Memorandum

To: Mr. Joseph Barr, Director
Mr. Adam Shulman, Transportation Planner
City of Cambridge Traffic, Parking & Transportation

Date: November 17, 2016
Updated January 20, 2017

Project #: 11356.00

From: Susan Sloan-Rossiter, Principal
Meghan Houdlette, PE

Re: MIT Kendall Square Proposed Changes to Building 1/One Broadway - Transportation Overview Analysis

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The MIT Kendall Square Initiative TIS was certified by TP&T on July 21, 2015. Since the certification, MIT has made the following changes to the Building Parcel 1 (NoMa) development site: circulation (site access/egress), the loading area access/egress, and slight changes to the land use program. The Planning Board approved November, 2015 Final Development Site Plan is included as Figure 1. This provides a comparison to Figures 2 and 3 which illustrate the proposed Site Plan that the proponent is submitting as part of the Design Review process. The changes to the proposed program include the addition of a small grocery store in the existing One Broadway Building totaling 12,500 GSF. The changes also include a slight reduction in the office land use and the transfer of 10,400 GSF of office from the liner building on NoMa into the One Broadway site. The 10,400 GSF of additional office will be located on the second and third floor above the grocery store along Main Street. The TIS analyzed 15,000 GSF of office in the liner building however, the current plan does not include office at this location. The retail and residential program in Building 1 will remain as proposed in the TIS. The access and egress patterns for the residential vehicles will shift from the proposed curb cut on Main Street to the existing One Broadway curb cut on Third Street. Residents will enter the One Broadway garage and use the ramp to enter the Building 1 garage on either the second or third level of parking. The loading and service access and egress will shift from Main Street to Broad Canal Way. Table 1 summarizes the changes to the development program.

Table 1 Comparison of TIS NoMa Parcel A and Revised Proposed Program by Land Use

Land Use	TIS		Revised Program		Net Change
	Building 1 + Liner	One Broadway	Building 1 + Liner	One Broadway	Total
Office(GSF)	15,000	0	0	10,400	-4,600
Retail(GSF)	16,000	0	16,000	0	0
Residential(GSF/Units)	285,000 / 300	0	285,000 / 300	0	0
Grocery (GSF)	0	0	0	12,500	+12,500
Total	316,000	0	301,000	22,900	+7,900

99 High Street
Boston, MA 02110-2354
P 617.728.7777

This technical memorandum will present the following components of the proposed site plan and its impacts on the surrounding transportation network:

1. Parking: Vehicle/Bicycle
2. Loading and Service
3. Trip Generation
4. Vehicle Access and Circulation
5. Vehicle Level of Service

1. Parking

Vehicle

Residential /Building 1

The site plan presented in the TIS included 179 parking spaces on levels 2-4 of the residential building representing a 0.6 spaces/unit parking ratio. Access to the parking garage was provided via a proposed driveway off of Main Street parallel to the proposed building. As shown in Figures 4-6, the proposed site plan includes 150 residential parking spaces on levels 2-3 of Building 1. The proposed parking ratio for the residential component of the project results in a parking ratio of 0.5 spaces/unit consistent with zoning. This shows a reduction in parking supply and resulting ratio from the TIS analysis. Access to the parking for the proposed site plan includes the use of the existing driveway to the One Broadway Garage on Third Street which will connect to the proposed garage at levels two and three. Access to these 150 residential parking spaces will be provided via a secure gate system which will only allow residents into the Building 1 parking garage at the second or third level of Building 1.

Commercial /One Broadway

The limited retail and office employees that will need parking will be accommodated in the existing One Broadway Garage. The One Broadway garage currently has some capacity for transient use and can accommodate the small number of additional retail/office employees or patrons. Based on similar grocery tenants in an urban setting, is expected that the vast majority of grocery patrons will walk, bike or take transit to the store. The small portion of grocery shoppers during the evening that will drive will also be accommodated in the One Broadway Garage after 5PM and during weekends. During the day, the grocery and retail shoppers will have access to the One Broadway garage as they currently do. The garage will maintain some capacity for daily ticket holders parking in One Broadway. They will pay an hourly rate as they do now. Like today, priority parking will be given to monthly pass holders, if capacity becomes tight. The gate system at One Broadway will be replaced with a state of the art system to improve transaction time and manage the garage capacity. The parking gate will be located three car lengths inside the garage

to help with queueing on Third Street. As part of changes to the One Broadway garage, the number of spaces will be reduced slightly from 316 to 293 spaces. All of the existing 114 surface parking spaces adjacent to the One Broadway building will be removed as part of the NoMa Project. This is a total reduction of 137 parking spaces for the One Broadway site.

A summary of the parking for NoMa is provided in Table 2. The proposed site plan results in a net decrease of 52 parking spaces for both Building 1 and One Broadway compared to the TIS.

Table 2 Parking Summary

Location	Existing	TIS	Proposed
One Broadway Surface	114	0	0
One Broadway Garage	316	316	293
Proposed Residential Building 1	0	179	150
Total	430	495	443

Impacts to the circulation and distribution of project generated trips will be described under Section 4. Vehicle Access and Circulation.

Bicycle

Long-term

The site plan for Building 1 in the TIS presented 323 indoor long-term bicycle parking spaces consistent with zoning requirements. As shown in Figures 7-10, the proposed site plan presents a total of 325 indoor long-term bicycle parking spaces consistent with zoning requirements.

Short-term

The site plan for Building 1 in the TIS presented 44 outdoor short-term bicycle parking spaces consistent with zoning requirements. As shown in Figures 11-14, the proposed site plan presents a total of 55 outdoor short-term bicycle parking spaces consistent with zoning requirements.

Proposed bicycle parking quantities for the new site plan are summarized in Table 3. Detailed information regarding the proposed Hubway locations are provided in Figures 15-17. Bike parking calculations are provided in Figures 18-19.

Table 3 Proposed Bicycle Parking Summary

Land Use	Long-Term	Short-Term
One Broadway Office	6	2
One Broadway Retail	2	11
Liner Retail	1	6
Res Tower Retail	1	6
Residential	315	30
Total	325	55

2. Loading & Service

The proposed development is expected to generate loading and service activity in addition to passenger vehicle traffic to the site. The TIS site plan showed the loading and service dock accessed via Main Street. The proposed site plan includes a loading dock area that will be accessed off of Broad Canal Way. This is an improvement since there is less pedestrian, bicycle and vehicular activity on Broad Canal Way compared to Main Street. The sight distance triangles for the Building 1 loading dock area are provided in Figures 20-26. The geometry of the required sight distance and edge of building limit truck driver's view when exiting the proposed Building 1 loading dock area. In order to improve this condition, we propose to a 5 foot "no pedestrian zone" through the application of bollards and/or planters at either edge and a hatched pavement marking to provide a safer conflict zone. The truck turns into and out of Building 1 are shown in Figures 27 through 32. Sight distance triangles for the One Broadway exit are provided in Figures 33 through 39. The Compactor turns for the loading dock are shown in Figures 40 and 41.

The TIS provided a daily truck trip generation estimate for each site. The TIS estimated 87 daily truck trips for Building 1 based on a residential general retail land use. The updated estimates for the proposed truck trips are provided in Table 4. These estimates are provided by potential tenants that would occupy the building. It is important to note that truck trips vary by day of week and therefore the potential tenants were able to provide a maximum weekly estimate for understanding the level of impact to Broad Canal Way. Truck trips are accounted for within ITE trip generation methodology and volumes in Table 4 are not additional trips. The grocery store and retail tenants truck trips are expected to occur during the very early morning time period which is not likely to coincide with the roadway peak hours. The residents of the building will be scheduling the residential loading dock for move-in/out activity mostly during weekends. It is expected that FedEx, UPS, USPS type truck trips will occur at various times throughout the day. There will be a dock master to manage the schedule and maintain the loading docks.

Table 4 New Weekly Project Truck Trips

Land Use	Inbound Broad Canal Way	Outbound Broad Canal Way
Grocery	150	150
Retail	100	100
Residential	53	53
Total	303	303

3. Trip Generation Analysis

The trip generation analysis presented in *Section 3 Project Traffic* of the TIS, has been modified to reflect the program changes in Table 1. Since the grocery store was not previously analyzed as part of the development, assumptions have been made to estimate the number of trips expected to be generated by the proposed grocery store. Mode share data for a grocery store land use is not specifically included in the K2C2 study therefore, the retail mode share has been assumed at 31 percent auto for the additional grocery store square footage.

In order to determine if this is an appropriate assumption, nearby mode share data for the Star Market in Central Square, Cambridge was considered. As part of the Traffic Mitigation Agreement for University Park, the patrons of the Central Square Star Market were surveyed to determine existing mode share splits. The results of the 2013 survey indicated that only 12 percent of patrons use vehicles to visit the grocery store. Therefore, assuming a 31 percent auto mode share for a grocery store in Kendall Square is a conservative assumption considering the 12 percent auto mode share found in the University Park Star Market survey, the grocery's small size and location across from the Kendall Square T station. Table 5 presents the resulting grocery store vehicle trip generation based on the mode shares described above.

Table 5 Grocery Store Vehicle Trip Generation Summary Comparison

	Daily			AM Peak			PM Peak		
Auto mode Share	**Entering**	**Exiting**	**Total**	**Entering**	**Exiting**	**Total**	**Entering**	**Exiting**	**Total**
31% (K2C2 Retail)	198	198	396	8	5	13	19	18	37

Assuming an auto mode share of 31 percent, the trip generation for NoMa Parcel A has been revised. Additionally, the office land use has been adjusted to reflect a small reduction bringing the total down to

10,400 GSF. These changes to the trip generation analysis are presented in Table 6 based on the proposed program.

Table 6 Comparison of TIS NoMa Parcel A and Revised Program Vehicle Trip Generation

	Daily			AM Peak Hour			PM Peak Hour		
TIS	**Entering**	**Exiting**	**Total**	**Entering**	**Exiting**	**Total**	**Entering**	**Exiting**	**Total**
Retail	106	106	212	3	2	5	9	10	19
Residential	319	319	638	10	39	49	39	21	60
Office	34	34	68	8	1	9	2	8	10
Total	459	459	918	21	42	63	50	39	89
Revised TIS									
Retail	106	106	212	3	2	5	9	10	19
Residential	319	319	638	10	39	49	39	21	60
Office	24	24	48	6	1	7	1	5	6
Grocery	198	198	396	8	5	13	19	18	37
Total	647	647	1,294	27	47	74	68	54	122
Net Change	188	188	376	6	5	11	18	15	33

The change in program of the addition of a 12,500 GSF grocery store and a reduction of 4,600 GSF of office compared to the TIS will result in an additional 11 morning and 33 evening peak hour inbound and outbound vehicle trips.

4. Vehicle Access and Circulation

In order to understand the impact of the revised program and shifting of the Building 1 vehicular and loading and service access, the trip distribution patterns have been changed to reflect the proposed circulation patterns. The TIS analyzed a condition where all project trips including retail, office and residential trips as well as loading and service vehicles would use the proposed driveway off of Main Street. This layout limited the circulation in that all project trips needed to take a right-turn into the site and a right-turn out of the site due to the median divided geometry. This caused more of the project generated trips to travel on Binney Street, Land Boulevard and Broadway/Main Street. The proposed change in passenger vehicle driveway location to use the existing One Broadway garage driveway improves the

overall quality of access because it allows more flexibility for users arriving and departing the site as shown in the revised TIS Figures 42-43. Now residents driving to the garage in Building 1 will be able to use Third Street or Main Street/Broadway.

Another difference from the TIS analysis to the revised program is that the retail, office and new grocery auto trips will park in the existing One Broadway Garage and those trips are also assigned in this analysis to the existing One Broadway garage entrance/exit on Third Street.

Revised project generated trip networks are provided in Figures 44-45. Revised Build trip networks are provided in Figures 46-47.

5. Vehicle Level of Service

The TIS vehicle capacity analysis has been updated to compare the level of service impacts of the proposed site plan with the TIS for the intersection of Third Street at Broadway. The vehicle level of service summary is provided in Table 7 and 8 for the signalized intersection of Third Street at Broadway. This signalized intersection is expected to experience the most impact to the change in site access.

Table 7 Third Street at Broadway Signalized Intersection Level of Service Results – AM Peak Hour

	TIS Build				Proposed Build			
	v/c	Delay	VLOS	Queue	v/c	Delay	VLOS	Queue
Broadway EB Left	0.79	35.3	D	161	0.83	36.1	D	168
Broadway EB Thru	0.48	31.7	C	106	0.47	31.6	C	103
Broadway WB Thru	1.24	152.5	F	~523	1.17	122.2	F	471
Broadway WB Right	0.92	61.9	E	197	0.96	69.6	E	208
Third SB Left	0.76	28.6	C	143	0.85	40.5	D	170
Third SB Right	0.38	22.9	C	47	0.42	26.7	C	53
Overall	**1.03**	**75.4**	**E**	**-**	**1.02**	**67.0**	**E**	**-**

Table 8 Third Street at Broadway Signalized Intersection Level of Service Results – PM Peak Hour

	TIS Build				Proposed Build			
	v/c	Delay	VLOS	Queue	v/c	Delay	VLOS	Queue
Broadway EB Left	0.83	56.0	E	173	0.95	72.4	E	198
Broadway EB Thru	0.67	22.1	C	108	0.66	22.2	C	107
Broadway WB Thru	0.83	56.0	E	236	0.75	34.0	C	211
Broadway WB Right	0.67	22.1	C	80	0.47	28.8	C	92
Third SB Left	0.83	56.0	E	~303	1.12	106.6	F	~349
Third SB Right	0.38	26.4	C	55	0.42	28.0	C	63
Overall	**0.89**	**43.1**	**D**	**-**	**0.93**	**51.7**	**D**	**-**

v/c volume-to-capacity ratio
Delay average delay expressed in seconds per vehicle
VLOS vehicular level of service
Queue queue length 50th (ft)

AM Peak Hour – the overall average delay for the intersection is expected to slightly decrease from 75 to 67 seconds (still LOS E) during the morning peak hour. This is attributed to a decrease in delay at the Broadway westbound approach due to the location of the egress on Third Street. The Third Street approach delay is expected to increase due to the additional southbound traffic exiting the proposed project driveway on Third Street.

PM Peak Hour – the overall average delay for the intersection is expected to increase slightly from 43 seconds to 52 seconds (still LOS D) during the evening peak hour with the shift in access location. This is attributed to the increase in traffic in the Broadway eastbound left movement and Third Street southbound movement.

The vehicle level of service comparison demonstrates that moving the access to the existing One Broadway Garage on Third Street will have a negligible impact to overall LOS operations during the peak hours.

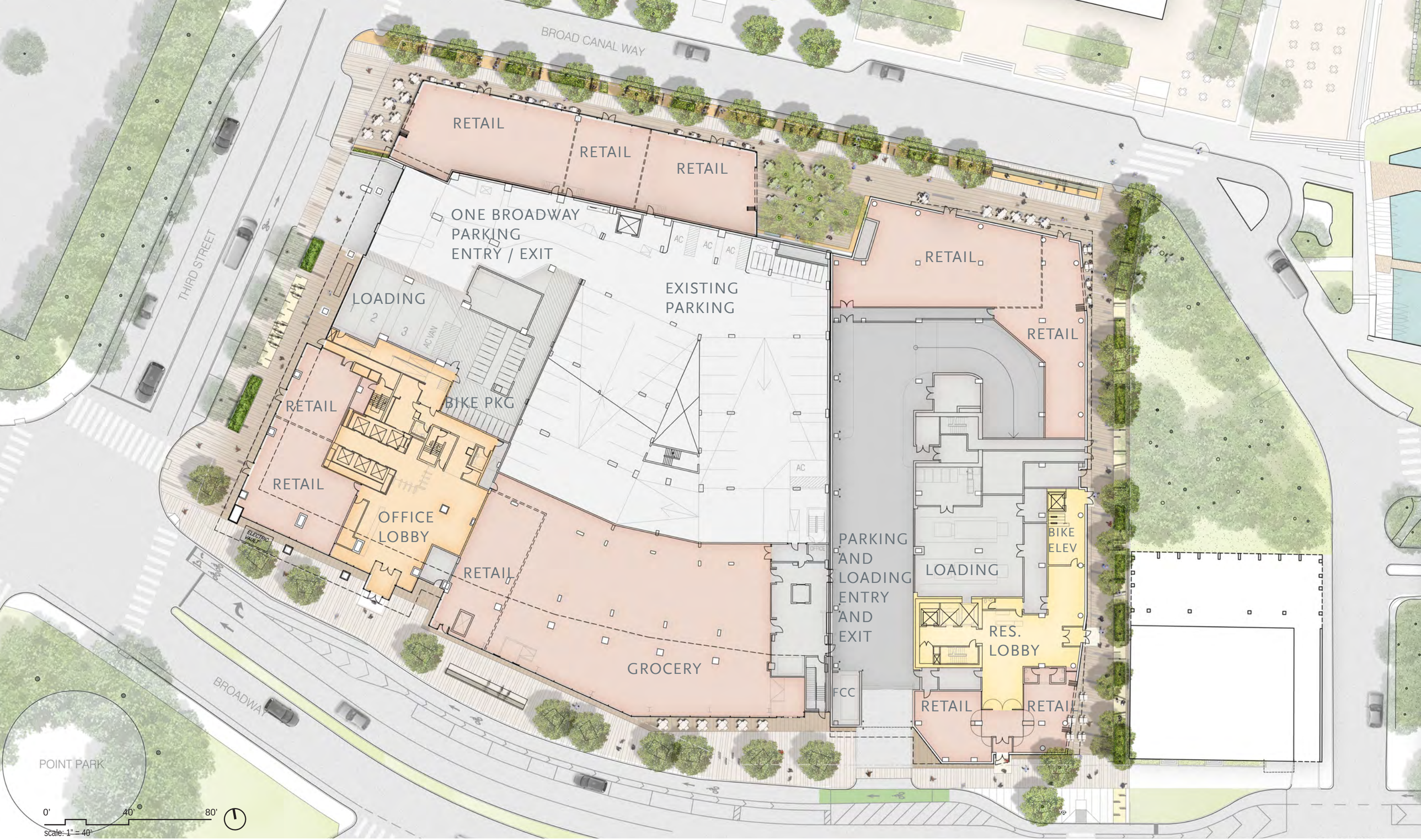

BROAD CANAL WAY
THIRD STREET
RETAIL
RETAIL
RETAIL
ONE BROADWAY
PARKING
ENTRY / EXIT
LOADING
2
3
AC VAN
EXISTING
PARKING
AC
AC
AC
RETAIL
RETAIL
RETAIL
BIKE PKG
OFFICE
LOBBY
ELECTRIC VAULT
RETAIL
GROCERY
PARKING
AND
LOADING
ENTRY
AND
EXIT
OFFICE
FCC
LOADING
BIKE
ELEV
RES.
LOBBY
RETAIL
RETAIL
BROADWAY
POINT PARK
0’
40’
80’
scale: 1” = 40’

FIGURE 1

FIGURE 2

GROUND FLOOR ENTRIES

RETAIL / ACTIVE USE
RESIDENTIAL UNITS
RES.COMMON SPACE
OFFICE
MECH. / PARKING
SERVICE
BIKE PARKING

BROAD CANAL WAY
THIRD STREET
BROADWAY
RED CROSS PARKING
RED CROSS

RETAIL EL. +/- 22'
RETAIL EL. +/- 21'-6"
RETAIL EL. +/- 21'-6"
RETAIL EL. +/- 20'
RETAIL EL. +/- 20'
RETAIL EL. +/- 20'-8"
OFFICE LOBBY EL. +/- 20'
FIRE COM.
ELECTRIC VAULT
UP
DOWN
+/- EL. 24.03'
+/- EL. 17.95'
+/- EL. 19.85'
GAS METERS
DOCK MNGR
RETAIL EL. +/- 20'-6"
RETAIL EL. +/- 20'-6"
BIKE REPAIR STATION
LOADING
EL+/- 19'-6"
6%
FUEL
FIRE PUMP
GAS METERS
MAIN ELECT
MDF
TRASH / RECYCLE
TRANSFORMER VAULT
WATER SVC
20' Setback
BIKE ENTRY
MAIL ENTRY
39 BIKES
RES MOVE-IN
BIKE
PET CARE
MAIL
EL+/-17'
EL+/-21'
RECEIVING
RECEIVING
ANTENNA SYSTEM
RES LOBBY
EL+/-21'
RETAIL EL. +/- 21'
RETAIL EL. +/- 21'
FCC

163'
33'-6"
6'-6"
104'-8"
86'-2"
95'-0"
13'-6"
115'-0"
41'
41'
25'-0"
40'
114'-7"
234'-8"
72'-6"
13'-0"
83'-9"
35'-0"
24'-6"
8'-0"
7'-6"

0' 40' 80'
scale: 1" = 40'

NOMA | ELKUS MANFREDI ARCHITECTS | LANDWORKS STUDIO

FIGURE 3
GROUND FLOOR

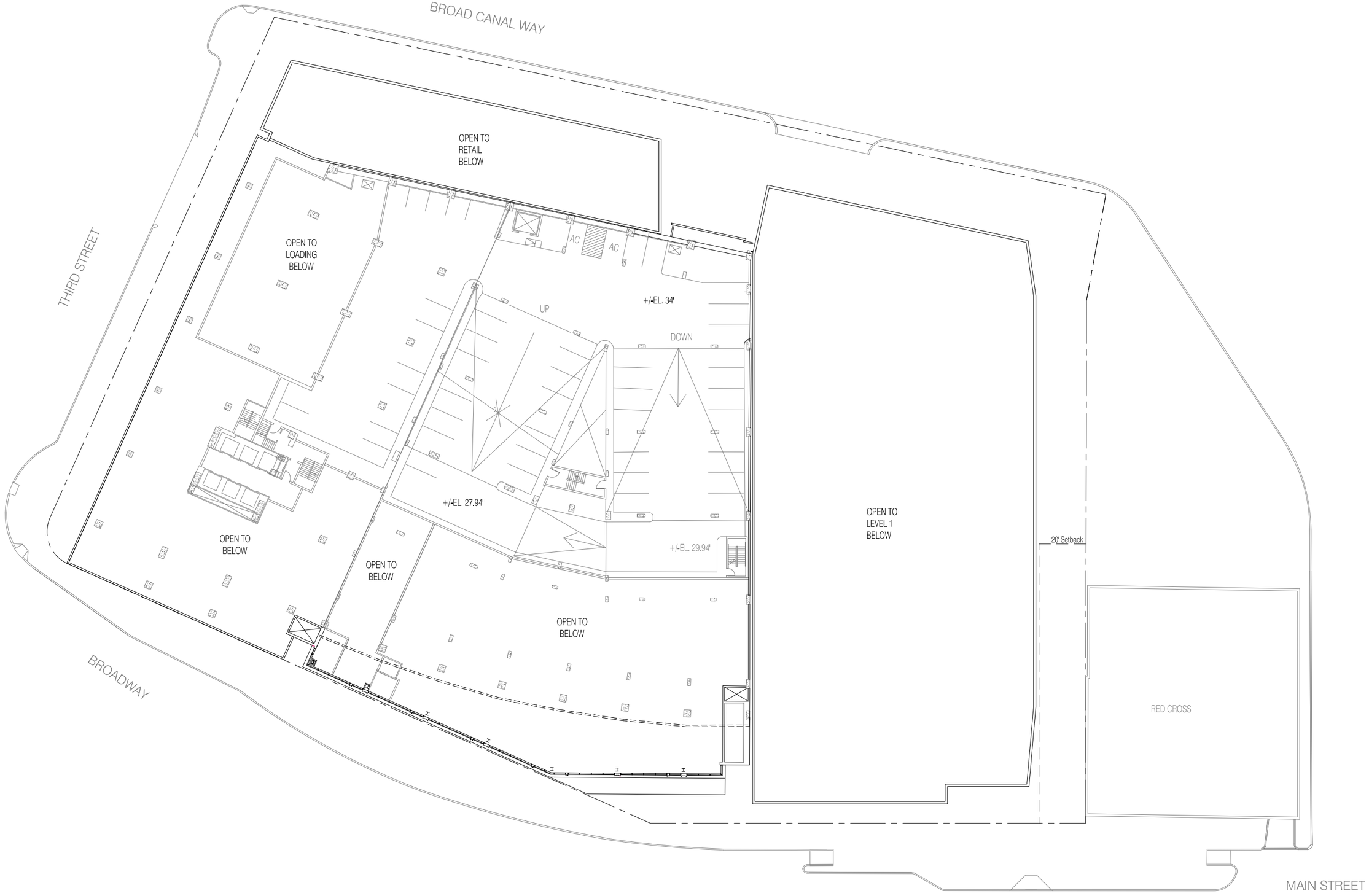


FIGURE 4

ONE BROADWAY PARKING MEZZANINE

RETAIL / ACTIVE USE

RESIDENTIAL UNITS

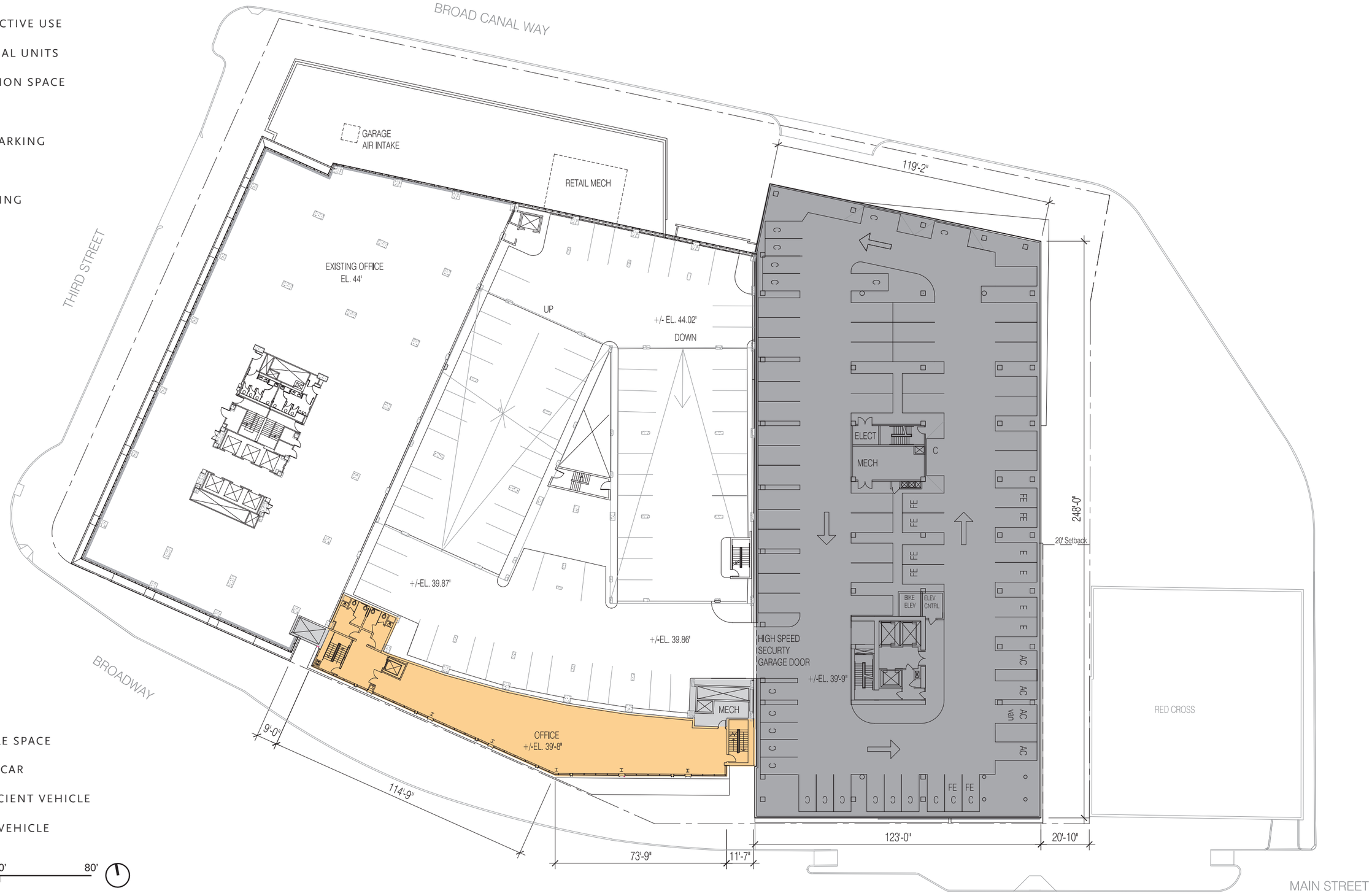
RES.COMMON SPACE

OFFICE

MECH. / PARKING

SERVICE

BIKE PARKING



AC ACCESSIBLE SPACE

C COMPACT CAR

FE FUEL EFFICIENT VEHICLE

E ELECTRIC VEHICLE

0' 40' 80'

scale: 1" = 40'

FIGURE 5

FLOOR 2 PARKING

RETAIL / ACTIVE USE

RESIDENTIAL UNITS

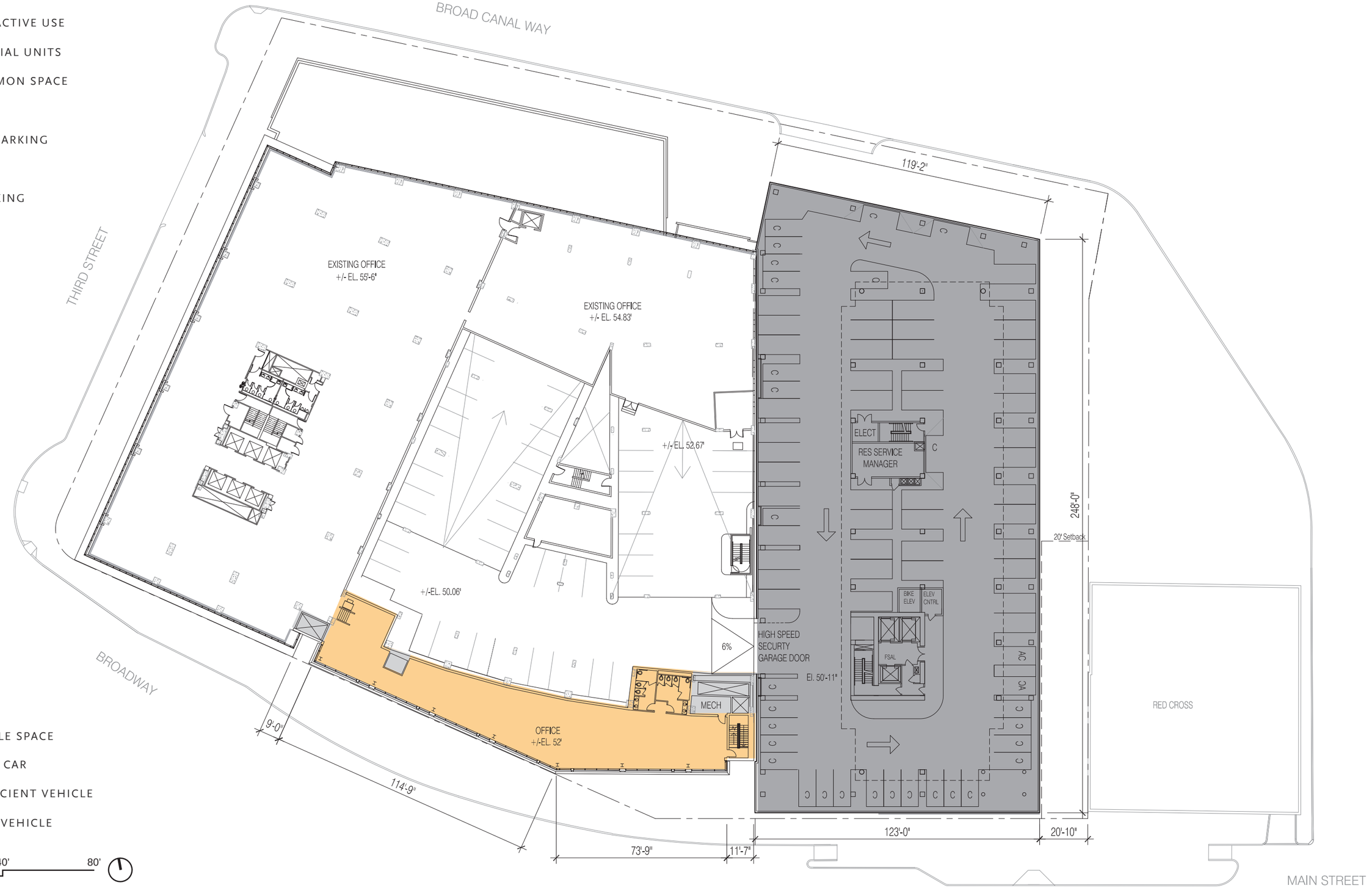
RES.COMMON SPACE

OFFICE

MECH. / PARKING

SERVICE

BIKE PARKING



AC ACCESSIBLE SPACE

C COMPACT CAR

FE FUEL EFFICIENT VEHICLE

E ELECTRIC VEHICLE

0' 40' 80'

scale: 1" = 40'

FIGURE 6

FLOOR 3 PARKING

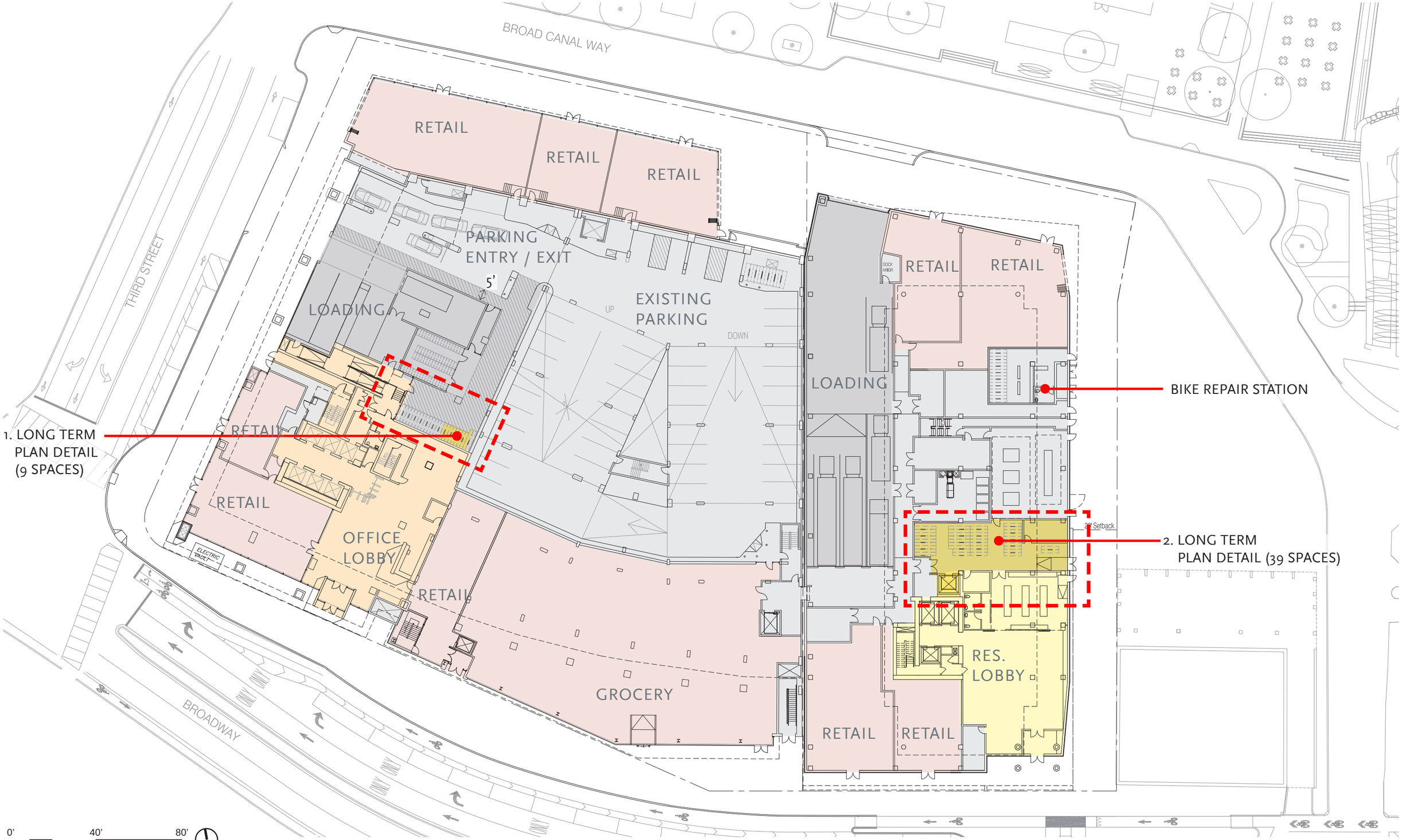


FIGURE 7

LONG TERM BIKE PARKING LOCATION PLAN - GROUND LEVEL

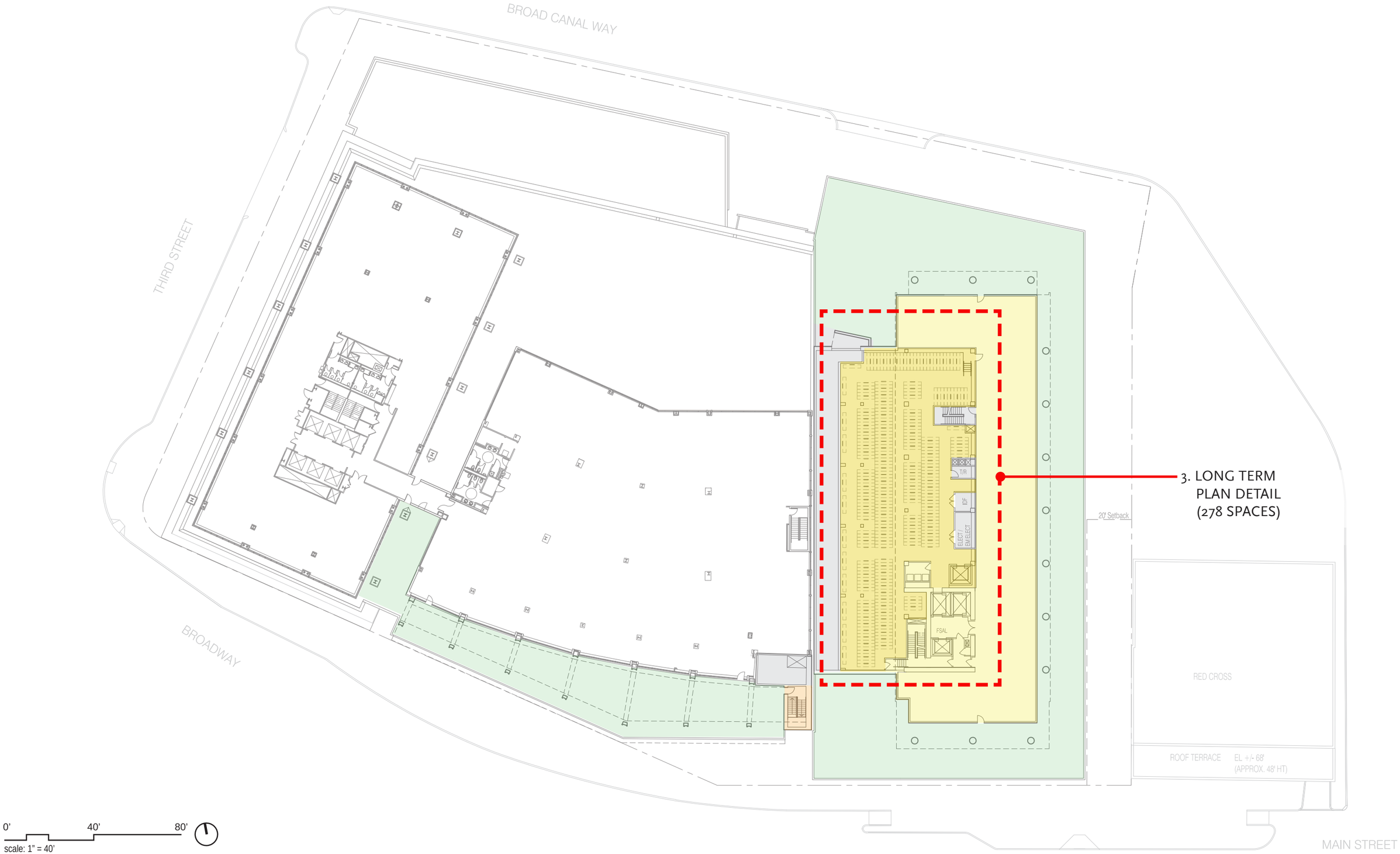
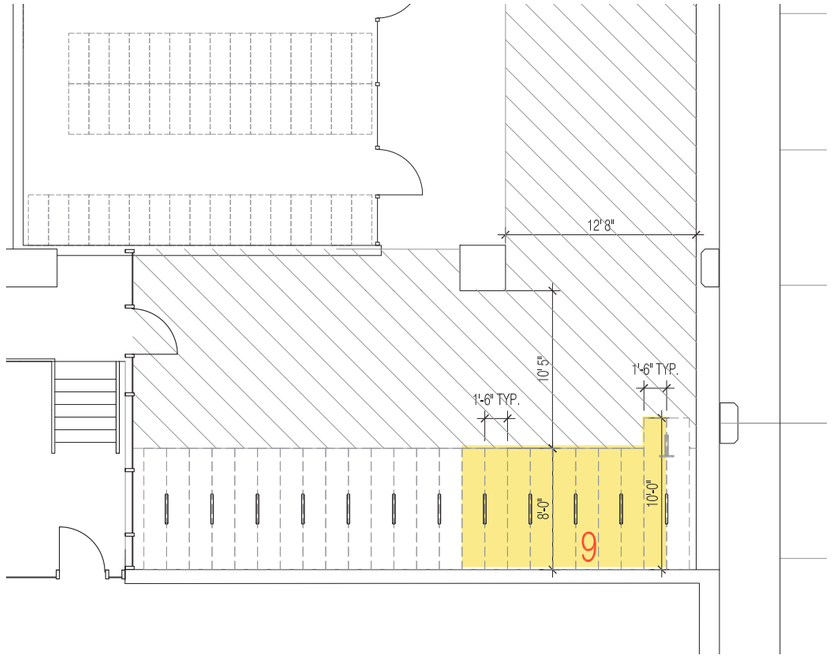


FIGURE 8

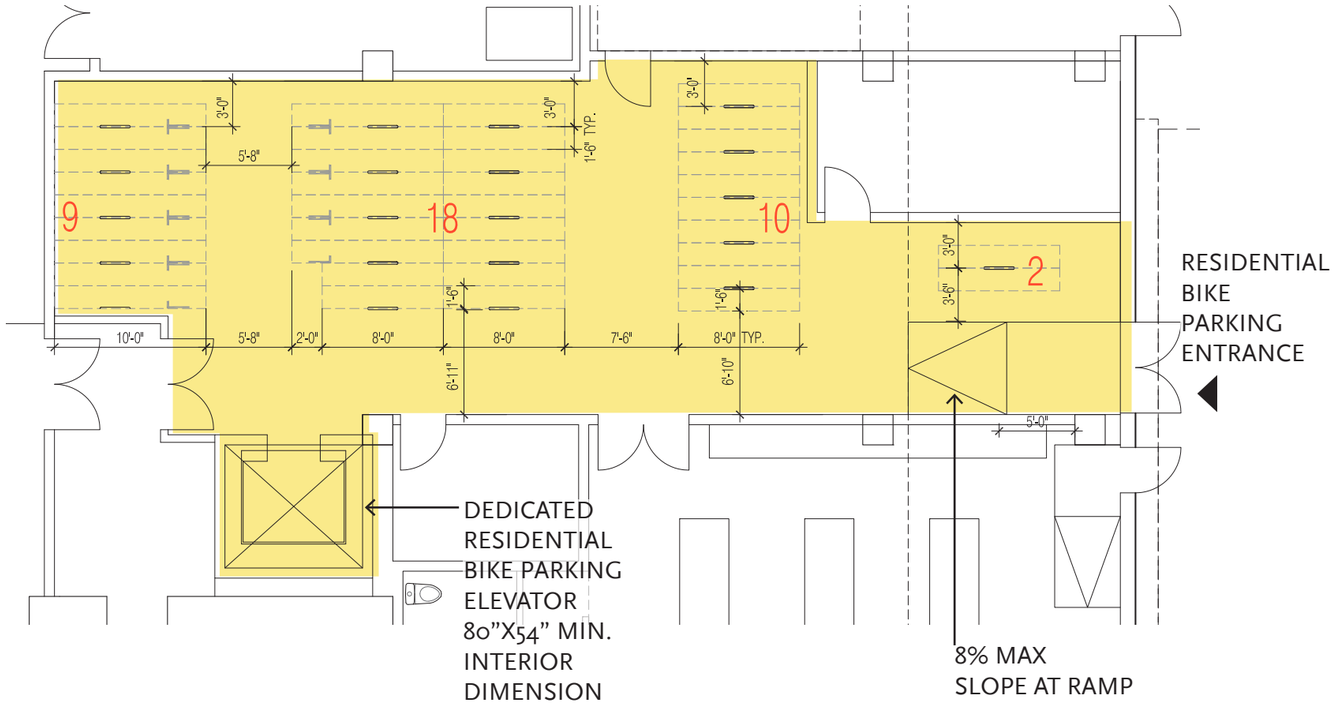
NOMA | ELKUS MANFREDI ARCHITECTS | LANDWORKS STUDIO

LONG TERM BIKE PARKING LOCATION PLAN - LEVEL FOUR



1 LONG TERM BIKE PARKING DETAIL PLAN - LEVEL 1 (9 SPACES)

1"=10'-0"



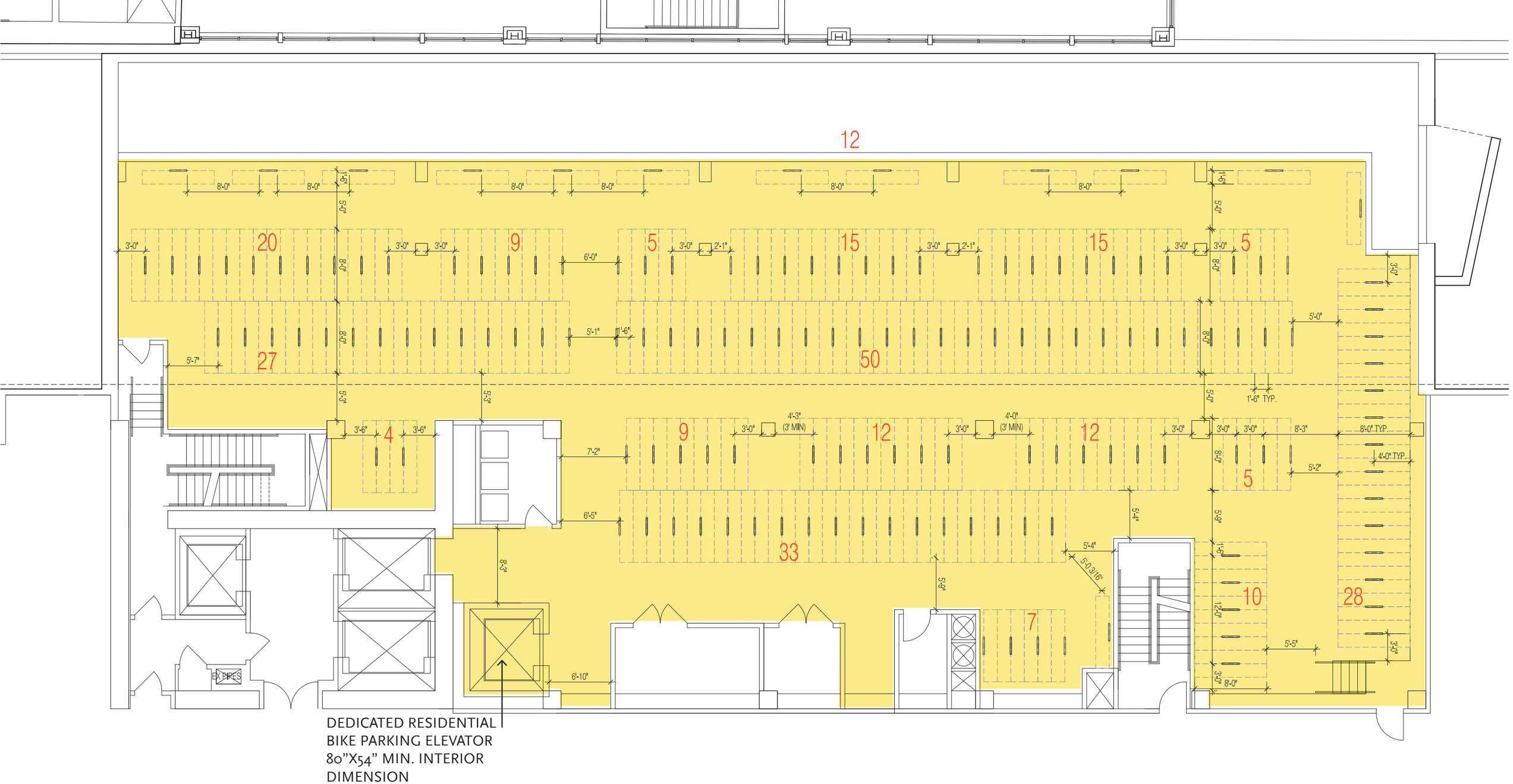
2 LONG TERM BIKE PARKING DETAIL PLAN - LEVEL 1 (39 SPACES)

1"=10'-0"

0 10 20

FIGURE 9

LONG TERM BIKE PARKING PLANS - GROUND LEVEL



3 LONG TERM BIKE PARKING DETAIL PLAN - LEVEL 4 (278 SPACES)

1"=10'-0"

0 10 20

FIGURE 10

SHORT TERM BIKE PARKING REQUIREMENTS

RES TOWER:
RETAIL: **6 SPACES** (W/IN 50' RADIUS OF ENTRANCE)
RESIDENTIAL: **30 SPACES** (8 SPACES W/IN 50' RADIUS OF ENTRANCE)
(INCL. 2 TANDEM SPACES)

TOTAL NEW SHORT TERM BIKE SPACES
RES TOWER: **36**

ONE BROADWAY LINER:
RETAIL: **6 SPACES** (W/IN 50' RADIUS OF ENTRANCE)
(INCL. 1 TANDEM SPACES)

ONE BROADWAY SOUTH ADDITIONS:
RETAIL: **18 SPACES** (8 SPACES W/IN 50' RADIUS OF ENTRANCE)
OFFICE: **6 SPACES** (W/IN 50' RADIUS OF ENTRANCE)
(INCL. 1 TANDEM SPACES)

TOTAL NEW SHORT TERM BIKE SPACES
ONE BROADWAY: **30**

SCALE 1"=60'

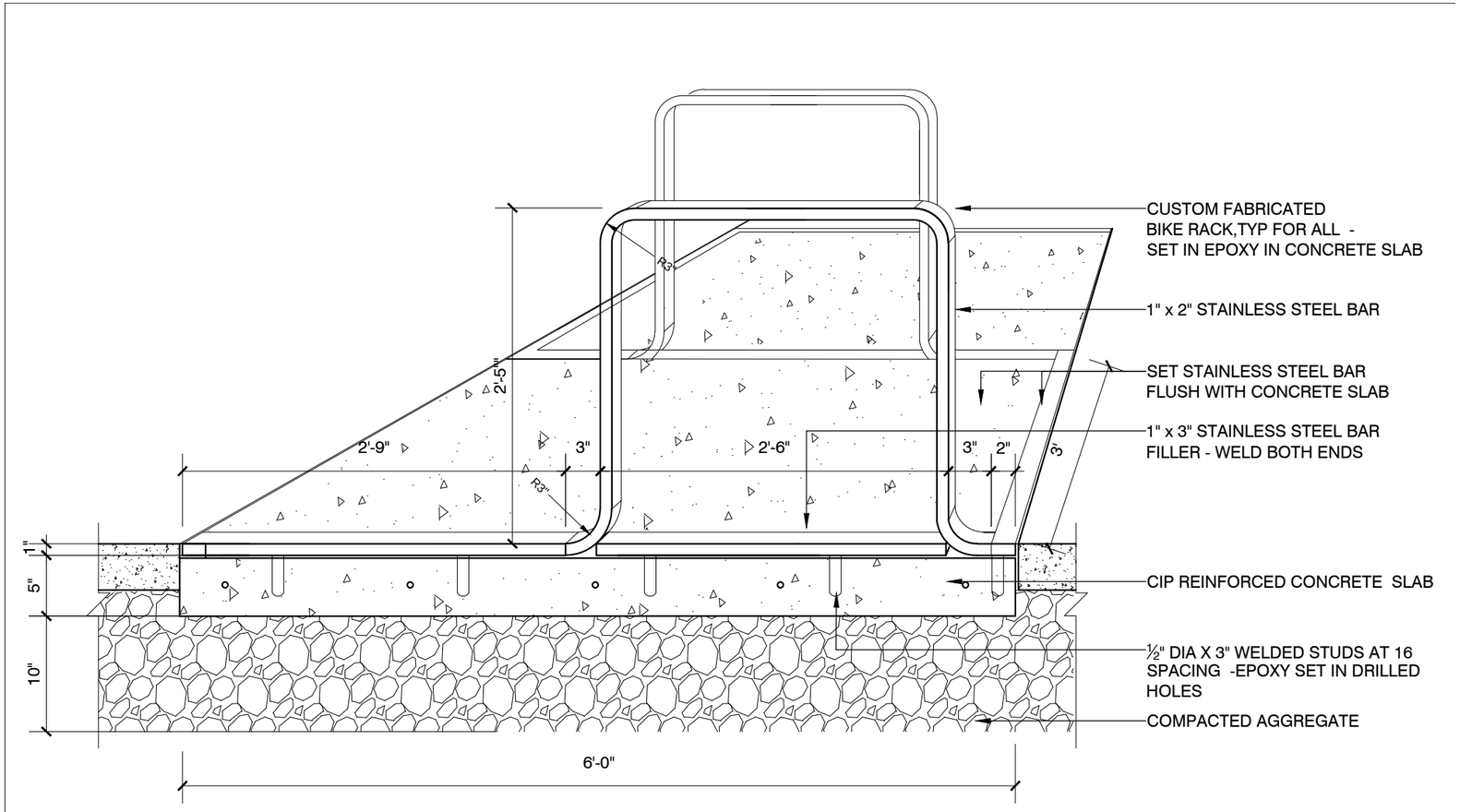
0 60' 120'

ENTRY

50' RADIUS

FIGURE 11

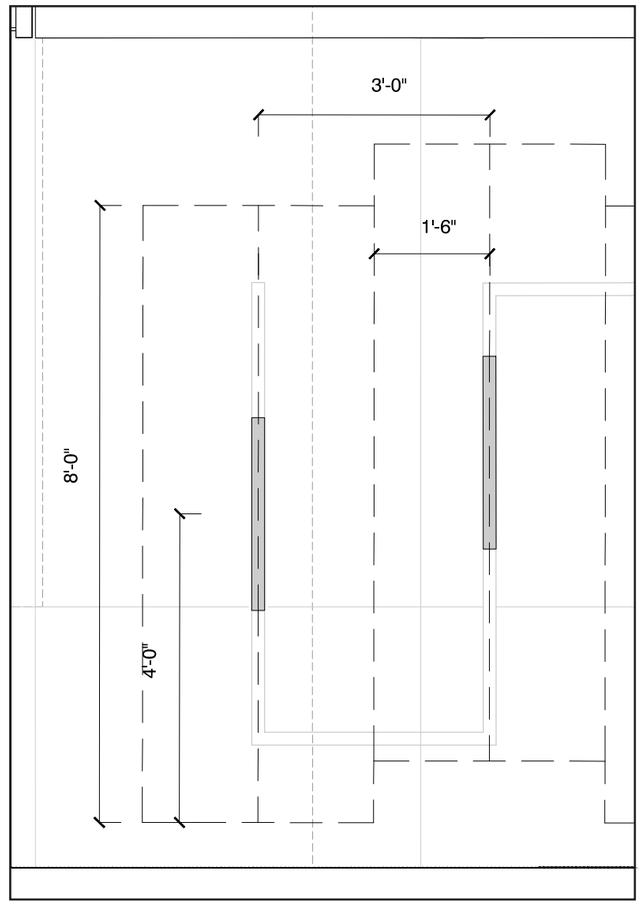
LANDSCAPE PLAN - SHORT TERM BIKE PARKING



SECTION / PERSPECTIVE

SCALE 1" =1' 0"

0 1' 2'



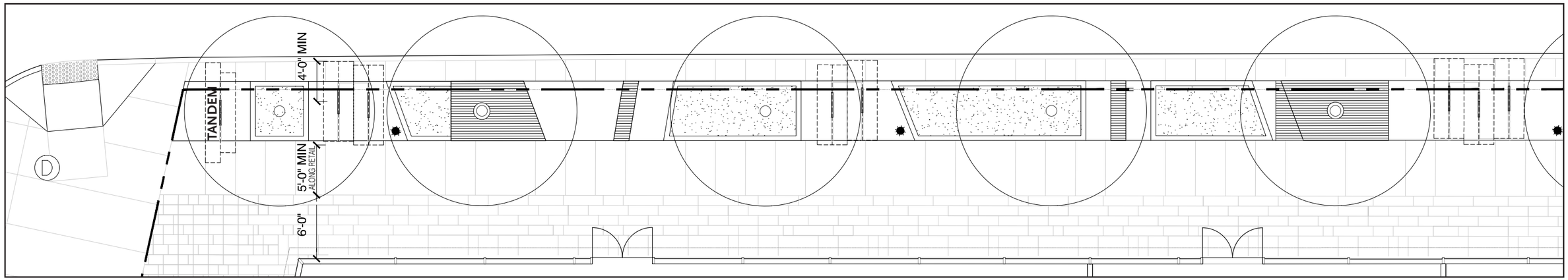
ENLARGED LAYOUT DE-
TAIL

SCALE 1/2" =1' 0"

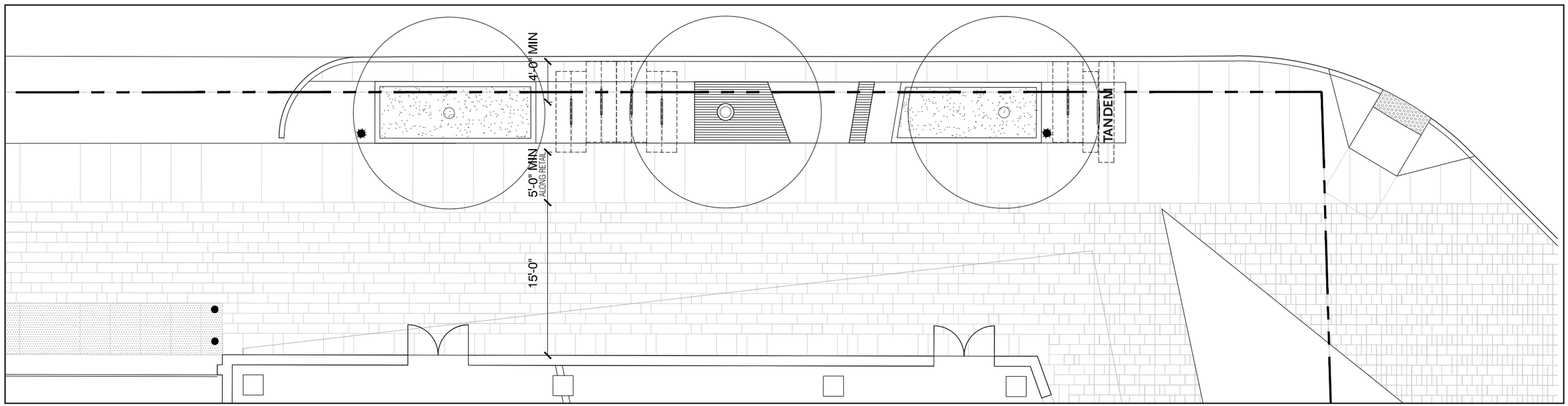
0 2' 4'

FIGURE 12

BIKE RACK DETAIL



PLAN A - BROAD CANAL WAY WEST - 16 SPACES



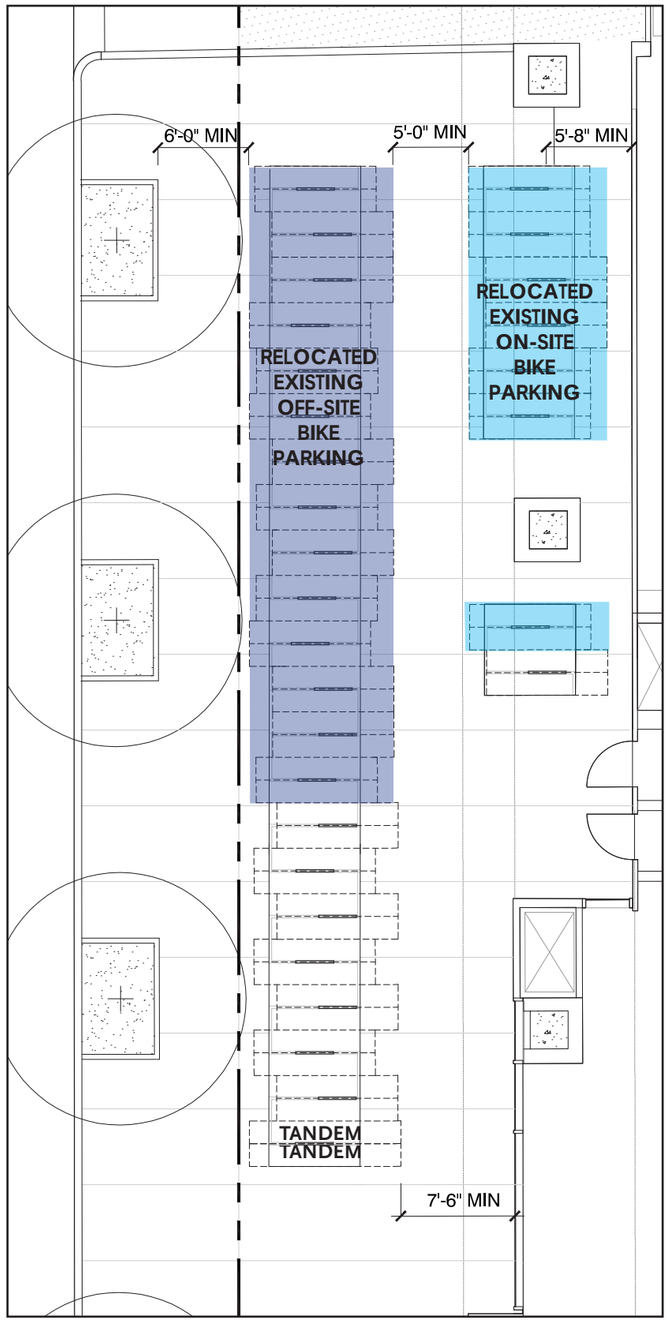
PLAN B - BROAD CANAL WAY EAST - 12 SPACES

SCALE 1"=10'

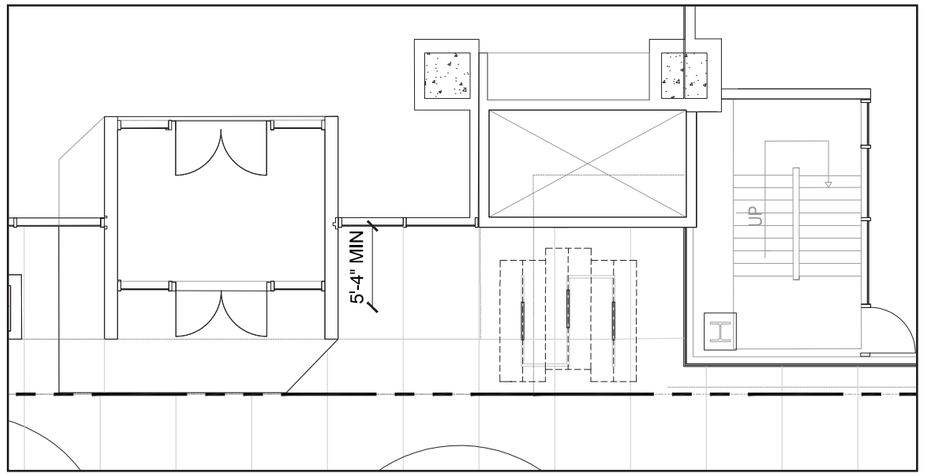
0 10' 20'

FIGURE 13

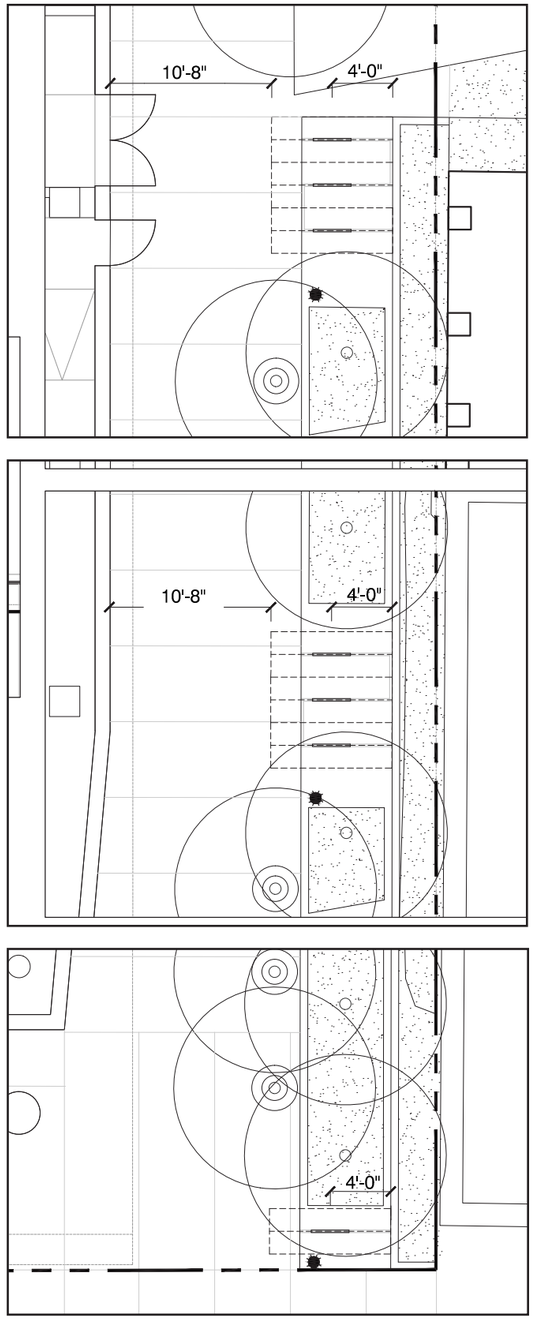
ENLARGED LANDSCAPE PLANS - SHORT TERM BIKE PARKING



PLAN C - THIRD STREET - 18 SPACES



PLAN D - ONE BROADWAY ENTRANCE - 6 SPACES



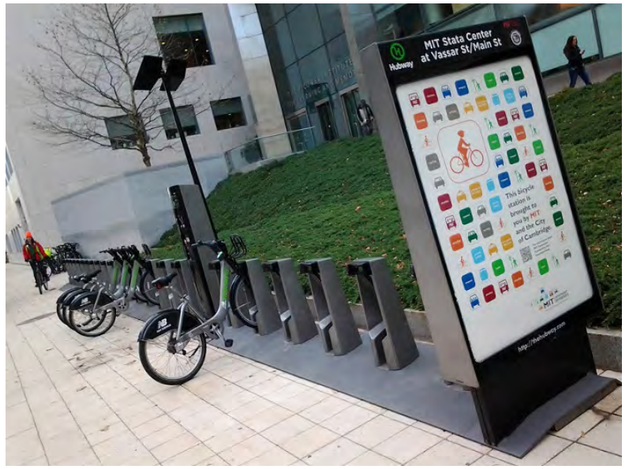
PLAN E - PEDESTRIAN CORRIDOR - 14 SPACES

SCALE 1"=10'

0 10' 20'

FIGURE 14

ENLARGED LANDSCAPE PLANS - SHORT TERM BIKE PARKING



NEW HUBWAY

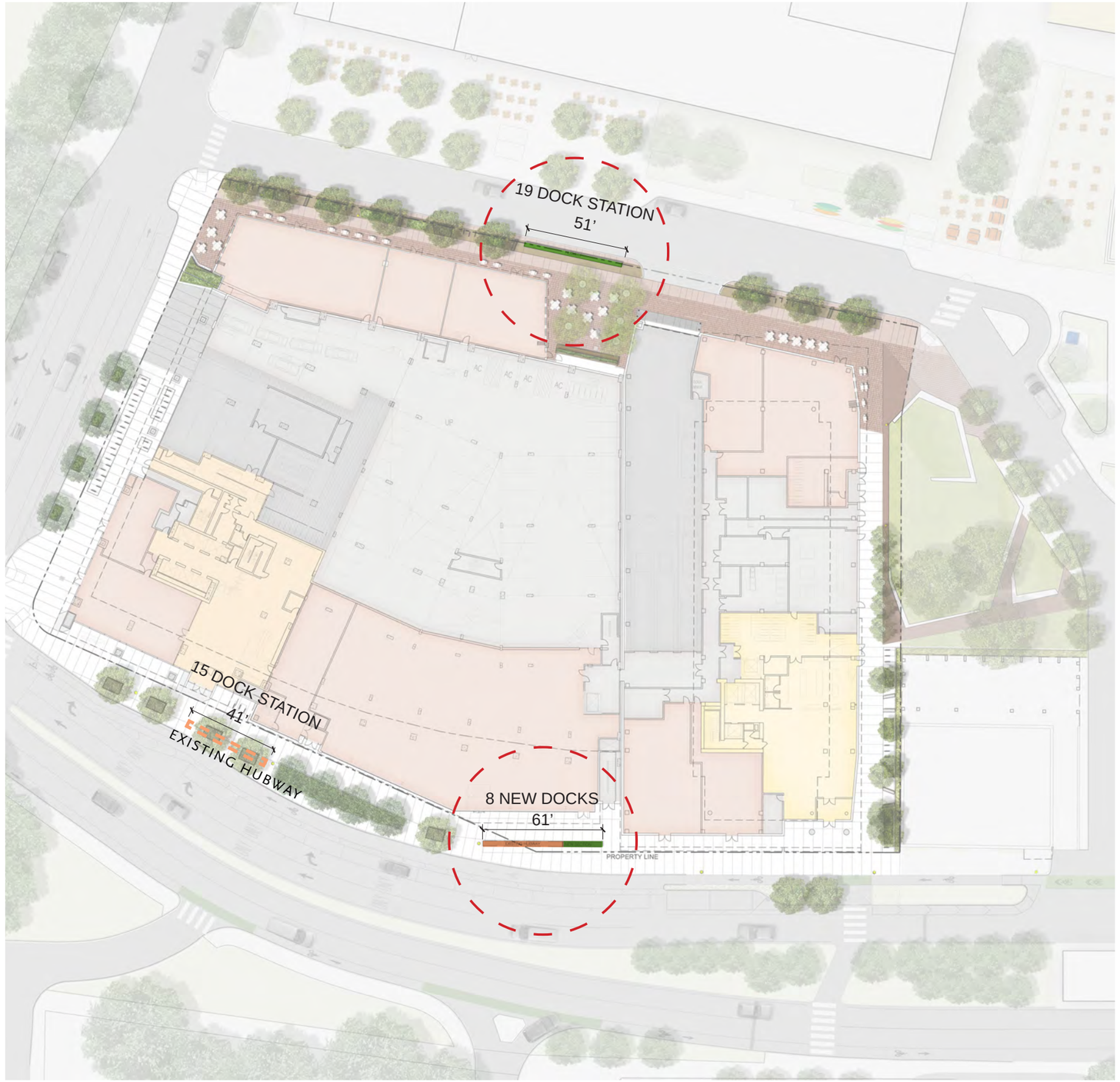
71’ IN TOTAL

27 NEW DOCKS, 1 MAP, 1 KIOSK

6’

FIGURE 15

NEW HUBWAY



SCALE 1”=60’ 0 60’ 120’

BROAD CANAL WAY

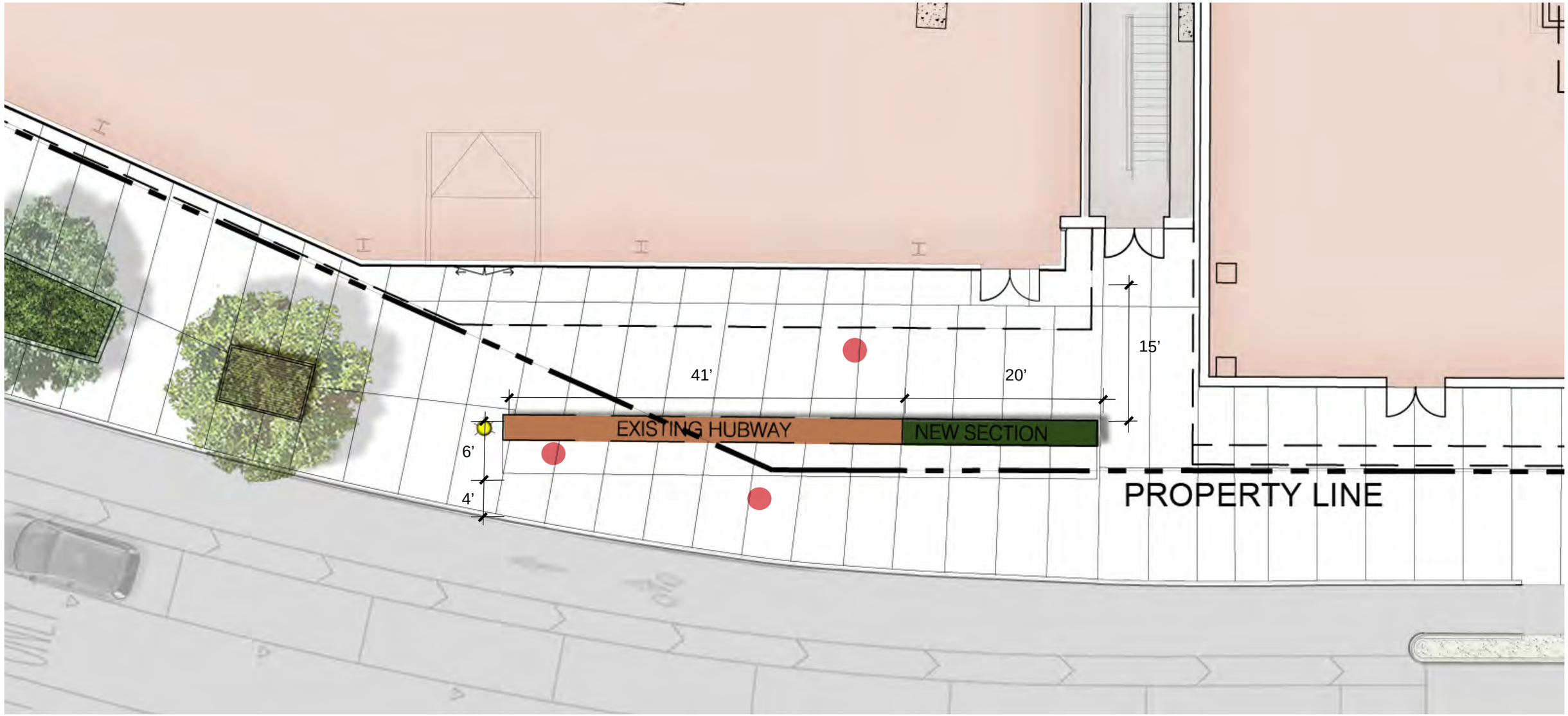
SCALE 1”=30’ 0 30’ 60’

MAIN STREET

SCALE 1”=30’ 0 30’ 60’

FIGURE 16

HUBWAY



UTILITY MANHOLES NEAR HUBWAY STATION

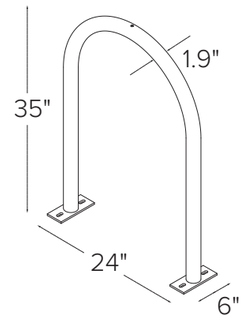
SCALE 1”=10’ 0 10’ 20’

FIGURE 17

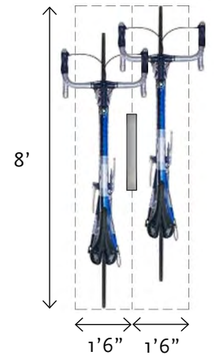
HUBWAY: MAIN STREET

REQUIRED BIKE PARKING - BUILDING 1

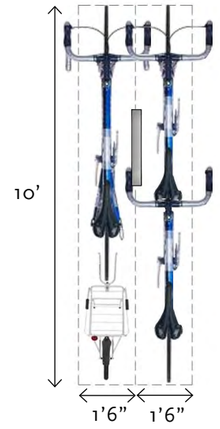
PROGRAM		LONG TERM MULTIPLIERS	LONG TERM SPACES REQUIRED	SHORT TERM MULTIPLIER	SHORT TERM SPACES REQUIRED
RETAIL	9,600 GFA	GFA/1000 (.1)	1	GFA/1000 (.6)	6
RESIDENTIAL	UP TO 300 UNITS	1 PER UNIT FOR 1ST 20 UNITS, 1.05 PER UNIT IN EXCESS OF 20 UNITS	315	.1 PER UNIT	30
TOTAL:			317 (REQ'D PER PUD SPECIAL PERMIT)		36
NUMBER OF TOTAL SPACES TO ACCOMODATE TANDEM/ TRAILERS		5%	16		2



BIKE RACK
(LONG TERM BIKE PARKING)



TYPICAL BIKE
PARKING SPACES



TAMDEM BIKE
PARKING SPACES

FIGURE 18

BIKE PARKING CALCULATIONS - BUILDING 1

REQUIRED NEW BIKE PARKING - SOUTH ADDITIONS TO ONE BROADWAY

PROGRAM		LONG TERM MULTIPLIERS	LONG TERM SPACES REQUIRED	SHORT TERM MULTIPLIER	SHORT TERM SPACES REQUIRED
RETAIL	18,230 GFA *	GFA/1000 (.1)	2	GFA/1000 (.6)	11
OFFICE	17,845 GFA **	GFA/1000 (.3)	6	GFA/1000 (.06)	2
TOTAL:			8		13

REQUIRED NEW BIKE PARKING- NORTH ADDITION TO ONE BROADWAY

PROGRAM		LONG TERM MULTIPLIERS	LONG TERM SPACES REQUIRED	SHORT TERM MULTIPLIER	SHORT TERM SPACES REQUIRED
RETAIL	9,000 GFA	GFA/1000 (.1)	1	GFA/1000 (.6)	6
TOTAL:			1		6

REQUIRED NEW BIKE PARKING- ONE BROADWAY

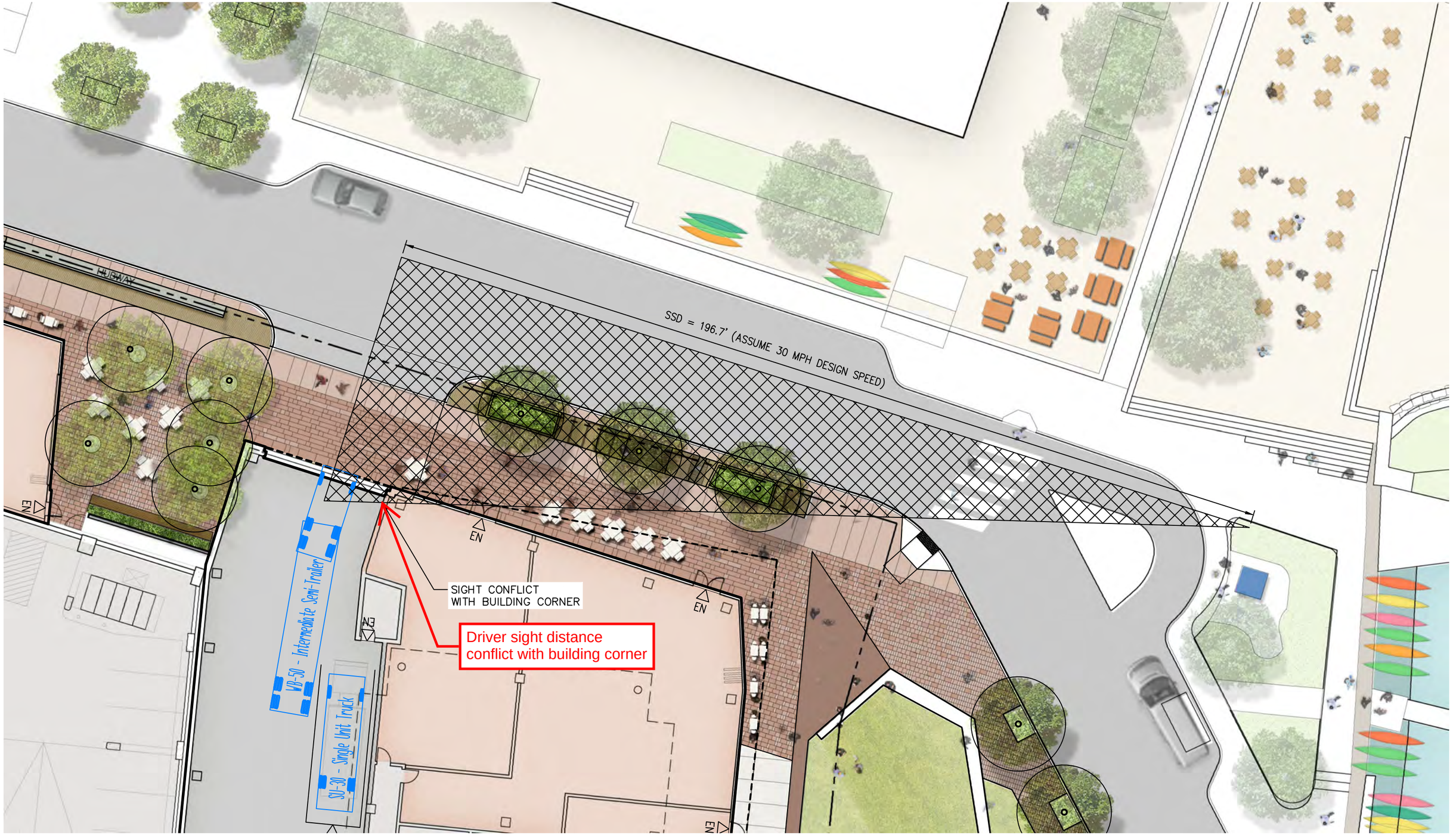
PROGRAM	LONG TERM MULTIPLIERS	LONG TERM SPACES REQUIRED	SHORT TERM MULTIPLIER	SHORT TERM SPACES REQUIRED
TOTAL:		9		19
NUMBER OF TOTAL SPACES TO ACCOMODATE TANDEM/ TRAILERS	5%	1		1

* TOTAL NEW & EXISTING GROUND FLOOR RETAIL.

** NET NEW OFFICE GFA INCLUDING LOBBY, 2 LEVELS ABOVE GROCERY AND ROOF TERRACE.

FIGURE 19

BIKE PARKING CALCULATIONS - ONE BROADWAY

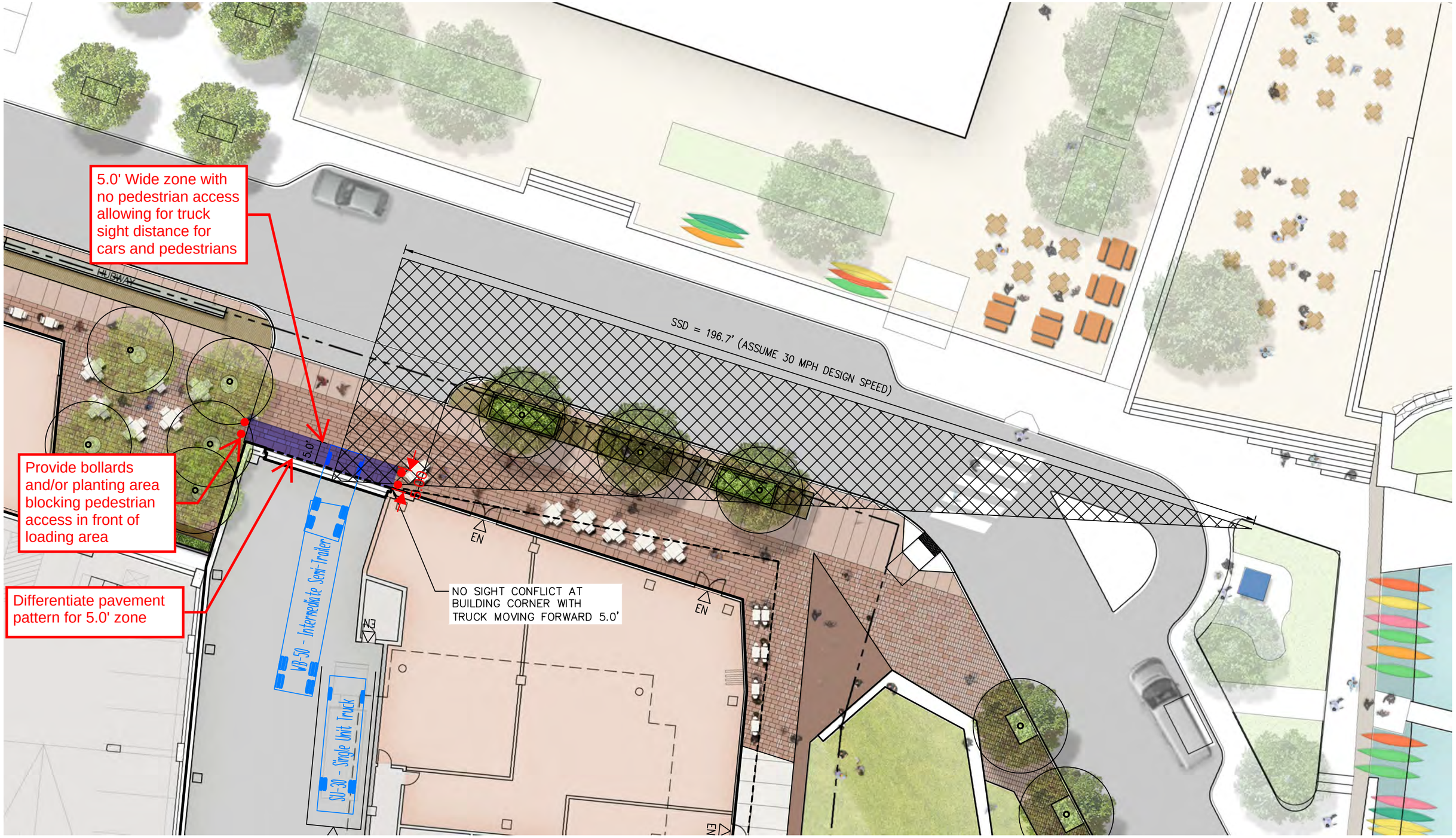


0 10 20 40 Feet

Sight Distance Looking East
MITIMCo
199 Main Street
Cambridge, MA

FiFigure 20

November 2016



0 10 20 40 Feet

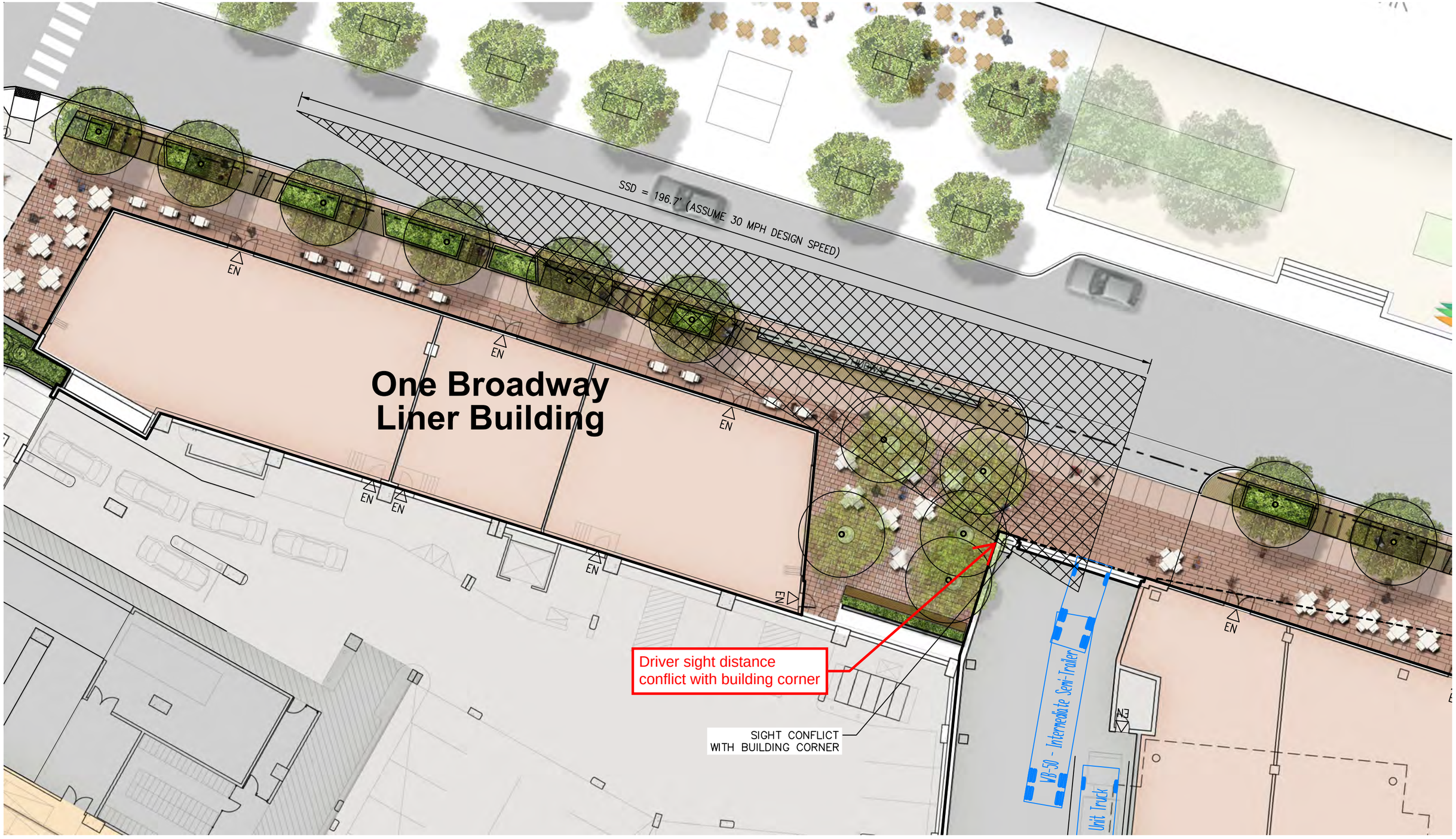
vhb

Sight Distance Looking East
MITIMCo
199 Main Street
Cambridge, MA

Figure 21

November 2016

\\vhb\proj\Boston\13024.00\cad\ld\Planmisc\CDD Loading Movements\13024.00 - CDD Sight Distance.dwg

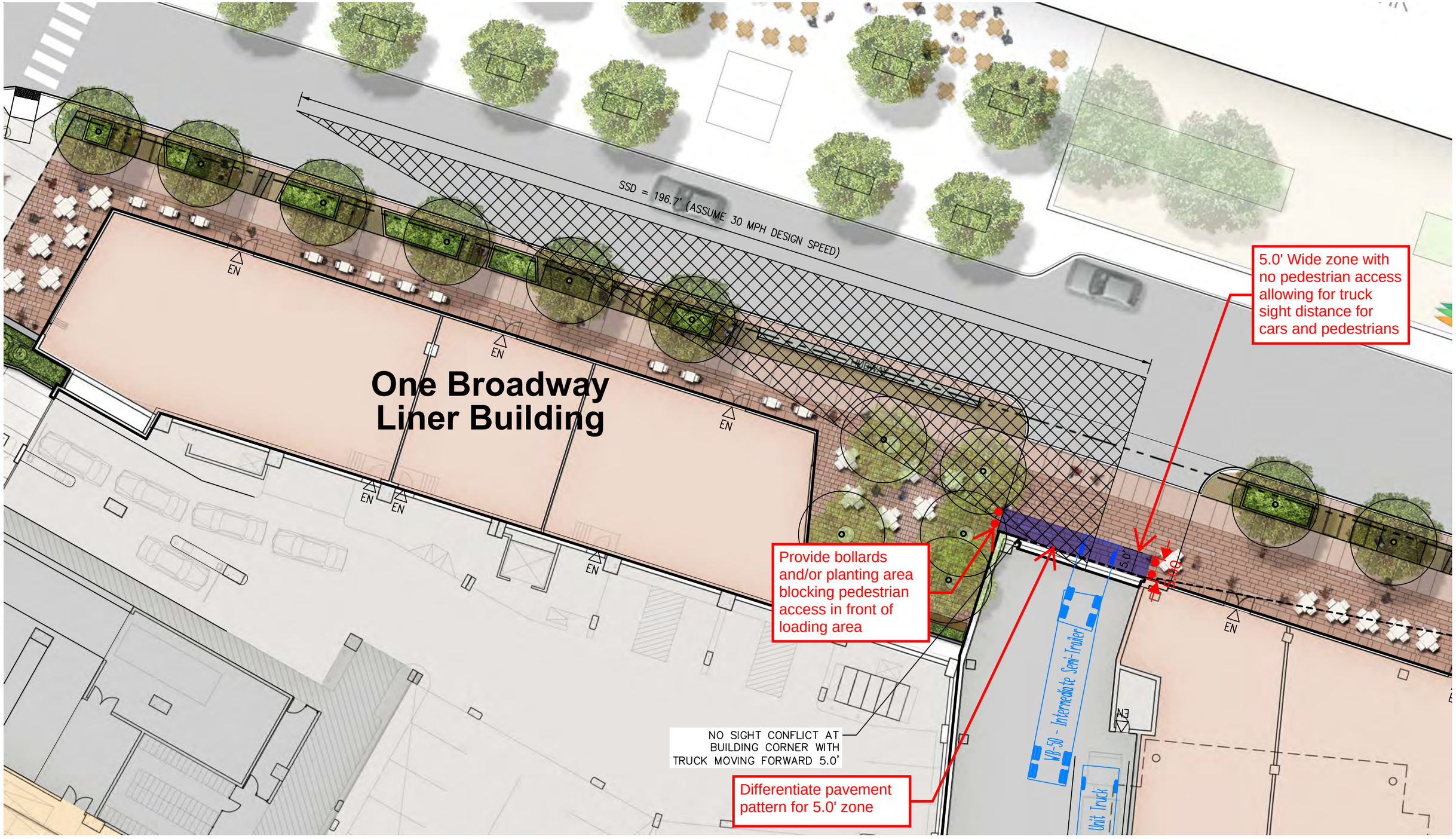


0 10 20 40 Feet

Sight Distance Looking West
MITIMCo
199 Main Street
Cambridge, MA

Figure 22

November 2016



0 10 20 40 Feet

Sight Distance Looking West
MITIMCo
199 Main Street
Cambridge, MA

Figure 23

November 2016

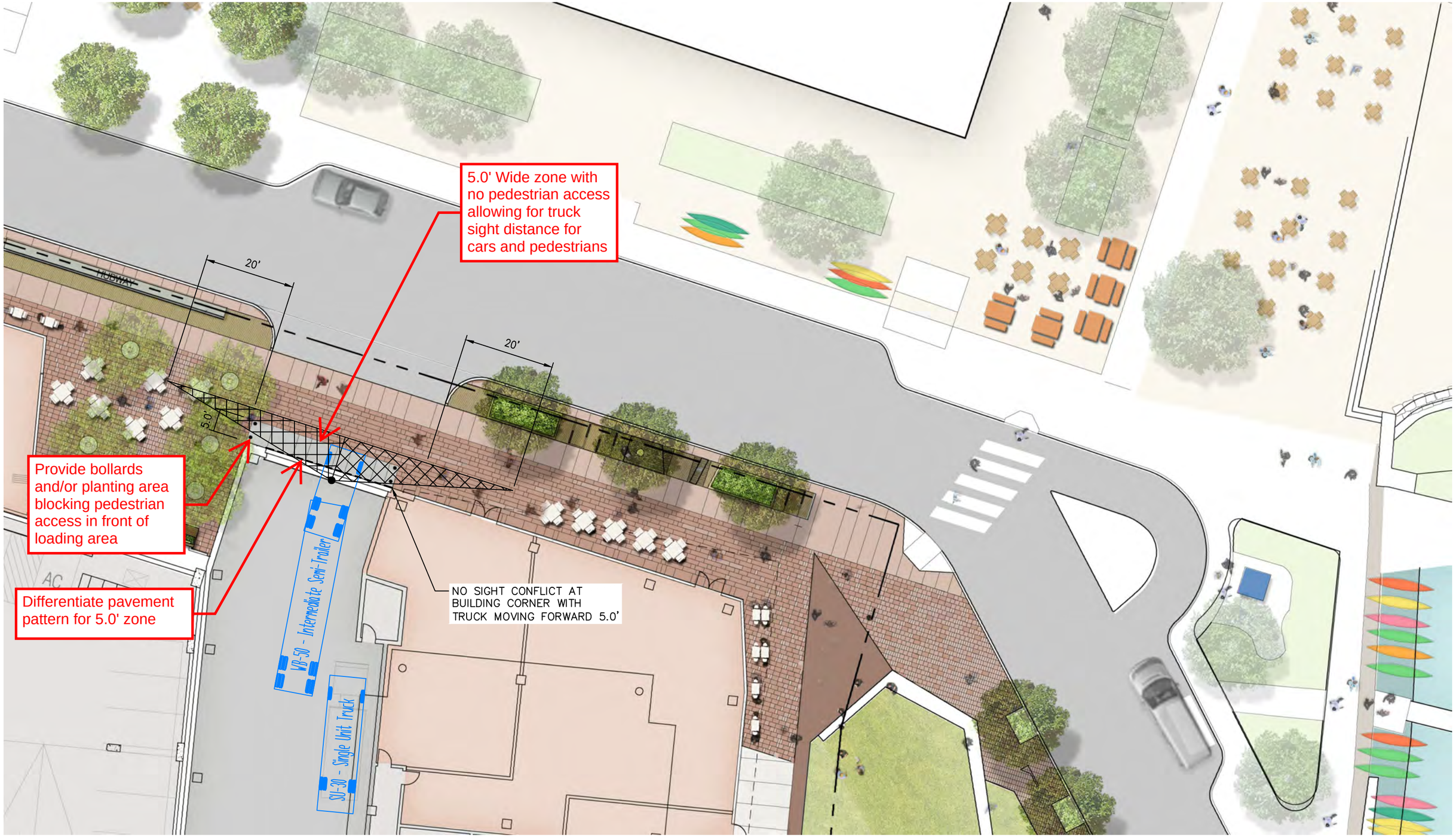
\\vhb\proj\Boston\13024.00\cad\ld\Planmisc\CDD Loading Movements\13024.00 - CDD Pedestrian Sight Distance.dwg

0 10 20 40 Feet

Pedestrian Sight Distance
WB-50 Leaving Loading
MITIMCo
199 Main Street, Cambridge, MA

Figure 24

November 2016

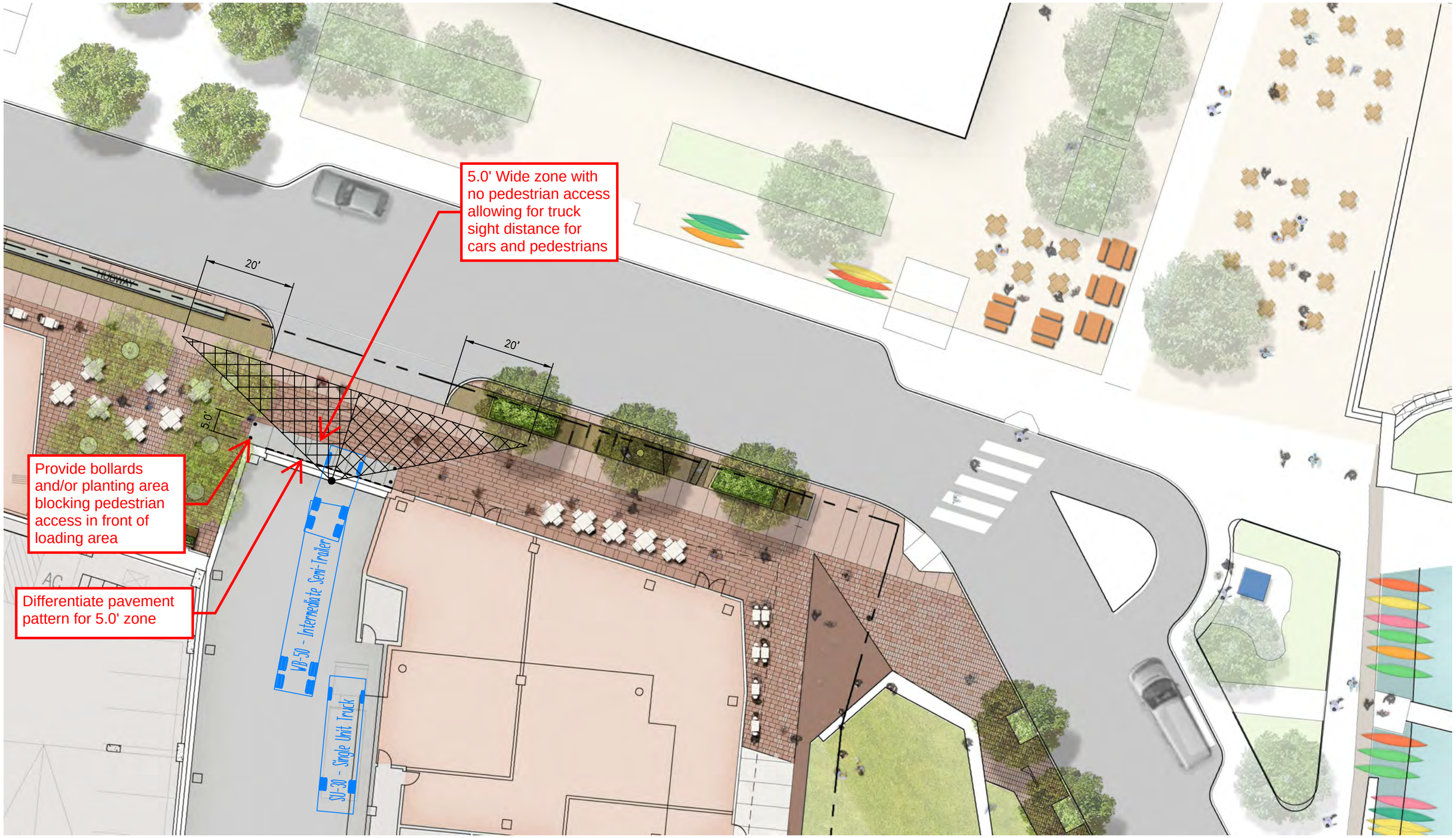


0 10 20 40 Feet

Pedestrian Sight Distance
WB-50 Leaving Loading
MITIMCo
199 Main Street, Cambridge, MA

Figure 25

November 2016



0 10 20 40 Feet

Pedestrian Sight Distance
WB-50 Leaving Loading
MITIMCo
199 Main Street, Cambridge, MA

Figure 26

November 2016

\\vhb\proj\Boston\13024.00\cad\ld\Planmisc\CDD Loading Movements\13024.00 - CDD Loading Turning Movements.dwg

WB–50 – Intermediate Semi–Trailer

Overall Length	55.000ft
Overall Width	8.500ft
Overall Body Height	12.052ft
Min Body Ground Clearance	1.334ft
Max Track Width	8.500ft
Lock–to–lock time	6.00s
Max Steering Angle (Virtual)	17.90°

0 20 40 80 Feet

vhb

WB-50 Entering Loading
MITIMCo
199 Main Street
Cambridge, MA

FFigure 27

November 2016

\\vhb\proj\Boston\13024.00\cad\ld\Planmisc\CDD Loading Movements\13024.00 - CDD Loading Turning Movements.dwg

WB-50 – Intermediate Semi-Trailer	
Overall Length	55.000ft
Overall Width	8.500ft
Overall Body Height	12.052ft
Min Body Ground Clearance	1.334ft
Max Track Width	8.500ft
Lock-to-lock time	6.00s
Max Steering Angle (Virtual)	17.90°

0 20 40 80 Feet

WB-50 Exiting Loading
MITIMCo
199 Main Street
Cambridge, MA

FFigure 28

November 2016

\\vhb\proj\Boston\13024.00\cad\ld\Planmisc\CDD Loading Movements\13024.00 - CDD Loading Turning Movements.dwg

0 20 40 80 Feet

Compactor Pick-Up
MITIMCo
199 Main Street
Cambridge, MA

Figure 29

November 2016

\\vhb\proj\Boston\13024.00\cad\ld\Planmisc\CDD Loading Movements\13024.00 - CDD Loading Turning Movements.dwg

Compactor Pick-Up	
Overall Length	34.500ft
Overall Width	8.500ft
Overall Body Height	12.898ft
Min Body Ground Clearance	1.364ft
Max Track Width	8.500ft
Lock-to-lock time	6.00s
Wall to Wall Turning Radius	45.000ft

0 20 40 80 Feet

vhb

Compactor Exiting
MITIMCo
199 Main Street
Cambridge, MA

FiFigure 30

November 2016

\\vhb\proj\Boston\13024.00\cad\ld\Planmisc\CDD Loading Movements\13024.00 - CDD Loading Turning Movements.dwg

0 20 40 80 Feet

SU-30 Entering Loading
MITIMCo
199 Main Street
Cambridge, MA

Figure 31

November 2016

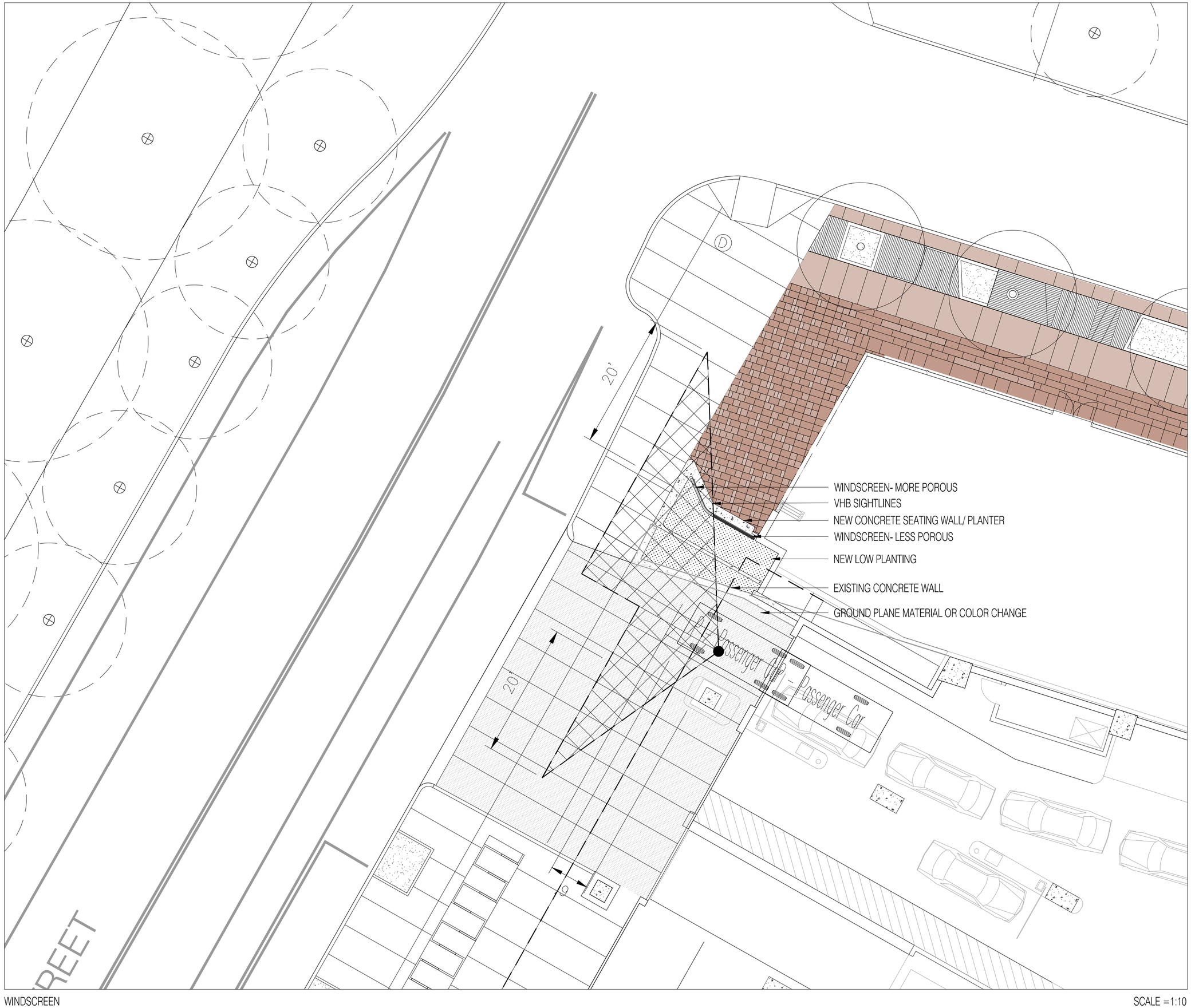
\\vhb\proj\Boston\13024.00\cad\ld\Planmisc\CDD Loading Movements\13024.00 - CDD Loading Turning Movements.dwg

0 20 40 80 Feet

SU-30 Exiting Loading
MITIMCo
199 Main Street
Cambridge, MA

Figure 32

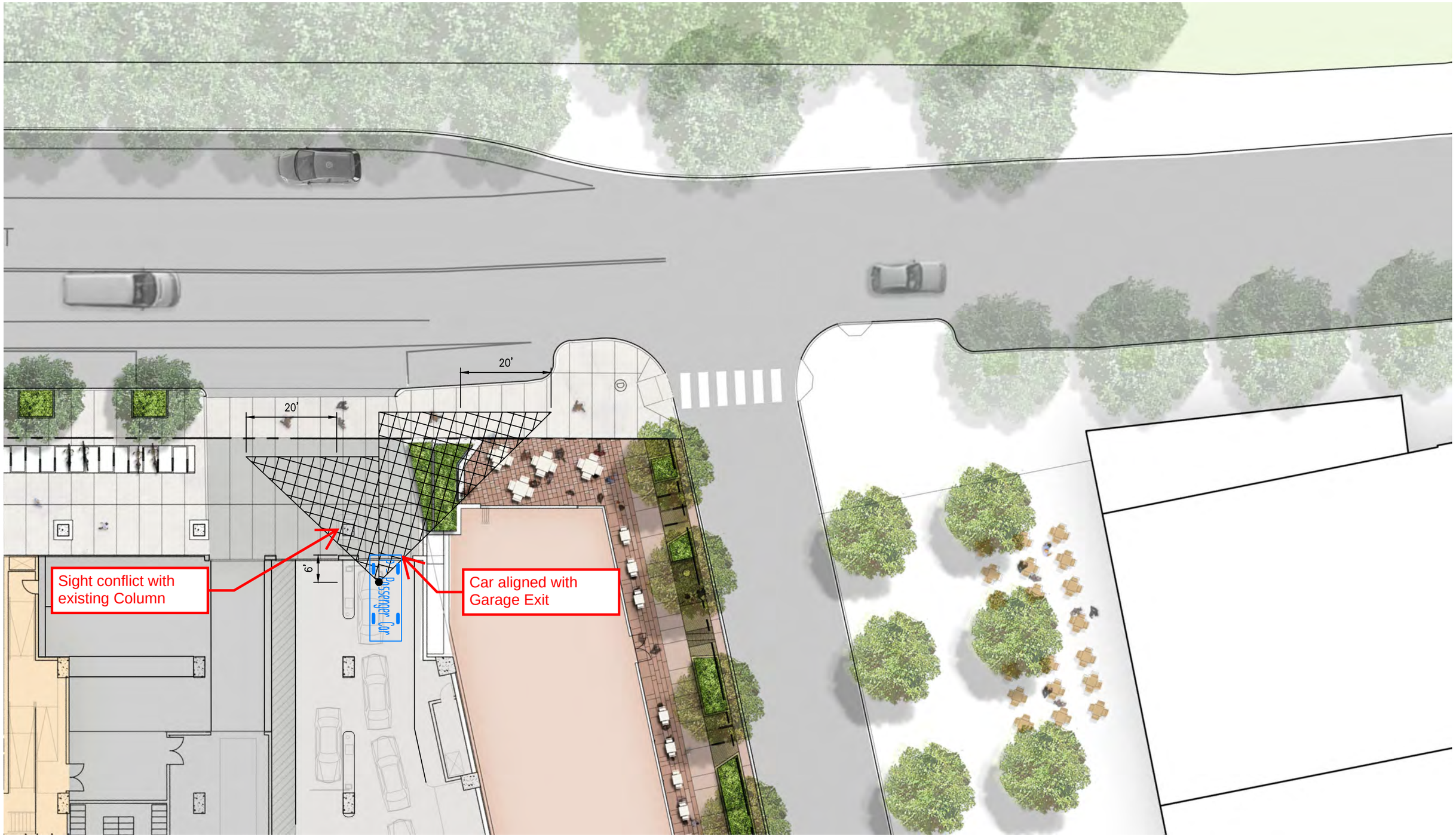
November 2016



WINDSCREEN

SCALE =1:10

Figure 33



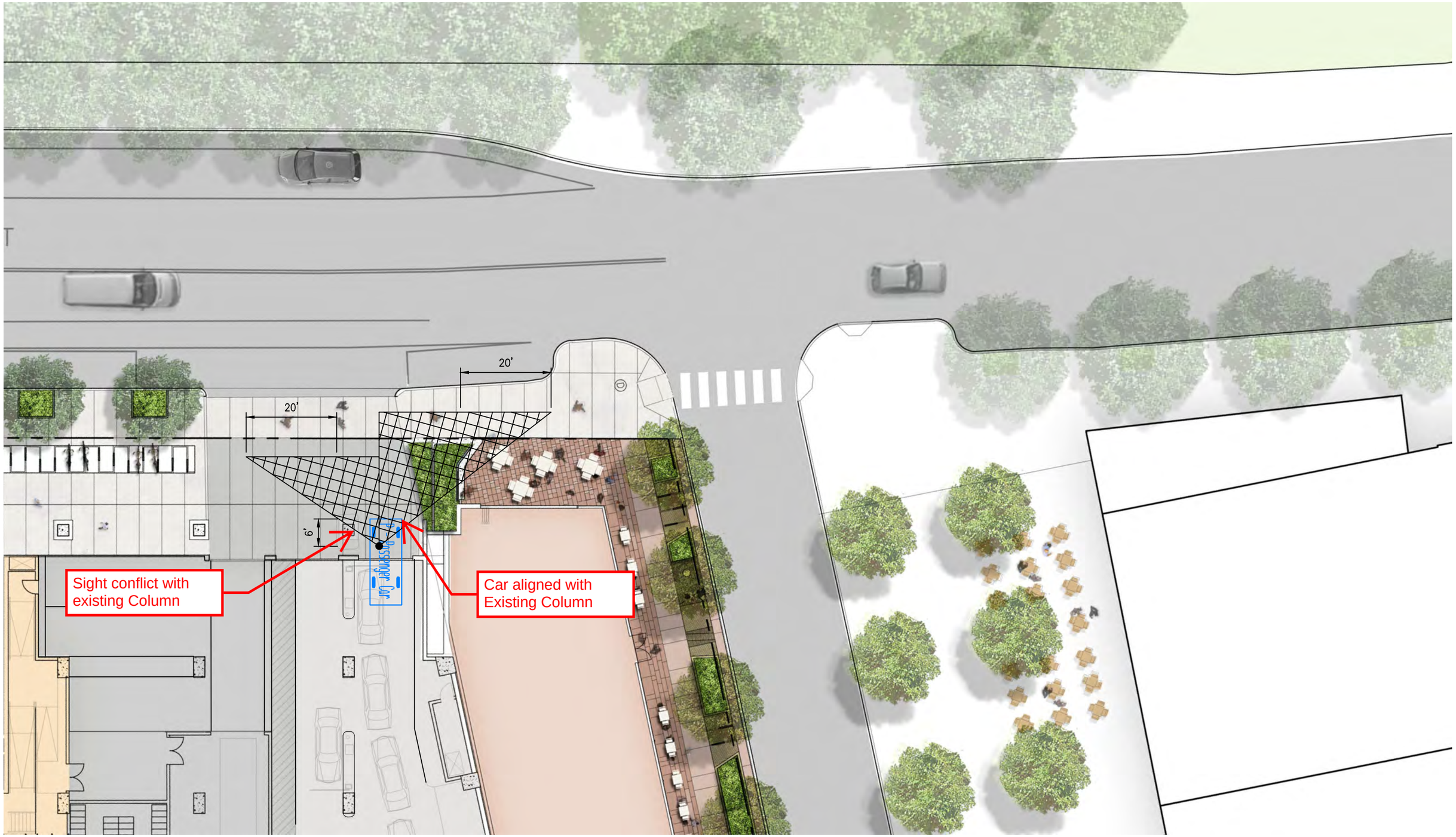
0 10 20 40 Feet

Pedestrian Sight Distance
Leaving Existing Garage
MITIMCo
One Broadway, Cambridge, MA

Figure 34

November 2016

\\vhb\proj\Boston\13024.00\cad\ld\Planmisc\CDD Loading Movements\13024.00 - CDD Pedestrian Sight Distance.dwg

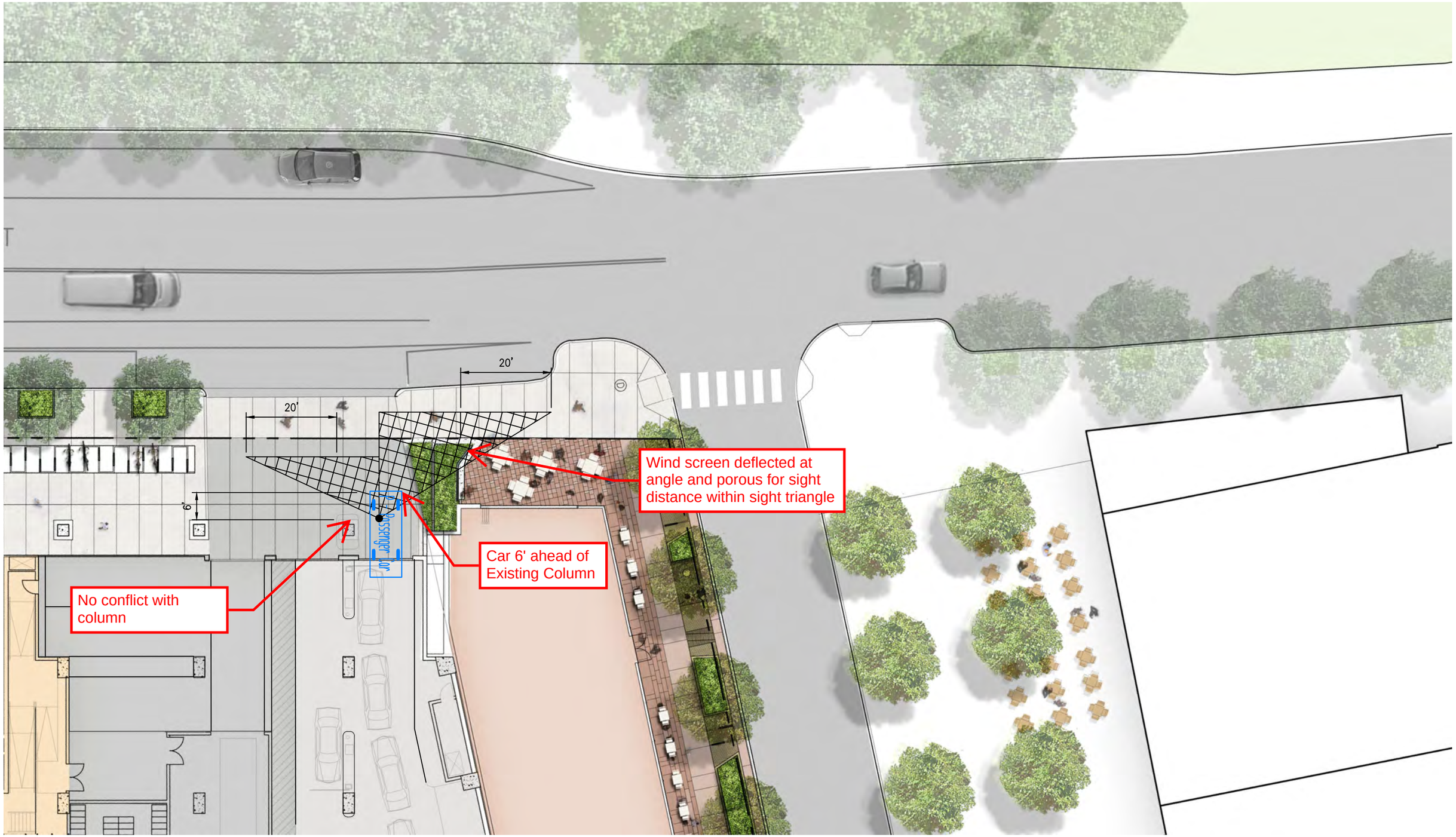


0 10 20 40 Feet

Pedestrian Sight Distance
Leaving Existing Garage
MITIMCo
One Broadway, Cambridge, MA

Figure 35

November 2016



0 10 20 40 Feet

Pedestrian Sight Distance
Leaving Existing Garage
MITIMCo
One Broadway, Cambridge, MA

Figure 36

November 2016

\\vhb\proj\Boston\13024.00\cad\ld\Planmisc\CDD Loading Movements\13024.00 - CDD Pedestrian Sight Distance.dwg

THIRD STREET

20’

20’

EN

EN

EN

EN

7.5’

Compactor Pick-Up

Sight conflict with existing Column

Truck aligned with Garage Exit

0 10 20 40 Feet

vhb

Pedestrian Sight Distance
Compactor Leaving Loading
MITIMCo
One Broadway, Cambridge, MA

Figure 37

November 2016

\\vhb\proj\Boston\13024.00\cad\ld\Planmisc\CDD Loading Movements\13024.00 - CDD Pedestrian Sight Distance.dwg

THIRD STREET

20'

20'

EN

EN

7.5'

Compactor Pick-up

Sight conflict with existing Column

Truck aligned with Existing Column

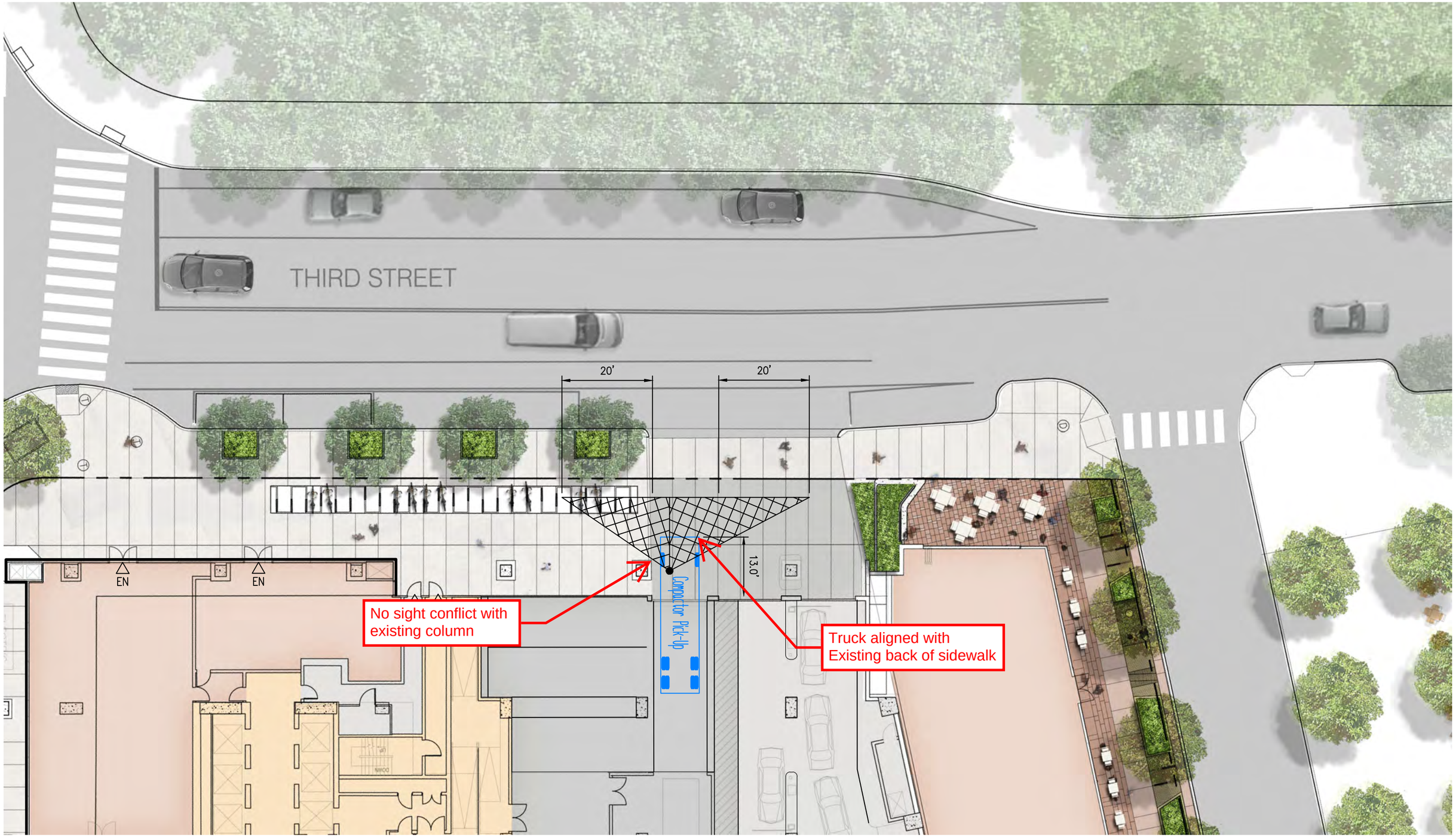
0 10 20 40 Feet

Pedestrian Sight Distance
Compactor Leaving Loading
MITIMCo
One Broadway, Cambridge, MA

Figure 38

November 2016

\\vhb\proj\Boston\13024.00\cad\ld\Planmisc\CDD Loading Movements\13024.00 - CDD Pedestrian Sight Distance.dwg

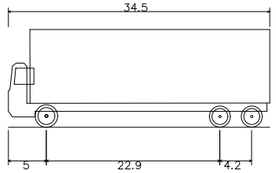


0 10 20 40 Feet

Pedestrian Sight Distance
Compactor Leaving Loading
MITIMCo
One Broadway, Cambridge, MA

Figure 39

November 2016



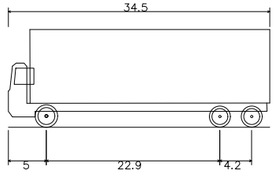
Compactor Pick-Up	
Overall Length	34.500ft
Overall Width	8.500ft
Overall Body Height	12.898ft
Min Body Ground Clearance	1.364ft
Max Track Width	8.500ft
Lock-to-lock time	6.00s
Wall to Wall Turning Radius	45.000ft

0 10 20 40 Feet

Compactor Pick-Up
MITIMCo
One Broadway
Cambridge, MA

Figure 40

November 2016



Compactor Pick-Up	
Overall Length	34.500ft
Overall Width	8.500ft
Overall Body Height	12.898ft
Min Body Ground Clearance	1.364ft
Max Track Width	8.500ft
Lock-to-lock time	6.00s
Wall to Wall Turning Radius	45.000ft

0 10 20 40 Feet

vhb

Compactor Leaving
MITIMCo
One Broadway
Cambridge, MA

Figure 41

November 2016

Ⓢ Signalized Intersection
Ⓤ Unsignalized Intersection
Project Site
PUD-5

Not to Scale

Figure 42
Trip Assignment
Office/Retail NoMa

MIT Kendall Square

Ⓢ Signalized Intersection

Ⓤ Unsignalized Intersection

Project Site

PUD-5

Not to Scale

Figure 43
Trip Assignment
Residential NoMa

MIT Kendall Square

Ⓢ Signalized Intersection

Ⓤ Unsignalized Intersection

Project Site

PUD-5

Not to Scale

Note:
Project generated trip numbers may be off by 1 trip between intersections due to rounding.

Figure 44
Net New Project Generated Trips AM Peak Hour Traffic Volumes 8:00 AM-9:00 AM Retail/Residential/R&D/Office/Museum

Ⓢ Signalized Intersection
Ⓤ Unsignalized Intersection
Project Site
PUD-5

Not to Scale

Note:
Project generated trip numbers may be off by 1 trip between intersections due to rounding.

Figure 45
Net New Project Generated Trips PM Peak Hour Traffic Volumes 4:45 PM-5:45 PM Retail/Residential/R&D/Office/Museum

MIT Kendall Square

Ⓢ Signalized Intersection

Ⓤ Unsignalized Intersection

Project Site

PUD-5

Not to Scale

Note:
*Vehicle trips only account for Project Generated Trips. Existing counts not available.

Figure 46
2015 Build Condition AM Peak Hour
Traffic Volumes 8:00 AM-9:00 AM

MIT Kendall Square

Ⓢ Signalized Intersection

Ⓤ Unsignalized Intersection

Project Site

PUD-5

Not to Scale

Note:
*Vehicle trips only account for Project Generated Trips. Existing counts not available.

Figure 47
2015 Build Condition PM Peak Hour
Traffic Volumes 4:45 PM-5:45 PM

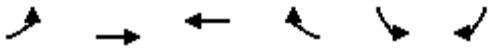
MIT Kendall Square

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	SBR2	NEL	NER
Lane Configurations											
Traffic Volume (vph)	251	385	63	0	640	346	154	150	122	0	0
Future Volume (vph)	251	385	63	0	640	346	154	150	122	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	10	12	12	11	11	11	12	11	12	12
Total Lost time (s)	6.0	3.0			3.0	3.0	3.0		6.0		
Lane Util. Factor	1.00	0.95			1.00	1.00	1.00		0.95		
Frpb, ped/bikes	1.00	0.97			1.00	1.00	1.00		1.00		
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00		1.00		
Frt	1.00	0.98			1.00	0.85	0.92		0.85		
Flt Protected	0.95	1.00			1.00	1.00	0.98		1.00		
Satd. Flow (prot)	1468	2811			1605	1391	1436		1247		
Flt Permitted	0.95	1.00			1.00	1.00	0.98		1.00		
Satd. Flow (perm)	1468	2811			1605	1391	1436		1247		
Peak-hour factor, PHF	0.93	0.93	0.92	0.92	0.93	0.93	0.95	0.92	0.95	0.92	0.92
Adj. Flow (vph)	270	414	68	0	688	372	162	163	128	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	270	482	0	0	688	372	338	0	115	0	0
Confl. Peds. (#/hr)			100								
Confl. Bikes (#/hr)						18					
Heavy Vehicles (%)	7%	3%	2%	2%	3%	1%	5%	2%	7%	2%	2%
Turn Type	Prot	NA			NA	Over	Prot		Over		
Protected Phases	4	2			6	3	3		4		
Permitted Phases											
Actuated Green, G (s)	19.0	32.0			32.0	24.0	24.0		19.0		
Effective Green, g (s)	20.0	33.0			33.0	25.0	25.0		20.0		
Actuated g/C Ratio	0.22	0.37			0.37	0.28	0.28		0.22		
Clearance Time (s)	7.0	4.0			4.0	4.0	4.0		7.0		
Lane Grp Cap (vph)	326	1030			588	386	398		277		
v/s Ratio Prot	c0.18	0.17			c0.43	c0.27	0.24		0.09		
v/s Ratio Perm											
v/c Ratio	0.83	0.47			1.17	0.96	0.85		0.42		
Uniform Delay, d1	33.4	21.8			28.5	32.1	30.7		30.0		
Progression Factor	1.01	1.44			1.00	1.00	0.93		0.81		
Incremental Delay, d2	2.3	0.1			93.7	37.5	11.8		2.5		
Delay (s)	36.1	31.6			122.2	69.6	40.5		26.7		
Level of Service	D	C			F	E	D		C		
Approach Delay (s)		33.2			103.8		37.0			0.0	
Approach LOS		C			F		D			A	

Intersection Summary			
HCM 2000 Control Delay	67.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	SBR2	NEL	NER
Lane Configurations											
Traffic Volume (vph)	288	551	73	0	417	195	409	68	132	0	0
Future Volume (vph)	288	551	73	0	417	195	409	68	132	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	12	11	11	11	12	11	13	12
Total Lost time (s)	3.0	3.0			3.0	3.0	3.0		3.0		
Lane Util. Factor	1.00	0.95			1.00	1.00	1.00		0.95		
Frpb, ped/bikes	1.00	0.98			1.00	1.00	1.00		1.00		
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00		1.00		
Frt	1.00	0.98			1.00	0.85	0.98		0.85		
Flt Protected	0.95	1.00			1.00	1.00	0.96		1.00		
Satd. Flow (prot)	1458	2964			1621	1364	1530		1322		
Flt Permitted	0.95	1.00			1.00	1.00	0.96		1.00		
Satd. Flow (perm)	1458	2964			1621	1364	1530		1322		
Peak-hour factor, PHF	0.89	0.89	0.92	0.92	0.97	0.97	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	324	619	79	0	430	201	445	74	143	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	324	698	0	0	430	201	533	0	129	0	0
Confl. Peds. (#/hr)			100								
Confl. Bikes (#/hr)						175					
Heavy Vehicles (%)	4%	2%	2%	2%	2%	3%	1%	2%	1%	2%	2%
Turn Type	Prot	NA			NA	Over	Prot		Over		
Protected Phases	4	2			6	3	3		4		
Permitted Phases											
Actuated Green, G (s)	20.0	31.0			31.0	27.0	27.0		20.0		
Effective Green, g (s)	21.0	32.0			32.0	28.0	28.0		21.0		
Actuated g/C Ratio	0.23	0.36			0.36	0.31	0.31		0.23		
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0		4.0		
Lane Grp Cap (vph)	340	1053			576	424	476		308		
v/s Ratio Prot	c0.22	0.24			c0.27	0.15	c0.35		0.10		
v/s Ratio Perm											
v/c Ratio	0.95	0.66			0.75	0.47	1.12		0.42		
Uniform Delay, d1	34.0	24.5			25.4	25.1	31.0		29.3		
Progression Factor	1.30	0.83			1.00	1.00	0.95		0.82		
Incremental Delay, d2	28.1	2.0			8.6	3.8	77.1		3.9		
Delay (s)	72.4	22.2			34.0	28.8	106.6		28.0		
Level of Service	E	C			C	C	F		C		
Approach Delay (s)		38.1			32.4		91.3			0.0	
Approach LOS		D			C		F			A	

Intersection Summary			
HCM 2000 Control Delay	51.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	84.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



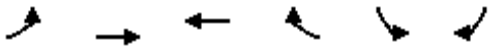
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR2
Lane Group Flow (vph)	270	482	688	372	338	115
v/c Ratio	0.83	0.47	1.17	0.96	0.85	0.42
Control Delay	37.8	32.1	122.5	71.8	42.1	27.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.8	32.1	122.5	71.8	42.1	27.4
Queue Length 50th (ft)	168	103	~471	208	170	53
Queue Length 95th (ft)	m148	m90	#682	#386	m184	m65
Internal Link Dist (ft)		882	68		124	
Turn Bay Length (ft)	340					200
Base Capacity (vph)	326	1031	588	386	399	277
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.83	0.47	1.17	0.96	0.85	0.42

Intersection Summary

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

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

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



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR2
Lane Group Flow (vph)	324	698	430	201	533	129
v/c Ratio	0.95	0.66	0.75	0.47	1.12	0.42
Control Delay	73.4	22.5	35.0	29.6	107.4	28.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	73.4	22.5	35.0	29.6	107.4	28.7
Queue Length 50th (ft)	198	107	211	92	~349	63
Queue Length 95th (ft)	m#237	m115	#331	159	m#516	m101
Internal Link Dist (ft)		882	68		136	
Turn Bay Length (ft)	340					200
Base Capacity (vph)	340	1053	576	424	476	308
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.95	0.66	0.75	0.47	1.12	0.42

Intersection Summary

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

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

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