that the combustible loading of cars is not exceeded by that of the structure.

406.3.3.1 Openings. For natural ventilation purposes, the exterior side of the structure shall have uniformly distributed openings on two or more sides. The area of such openings in exterior walls on a tier must be at least 20 percent of the total perimeter wall area of each tier. The aggregate length of the openings considered to be providing natural ventilation shall constitute a

minimum of 40 percent of the perimeter of the tier. Interior walls shall be at least 20 percent open with uniformly distributed openings.

Exception: Openings are not required to be distributed over 40 percent of the building perimeter where the required openings are uniformly distributed over two opposing sides of the building.

❖ Key attributes of an open parking garage, based on the fire records of such facilities, include the exterior wall openings and ventilation of the structure. This section requires that 40 percent of the building perimeter have openings that are uniformly distributed on no less than two sides of the structure. In addition to providing for adequate distribution, the section also requires that a minimum of 20 percent of the total perimeter wall area at each level must be open. The openings in the exterior wall must be free so that natural ventilation will occur without interior wall obstructions.

In instances where the open parking garage is provided with openings on two opposite sides of the structure, thereby providing cross ventilation, the 40-percent criterion does not apply; however, the openings must still meet the 20-percent criterion of the total perimeter wall area.

In every case, interior walls are to have distributed openings totaling 20 percent of the wall area to allow ventilation of all spaces (see Figure 406.3.3.1).

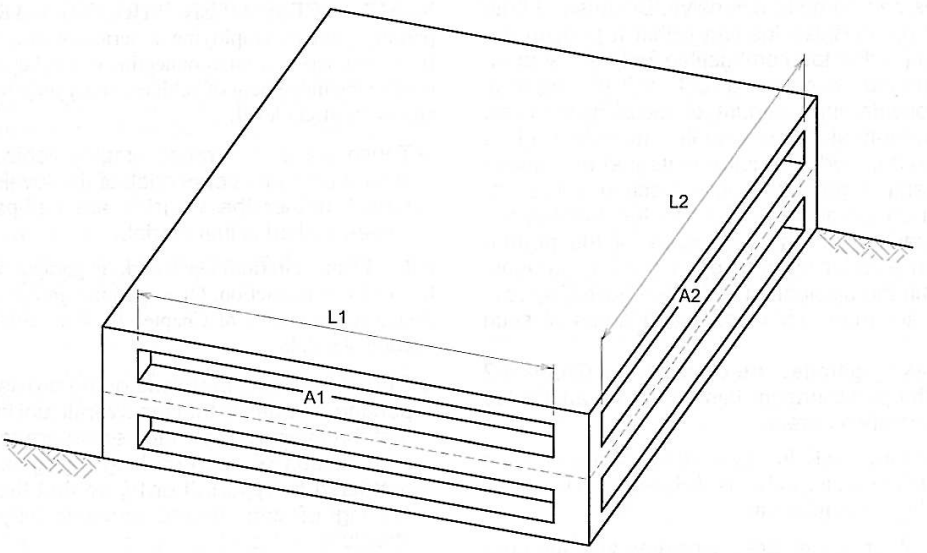
406.3.4 Uses. Mixed uses shall be allowed in the same building as an open parking garage subject to the provisions of Sections 508.3, 402.7.1, 406.3.13, 509.3, 509.4 and 509.7.

❖ Because of the increased height and area limitations provided for open parking garages, these structures are limited to just private motor vehicles. Facilities used for the parking of trucks or buses must be classified as an enclosed parking garage even if the opening requirements of Section 406.3.3.1 are met. Open parking garages or buildings that contain open parking garages may contain other occupancies as permitted by the other general provisions of the code.

406.3.5 Area and height. Area and height of open parking garages shall be limited as set forth in Chapter 5 for Group S-2 occupancies and as further provided for in Section 508.3.

❖ When an open parking garage is located within a building containing other occupancies, the code requires that the height and area limitations for the open parking garage be determined by using the normal provisions found in Chapter 5 for a Group S-2 occupancy. This essentially means that the garage would receive the same allowable areas of an enclosed parking garage or a storage building that was classified in the same occupancy.

406.3.5.1 Single use. When the open parking garage is used exclusively for the parking or storage of private motor vehicles, with no other uses in the building, the area and height shall be



A1, A2 = AREA OF OPENINGS
L1, L2 = LENGTH OF OPENINGS
L1 + L2 > 40 PERCENT OF BUILDING PERIMETER
A1 + A2 > 20 PERCENT OF BUILDING PERIMETER WALL AREA

Figure 406.3.3.1
TWO-STORY OPEN PARKING GARAGE

modified in 780 CMR 1014.1 or 1018.2. For the purposes of 780 CMR 10.00, occupied roofs shall be provided with exits as required for stories. The required number of exits from any story, basement or individual space shall be maintained until arrival at grade or the public way.

TABLE 1018.1 MINIMUM NUMBER OF EXITS FOR OCCUPANT LOAD

OCCUPANT LOAD	MINIMUM NUMBER OF EXITS
1-500	2
501-1,000	3
More than 1,000	4

1018.1.1 Open Parking Structures. Parking structures shall not have less than two exits from each parking tier, except that only one exit is required where vehicles are mechanically parked. Unenclosed vehicle ramps shall not be considered as required exits unless pedestrian facilities are provided.

1018.1.2 Helistops. The means of egress from helistops shall comply with the provisions of 780 CMR 10.00, provided that landing areas located on buildings or structures shall have two or more exits. For landing platforms or roof areas less than 60 feet (18 288 mm) long, or less than 2,000 square feet (186 m^2) in area, the second means of egress is permitted to be a fire escape or ladder leading to the floor below.

1018.2 Buildings with One Exit. Only one exit shall be required in buildings as described in 780 CMR 1018.2, Items 1. through 3.:

1. Buildings described in Table 1018.2, provided that the building has not more than one level below the first story above grade plane.
2. Buildings of Group R-3 occupancy.
3. Single-level buildings with the occupied space at the level of exit discharge provided that the story or space complies with 780 CMR 1014.1 as a space with one means of egress.

TABLE 1018.2 BUILDINGS WITH ONE EXIT

OCCUPANCY	MAXIMUM HEIGHT OF BUILDING ABOVE GRADE PLANE	MAXIMUM OCCUPANTS (OR DWELLING UNITS) PER FLOOR AND TRAVEL DISTANCE
A, B[d], E, F, M, U	1 Story	50 occupants and 75 feet travel distance
H-2, H-3	1 Story	3 occupants and 25 feet travel distance
H-4, H-5, I, R	1 Story	10 occupants and 75 feet travel distance
S[a]	1 Story	30 occupants and 100 feet travel distance
B[b], F, M, S[a]	2 Stories	30 occupants and 75 feet travel distance
R-2	2 Stories[c]	4 dwelling units and 50 feet travel distance

For SI: 1 foot = 304.8 mm.

a. For the required number of exits for open parking structures, see 780 CMR 1018.1.1.
b. For the required number of exits for air traffic control towers, see 780 CMR 412. 1.
c. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with 780 CMR 1025 shall have a maximum height of three stories above grade.
d. Buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 with an occupancy in Group B shall have a maximum travel distance of 100 feet.

1018.3 Exit Continuity. Exits shall be continuous from the point of entry into the exit to the exit discharge.

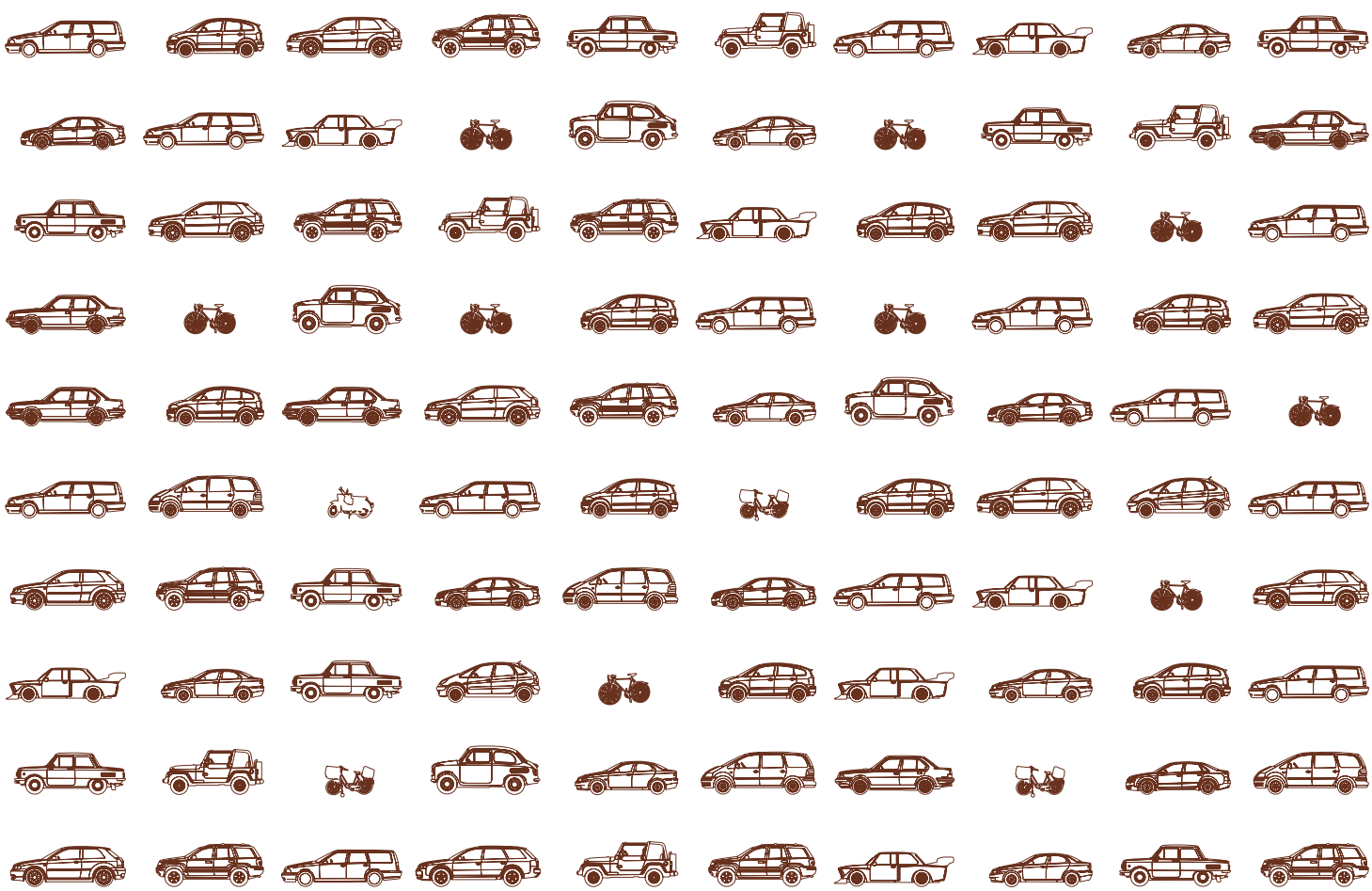
1018.4 Exit Door Arrangement. Exit door arrangement shall meet the requirements of 780 CMR 1014.2 through 1014.2.2.

780 CMR 1019.0 VERTICAL EXIT ENCLOSURES

1019.1 Enclosures Required. Interior exit stairways and interior exit ramps shall be enclosed with fire barriers. Exit enclosures shall have a fire-resistance rating of not less than two hours where connecting four stories or more and not less than one hour where connecting less than four stories. The number of stories connected by the shaft enclosure shall include any basements but not any mezzanines. An exit enclosure shall not be used for any purpose other than means of egress. Enclosures shall be constructed as fire barriers in accordance with 780 CMR 706.

Exceptions:

1. In other than Group H and I occupancies, a stairway serving an occupant load of less than ten not more than one story above the level of exit discharge is not required to be enclosed.
2. Exits in buildings of Group A-5 where all portions of the means of egress are essentially open to the outside need not be enclosed.
3. Stairways serving and contained within a single residential dwelling unit or sleeping unit in occupancies in Group R-2 or R-3 and sleeping units in occupancies in Group R-1 are not required to be enclosed.
4. Stairways that are not a required means of egress element are not required to be enclosed where such stairways comply with 780 CMR 707.2.
5. Stairways in open parking structures which serve only the parking structure are not required to be enclosed.
6. Stairways in occupancies in Group I-3 as provided for in 780 CMR 408.3.6 are not required to be enclosed.
7. Means of egress stairways as required by 780 CMR 410.5.4 are not required to be enclosed.



Medford Garage
Feasibility Study

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