

## MEMORANDUM

**DATE:** September 23, 2020

**TO:** Comprehensive Land Holdings, LLC  
c/o Regnante Sterio LLP  
401 Edgewater Pl, Ste 630  
Wakefield, MA 01880

**FROM:** Robert J. Michaud, P.E. – Managing Principal  
Daniel A. Dumais, P.E. – Senior Project Manager

**RE:** **Proposed 40B Residential Development**  
91 Beatrice Circle – Belmont, MA



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MDM Transportation Consultants, Inc. (MDM) has prepared this traffic impact memorandum (TIM) for the proposed residential development to be located at 91 Beatrice Circle in Belmont, Massachusetts. The location of the site relative to adjacent roadways is shown in **Figure 1**. This memorandum describes existing traffic volumes and travel speeds for the Route 2 Frontage Road, Hinckley Way, evaluates sight lines to/from the site driveway, estimates trip generation characteristics of the proposed development, quantifies incremental traffic impacts of the Site development on the adjacent roadways, and evaluates safety-related conditions at key study locations that provide access to the Site.

Key findings of the traffic memorandum are as follows:

- *Safety Characteristics.* No crashes were reported at the roadway segment along Frontage Road between Beatrice Circle and Clifton Street in the three-year study period and no HSIP locations are listed for the study area; therefore, no immediate safety countermeasures are warranted based on the crash history.
- *Measured Travel Speeds.* The observed 85<sup>th</sup> percentile travel speed along Hinckley Way adjacent to the Site is 38 mph. This speed is the appropriate basis for determining driveway sight lines to conform with sight line criteria published by AASHTO.
- *Sight Line Safety Characteristics.* Proposed clearing and regrading associated with construction of the proposed Site driveway will provide sight lines that exceed AASHTO's recommended criteria both stopping sight distance (SSD) and intersection sight distance (ISD) based on observed 85<sup>th</sup> percentile travel speeds along Hinckley Way. This will provide ample visibility for vehicles approaching and leaving the Site driveway to properly exit/enter the Hinckley Way traffic stream in a safe manner.



Figure 1

Site Location

- *Nominal Trip Generation.* Based on industry standard trip generation rates, the proposed development is estimated to generate approximately 7 trips during the weekday morning peak hour (2 entering and 5 exiting), 8 trips during the weekday evening peak hour (6 entering and 2 exiting), and 96 vehicle trips on a weekday. While the Site is likely to benefit by its close proximity to public transportation and opportunities for pedestrian/bicycle use, the analysis utilizes ITE-based trip generation without downward adjustment to present a conservative analysis.
- *Adequate Roadway Capacity.* Under Design Year conditions, capacity analyses indicate that the unsignalized Site Driveway approach to Hinckley Way will operate with minimal delay at level of service (LOS) A during the weekday morning and weekday evening peak hours.
- *Site Access/Circulation.* AutoTURN analysis has been completed for the preliminary site plan using the Town's Ladder truck and single unit (SU) delivery truck. Site access, circulation aisles and parking layout provide adequate maneuvering area for the largest potential responding vehicle (ladder truck).

In summary, trip generation for the development is projected to be nominal on area roadways relative to Baseline conditions with no material impact to operating conditions in the study area. The assessment indicates that there is ample capacity along Hinckley Way to accommodate these project-related traffic increases without the need for major infrastructure enhancements. Proposed access access/egress improvements and pedestrian and bicycle accommodations as outlined in the *Conclusions and Recommendations* section of this report will adequately mitigate the project impacts.

## PROJECT DESCRIPTION

The existing Site consists of a single-family home on approximately 0.5± acres along Frontage Road (91 Beatrice Circle) in Belmont, MA. Under the proposed site programming, the single-family home will be removed, and redeveloped with 4 single rental homes and 8 multifamily townhouse rental units. The proposed access/egress will remain via a modification to the driveway along the Frontage Road. A preliminary site plan prepared by DeCelle-Burke-Sala & Associates is presented in **Figure 2**.



## EXISTING TRAFFIC & SAFETY CHARACTERISTICS

An overview of existing roadway conditions, traffic volumes, and safety characteristics is provided below.

### *Hinckley Way (aka eastbound Frontage Road)*

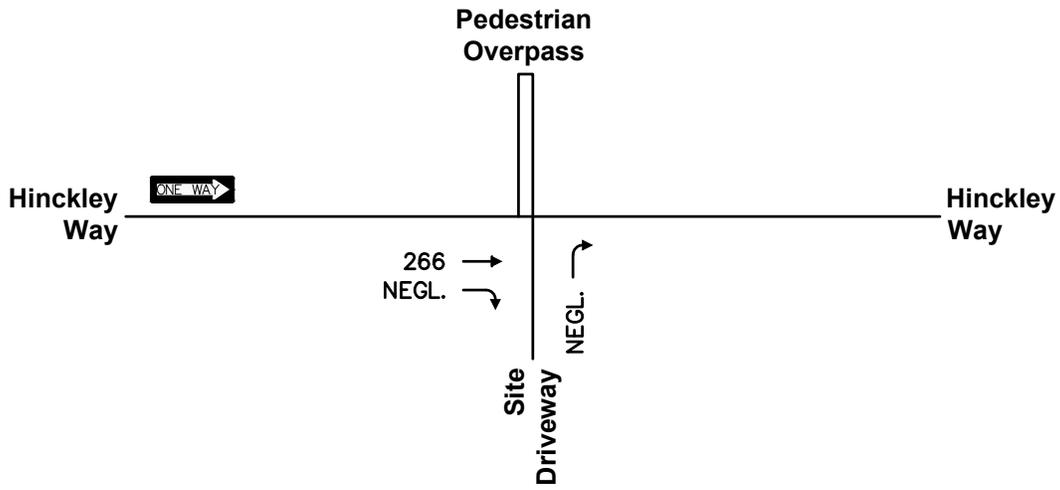
Hinckley Way is generally an east-west local roadway under Town jurisdiction that runs parallel to Route 2 as a Frontage Road. Hinckley Way provides a connection between Pilgrim Road in Arlington to the west and Pleasant Street (Route 60) to the east. The roadway provides two eastbound travel lanes and a sidewalk along its southern side. There is no posted (regulatory) speed limit on Hinckley Way in the study area. Land uses along Hinckley Way are primarily residential homes.

### **Baseline Traffic Data**

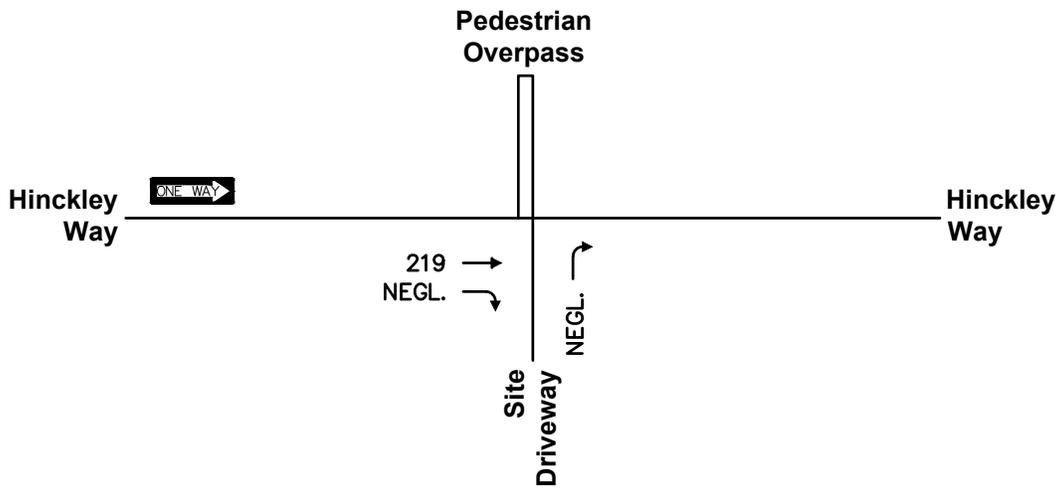
This traffic memorandum evaluates transportation characteristics of roadways and intersections that provide a primary means of access to the Site and includes the intersections Site driveway intersection with Hinckley Way. Traffic volume data was collected at the study area intersection during the weekday morning (7:00 AM – 9:00 AM) and the weekday evening (4:00 PM - 6:00 PM) peak traffic periods. A review of historical traffic data indicates that peak hour traffic volumes remain below normal average conditions due to the Covid-19 pandemic. Accordingly, the weekday morning traffic volumes have been adjusted by 46%, the weekday evening peak hour have been adjusted by 33% and the Daily has been adjusted by 41% to represent average traffic volume conditions. Turning movement counts and historical adjustment data are provided in the **Attachments**. The Baseline weekday morning and weekday evening peak hour traffic volumes are shown in **Figure 3**.

### **Daily Traffic Flow**

Daily traffic volumes on Hinckley Way were collected in the site vicinity using an automatic traffic recorder (ATR) with radar technology in June 2020. Traffic volume data is provided in the **Attachments** and summarized below in **Table 1**.



Weekday Morning Peak Hour



Weekday Evening Peak Hour



North

Scale: Not to Scale

**NOTES:**

NEGL. = Negligible

= Signalized Intersection

Figure 3

**Baseline Conditions  
Weekday Traffic Volumes**

**TABLE 1  
 BASELINE TRAFFIC VOLUME SUMMARY  
 HINCKLEY WAY WEST OF 91 BEATRICE CIRCLE**

Time Period	Daily Volume (vpd) <sup>1</sup>	Peak Hour Volume (vph) <sup>2</sup>	Percent Daily Traffic <sup>3</sup>
<i>Weekday Morning Peak Hour</i>	3,280	266	8%
<i>Weekday Evening Peak Hour</i>	3,280	219	7%

<sup>1</sup>Two-way daily traffic expressed in vehicles per day adjusted by 41% to reflect pre-pandemic conditions.

<sup>2</sup>Two-way peak-hour volume expressed in vehicles per hour adjusted by 46% (AM) and 33% (PM) to reflect pre-pandemic conditions.

<sup>3</sup>The percent of daily traffic that occurs during the peak hour.

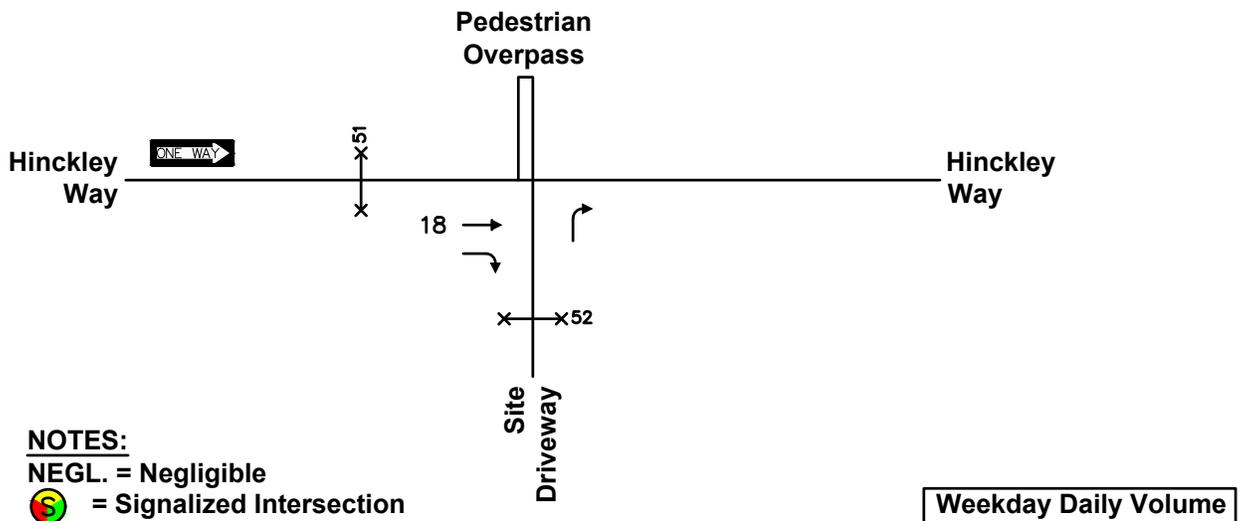
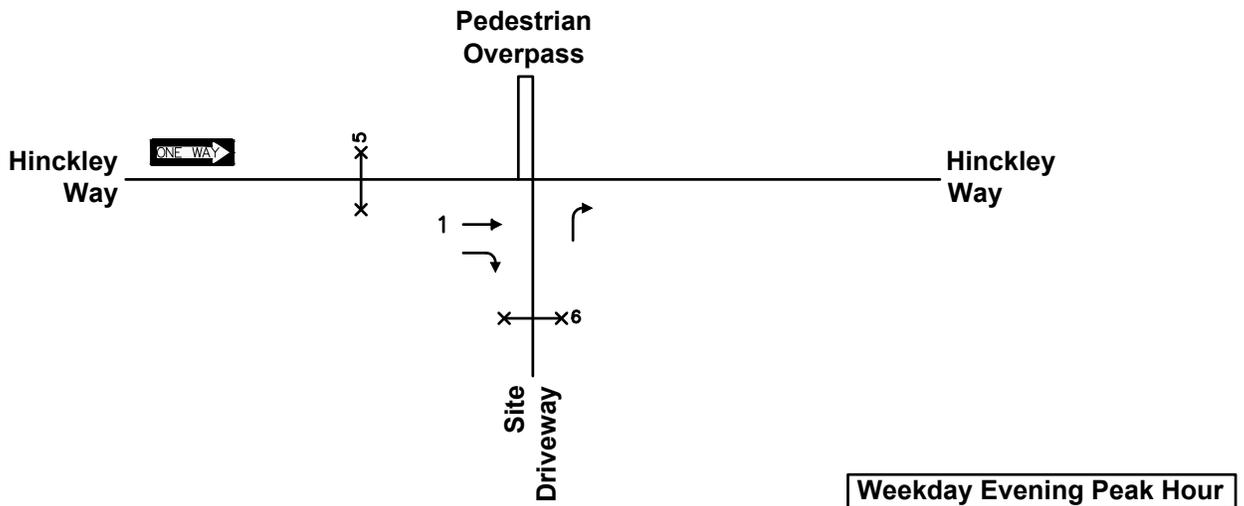
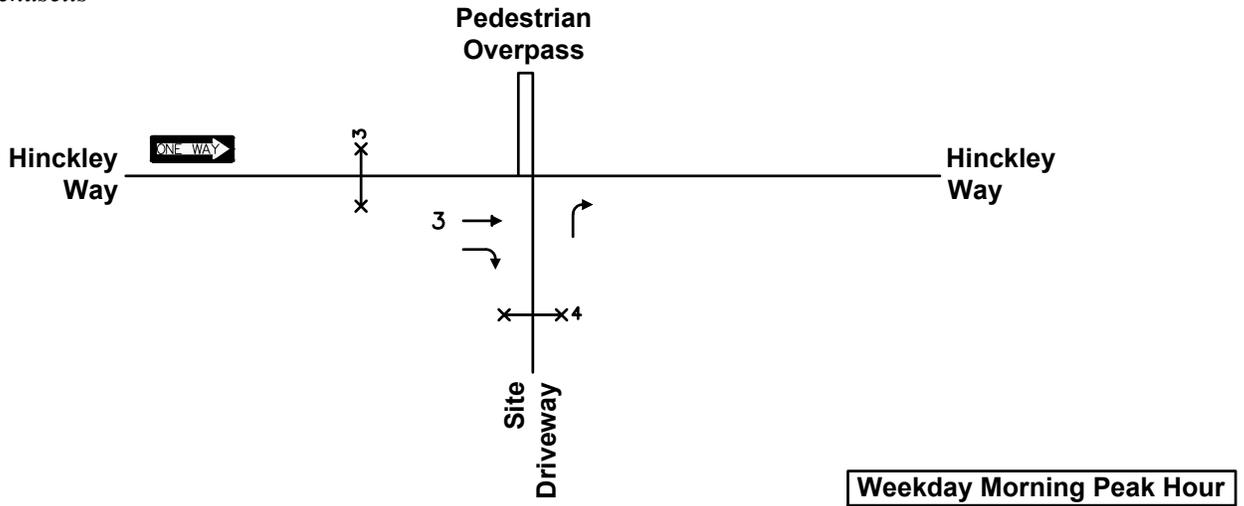
As summarized in **Table 1**, Hinckley Way carries approximately 3,280 vehicles per day (vpd) with approximately 266 vehicles during the weekday morning peak hour and 219 vehicles during the weekday evening peak hour. The peak hour traffic volumes represent approximately 7 to 8 percent of the daily traffic volumes.

### **Pedestrian and Bicycle Volumes**

Pedestrian and bicycle traffic activity was observed to coincide with vehicular count data. A pedestrian bridge adjacent to the Site also provides access to the westbound Concord Road (aka westbound Frontage Road) over Route 2. MBTA bus stops are provided along both frontage roads in close proximity to the bridge. Pedestrian volumes on the bridge and pedestrian and bicycle volumes along Hinckley Way adjacent to the Site were collected in June 2020 are summarized in **Figure 4** with count data provided in the **Attachments**.

As summarized in **Figure 4**:

- *Pedestrian Volumes.* The pedestrian bridge adjacent to the Site carries approximately 5 or less pedestrians during the peak hours and approximately 51 daily pedestrians. Likewise, the sidewalk system adjacent to the Site carries 6 or less pedestrians during the peak hours and 52 daily pedestrians.
- *Bicycle Volumes.* Hinckley Way adjacent to the Site was observed to have less than 5 bicycles during the peak hours and approximately 18 bicycles on a daily basis.



North

**NOTES:**  
NEGL. = Negligible  
 = Signalized Intersection

Scale: Not to Scale

**Figure 4**

**Baseline Conditions  
Weekday Pedestrian and Bicycle Volumes  
(91 Beatrice Circle at Pedestrian Overpass)**

## Measured Travel Speeds

Vehicle speeds were obtained for Frontage Road adjacent to the Site using a radar recorder. These measured travel speeds provide a basis for determining sight line requirements at the proposed site driveway. **Table 2** presents a summary of the travel speed data collected for Frontage Road in the site vicinity.

**TABLE 2**  
**SPEED STUDY RESULTS – HINCKLEY WAY**

<u>Travel Direction</u>	<u>Travel Speed</u>	
	<u>Mean<sup>1</sup></u>	<u>85<sup>th</sup> Percentile<sup>2</sup></u>
Eastbound	33	38

<sup>1</sup>Arithmetic mean

<sup>2</sup>The speed at or below which 85 percent of the vehicles are traveling

As summarized in **Table 2**, the mean (average) travel speed on Frontage Road was observed to be 33 mph and the 85<sup>th</sup> percentile travel speeds were observed to be 38 mph. This speed data provides a basis for determining appropriate sight lines for the proposed driveway along Hinckley Way. The speed data is provided in the **Attachments**.

## Intersection Crash History

In order to identify crash trends and safety characteristics for study area intersections, crash data were obtained from MassDOT for the Town of Belmont for the three-year period 2017 through 2019 (the most recent data currently available from MassDOT). In addition, review of the MassDOT high crash cluster mapping was conducted to determine locations listed as eligible for Highway Safety Improvement Program (HSIP) evaluation and funding.

No crashes were reported at the roadway segment along Frontage Road between Beatrice Circle and Clifton Street in the three-year study period and no HSIP locations are listed for the study area; therefore, no immediate safety countermeasures are warranted based on the crash history.

## Public Transportation Facilities

According to area Census data on travel mode, approximately 20% of residents in the immediate Census tracts 3566.01, 3571, and 3578 use public transit or walking/biking to commute to work. An additional 11% indicated that they work from home resulting in a single occupancy vehicle (SOV) use of approximately 65% for the immediate study area.

The Massachusetts Bay Transportation Authority (MBTA) currently operates several bus routes within ½ mile (less than a 10-minute walk) of the Site. The bus routes connect to various regional transit facilities including MBTA T Stations (Alewife). Specific public transportation services currently operated in the immediate area of the Project Site is as follows:

- **MBTA Bus 62:** Bus 62 runs from Bedford VA Hospital to the Alewife MBTA Station in Cambridge. The route passes the Site along Frontage Road with a stop immediately adjacent to the site. Service generally runs M-F 6:00 am to 11:00 pm, Saturdays 8:00am to 8:00 pm and no service on Sundays.
- **MBTA Bus 76:** Bus 76 runs from Hanscom AFB and Lincoln Labs to the Alewife MBTA Station in Cambridge. The route passes the Site along Frontage Road with a stop immediately adjacent to the site. Service generally runs M-F 6:00 am to 11:00 pm, Saturdays 8:00am to 8:00 pm and no service on Sundays.
- **MBTA Bus 78:** Bus 78 runs from Arlmont Village to the Harvard MBTA Station. The route passes the Site along Frontage Road with a stop immediately adjacent to the site. Service generally runs M-F 5:30 am to 1:00 am, Saturdays and Sundays 7:00am to 1:00 am.
- **MBTA Bus 84:** Bus 84 runs from Arlmont Village to the Alewife MBTA Station. The route passes the Site along Frontage Road with a stop immediately adjacent to the site. Service generally runs M-F 6:45 am to 6:45 pm, with no service on Saturdays and Sundays.

To remain conservative no credit (trip reduction) was taken for the use of alternative transportation options (public transit, walk, bike, work from home). Specific route and schedule information is provided in the **Attachments**.

### **Sight Line Evaluation**

An evaluation of sight lines was conducted to ensure that minimum recommended sight lines are available at the site driveway intersection with Hinckley Way. The evaluation documents sight lines under proposed conditions for vehicles as they relate to these roadways with comparison to recommended guidelines.

The American Association of State Highway and Transportation Officials' (AASHTO) standards<sup>1</sup> reference two types of sight distance which are relevant at the site driveway intersection: stopping sight distance (SSD) and intersection sight distance (ISD). Sight lines for critical vehicle movements at the site driveway intersection along Frontage Road were compared to minimum SSD and ISD recommendations for the observed travel speeds in the area.

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<sup>1</sup> A policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials (AASHTO), 2018.

## Stopping Sight Distance

Sight distance is the length of roadway visible to the motorist to a fixed object. The minimum sight distance available on a roadway should be sufficiently long enough to enable a below-average operator, traveling at or near the design speed limit, to stop safely before reaching a stationary object in its path, in this case, a vehicle exiting onto Frontage Road. The SSD criteria are defined by AASHTO based on design and operating speeds, anticipated driver behavior and vehicle performance, as well as physical roadway conditions. SSD includes the length of roadway traveled during the perception and reaction time of a driver to an object, and the distance traveled during brake application on wet level pavement. Adjustment factors are applied to account for roadway grades when applicable.

SSD was estimated in the field using AASHTO standards for driver's eye (3.5 feet) and object height equivalent to the taillight height of a passenger car (2.0 feet) for the Frontage Road approach to the site driveway. **Table 3** presents a summary of the available SSD as they relate to Frontage Road and AASHTO's recommended SSD based on observed speeds along Frontage Road.

**TABLE 3**  
**STOPPING SIGHT DISTANCE SUMMARY**  
**FRONTAGE ROAD APPROACH TO SITE DRIVEWAY**

Approach/ Travel Direction	Available SSD	AASHTO Recommended <sup>1</sup>	
		Average Travel Speed <sup>2</sup>	85 <sup>th</sup> Percentile Travel Speed <sup>3</sup>
<i>Eastbound</i>	>400 Feet	260 Feet	320 Feet

<sup>1</sup>Recommended sight distance based on AASHTO, A Policy on Geometric Design of Highways and Streets. Based on driver height of eye of 3.5 feet to object height of 2.0 feet.

<sup>2</sup>Average Speed: 33 mph EB.

<sup>3</sup>85<sup>th</sup> Percentile travel speed: 38 mph EB.

As summarized in **Table 3**, analysis results indicate that the existing available sight lines exceed AASHTO's recommended SSD criteria along Hinckley Way for the observed travel speeds. Stopping sight distance calculations are provided in the **Attachments**.

*Intersection Sight Distance*

Clear sight lines provide sufficient sight distance for a stopped driver on a minor-road approach to depart from the intersection and enter or cross the major road. As stated under AASHTO's Intersection Sight Distance (ISD) considerations, "...If the available sight distance for an entering ...vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to avoid collisions...To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road." AASHTO's ISD criteria are defined into several "cases". In this case, the site driveway approach is under "STOP" control. The ISD in question relates to the ability to turn right onto Hinckley Way.

Available ISD was estimated in the field using AASHTO standards for driver's eye (3.5 feet), object height (3.5 feet) and decision point (8 to 14.5 feet from the edge of the travel lane) for the eastbound travel direction on Hinckley Way. **Table 4** presents a summary of the available ISD for the departures from the site driveway and AASHTO's recommended ISD criteria.

**TABLE 4  
INTERSECTION SIGHT DISTANCE SUMMARY  
SITE DRIVEWAY DEPARTURE TO HINCKLEY WAY**

View Direction	Available ISD	AASHTO Minimum <sup>1</sup>	AASHTO Ideal <sup>2</sup>
		85 <sup>th</sup> Percentile Travel Speed <sup>2</sup>	85 <sup>th</sup> Percentile Travel Speed <sup>2</sup>
<i>Looking West</i>	>400 Feet	320 Feet	365 Feet

<sup>1</sup>Recommended sight distance based on AASHTO, A Policy on Geometric Design of Highways and Streets. Based on driver height of eye of 3.5 feet to object height of 2.0 feet. Minimum value as noted represents SSD per AASHTO guidance.

<sup>2</sup>85<sup>th</sup> Percentile travel speed: 38 mph EB.

The results of the ISD analysis presented in **Table 4** indicate that with clearing and grading associated with the construction of the proposed site driveway, the available sight lines looking west from the site driveway onto Hinckley Way will exceed the sight line requirements from AASHTO for the 85<sup>th</sup> percentile travel speeds. MDM recommends that any new plantings (shrubs, bushes) or physical landscape features to be located within the sight lines should also be maintained at a height of 2 feet or less above the adjacent roadway grade to ensure unobstructed lines of sight.

## DESIGN YEAR TRAFFIC VOLUMES

Design Year traffic conditions are developed by adding additional site-generated trips associated with the proposed development to the Baseline traffic volumes within the study area. Specific methodologies and assumptions used to estimate trips and trip distribution are discussed below.

### Trip Generation

The trip generation estimates for the proposed Site development are provided for the weekday morning and weekday evening, which correspond to the critical analysis periods for the proposed use and adjacent street traffic flow. New traffic generated by the project was estimated using trip rates published in ITE's *Trip Generation* for the Land Use Code (LUC) based on trip rates for Multifamily Housing – Low-Rise (LUC 220).

**Table 5** presents the trip-generation estimates for the proposed development based on ITE methodology applied to 16 residential units.

**TABLE 5**  
**TRIP-GENERATION SUMMARY**

Peak Hour/Direction	Proposed Development (12 Units) <sup>1</sup>
<i>Weekday Morning Peak Hour:</i>	
Entering	2
Exiting	5
Total	7
<i>Weekday Evening Peak Hour:</i>	
Entering	6
Exiting	2
Total	8
<i>Weekday Daily (24 hours)</i>	96

<sup>1</sup>ITE LUC 220 – Multifamily Housing – Low-Rise applied to 8 units and ITE LUC 210 – Single Family Detached Housing applied to 4 units.

As summarized in **Table 5**, based on industry-standard trip rates, the proposed development is estimated to generate approximately 7 trips during the weekday morning peak hour (2 entering and 5 exiting), 8 trips during the weekday evening peak hour (6 entering and 2 exiting), and 96 vehicle trips on a weekday.

## **2020 Design Year Traffic Volumes**

Design Year conditions for the weekday morning and weekday evening peak hours include Baseline traffic volumes along Hinckley Way and site-generated trips restricted to right-in/right out movements. Development-related trips at the study intersection for the weekday morning and weekday evening peak hour are included in the **Attachments**. The resulting 2020 Design Year traffic volumes are quantified in **Figure 5**.

## **OPERATIONS ANALYSIS**

This section provides an overview of operational analysis methodology, an assessment of roadway operations under Baseline and projected Design Year conditions.

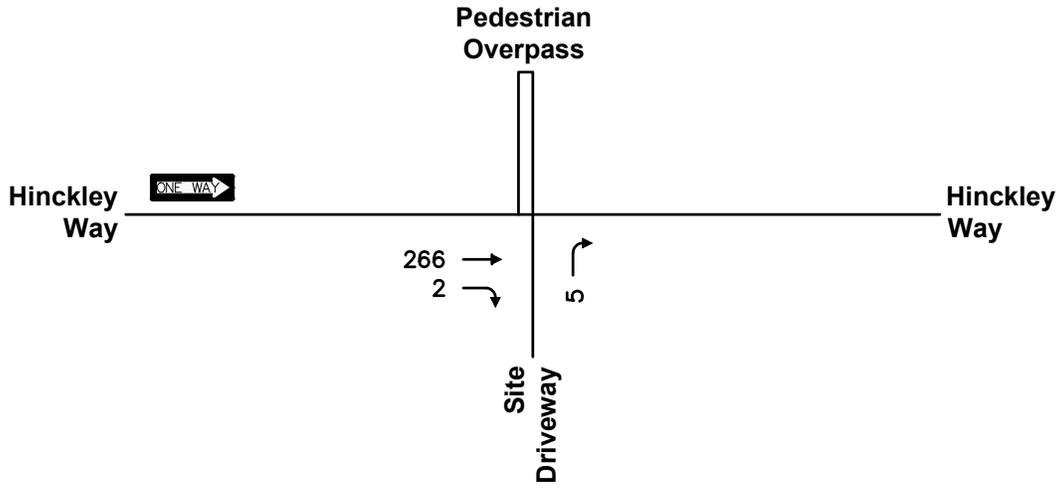
### **Analysis Methodology**

Intersection capacity analyses are presented in this section for the Baseline and Design Year traffic-volume conditions. Capacity analyses, conducted in accordance with EEA/MassDOT guidelines, provide an index of how well the roadway facilities serve the traffic demands placed upon them. The operational results provide the basis for recommended access and roadway improvements in the following section.

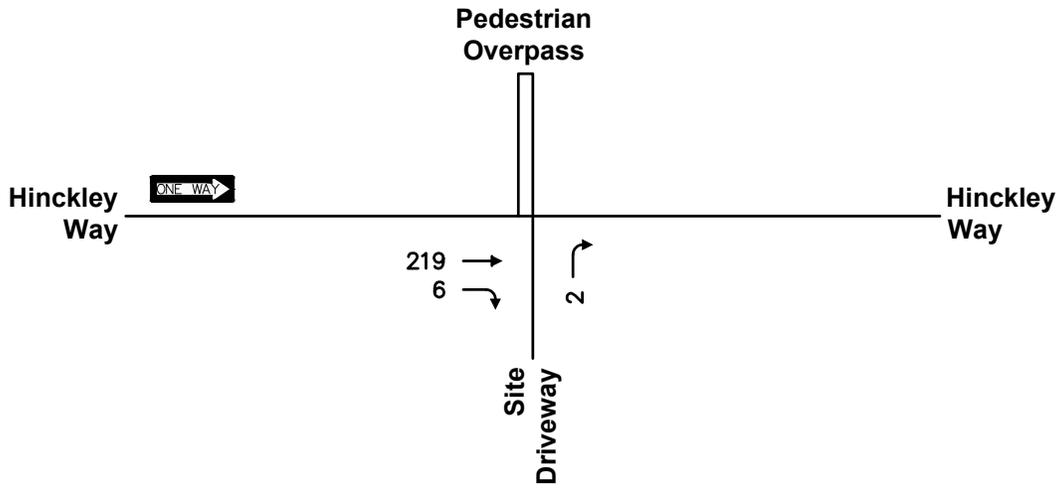
Capacity analysis of intersections is developed using the Synchro® computer software, which implements the methods of the Highway Capacity Manual 6<sup>th</sup> Edition (HCM). The resulting analysis presents a level-of-service (LOS) designation for individual intersection movements. The LOS is a letter designation that provides a qualitative measure of operating conditions based on several factors including roadway geometry, speeds, ambient traffic volumes, traffic controls, and driver characteristics. Since the LOS of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of LOS, depending on the time of day, day of week, or period of year. A range of six levels of service are defined on the basis of average delay, ranging from LOS A (the least delay) to LOS F (delays greater than 50 seconds for unsignalized movements). The specific control delays and associated LOS designations are presented in the **Attachments**.

### **Analysis Results**

Level-of-Service (LOS) analyses were conducted for the Baseline and Design Year conditions for the study intersections. The results of the intersection capacity are summarized below in **Table 6**. Detailed analysis results are presented in the **Attachments**.



Weekday Morning Peak Hour



Weekday Evening Peak Hour



North

Scale: Not to Scale

**NOTES:**

NEGL. = Negligible

= Signalized Intersection

**Figure 5**

**Design Year Condition  
 Weekday Traffic Volumes**

**TABLE 6  
INTERSECTION CAPACITY ANALYSIS RESULTS  
HINCKLEY WAY AT SITE DRIVEWAY**

Period	Approach	2020 Baseline			2020 Design Year		
		v/c <sup>1</sup>	Delay <sup>2</sup>	LOS <sup>3</sup>	v/c	Delay	LOS
<i>Weekday Morning Peak Hour</i>	Eastbound	0.00	<5	A	0.00	<5	A
	NB Exit	0.00	<5	A	0.01	9	A
<i>Weekday Evening Peak Hour</i>	Eastbound	0.00	<5	A	0.00	<5	A
	NB Exit	0.00	9	A	0.00	9	A

<sup>1</sup>Volume-to-capacity ratio; <sup>2</sup>Average control delay per vehicle (in seconds); <sup>3</sup>Level of service; <sup>4</sup>n/a = not applicable

As summarized in **Table 6**, under Design Year conditions, capacity analyses indicate that the unsignalized Site Driveway approach to Hinckley Way will continue to operate below capacity at level of service (LOS) A during peak hours. The project will result in a nominal change to traffic operations for mainline travel along Hinckley Way.

#### **SITE ACCESS/CIRCULATION**

AutoTURN analysis has been completed for the preliminary site plan using the Town’s Ladder truck and a single unit (SU) delivery truck. Site access, circulation aisles and parking layout provide adequate maneuvering area for the largest potential responding vehicle (ladder truck). Supporting AutoTurn® truck turn analysis and exhibits are provided to confirm this finding (refer to the **Attachments**).

#### **RECOMMENDATIONS AND CONCLUSIONS**

MDM finds Hinckley Way and roadways within the site vicinity can accommodate the nominal traffic increases of the project. Relative traffic increases for the proposed project represents an inconsequential change in area roadway volumes - a level of change that falls well within normal day-to-day fluctuations in traffic entering and exiting the study area and is immaterial to traffic operations along Hinckley Way. However, several mitigation actions are identified to support the project to ensure that site access meets applicable safety criteria, to enhance neighborhood walking/bicycling and access to public transportation opportunities and to reduce dependency on single-occupant auto use. These include (a) access-related improvements, (b) pedestrian and bicycle accommodations, and (c) off-site improvements as summarized below.

### Access/Egress Improvements

- *Driveway Design.* Driveway alignment, widths and curb radii have been designed to achieve (a) approximate perpendicular orientation at Hinckley Way; (b) total minimum width to facilitate access/egress via Hinckley Way; (c) minimum curb radii as required to accommodate the Town's largest fire apparatus (ladder truck) and single unit delivery vehicles, and (d) the driveway apron will be constructed with a continuous sidewalk to promote slower travel speeds. Driveway grading and orientation will meet or exceed minimum recommended stopping sight distance presented herein. Signs and pavement markings that are compliant with the Manual on Uniform Traffic Control Devices (MUTCD) should be installed on the approach to Hinckley Way including a STOP sign (R1-1) and STOP line pavement markings.
- *Sight Line Triangles.* Plantings (shrubs, bushes) and structures (walls, fences, etc.) shall be maintained at a height of 2 feet or less within the sight lines in vicinity of the Site Driveway intersections with Hinckley Way to provide unobstructed sight lines.

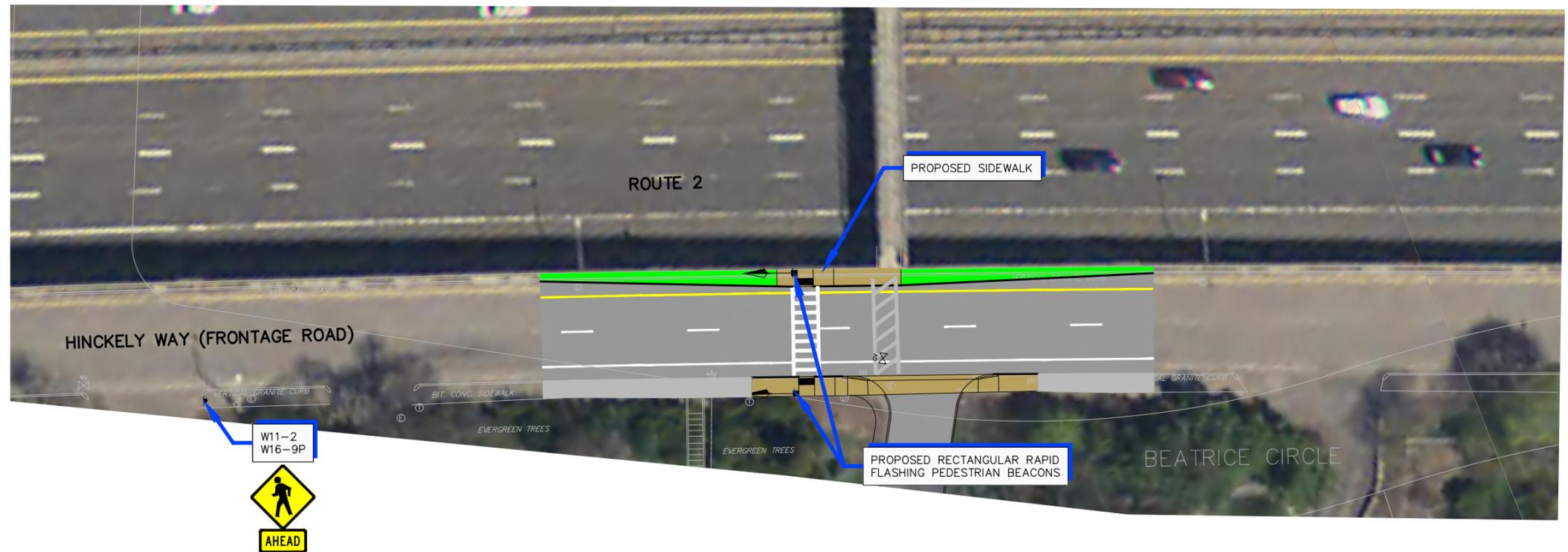
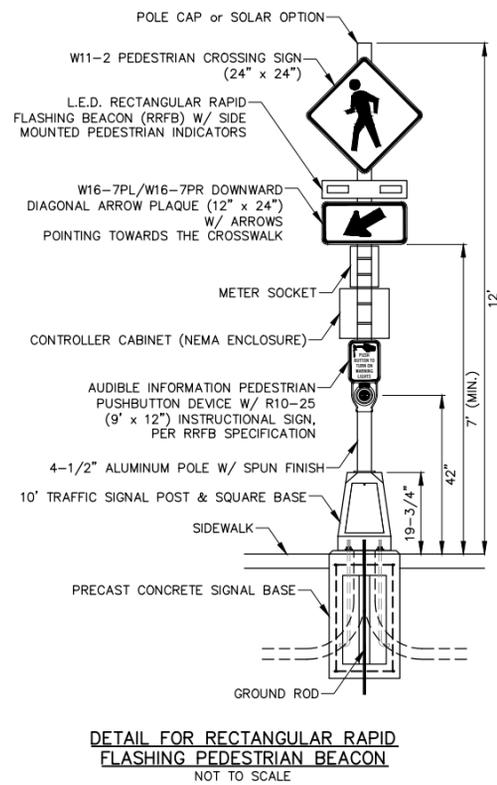
### Pedestrian and Bicycle Accommodations

- *Pedestrian Connections.* The Site Plan incorporates sidewalks that connect the proposed buildings to the on-site surface parking areas. The sidewalk will also connect to the existing sidewalk system along Hinckley Way provides access to the nearby bus stop.
- *Bicycle Amenities.* The Proponent will provide bicycle accommodations within the property including bike racks near the buildings entranceways to encourage and facilitate this mode of transportation to/from the Site.

### Off-site Improvements

- *High Visibility Pedestrian Crossing.* As part of the project the Proponent proposes to relocate the existing pedestrian crosswalk along Hinckley Way at the Route 2 pedestrian bridge to a location to the west of the proposed driveway for the Site as shown in **Figure 6** (Conceptual Improvement Plan). As part of the relocation MDM recommends the installation of rectangular rapid flashing pedestrian beacons (RRFB) and new ADA compliant ramps at the new crosswalk location. The proposed crosswalk location will provide ADA compliant ramps and will enhance the visibility of the crossing with the inclusion of pedestrian actuated RRFB pedestrian crossing signs.

In summary, trip generation for the development is projected to be nominal on area roadways relative to Baseline conditions with no material impact to operating conditions in the study area. The assessment indicates that there is ample capacity along Hinckley Way to accommodate these project-related traffic increases without the need for major infrastructure enhancements. Proposed access access/egress improvements, and pedestrian and bicycle accommodations as outlined above will adequately mitigate the project impacts.



**NOTES**

1. THIS PLAN INTENDED FOR DISCUSSION PURPOSES ONLY; IT IS NOT FOR CONSTRUCTION.
2. FINAL DESIGN IS SUBJECT TO FIELD SURVEY BY OTHERS.
3. PROPERTY LINES AND ACCESS LINE LOCATIONS ARE APPROXIMATE ONLY AND ARE SUBJECT TO DEED AND TITLE RECORDS.
4. BASE PLAN SOURCE: DeCelle-Burke-Sale & Associates, Inc.

**DRAFT**



Figure 6

<b>Conceptual Improvement Plan</b>		
91 BEATRICE CIRCLE BELMONT, MASSACHUSETTS PREPARED FOR: <b>COMPREHENSIVE LAND HOLDINGS, LLC</b> 2476 NORTH MIDDLESEX AVENUE HERNANDO, FLORIDA 34442		
<b>MDM</b> TRANSPORTATION CONSULTANTS, INC. PLANNERS & ENGINEERS <small>28 Lord Road, Suite 280          Marlborough, MA 01752          Tel: (508) 303-0370          Fax: (508) 303-0371</small>		
DATE: July 27, 2020	SCALE: As Noted	
PROJECT No. 1088	File: 1088 Concept Plan 7-27-2020	Sheet 1 of 1

# ATTACHMENTS

- Traffic Volume Data
- Pedestrian and Bicycle Volume Data
- Speed Data
- Public Transit Information
- Sight Distance Calculations
- Trip Generation
- Capacity Analysis
- AutoTURN® Analysis

□ Traffic Volume Data

Hinckley Way  
Near Pedestrian Bridge  
Belmont, MA

**MDM** TRANSPORTATION CONSULTANTS, INC.  
**Planners & Engineers**

28 Lord Road, Suite 280  
Marlborough, MA 01752

Site Code:

Start Time	01-Jul-20 Wed	Eastbound		Hour Totals		Combined Totals	
		Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		6	40				
12:15		1	49				
12:30		1	43				
12:45		3	38	11	170	11	170
01:00		4	39				
01:15		0	46				
01:30		1	53				
01:45		1	48	6	186	6	186
02:00		1	36				
02:15		1	42				
02:30		1	48				
02:45		1	52	4	178	4	178
03:00		0	42				
03:15		2	47				
03:30		0	39				
03:45		0	26	2	154	2	154
04:00		0	42				
04:15		1	40				
04:30		3	53				
04:45		2	29	6	164	6	164
05:00		3	35				
05:15		4	42				
05:30		9	42				
05:45		18	35	34	154	34	154
06:00		17	34				
06:15		19	30				
06:30		18	33				
06:45		24	34	78	131	78	131
07:00		34	27				
07:15		29	24				
07:30		35	26				
07:45		39	17	137	94	137	94
08:00		50	23				
08:15		47	19				
08:30		44	19				
08:45		41	11	182	72	182	72
09:00		40	13				
09:15		44	18				
09:30		46	8				
09:45		32	6	162	45	162	45
10:00		37	10				
10:15		31	12				
10:30		43	5				
10:45		30	10	141	37	141	37
11:00		37	7				
11:15		36	7				
11:30		36	5				
11:45		50	1	159	20	159	20
Total		922	1405			922	1405
Percent		39.6%	60.4%			39.6%	60.4%
Total		922	1405			922	1405
Percent		39.6%	60.4%			39.6%	60.4%
Combined Total		2327				2327	

N: Site Driveway  
E/W: Hinckley Way  
Belmont, MA

File Name : 1088 Hinckley at Driveway  
Site Code : 1088  
Start Date : 7/1/2020  
Page No : 1

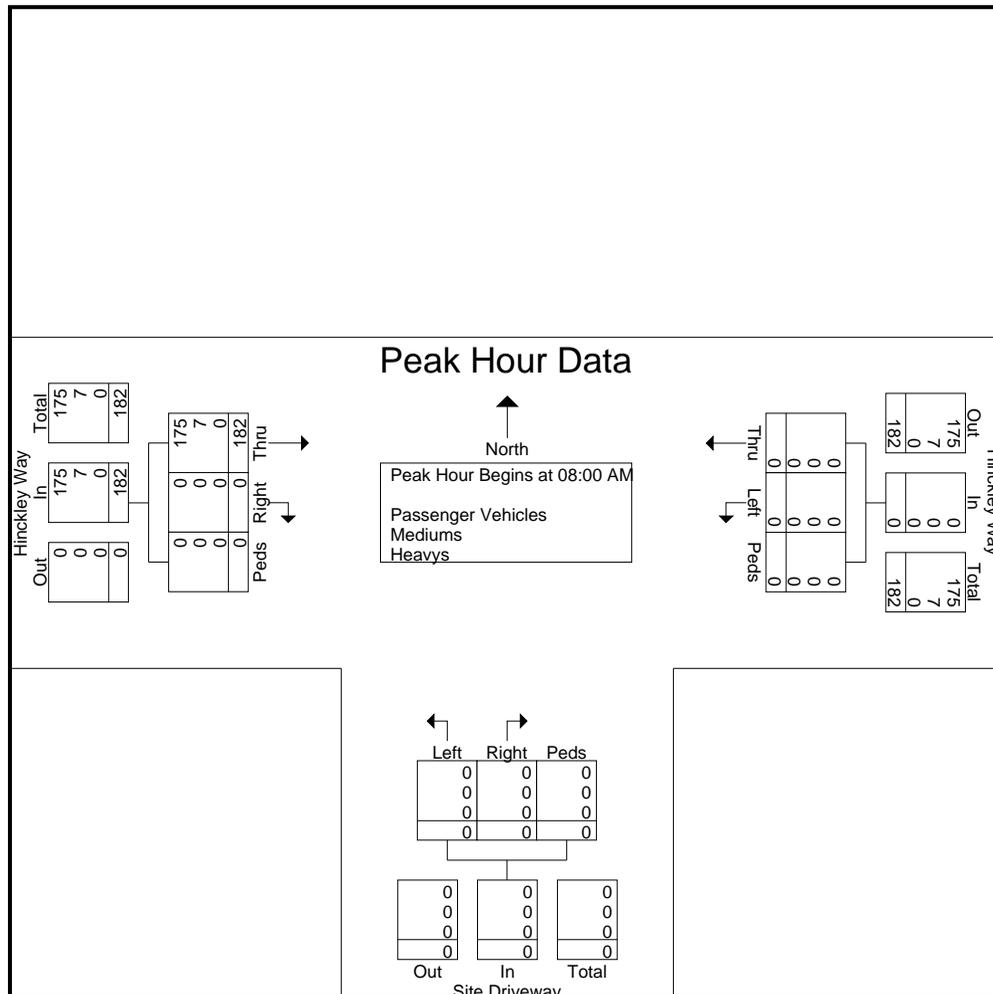
Groups Printed- Passenger Vehicles - Mediums - Heavys

Start Time	Hinckley Way From East				Site Driveway From South				Hinckley Way From West				Int. Total
	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	
07:00 AM	0	0	0	0	0	0	0	0	0	34	0	34	34
07:15 AM	0	0	0	0	0	0	0	0	0	29	0	29	29
07:30 AM	0	0	0	0	0	0	0	0	0	35	0	35	35
07:45 AM	0	0	0	0	0	0	0	0	0	39	0	39	39
Total	0	0	0	0	0	0	0	0	0	137	0	137	137
08:00 AM	0	0	0	0	0	0	0	0	0	50	0	50	50
08:15 AM	0	0	0	0	0	0	0	0	0	47	0	47	47
08:30 AM	0	0	0	0	0	0	0	0	0	44	0	44	44
08:45 AM	0	0	0	0	0	0	0	0	0	41	0	41	41
Total	0	0	0	0	0	0	0	0	0	182	0	182	182
04:00 PM	0	0	0	0	0	0	0	0	0	42	0	42	42
04:15 PM	0	0	0	0	0	0	0	0	0	40	0	40	40
04:30 PM	0	0	0	0	0	0	0	0	0	53	0	53	53
04:45 PM	0	0	0	0	1	0	0	1	1	29	0	30	31
Total	0	0	0	0	1	0	0	1	1	164	0	165	166
05:00 PM	0	0	0	0	0	0	0	0	0	35	0	35	35
05:15 PM	0	0	0	0	0	0	0	0	0	42	0	42	42
05:30 PM	0	0	0	0	0	0	0	0	0	42	0	42	42
05:45 PM	0	0	0	0	0	0	0	0	0	34	0	34	34
Total	0	0	0	0	0	0	0	0	0	153	0	153	153
Grand Total	0	0	0	0	1	0	0	1	1	636	0	637	638
Apprch %	0	0	0	0	100	0	0	0	0.2	99.8	0	99.8	
Total %	0	0	0	0	0.2	0	0	0.2	0.2	99.7	0	99.8	
Passenger Vehicles	0	0	0	0	1	0	0	1	1	604	0	605	606
% Passenger Vehicles	0	0	0	0	100	0	0	100	100	95	0	95	95
Mediums	0	0	0	0	0	0	0	0	0	30	0	30	30
% Mediums	0	0	0	0	0	0	0	0	0	4.7	0	4.7	4.7
Heavys	0	0	0	0	0	0	0	0	0	2	0	2	2
% Heavys	0	0	0	0	0	0	0	0	0	0.3	0	0.3	0.3

N: Site Driveway  
E/W: Hinckley Way  
Belmont, MA

File Name : 1088 Hinckley at Driveway  
Site Code : 1088  
Start Date : 7/1/2020  
Page No : 2

Start Time	Hinckley Way From East				Site Driveway From South				Hinckley Way From West				Int. Total
	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 08:00 AM													
08:00 AM	0	0	0	0	0	0	0	0	0	50	0	50	50
08:15 AM	0	0	0	0	0	0	0	0	0	47	0	47	47
08:30 AM	0	0	0	0	0	0	0	0	0	44	0	44	44
08:45 AM	0	0	0	0	0	0	0	0	0	41	0	41	41
Total Volume	0	0	0	0	0	0	0	0	0	182	0	182	182
% App. Total	0	0	0	0	0	0	0	0	0	100	0	100	100
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.910	.000	.910	.910
Passenger Vehicles	0	0	0	0	0	0	0	0	0	175	0	175	175
% Passenger Vehicles	0	0	0	0	0	0	0	0	0	96.2	0	96.2	96.2
Mediums	0	0	0	0	0	0	0	0	0	7	0	7	7
% Mediums	0	0	0	0	0	0	0	0	0	3.8	0	3.8	3.8
Heavys	0	0	0	0	0	0	0	0	0	0	0	0	0
% Heavys	0	0	0	0	0	0	0	0	0	0	0	0	0





# Volume Count Report

LOCATION INFO	
Location ID	4013
Type	SPOT
Funct'l Class	3
Located On	CAMBRIDGE TURNPIKE
Loc On Alias	
AT	LEXINGTON TOWN LINE
Direction	2-WAY
County	Middlesex
Community	Lincoln
MPO ID	
HPMS ID	157000100350
Agency	MHD

COUNT DATA INFO	
Count Status	Accepted
Start Date	Tue 6/23/2020
End Date	Wed 6/24/2020
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	000000401304
Study	
Speed Limit	
Description	
Sensor Type	
Source	TCDS_COUNT_IMPORT_COMBINE
Latitude,Longitude	

INTERVAL: 60-MIN	
Time	Hourly Count
0:00-1:00	107
1:00-2:00	65
2:00-3:00	53
3:00-4:00	64
4:00-5:00	219
5:00-6:00	1,294
6:00-7:00	2,521
7:00-8:00	2,608
8:00-9:00	2,422
9:00-10:00	2,186
10:00-11:00	1,989
11:00-12:00	2,093
12:00-13:00	2,048
13:00-14:00	2,236
14:00-15:00	2,657
15:00-16:00	2,875
16:00-17:00	2,916
17:00-18:00	2,721
18:00-19:00	1,977
19:00-20:00	1,396
20:00-21:00	860
21:00-22:00	661
22:00-23:00	410
23:00-24:00	343
<b>Total</b>	<b>36,721</b>
<b>AM Peak</b>	07:00-08:00 2,608
<b>PM Peak</b>	16:00-17:00 2,916

461.

5030

331.

5637

411.

# Volume Count Report

LOCATION INFO	
Location ID	4013
Type	SPOT
Funct'l Class	3
Located On	CAMBRIDGE TURNPIKE
Loc On Alias	
AT	LEXINGTON TOWN LINE
Direction	2-WAY
County	Middlesex
Community	Lincoln
MPO ID	
HPMS ID	157000100350
Agency	MHD

COUNT DATA INFO	
Count Status	Accepted
Start Date	Tue 6/18/2019
End Date	Wed 6/19/2019
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	2-WAY
Notes	
Station	000000401304
Study	
Speed Limit	
Description	
Sensor Type	
Source	CombineVolumeCountsIncremental
Latitude,Longitude	

INTERVAL:60-MIN	
Time	Hourly Count
0:00-1:00	219
1:00-2:00	123
2:00-3:00	88
3:00-4:00	87
4:00-5:00	353
5:00-6:00	2,043
6:00-7:00	4,191
7:00-8:00	4,697
8:00-9:00	4,690
9:00-10:00	3,722
10:00-11:00	3,106
11:00-12:00	2,849
12:00-13:00	2,833
13:00-14:00	2,836
14:00-15:00	3,285
15:00-16:00	3,766
16:00-17:00	4,099
17:00-18:00	4,353
18:00-19:00	3,972
19:00-20:00	2,824
20:00-21:00	1,749
21:00-22:00	1,526
22:00-23:00	985
23:00-24:00	591
<b>Total</b>	<b>58,987</b>
<b>AADT</b>	<b>54,032</b>
<b>AM Peak</b>	07:00-08:00 4,697
<b>PM Peak</b>	17:00-18:00 4,353

9387

8452

□ Pedestrian and Bicycle Volume Data

Study Name 1088 Pedestrian Bridge Crossing Study  
 Start Date 07/01/2020  
 Start Time 12:00 AM  
 Site Code 1088

PEDESTRIANS

Channel Direction	Crosswalk	
	Southbound	Northbound
12:00 AM	0	0
12:15 AM	0	0
12:30 AM	0	0
12:45 AM	0	0
1:00 AM	0	0
1:15 AM	0	0
1:30 AM	0	0
1:45 AM	0	0
2:00 AM	0	0
2:15 AM	0	0
2:30 AM	0	0
2:45 AM	0	0
3:00 AM	0	0
3:15 AM	0	0
3:30 AM	0	0
3:45 AM	0	0
4:00 AM	0	0
4:15 AM	0	0
4:30 AM	0	0
4:45 AM	0	0
5:00 AM	0	0
5:15 AM	0	0
5:30 AM	1	0
5:45 AM	0	0
6:00 AM	1	0
6:15 AM	1	0
6:30 AM	0	1
6:45 AM	0	0
7:00 AM	0	0
7:15 AM	0	0
7:30 AM	2	0
7:45 AM	0	1
8:00 AM	0	0
8:15 AM	0	0
8:30 AM	0	0
8:45 AM	0	0
9:00 AM	0	0
9:15 AM	0	0
9:30 AM	1	0
9:45 AM	0	1
10:00 AM	0	1
10:15 AM	0	0
10:30 AM	1	0
10:45 AM	2	0
11:00 AM	1	0
11:15 AM	0	0
11:30 AM	0	0
11:45 AM	0	0
12:00 PM	0	0
12:15 PM	0	0
12:30 PM	0	0
12:45 PM	0	0
1:00 PM	0	1
1:15 PM	0	1
1:30 PM	1	0
1:45 PM	3	0
2:00 PM	1	0
2:15 PM	0	2
2:30 PM	0	2
2:45 PM	1	0
3:00 PM	0	0
3:15 PM	0	0
3:30 PM	0	0
3:45 PM	0	0
4:00 PM	0	1
4:15 PM	0	0
4:30 PM	2	0
4:45 PM	0	2
5:00 PM	0	0
5:15 PM	1	0
5:30 PM	2	0
5:45 PM	0	0
6:00 PM	2	1
6:15 PM	0	0
6:30 PM	0	1
6:45 PM	2	0
7:00 PM	0	2
7:15 PM	0	0
7:30 PM	2	0
7:45 PM	0	0
8:00 PM	2	0
8:15 PM	0	0
8:30 PM	1	0
8:45 PM	0	0
9:00 PM	0	0
9:15 PM	0	0
9:30 PM	0	2
9:45 PM	0	0
10:00 PM	0	0
10:15 PM	0	0
10:30 PM	0	0
10:45 PM	0	0
11:00 PM	0	0
11:15 PM	2	0
11:30 PM	0	0
11:45 PM	0	0
<b>TOTAL</b>	<b>32</b>	<b>19</b>

BICYCLES

Channel Direction	Crosswalk	
	Southbound	Northbound
12:00 AM	0	0
12:15 AM	0	0
12:30 AM	0	0
12:45 AM	0	0
1:00 AM	0	0
1:15 AM	0	0
1:30 AM	0	0
1:45 AM	0	0
2:00 AM	0	0
2:15 AM	0	0
2:30 AM	0	0
2:45 AM	0	0
3:00 AM	0	0
3:15 AM	0	0
3:30 AM	0	0
3:45 AM	0	0
4:00 AM	0	0
4:15 AM	0	0
4:30 AM	0	0
4:45 AM	0	0
5:00 AM	0	0
5:15 AM	0	0
5:30 AM	0	0
5:45 AM	0	0
6:00 AM	0	0
6:15 AM	0	0
6:30 AM	0	0
6:45 AM	0	0
7:00 AM	0	0
7:15 AM	1	0
7:30 AM	0	0
7:45 AM	0	0
8:00 AM	0	0
8:15 AM	0	0
8:30 AM	0	0
8:45 AM	0	0
9:00 AM	0	0
9:15 AM	0	0
9:30 AM	0	0
9:45 AM	0	0
10:00 AM	0	0
10:15 AM	0	0
10:30 AM	0	0
10:45 AM	0	0
11:00 AM	0	0
11:15 AM	0	0
11:30 AM	0	0
11:45 AM	0	0
12:00 PM	0	0
12:15 PM	0	0
12:30 PM	0	0
12:45 PM	0	0
1:00 PM	0	0
1:15 PM	0	0
1:30 PM	0	0
1:45 PM	0	0
2:00 PM	0	0
2:15 PM	0	1
2:30 PM	1	0
2:45 PM	0	0
3:00 PM	0	0
3:15 PM	0	0
3:30 PM	0	0
3:45 PM	0	0
4:00 PM	0	0
4:15 PM	0	0
4:30 PM	0	0
4:45 PM	0	0
5:00 PM	0	0
5:15 PM	0	0
5:30 PM	0	0
5:45 PM	0	0
6:00 PM	0	0
6:15 PM	0	0
6:30 PM	0	0
6:45 PM	0	0
7:00 PM	0	0
7:15 PM	0	0
7:30 PM	0	0
7:45 PM	0	0
8:00 PM	0	0
8:15 PM	0	0
8:30 PM	0	0
8:45 PM	0	0
9:00 PM	0	0
9:15 PM	0	0
9:30 PM	0	0
9:45 PM	0	0
10:00 PM	0	0
10:15 PM	0	0
10:30 PM	0	0
10:45 PM	0	0
11:00 PM	0	0
11:15 PM	0	0
11:30 PM	0	0
11:45 PM	0	0
<b>TOTAL</b>	<b>2</b>	<b>1</b>

Study Name 1088 Hinckley Sidewalk Study  
 Start Date 07/01/2020  
 Start Time 12:00 AM  
 Site Code 1088

PEDESTRIANS

Channel Direction	Sidewalk	Sidewalk
	Westbound	Eastbound
12:00 AM	0	0
12:15 AM	0	0
12:30 AM	0	0
12:45 AM	0	0
1:00 AM	0	0
1:15 AM	0	0
1:30 AM	0	0
1:45 AM	0	0
2:00 AM	0	0
2:15 AM	0	0
2:30 AM	0	0
2:45 AM	0	0
3:00 AM	0	0
3:15 AM	0	0
3:30 AM	0	0
3:45 AM	0	0
4:00 AM	0	0
4:15 AM	0	0
4:30 AM	0	0
4:45 AM	0	0
5:00 AM	0	0
5:15 AM	0	0
5:30 AM	0	1
5:45 AM	0	0
6:00 AM	0	0
6:15 AM	2	1
6:30 AM	0	0
6:45 AM	0	0
7:00 AM	0	0
7:15 AM	0	1
7:30 AM	0	2
7:45 AM	1	0
8:00 AM	0	0
8:15 AM	0	0
8:30 AM	2	0
8:45 AM	0	0
9:00 AM	0	0
9:15 AM	0	0
9:30 AM	0	1
9:45 AM	1	0
10:00 AM	1	0
10:15 AM	0	0
10:30 AM	0	0
10:45 AM	0	1
11:00 AM	0	3
11:15 AM	0	0
11:30 AM	0	0
11:45 AM	1	0
12:00 PM	0	0
12:15 PM	0	0
12:30 PM	0	0
12:45 PM	1	0
1:00 PM	2	1
1:15 PM	2	1
1:30 PM	0	1
1:45 PM	0	1
2:00 PM	0	0
2:15 PM	2	0
2:30 PM	2	0
2:45 PM	0	1
3:00 PM	0	0
3:15 PM	0	0
3:30 PM	0	0
3:45 PM	0	0
4:00 PM	0	0
4:15 PM	0	0
4:30 PM	0	4
4:45 PM	2	0
5:00 PM	0	0
5:15 PM	0	0
5:30 PM	0	0
5:45 PM	0	0
6:00 PM	0	2
6:15 PM	0	0
6:30 PM	1	0
6:45 PM	0	0
7:00 PM	0	0
7:15 PM	0	1
7:30 PM	0	3
7:45 PM	0	0
8:00 PM	0	2
8:15 PM	0	0
8:30 PM	0	1
8:45 PM	0	0
9:00 PM	0	0
9:15 PM	0	0
9:30 PM	2	2
9:45 PM	0	0
10:00 PM	0	0
10:15 PM	0	0
10:30 PM	0	0
10:45 PM	0	0
11:00 PM	0	0
11:15 PM	0	0
11:30 PM	0	0
11:45 PM	0	0
<b>TOTAL</b>	<b>22</b>	<b>30</b>

BICYCLES

Channel Direction	Sidewalk	Sidewalk
	Westbound	Eastbound
12:00 AM	0	0
12:15 AM	0	0
12:30 AM	0	0
12:45 AM	0	0
1:00 AM	0	0
1:15 AM	0	0
1:30 AM	0	0
1:45 AM	0	0
2:00 AM	0	0
2:15 AM	0	0
2:30 AM	0	0
2:45 AM	0	0
3:00 AM	0	0
3:15 AM	0	0
3:30 AM	0	0
3:45 AM	0	0
4:00 AM	0	0
4:15 AM	0	0
4:30 AM	0	0
4:45 AM	0	0
5:00 AM	0	0
5:15 AM	0	0
5:30 AM	0	0
5:45 AM	0	0
6:00 AM	0	0
6:15 AM	0	0
6:30 AM	0	0
6:45 AM	0	0
7:00 AM	0	0
7:15 AM	0	0
7:30 AM	0	0
7:45 AM	0	0
8:00 AM	0	0
8:15 AM	0	0
8:30 AM	0	0
8:45 AM	0	0
9:00 AM	0	0
9:15 AM	0	0
9:30 AM	0	0
9:45 AM	0	0
10:00 AM	0	0
10:15 AM	0	0
10:30 AM	0	0
10:45 AM	0	0
11:00 AM	0	0
11:15 AM	0	0
11:30 AM	0	0
11:45 AM	0	0
<b>TOTAL</b>	<b>1</b>	<b>0</b>

□ Speed Data

EB: Hinckley Way  
West of Site Driveway  
Belmont, MA

**MDM** TRANSPORTATION CONSULTANTS, INC.  
**Planners & Engineers**

28 Lord Road, Suite 280  
Marlborough, MA 01752

Site Code: 1088

Start Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total	85th Percent
06/30/20	0	0	0	3	3	2	0	0	0	0	0	0	0	0	8	37
01:00	0	0	0	2	3	0	0	0	0	0	0	0	0	0	5	33
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
03:00	0	0	0	0	2	0	0	1	0	0	0	0	0	0	3	47
04:00	0	0	0	0	2	1	0	0	0	0	0	0	0	0	3	37
05:00	0	0	0	2	9	18	2	0	0	0	0	0	0	0	31	39
06:00	0	1	0	11	44	28	10	0	0	0	0	0	0	0	94	39
07:00	0	1	4	38	56	27	1	0	0	0	0	0	0	0	127	36
08:00	0	0	5	36	65	18	1	0	0	0	0	0	0	0	125	35
09:00	0	2	15	54	62	11	1	0	0	0	0	0	0	0	145	34
10:00	1	1	18	55	57	17	2	0	0	0	0	0	0	0	151	34
11:00	4	3	19	69	46	9	1	0	0	0	0	0	0	0	151	33
12 PM	0	2	12	45	76	28	5	0	0	0	0	0	0	0	168	36
13:00	0	0	6	25	71	38	7	0	0	0	0	0	0	0	147	38
14:00	0	0	6	24	82	52	7	0	1	0	0	0	0	0	172	38
15:00	0	0	2	16	68	41	7	2	1	0	0	0	0	0	137	38
16:00	0	1	1	20	65	43	10	1	0	0	0	0	0	0	141	38
17:00	0	0	2	16	42	55	11	1	0	0	0	0	0	0	127	39
18:00	0	1	3	24	70	24	11	0	0	0	0	0	0	0	133	38
19:00	0	0	2	16	41	23	6	0	0	0	0	0	0	0	88	38
20:00	0	1	2	11	38	18	3	0	0	0	0	0	0	0	73	37
21:00	0	0	1	2	11	5	3	1	0	0	0	0	0	0	23	40
22:00	0	0	1	3	16	7	1	0	0	0	0	0	0	0	28	37
23:00	1	0	0	3	5	3	1	0	1	0	0	0	0	0	14	39
<b>Total</b>	<b>6</b>	<b>13</b>	<b>99</b>	<b>475</b>	<b>934</b>	<b>468</b>	<b>90</b>	<b>6</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2094</b>	

# MDM TRANSPORTATION CONSULTANTS, INC.

## Planners & Engineers

EB: Hinckley Way  
West of Site Driveway  
Belmont, MA

28 Lord Road, Suite 280  
Marlborough, MA 01752

Site Code: 1088

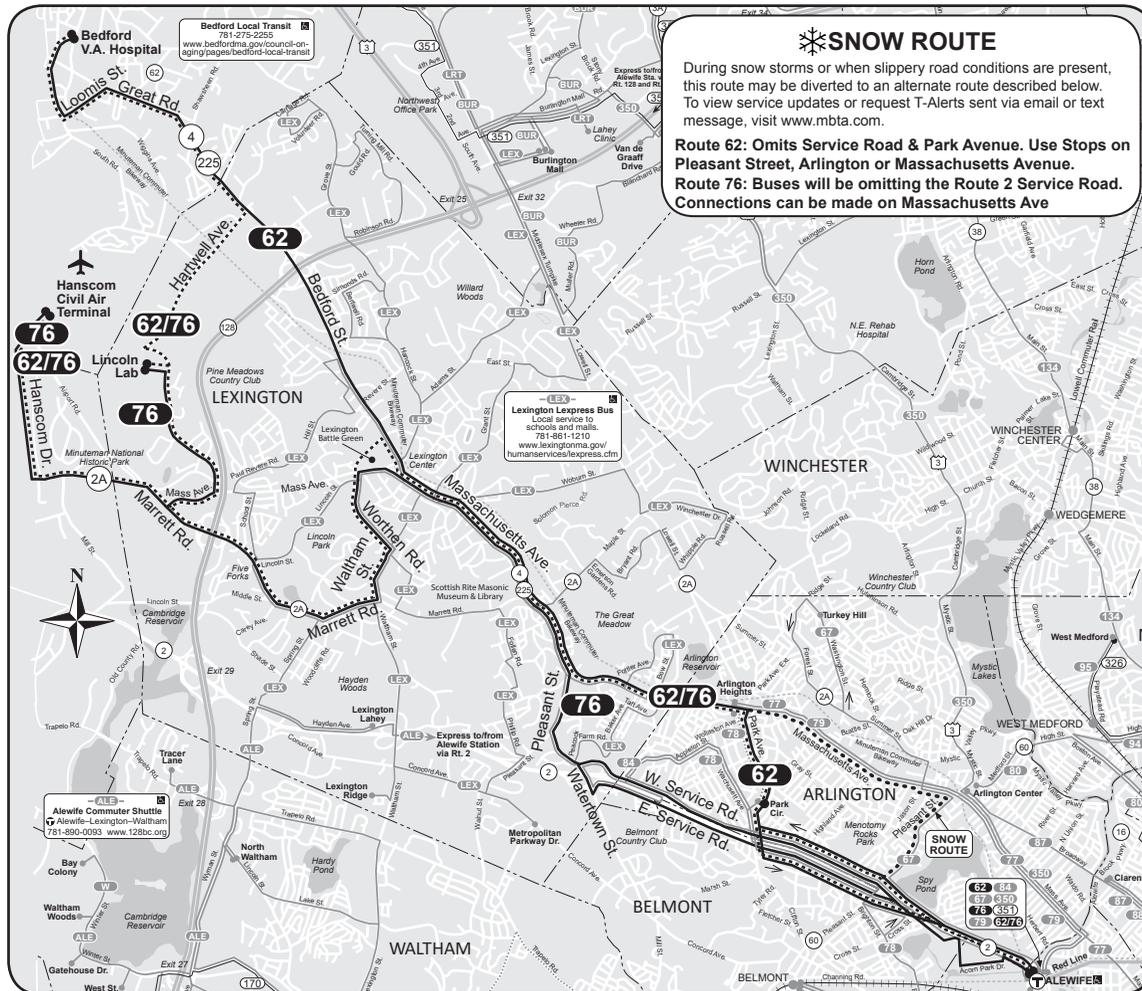
Eastbound																
Start Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total	85th Percent
07/01/20	0	0	0	1	5	4	2	0	0	0	0	0	0	0	12	40
01:00	0	0	0	0	2	1	3	0	0	0	0	0	0	0	6	43
02:00	0	0	0	0	3	1	0	0	0	0	0	0	0	0	4	37
03:00	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	34
04:00	0	0	0	1	2	3	0	0	0	0	0	0	0	0	6	38
05:00	0	0	2	9	11	12	2	0	0	0	0	0	0	0	36	38
06:00	0	0	0	6	28	29	8	1	0	0	0	0	0	0	72	39
07:00	0	0	4	24	55	44	4	2	0	0	0	0	0	0	133	38
08:00	0	3	21	50	75	32	1	0	0	1	0	0	0	0	183	36
09:00	2	6	38	62	23	7	1	0	0	0	0	0	0	0	139	32
10:00	1	5	21	41	31	17	5	0	0	0	0	0	0	0	121	36
11:00	0	1	6	42	70	35	6	0	0	0	0	0	0	0	160	37
12 PM	0	0	5	29	80	48	7	0	0	0	0	0	0	0	169	38
13:00	0	0	9	25	85	60	5	0	0	0	0	0	0	0	184	38
14:00	0	1	7	21	86	43	11	1	0	0	0	0	0	0	170	38
15:00	1	0	7	31	56	49	14	0	0	0	0	0	0	0	158	39
16:00	0	0	1	23	70	56	4	2	0	0	0	0	0	0	156	38
17:00	0	0	8	18	66	51	16	0	0	0	0	0	0	0	159	39
18:00	0	0	2	18	57	41	9	3	0	0	0	0	0	0	130	39
19:00	0	0	2	13	45	27	6	1	0	0	0	0	0	0	94	38
20:00	0	0	5	11	31	19	6	0	0	0	0	0	0	0	72	38
21:00	0	2	2	6	21	12	2	0	0	0	0	0	0	0	45	38
22:00	0	0	0	9	19	4	4	0	0	0	0	0	0	0	36	38
23:00	0	0	1	7	7	4	2	0	0	0	0	0	0	0	21	38
<b>Total</b>	<b>4</b>	<b>18</b>	<b>141</b>	<b>447</b>	<b>930</b>	<b>599</b>	<b>118</b>	<b>10</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2268</b>	

15th Percentile : 27 MPH  
 50th Percentile : 32 MPH  
 85th Percentile : 38 MPH  
 95th Percentile : 40 MPH

Statistics      10 MPH Pace Speed : 31-40 MPH  
 Number in Pace : 2931  
 Percent in Pace : 67.2%  
 Number of Vehicles > 30 MPH : 3159  
 Percent of Vehicles > 30 MPH : 72.4%  
 Mean Speed(Average) : 33 MPH

□ Public Transit Information

**Route 62 Bedford VA Hospital - Alewife Station**  
**Route 76 Lincoln Lab - Alewife Station**



# 62•76

Effective March 15, 2020

**62 Bedford VA Hospital-Alewife Station**  
**76 Lincoln Lab-Alewife Sta.**

Serving

- Bedford Center
- Hanscom Civil Air Terminal
- Lexington Center
- Arlington Heights
- Five Forks
- Lexington Battle Green
- Red Line



**Massachusetts Bay Transportation Authority** *massDOT*  
 Massachusetts Department of Transportation

Information 617-222-3200 • 1-800-392-6100  
 (TTY) 617-222-5146 • [www.mbta.com](http://www.mbta.com)

**62 & 76**

**Weekday**

Inbound					
Leave VA Hospital	Leave Lincoln Lab	Arrive Civil Air Terminal	Lv/Arrive Lexington Center	Arrive Alewife Station	
76	.....	6:00A	6:07A	6:22A	6:37A
62 b	6:24A	.....	.....	6:38	6:56
62	.....	.....	.....	6:50	7:13
76	.....	6:40	6:47	7:03	7:25
62	6:52	.....	.....	7:11	7:36
76	.....	7:00	7:08	7:26	7:48
62	.....	.....	.....	7:30	7:58
62	7:20	.....	.....	7:39	8:04
62	.....	.....	.....	7:50	8:18
76	.....	7:35	7:43	8:01	8:23
62	7:55	.....	.....	8:14	8:39
76	.....	8:05	8:13	8:31	8:53
62	8:32	.....	.....	8:51	9:10
76	.....	8:41	8:49	9:05	9:20
62	9:05	.....	.....	9:23	9:42
76	.....	9:11	9:18	9:33	9:48
62	9:45	.....	.....	10:04	10:24
76	.....	10:11	10:18	10:33	10:48
62	10:45	.....	.....	11:05	11:25
76	.....	11:11	11:18	11:33	11:48
62	11:45	.....	.....	12:05P	12:25P
76	.....	12:11P	12:18P	12:33P	12:47P
62	12:45P	.....	.....	1:05	1:25
76	.....	1:18	.....	1:32	1:47
62	1:45	.....	.....	2:05	2:25
76	.....	2:20	.....	2:35	2:53
62	2:45	.....	.....	3:06	3:27
76	.....	3:23	.....	3:38	3:58
62	3:50	.....	.....	4:13	4:34
76	.....	4:33	.....	4:48	5:11
62	4:35	.....	.....	4:58	5:28
76	.....	5:05	.....	5:20	5:39
62	5:05	.....	.....	5:23	5:53
62	.....	.....	.....	5:47	6:05
76	.....	5:40	.....	5:55	6:14
62	5:55	.....	.....	6:11	6:28
76	.....	6:10	.....	6:25	6:40
62	6:25	.....	.....	6:41	6:58
76	.....	6:36	.....	6:47	7:01
62	6:44	.....	.....	7:00	7:17
76	.....	7:03	.....	7:14	7:28
62	7:15	.....	.....	7:31	7:43
62 b	7:55	.....	.....	7:46	8:00
76	.....	f 8:05	.....	8:05	8:19
62 b	8:40	.....	.....	8:11	8:25
76	.....	.....	.....	8:50	9:04
76	.....	f 9:05	.....	9:11	9:25
76	.....	10:15	.....	10:26	10:39

Outbound				
Leave Alewife Station	Arrive Lexington Center	Arrive Civil Air Terminal	Arrive Lincoln Lab	Arrive VA Hospital
62 b	5:47A	6:03A	.....	.....
76	6:05	6:20	.....	6:34A
62	6:10	6:29	.....	6:45A
76	6:20	6:35	.....	6:49
62	6:40	6:59	.....	7:15
76	7:00	7:15	.....	7:29
62	7:10	7:29	.....	7:48
76	7:30	7:45	.....	7:59
62	7:45	8:06	.....	8:25
76	8:00	8:18	.....	8:34
62	8:15	8:37	.....	8:55
76	8:30	8:48	.....	9:04
62	9:00	9:19	.....	9:37
76	9:30	9:46	.....	10:00
62	9:55	10:14	.....	10:32
76	10:30	10:46	.....	11:00
62	10:55	11:14	.....	11:32
76	11:30	11:46	.....	12:00N
62	11:55	12:14P	.....	12:32P
76	12:30P	12:46P	1:00P	1:10P
62	12:55	1:14	.....	1:33P
76	1:30	1:46	2:00	2:10
62	1:55	2:15	.....	2:36
76	2:30	2:47	3:06	3:18
62	3:00	3:25	.....	3:48
76	3:30	3:48	4:09	4:24
62	3:40	4:05	.....	4:28
76	4:05	4:25	4:46	5:00
62	4:10	4:35	.....	4:58
76	4:35	4:54	5:12	5:24
62	4:50	5:14	.....	5:35
76	5:05	5:28	5:45	5:57
62 c	5:15	5:42	.....	.....
62	5:25	5:49	.....	6:10
76	5:37	6:00	6:14	6:23
62	5:47	6:10	.....	6:30
62 c	5:59	6:21	.....	.....
76	6:10	6:30	6:44	6:53
62	6:20	6:41	.....	7:01
76	6:45	7:05	7:19	7:28
62 b	7:10	7:30	.....	.....
76	f 7:35	7:53	.....	.....
62 b	8:05	8:23	.....	.....
76	f 8:35	8:53	.....	.....
76	9:35	9:50	10:01	10:10

Route 76 indicated by shaded areas

**62 & 76**

**Saturday**

Inbound				Outbound			
Leave VA Hospital	Arrive Civil Air Terminal	Arrive Lexington Center	Arrive Alewife Station	Leave Alewife Station	Arrive Lexington Center	Arrive Civil Air Terminal	Arrive VA Hospital
8:00A	8:19A	8:37A	8:52A	7:00A	7:16A	7:29A	7:48A
9:10	9:29	9:47	10:02	8:00	8:18	8:31	8:52
10:20	10:39	10:57	11:12	9:10	9:28	9:41	10:02
11:30	11:49	12:07P	12:26P	10:20	10:40	10:54	11:17
				11:30	11:50	12:04P	12:27P
12:40P	12:59P	1:16P	1:34P				
1:50	2:09	2:26	2:44	12:40P	1:00P	1:14P	1:36P
3:00	3:19	3:36	3:53	1:50	2:07	2:21	2:44
4:00	4:19	4:35	4:54	3:00	3:19	3:33	3:56
5:00	5:19	5:34	5:50	4:00	4:18	4:30	4:52
6:00	6:17	6:32	6:47	5:00	5:18	5:30	5:52
7:00	7:17	7:31	7:47	6:00	6:18	6:30	6:50
8:00	8:18	8:31	8:47	7:00	7:18	7:30	7:50

- b - To/from Bedford Center. Does NOT serve VA Hospital.
- c - To Lexington Center
- f - Operates between Five Forks and Alewife Station and does NOT serve Lincoln Lab or Hanscom Civil Air Terminal.

**NOTE:** No Saturday service on Bedford Street between Lexington Center and Hartwell Avenue. All Saturday service operates via Arlington Heights.

All buses are accessible to persons with disabilities

**ROUTE 76 NOTE:**

For AM weekday outbound service to Hanscom Civil Air Terminal, stay on bus at Lincoln Lab. In the PM the bus will serve Hanscom then Lincoln Lab.

**Route 62 & 76  
Bedford VA  
Hospital or  
Lincoln Lab-  
Alewife Station**

Fare	Local Bus	Bus + Bus	Rapid Transit	Bus + Rapid Transit
CharlieCard	\$1.70	\$1.70	\$2.40	\$2.40
CharlieTicket	\$2.00	\$2.00	\$2.90	\$4.90
Cash-on-Board	\$2.00	\$4.00	\$2.90	\$4.90
Student/Youth*	\$0.85	\$0.85	\$1.10	\$1.10
Senior/TAP**	\$0.85	\$0.85	\$1.10	\$1.10

VALID PASSES: LinkPass (\$90.00/mo.); Local Bus (\$55/mo.); \*Student/Youth LinkPass (\$30.00/mo.); \*\*Senior/TAP LinkPass (\$30/mo.); and express bus, commuter rail, and boat passes.

FREE FARES: Children 11 and under ride free when accompanied by an adult; Blind Access CharlieCard holders ride free and if using a guide, the guide rides free. \* Requires Student CharlieCard or Youth CharlieCard. Student CharlieCards are available to students through participating middle schools and high schools. Youth CharlieCards are available through community partners in the Boston metro area. Visit [www.mta.com/youthpass](http://www.mta.com/youthpass) for details.

\*\* Requires Senior/TAP CharlieCard, available to Medicare cardholders, seniors 65+, and persons with disabilities.

**Spring & Summer 2020 Holidays**  
4/20: see Weekday; 5/25: see Sunday  
7/3: see Saturday; 7/4: see Sunday

**No service on Sunday**

Route/Schedule Change

# 78•84

Effective June 21, 2020

78 Arlmont Village-Harvard Station

84 Arlmont Village-Alewife Station

Serving

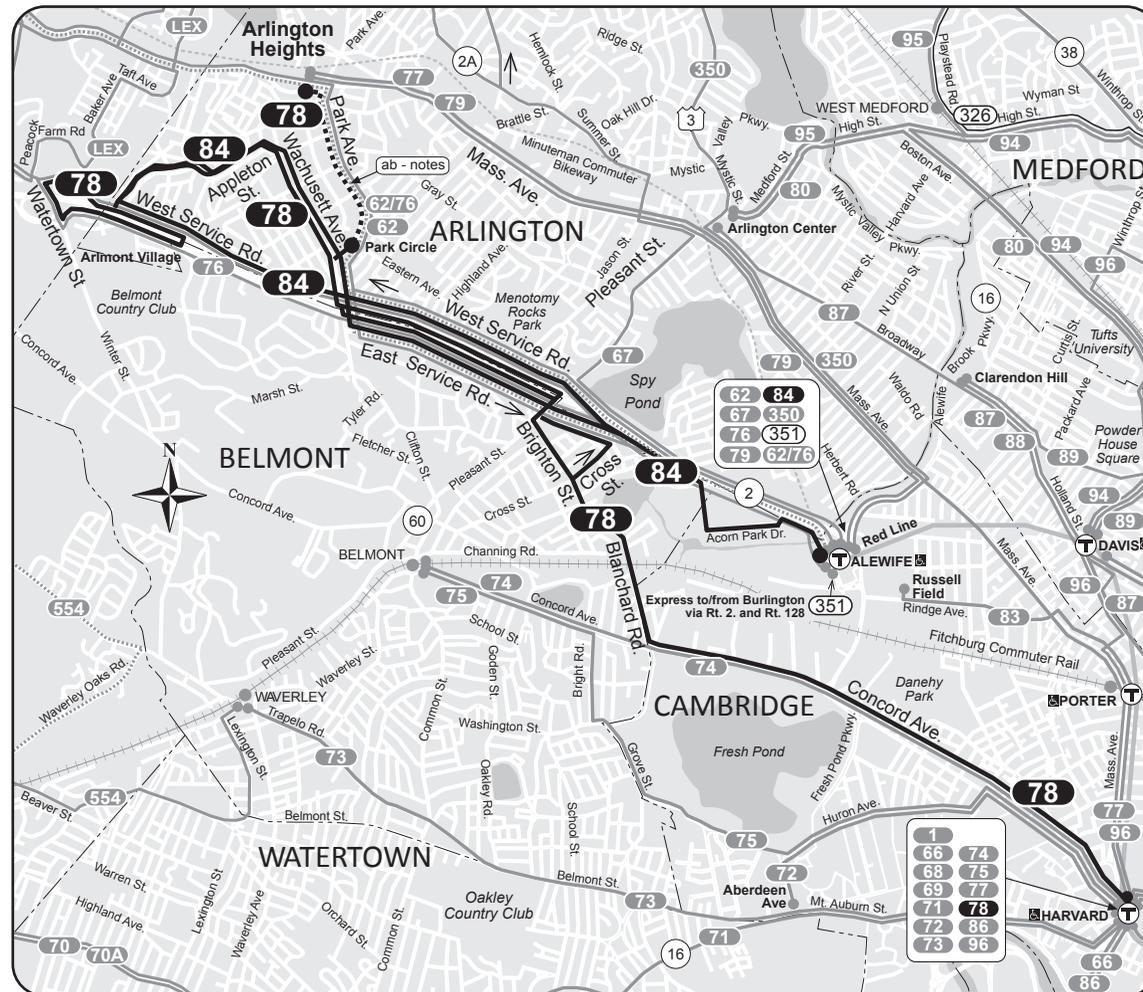
- Park Circle
- Arlington Heights
- Harvard University
- Eliot Street
- Red Line



**T** Massachusetts Bay Transportation Authority **massDOT**  
Massachusetts Department of Transportation

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(TTY) 617-222-5146 • www.mbta.com

## Route 78 Arlmont Village - Harvard Station Route 84 Arlmont Village - Alewife Station



78 Weekday					
Inbound			Outbound		
Leave Arlmont Village	Arrive Pleasant Street	Arrive Harvard Square	Leave Harvard Square	Arrive Pleasant Street	Arrive Arlmont Village
5:35A	5:42A	6:01A	5:45A	5:57A	6:17A
6:00	6:07	6:26	6:05	6:17	6:37
6:25	6:32	6:53	b 6:30	6:42	6:50
6:48	6:55	7:20	b 7:00	7:16	7:24
a 7:08	7:15	7:42	b 7:27	7:43	7:51
a 7:28	7:35	8:02	b 7:52	8:08	8:16
a 7:58	8:05	8:32	8:20	8:38	8:54
a 8:31	8:38	9:02	8:50	9:06	9:18
9:03	9:10	9:33	9:13	9:27	9:39
9:28	9:35	9:55	9:48	10:02	10:14
9:46	9:53	10:13	10:18	10:32	10:44
10:19	10:26	10:46	10:51	11:05	11:17
10:49	10:56	11:16	11:21	11:35	11:47
11:22	11:29	11:49	11:54	<b>12:08P</b>	<b>12:20P</b>
11:52	11:59	<b>12:19P</b>			
			<b>12:24P</b>	<b>12:38</b>	<b>12:50</b>
<b>12:25P</b>	<b>12:32P</b>	<b>12:52</b>	<b>12:57</b>	<b>1:11</b>	<b>1:23</b>
<b>12:55</b>	<b>1:02</b>	<b>1:22</b>	<b>1:27</b>	<b>1:41</b>	<b>1:53</b>
<b>1:28</b>	<b>1:35</b>	<b>1:55</b>	<b>2:00</b>	<b>2:14</b>	<b>2:26</b>
<b>1:58</b>	<b>2:05</b>	<b>2:25</b>	<b>2:30</b>	<b>2:48</b>	<b>3:02</b>
<b>2:31</b>	<b>2:37</b>	<b>2:58</b>	<b>3:10</b>	<b>3:30</b>	<b>3:45</b>
<b>3:07</b>	<b>3:13</b>	<b>3:34</b>	<b>3:50</b>	<b>4:13</b>	<b>4:30</b>
<b>3:51</b>	<b>3:57</b>	<b>4:18</b>	<b>b 4:20</b>	<b>4:39</b>	<b>4:49</b>
<b>4:36</b>	<b>4:42</b>	<b>5:03</b>	<b>b 4:50</b>	<b>5:12</b>	<b>5:24</b>
<b>a 4:55</b>	<b>5:02</b>	<b>5:25</b>	<b>b 5:20</b>	<b>5:43</b>	<b>5:55</b>
<b>a 5:32</b>	<b>5:38</b>	<b>6:02</b>	<b>b 5:50</b>	<b>6:06</b>	<b>6:18</b>
<b>a 6:03</b>	<b>6:09</b>	<b>6:32</b>	<b>b 6:20</b>	<b>6:34</b>	<b>6:46</b>
<b>6:19</b>	<b>6:25</b>	<b>6:45</b>	<b>6:47</b>	<b>7:02</b>	<b>7:19</b>
<b>a 6:30</b>	<b>6:36</b>	<b>6:57</b>	<b>7:25</b>	<b>7:40</b>	<b>7:57</b>
<b>a 6:54</b>	<b>7:00</b>	<b>7:21</b>	<b>7:55</b>	<b>8:09</b>	<b>8:20</b>
<b>7:25</b>	<b>7:31</b>	<b>7:51</b>	<b>8:20</b>	<b>8:34</b>	<b>8:45</b>
<b>8:03</b>	<b>8:09</b>	<b>8:29</b>	<b>8:50</b>	<b>9:04</b>	<b>9:15</b>
<b>9:04</b>	<b>9:10</b>	<b>9:30</b>	<b>9:34</b>	<b>9:48</b>	<b>9:59</b>
<b>10:05</b>	<b>10:11</b>	<b>10:29</b>	<b>10:33</b>	<b>10:46</b>	<b>10:57</b>
<b>11:04</b>	<b>11:10</b>	<b>11:28</b>	<b>11:33</b>	<b>11:46</b>	<b>11:57</b>
<b>12:02A</b>	<b>12:08A</b>	<b>12:26A</b>	<b>12:30A</b>	<b>12:43A</b>	<b>12:54A</b>

a - From Arlington Heights, does NOT serve Arlmont Village  
b - To Arlington Heights, does NOT serve Arlmont Village

All buses are accessible to persons with disabilities

78 Saturday					
Inbound			Outbound		
Leave Arlmont Village	Arrive Pleasant Street	Arrive Harvard Square	Leave Harvard Square	Arrive Pleasant Street	Arrive Arlmont Village
6:55A	7:03A	7:17A	6:25A	6:38A	6:49A
7:50	7:58	8:15	7:20	7:33	7:44
8:50	8:58	9:18	8:20	8:33	8:44
9:50	9:58	10:18	9:20	9:33	9:44
10:50	10:58	11:18	10:20	10:34	10:47
11:52	<b>12:00N</b>	<b>12:20P</b>	11:20	11:34	11:47
<b>12:56P</b>	<b>1:04</b>	<b>1:24</b>	<b>12:24P</b>	<b>12:38P</b>	<b>12:51P</b>
<b>1:59</b>	<b>2:07</b>	<b>2:27</b>	<b>1:28</b>	<b>1:42</b>	<b>1:56</b>
<b>3:00</b>	<b>3:08</b>	<b>3:28</b>	<b>2:29</b>	<b>2:43</b>	<b>2:57</b>
<b>4:01</b>	<b>4:08</b>	<b>4:28</b>	<b>3:30</b>	<b>3:44</b>	<b>3:58</b>
<b>5:01</b>	<b>5:08</b>	<b>5:28</b>	<b>4:30</b>	<b>4:44</b>	<b>4:58</b>
<b>6:01</b>	<b>6:08</b>	<b>6:28</b>	<b>5:30</b>	<b>5:44</b>	<b>5:58</b>
<b>7:01</b>	<b>7:08</b>	<b>7:25</b>	<b>6:30</b>	<b>6:44</b>	<b>6:58</b>
<b>8:01</b>	<b>8:08</b>	<b>8:25</b>	<b>7:30</b>	<b>7:44</b>	<b>7:58</b>
<b>9:00</b>	<b>9:07</b>	<b>9:24</b>	<b>8:30</b>	<b>8:42</b>	<b>8:55</b>
<b>10:00</b>	<b>10:05</b>	<b>10:21</b>	<b>9:30</b>	<b>9:42</b>	<b>9:55</b>
<b>11:05</b>	<b>11:10</b>	<b>11:26</b>	<b>10:30</b>	<b>10:42</b>	<b>10:55</b>
<b>12:05A</b>	<b>12:10A</b>	<b>12:26A</b>	<b>11:30</b>	<b>11:42</b>	<b>11:52</b>
			<b>12:35A</b>	<b>12:47A</b>	<b>12:57A</b>

78 Sunday					
Inbound			Outbound		
Leave Arlmont Village	Arrive Pleasant Street	Arrive Harvard Square	Leave Harvard Square	Arrive Pleasant Street	Arrive Arlmont Village
6:40A	6:48A	7:00A	6:10A	6:21A	6:33A
7:35	7:43	7:55	7:05	7:16	7:28
8:35	8:43	8:59	8:05	8:16	8:28
9:35	9:43	9:59	9:05	9:16	9:28
10:35	10:43	11:02	10:05	10:19	10:31
11:35	11:43	<b>12:02P</b>	11:05	11:19	11:31
<b>12:37P</b>	<b>12:45P</b>	<b>1:04</b>	<b>12:07P</b>	<b>12:23P</b>	<b>12:35P</b>
<b>1:39</b>	<b>1:47</b>	<b>2:06</b>	<b>1:08</b>	<b>1:24</b>	<b>1:36</b>
<b>2:41</b>	<b>2:48</b>	<b>3:06</b>	<b>2:10</b>	<b>2:26</b>	<b>2:38</b>
<b>3:43</b>	<b>3:50</b>	<b>4:08</b>	<b>3:11</b>	<b>3:27</b>	<b>3:39</b>
<b>4:44</b>	<b>4:51</b>	<b>5:09</b>	<b>4:12</b>	<b>4:26</b>	<b>4:38</b>
<b>5:45</b>	<b>5:52</b>	<b>6:10</b>	<b>5:13</b>	<b>5:27</b>	<b>5:39</b>
<b>6:45</b>	<b>6:52</b>	<b>7:08</b>	<b>6:13</b>	<b>6:27</b>	<b>6:39</b>
<b>7:45</b>	<b>7:52</b>	<b>8:06</b>	<b>7:10</b>	<b>7:24</b>	<b>7:36</b>
<b>8:45</b>	<b>8:52</b>	<b>9:06</b>	<b>8:10</b>	<b>8:23</b>	<b>8:35</b>
<b>9:45</b>	<b>9:52</b>	<b>10:06</b>	<b>9:10</b>	<b>9:23</b>	<b>9:35</b>
<b>10:45</b>	<b>10:52</b>	<b>11:06</b>	<b>10:10</b>	<b>10:23</b>	<b>10:35</b>
<b>11:45</b>	<b>11:52</b>	<b>12:06A</b>	<b>11:10</b>	<b>11:23</b>	<b>11:35</b>
<b>12:40A</b>	<b>12:47A</b>	<b>1:01</b>	<b>12:10A</b>	<b>12:23A</b>	<b>12:35A</b>

84 Weekday					
Inbound			Outbound		
Leave Arlmont Village	Arrive Pleasant Street	Arrive Alewife Station	Leave Alewife Station	Arrive Pleasant Street	Arrive Arlmont Village
6:42A	6:52A	6:58A	7:04A	7:06A	7:10A
7:14	7:24	7:32	7:36	7:38	7:42
7:45	7:56	8:04	8:08	8:10	8:14
8:17	8:28	8:35	8:39	8:41	8:45
8:48	8:56	9:03			
<b>4:10P</b>	<b>4:17P</b>	<b>4:23P</b>	<b>3:58P</b>	<b>4:02P</b>	<b>4:08P</b>
<b>4:42</b>	<b>4:49</b>	<b>4:55</b>	<b>4:30</b>	<b>4:34</b>	<b>4:40</b>
<b>5:12</b>	<b>5:20</b>	<b>5:27</b>	<b>5:25</b>	<b>5:29</b>	<b>5:36</b>
<b>5:38</b>	<b>5:46</b>	<b>5:53</b>	<b>5:45</b>	<b>5:49</b>	<b>5:56</b>
<b>5:58</b>	<b>6:06</b>	<b>6:13</b>	<b>6:05</b>	<b>6:09</b>	<b>6:16</b>
<b>6:47</b>	<b>6:54</b>	<b>6:59</b>	<b>6:35</b>	<b>6:39</b>	<b>6:46</b>

No Route 84 service on weekends.

NOTE: Buses arrive at Park Circle approximately 4 minutes after leaving Arlmont Village

**Harvard Busway construction note:**  
Harvard Bus Tunnel will be undergoing renovations. Inbound service will not serve Harvard Station Busway during this time. Passengers wishing to access Harvard Station are advised to disembark at the temporary bus stop located on Brattle St @ Palmer St. Outbound service is unaffected, and will continue to board passengers in the Harvard Station Busway.

Fare	Local Bus	Bus + Bus	Rapid Transit	Bus + Rapid Transit
CharlieCard	\$1.70	\$1.70	\$2.40	\$2.40
CharlieTicket	\$2.00	\$2.00	\$2.90	\$4.90
Cash-on-Board	\$2.00	\$4.00	\$2.90	\$4.90
Student/Youth*	\$0.85	\$0.85	\$1.10	\$1.10
Senior/TAP**	\$0.85	\$0.85	\$1.10	\$1.10

VALID PASSES: LinkPass (\$90.00/mo.); Local Bus (\$55/mo.); \*Student/Youth LinkPass (\$30.00/mo.); \*\*Senior/TAP LinkPass (\$30/mo.); and express bus, commuter rail, and boat passes.  
**FREE FARES:** Children 11 and under ride free when accompanied by an adult; Blind Access CharlieCard holders ride free and if using a guide, the guide rides free.  
\* Requires Student CharlieCard or Youth CharlieCard. Student CharlieCards are available to students through participating middle schools and high schools. Youth CharlieCards are available through community partners in the Boston metro area. Visit [www.mbta.com/youthpass](http://www.mbta.com/youthpass) for details.  
\*\* Requires Senior/TAP CharlieCard, available to Medicare cardholders, seniors 65+, and persons with disabilities.

**Spring & Summer 2020 Holidays**  
**4/20: see Weekday; 5/25: see Sunday**  
**7/3: see Saturday; 7/4: see Sunday**

## □ Sight Distance Calculations

**Stopping Sight Distance - Average**

Frontage Road approach to Site Driveway

		SPEED (MPH)	BRAKE REACTION DISTANCE (FT)	BRAKING DISTANCE (FT)	CALCULATED STOPPING SIGHT DISTANCE (FT)
<b>Direction 1</b>	EB	33	121.275	135.5	256.8

<u>INPUTS</u>	<u>Direction 1</u>
Travel Direction	EB
Speed	33
Grade	-0.08
t	2.5
a	11.2

**Stopping Sight Distance (SSD) - Source: AASHTO**

SSD = Reaction Distance + Brake Distance

Reaction Distance = 1.47 x t x V

Brake Distance =  $V^2 / (30 \times ((a/32.2)+G))$

Where:  
t = reaction time (sec)  
V = travel speed (mph)  
G= roadway grade  
a - deceleration rate (ft/sec<sup>2</sup>)

**Stopping Sight Distance - 85th Percentile**

Frontage Road approach to Site Driveway

		SPEED (MPH)	BRAKE REACTION DISTANCE (FT)	BRAKING DISTANCE (FT)	CALCULATED STOPPING SIGHT DISTANCE (FT)
<b>Direction 1</b>	EB	38	139.65	179.7	319.4

INPUTS

Direction 1

Travel Direction	EB
Speed	38
Grade	-0.08
t	2.5
a	11.2

**Stopping Sight Distance (SSD) - Source: AASHTO**

SSD = Reaction Distance + Brake Distance

Reaction Distance = 1.47 x t x V

Brake Distance =  $V^2 / (30 \times ((a/32.2)+G))$

Where:

t = reaction time (sec)

V = travel speed (mph)

G= roadway grade

a - deceleration rate (ft/sec<sup>2</sup>)

## Intersection Sight Distance Calculations

Source: *A Policy on Geometric Design of Highways and Street, 6th Edition*; AASHTO; 2011.

$$ISD = 1.47 * V * t$$

V = speed

t = time gap

t = 7.5 s for a passenger car for Left Turn from a Stop

t = 6.5 s for a passenger car for Right Turn from a Stop

### Frontage Road

$$ISD = 1.47 * 38 * 6.5 = 363 \text{ ft } \mathbf{SAY 365 \text{ ft}}$$

(right-turn from a stop)

□ Trip Generation

Institute of Transportation Engineers (ITE) 10th Edition  
Land Use Code (LUC) 210 - Single-Family Detached Housing

Average Vehicle Trips Ends vs: Dwelling Units  
Independent Variable (X): 4

**AVERAGE WEEKDAY DAILY**

$T = 9.5^*(X)$   
 $T = 9.5^* \quad 4$   
 $T = 38.00$   
 $T = 38$  vehicle trips  
with 50% ( 19 vpd) entering and 50% ( 19 vpd) exiting.

**WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC**

$T = 0.74^*(X)$   
 $T = 0.74^* \quad 4$   
 $T = 2.96$   
 $T = 3$  vehicle trips  
with 25% ( 1 vph) entering and 75% ( 2 vph) exiting.

**WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC**

$T = 0.99^*(X)$   
 $T = 0.99^* \quad 4$   
 $T = 3.96$   
 $T = 4$  vehicle trips  
with 63% ( 3 vph) entering and 37% ( 1 vph) exiting.

**SATURDAY DAILY**

$T = 9.54^*(X)$   
 $T = 9.54^* \quad 4$   
 $T = 38.16$   
 $T = 38$  vehicle trips  
with 50% ( 19 vph) entering and 50% ( 19 vph) exiting.

**SATURDAY MIDDAY PEAK HOUR OF GENERATOR**

$T = 0.93^*(X)$   
 $T = 0.93^* \quad 4$   
 $T = 3.72$   
 $T = 4$  vehicle trips  
with 54% ( 2 vph) entering and 46% ( 2 vph) exiting.

**Institute of Transportation Engineers (ITE) 10th Edition  
Land Use Code (LUC) 220 - Multifamily Housing (Low-Rise)**

Average Vehicle Trips Ends vs: Dwelling Units  
Independent Variable (X): 8

**AVERAGE WEEKDAY DAILY**

$$T = 7.32 * X$$

$$T = 7.32 * 8$$

$$T = 58.56$$

$$T = 58 \text{ vehicle trips}$$

with 50% ( 29 vpd) entering and 50% ( 29 vpd) exiting.

**WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC**

$$T = 0.46 * X$$

$$T = 0.46 * 8$$

$$T = 3.68$$

$$T = 4 \text{ vehicle trips}$$

with 23% ( 1 vph) entering and 77% ( 3 vph) exiting.

**WEEKDAY MORNING PEAK HOUR OF GENERATOR**

$$T = 0.56 * X$$

$$T = 0.56 * 8$$

$$T = 4.48$$

$$T = 4 \text{ vehicle trips}$$

with 28% ( 1 vph) entering and 72% ( 3 vph) exiting.

**WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC**

$$T = 0.56 * X$$

$$T = 0.56 * 8$$

$$T = 4.48$$

$$T = 4 \text{ vehicle trips}$$

with 63% ( 3 vph) entering and 37% ( 1 vph) exiting.

**WEEKDAY EVENING PEAK HOUR OF GENERATOR**

$$T = 0.67 * X$$

$$T = 0.67 * 8$$

$$T = 5.36$$

$$T = 5 \text{ vehicle trips}$$

with 59% ( 3 vph) entering and 41% ( 2 vph) exiting.

**SATURDAY DAILY**

$$T = 8.14 * X$$

$$T = 8.14 * 8$$

$$T = 65.12$$

$$T = 66 \text{ vehicle trips}$$

with 50% ( 33 vpd) entering and 50% ( 33 vpd) exiting.

**SATURDAY MIDDAY PEAK HOUR OF GENERATOR**

$$T = 0.70 * X$$

$$T = 0.70 * 8$$

$$T = 5.60$$

$$T = 6 \text{ vehicle trips}$$

with 49% ( 3 vph) entering and 51% ( 3 vph) exiting.

□ Capacity Analysis

HCM 6th TWSC  
1: Site Driveway & Hinckley Way

2020 Baseline Condition  
Weekday Morning Peak Hour

Intersection

Int Delay, s/veh	0					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑					↑
Traffic Vol, veh/h	266	0	0	0	0	0
Future Vol, veh/h	266	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Stop	Stop	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	4	0	0	0	0	0
Mvmt Flow	292	0	0	0	0	0

Major/Minor	Major1		Minor1	
Conflicting Flow All	0	0	-	146
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	-	-	6.9
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	-	3.3
Pot Cap-1 Maneuver	-	-	0	881
Stage 1	-	-	0	-
Stage 2	-	-	0	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	881
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	NB
HCM Control Delay, s	0	0
HCM LOS		A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR
Capacity (veh/h)	-	-	-
HCM Lane V/C Ratio	-	-	-
HCM Control Delay (s)	0	-	-
HCM Lane LOS	A	-	-
HCM 95th %tile Q(veh)	-	-	-

HCM 6th TWSC  
1: Site Driveway & Hinckley Way

2020 Baseline Condition  
Weekday Evening Peak Hour

Intersection

Int Delay, s/veh	0					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑					↑
Traffic Vol, veh/h	219	1	0	0	0	1
Future Vol, veh/h	219	1	0	0	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Stop	Stop	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	78	78	78	78	78	78
Heavy Vehicles, %	6	0	0	0	0	0
Mvmt Flow	281	1	0	0	0	1

Major/Minor	Major1		Minor1	
Conflicting Flow All	0	0	-	141
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	-	-	6.9
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	-	3.3
Pot Cap-1 Maneuver	-	-	0	888
Stage 1	-	-	0	-
Stage 2	-	-	0	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	888
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	NB
HCM Control Delay, s	0	9.1
HCM LOS		A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR
Capacity (veh/h)	888	-	-
HCM Lane V/C Ratio	0.001	-	-
HCM Control Delay (s)	9.1	-	-
HCM Lane LOS	A	-	-
HCM 95th %tile Q(veh)	0	-	-

HCM 6th TWSC  
1: Site Driveway & Hinckley Way

2020 Design Year Condition  
Weekday Morning Peak Hour

Intersection

Int Delay, s/veh	0.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑					↑
Traffic Vol, veh/h	266	2	0	0	0	5
Future Vol, veh/h	266	2	0	0	0	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Stop	Stop	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	4	0	0	0	0	0
Mvmt Flow	292	2	0	0	0	5

Major/Minor	Major1		Minor1	
Conflicting Flow All	0	0	-	147
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	-	-	6.9
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	-	3.3
Pot Cap-1 Maneuver	-	-	0	880
Stage 1	-	-	0	-
Stage 2	-	-	0	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	880
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	NB
HCM Control Delay, s	0	9.1
HCM LOS		A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR
Capacity (veh/h)	880	-	-
HCM Lane V/C Ratio	0.006	-	-
HCM Control Delay (s)	9.1	-	-
HCM Lane LOS	A	-	-
HCM 95th %tile Q(veh)	0	-	-

HCM 6th TWSC  
1: Site Driveway & Hinckley Way

2020 Design Year Condition  
Weekday Evening Peak Hour

Intersection

Int Delay, s/veh	0.1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑					↑
Traffic Vol, veh/h	219	6	0	0	0	2
Future Vol, veh/h	219	6	0	0	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Stop	Stop	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	78	78	78	78	78	78
Heavy Vehicles, %	6	0	0	0	0	0
Mvmt Flow	281	8	0	0	0	3

Major/Minor	Major1		Minor1	
Conflicting Flow All	0	0	-	145
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	-	-	6.9
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	-	3.3
Pot Cap-1 Maneuver	-	-	0	882
Stage 1	-	-	0	-
Stage 2	-	-	0	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	882
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

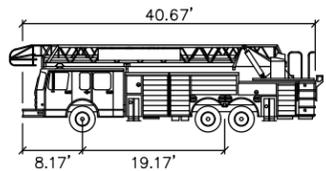
Approach	EB	NB
HCM Control Delay, s	0	9.1
HCM LOS		A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR
Capacity (veh/h)	882	-	-
HCM Lane V/C Ratio	0.003	-	-
HCM Control Delay (s)	9.1	-	-
HCM Lane LOS	A	-	-
HCM 95th %tile Q(veh)	0	-	-

□ AutoTURN® Analysis



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  2. FINAL DESIGN IS SUBJECT TO FIELD SURVEY BY OTHERS.
  3. PROPERTY LINES AND ACCESS LINE LOCATIONS ARE APPROXIMATE ONLY AND ARE SUBJECT TO DEED AND TITLE RECORDS.
  4. BASE PLAN SOURCE: DECELLE-BURKE-SALE & ASSOCIATES, INC.



Belmont Ladder 2: E-One 110'RMA

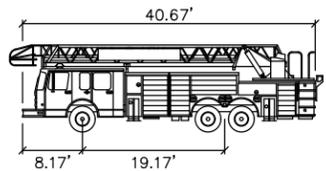
	feet
Width	: 8.3'
Track	: 8.3'
Lock to Lock Time	: 6.0 seconds
Steering Angle	: 42.0°



<b>Autoturn Analysis</b>		
91 BEATRICE CIRCLE BELMONT, MASSACHUSETTS PREPARED FOR: <b>COMPREHENSIVE LAND HOLDINGS, LLC</b> 2476 NORTH MIDDLESEX AVENUE HERNANDO, FLORIDA 34442		
<b>TRANSPORTATION CONSULTANTS, INC.</b> PLANNERS & ENGINEERS		
28 Lord Road, Suite 280 Marlborough, MA 01752 Tel: (508) 303-0370 Fax: (508) 303-0371		
DATE: August 4, 2020	SCALE: As Noted	
PROJECT No. 1088	File: 1088 AutoTurn 8-4-2020.dwg	Sheet 1 of 1



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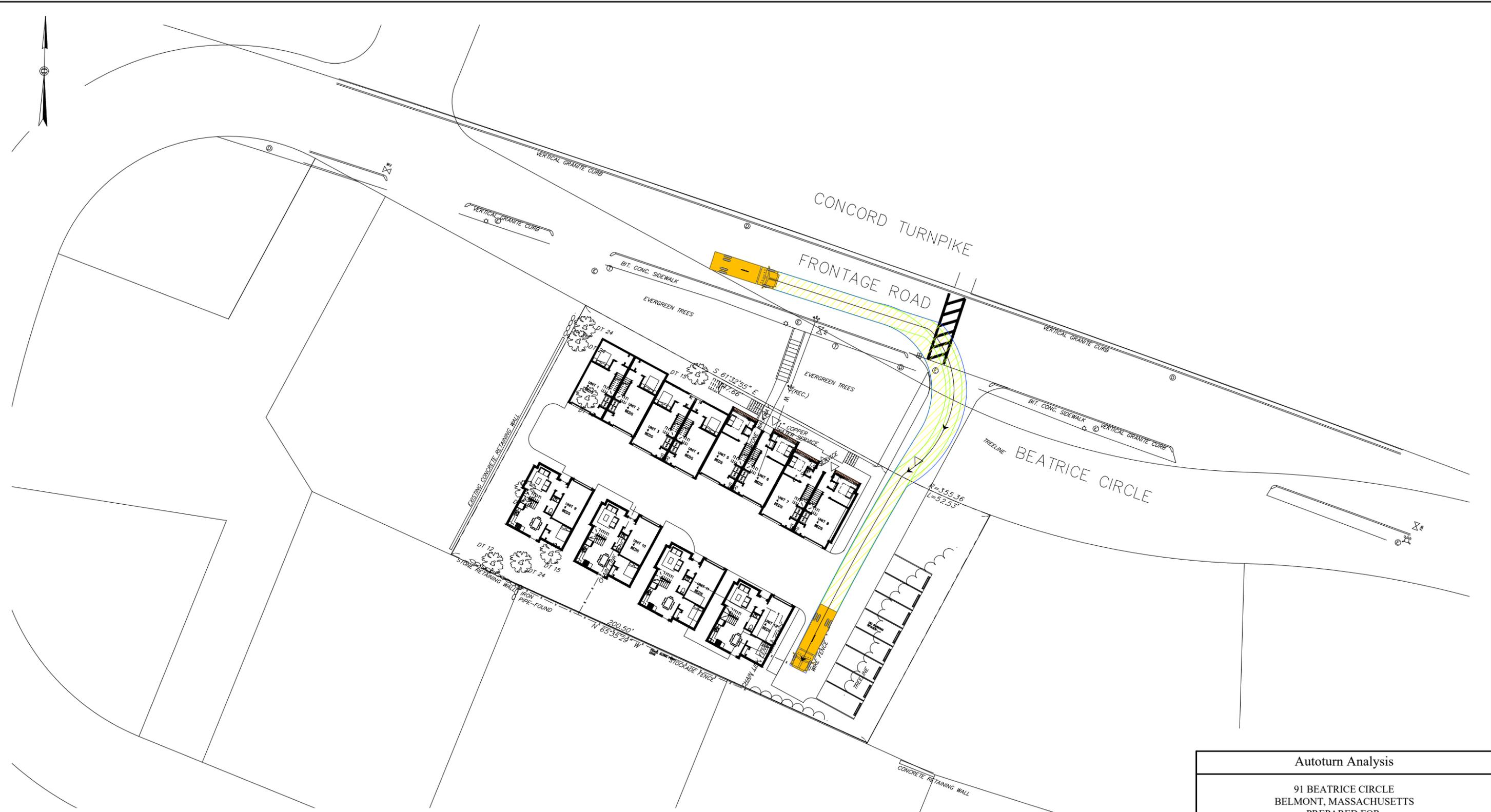


Belmont Ladder 2: E-One 110'RMA

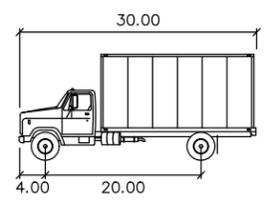
	feet
Width	: 8.3'
Track	: 8.3'
Lock to Lock Time	: 6.0 seconds
Steering Angle	: 42.0°



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SU-30

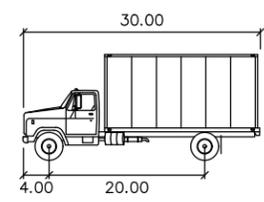
Width : 8.0'  
 Track : 8.0'  
 Lock to Lock Time : 6.0 seconds  
 Steering Angle : 31.8'



<b>Autoturn Analysis</b>		
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<b>MDM</b> TRANSPORTATION CONSULTANTS, INC. PLANNERS & ENGINEERS		
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SU-30

Width : 8.0'  
 Track : 8.0'  
 Lock to Lock Time : 6.0 seconds  
 Steering Angle : 31.8'



**Autoturn Analysis**

91 BEATRICE CIRCLE  
 BELMONT, MASSACHUSETTS  
 PREPARED FOR:  
**COMPREHENSIVE LAND HOLDINGS, LLC**  
 2476 NORTH MIDDLESEX AVENUE  
 HERNANDO, FLORIDA 34442

**MDM** TRANSPORTATION CONSULTANTS, INC.  
 PLANNERS & ENGINEERS

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 Marlborough, MA 01752  
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Sheet 1 of 1	