

To: Mr. Glenn Clancy, PE
Director of Community Development
Town of Belmont
19 Moore Street
Belmont, MA 02478

Date: August 15, 2019

From: Sam Offei-Addo, PE, PTOE
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Proj. No. 28374.50

Re: Town of Belmont Skating Rink
Site Access Evaluation

Introduction

At the request of the Town of Belmont, BSC group has conducted an evaluation of transportation issues related to the construction of a proposed skating rink located along Concord Avenue, adjacent to Belmont High School. The parcel is located on Belmont School Department property, directly west of Harris Field. The site currently contains the existing Viglirolo Ice Rink and athletic fields used by Belmont High School.

The Town of Belmont is seeking to evaluate various options for site configuration and site access locations to determine the most appropriate layout and design of the Project. This evaluation is limited to site access location related to the adjacent transportation network and provides a comparison of three different driveway locations. The evaluation and conclusions provided in this memo will be used to develop the Request for Proposals (RFP) to select a contractor for construction of the Project.

Background

The Town of Belmont is currently in the process of upgrading the Middle and High School through the Massachusetts School Building Authority (MSBA). The new high school will include major renovations and additions to the existing school and will change transportation patterns related to circulation, site access, and pedestrian facilities. The high school will have two vehicular access points. Primary access will be provided along Concord Avenue, opposite Goden Street. Secondary access to the high school site will be provided along Hittinger Street at the east end of the property. A traffic signal is proposed at the intersection of Concord Avenue at Goden Street and the proposed site driveway that will allow left-turns to and from Concord Avenue. The high school project is currently in the final stages of design and construction is expected to commence in 2019. A detailed traffic study was conducted for the high school project and submitted as part of a 2018 Schematic Design Report. Traffic data and other relevant information from that study was used to form the basis of the evaluation of the proposed skating rink and athletic field project.

The site that is the subject of this study is located on the Town of Belmont School Department property and will also be redesigned to include a new ice rink and athletic fields. The requirements of the site include one and a half sheets of ice, the retention of the existing athletic facilities, and parking for 110 vehicles. The Town of Belmont provided several conceptual plans for the location of the ice rink building and the athletic fields. Vehicular circulation, site access, and parking facilities will be affected by the selected concept. Access to the site will be provided by a new curb cut along the north side of Concord Avenue. The existing parking area located along the north side of Concord Avenue will be eliminated with the redevelopment of the site. This study evaluates the transportation impacts of the proposed driveway locations, vehicular circulation along Concord Avenue, and intersection operations at the adjacent intersections.

The future ice rink will be operated by a private company, with priority given to school uses. This evaluation focuses on average day uses at the ice rink facility, as future programming including special events are currently not known. The evaluation presented in this memorandum includes a description of existing conditions, a description of the Project and options for site access, trip generation and vehicular circulation, an intersection operations analysis, and a comparison of the three options for site access. This evaluation is intended to provide the Town with guidance to locate the future driveway and assist with the overall design of the site.

Existing Conditions

The Project site is located on Belmont School Department property along the north side of Concord Avenue and is bounded by Harris Field to the east, commercial properties to the west, and the Massachusetts Bay Transportation Authority (MBTA) commuter rail right-of-way to the north. The site currently contains the Viglirolo Ice Rink and athletic fields that serve the high school. Access to the site is provided by an approximately 300-foot long driveway adjacent to and along the north side of Concord Avenue. Storage for approximately 25-30 vehicles is provided along the driveway. On-street parking along Concord Avenue and the intersecting side streets also serves the existing needs of the site during times of higher demand. Pedestrian access to the site is provided by sidewalks along Concord Avenue and walkways that connect the fields and ice rink with the high school.

The existing ice rink currently serves Belmont High School and is open to residents for recreational purposes throughout the year. The existing athletic fields are used by Belmont High School's junior varsity athletic teams. The following sections describe the conditions of the existing transportation infrastructure within the study area.

Study Area

The study area selected for evaluation includes the segment of Concord Avenue between Goden Street and Common Street/Leonard Street. The following three intersections were selected for analysis purposes:

- Concord Avenue/Goden Street
- Concord Avenue/Cottage Street
- Concord Avenue/Common Street/Leonard Street/Royal Road

The proposed site driveways will also be evaluated as part of this study. The existing study area and site location are shown in Figure 1.

Existing Roadway and Intersection Conditions

Concord Avenue

Concord Avenue is a two-lane urban principal under Town of Belmont jurisdiction that travels in an east-west direction between the Town of Lexington and Harvard Square, providing access to the Belmont High School and Belmont Center. In the vicinity of the Project site, the roadway consists of a single travel lane, a bicycle lane, and a parking lane in both directions. The directions of travel are separated by a raised median, with breaks at some intersections and driveways. Sidewalks are provided along both sides of Concord Avenue, with curb ramps and crosswalks at intersections.

Concord Avenue at Common Street

Concord Avenue and Common Street intersect to form a three-legged, unsignalized intersection, located west of the Project site. The Common Street eastbound approach consists of an exclusive left-turn lane and a through lane. The Concord Avenue westbound approach consists of a single lane wide enough to accommodate two lanes of traffic for through and right-turn movements. The westbound movement also contains an exclusive bicycle lane. The Concord Avenue southbound approach also consists of a single lane wide enough to accommodate two lanes of traffic for left and right-turning vehicles. There is no defined traffic control at the intersection, although the southbound approach operates under stop-control. Sidewalks are provided along both sides of all approaches at the intersections. Crosswalks and curb ramps are not present.

Concord Avenue at Cottage Street

Concord Avenue and Cottage Street intersect to form a three-legged intersection that generally operates under flash-control. A pedestrian pushbutton is present at the intersection to actuate an exclusive pedestrian phase. The Cottage Street northbound approach consists of a single lane under stop-control. Cottage Street is one-way in the northbound direction, with parking allowed on the east side. As previously described, Concord Avenue consists of a single travel lane, a bicycle lane, and a parking lane in each direction. The Project site is located opposite Cottage Street along the north side of Concord Avenue.

Concord Avenue at Goden Street

Concord Avenue and Goden Street intersect to form a three-legged unsignalized intersection, located east of the Project site. The Goden Street northbound approach consists of a single travel lane, allowing both left and right-turns. The Concord Avenue approaches both consist of a single travel lane, a bicycle lane, and a parking lane. Primary access for the proposed high school will be located opposite Goden Street and a traffic signal will be installed at this location. The traffic signal is incorporated into the future conditions analyses included in this evaluation.

Existing Traffic Conditions

Existing traffic data for the study area intersections was obtained from the Belmont High School Traffic Study – Existing Conditions and Recommendations Report¹. Turning movement counts (TMCs) were performed during the weekday morning and afternoon peak periods of school activity in September 2017. Counts were not conducted at the intersection of Concord Avenue at Cottage Street. Traffic volumes for vehicles exiting Cottage Street to travel to Concord Avenue were estimated based on balancing from the intersection at Goden Street. Due to the curb cuts and school activity between the two locations, the balancing method of estimating traffic volumes may slightly overestimate the traffic volumes on Cottage street, which would result in a more conservative (or worst-case scenario) analysis.

The existing traffic volumes are presented in Figures 2 and 3 for the weekday morning and afternoon peak hours, respectively.

Motor Vehicle Crash History

Motor vehicle crash data were obtained for the study area intersections from the MassDOT crash database for the years 2014-2018. The data is used to identify correctable safety issues and crash trends. The crashes are organized by various characteristics and an overall crash rate is calculated based on the number of crashes and traffic volumes that travel through each intersection. The rates are then compared to the district's average

¹ *Belmont High School Traffic Study – Existing Conditions and Recommendations Report*; Nelson Nygaard; June 2018.

crash rate for similar types of intersections to determine if there are more crashes than what is expected. The MassDOT District 4 (the district in which Belmont is located) average for unsignalized intersections is 0.57 crashes per million entering vehicles (MEV). Table 1 presents the motor vehicle crash data for the study area.

Table 1
Motor Vehicle Crash Summary

	Concord Avenue at Goden Street	Concord Avenue at Cottage Street	Concord Avenue at Common Street
Year			
2014	0	1	6
2015	1	0	5
2016	2	1	3
2017	1	0	10
2018	4	2	1
Collision Type			
Angle	5	1	12
Head-on	0	0	1
Rear-end	1	3	3
Sideswipe	2	0	7
Single-vehicle crash	0	0	2
Unknown	0	0	0
Severity			
Fatality	0	0	0
Injury	1	0	4
Property-related	7	4	19
Unknown	0	0	2
Light Conditions			
Daylight	5	3	22
Dawn/Dusk	2	0	0
Dark	1	1	3
Road Conditions			
Dry	6	4	22
Wet	2	0	3
Snow/Ice	0	0	0
Unknown	0	0	0
Time of Day			
12AM – 7AM	0	0	0
7AM – 9AM	2	0	6
9AM – 4PM	4	3	7
4PM – 6PM	1	1	8
6PM – 12AM	1	0	4
Total Crashes	8	4	25
Crash Rate¹	0.27	0.15	0.65

¹ Crashes per million vehicles entering the intersection

As shown in Table 1, the intersection of Concord Avenue at Common Street averaged 0.65 crashes per MEV over the five-year period. The intersections of Concord Avenue at Goden Street and Concord Avenue at Cottage Street experienced a total of 12 crashes over the five-year period, with one injury reported. The majority of crashes at Concord Avenue/Goden Street were angle type collisions and the most common crashes

at Concord Avenue/Cottage Street were rear-end type collisions. The crashes at Goden Street could be a result of vehicles turning from and to Goden Street as they cross the through traffic along Concord Avenue. The rear-end collisions at Cottage Street could be a result of congestion related to on-street parking and the pedestrian signal at the intersection, which may create unexpected stops for the through traffic along Concord Avenue. Based on this evaluation, there are no major safety issues at the intersections of Concord Avenue/Goden Street and Concord Avenue/Cottage Street, which are adjacent to the high school property. The intersection of Concord Avenue at Common Street experienced more crashes than the average unsignalized intersection. This could be a result of confusing right-of-way, lack of traffic control, and significant congestion during the peak periods.

Pedestrian and Bicycle Facilities

The study area and Concord Avenue is well served with both pedestrian and bicycle facilities, providing access to the high school property and the Project site. The following pedestrian facilities are provided along Concord Avenue:

- A continuous sidewalk is provided along both sides of Concord Avenue, with crosswalks and curb ramps at intersecting roadways.
- A pedestrian signal is located at Cottage Street, which provides an exclusive pedestrian phase upon pushbutton actuation to allow safe crossings between the high school property and the Project site and the south side of Concord Avenue. The pedestrian signal serves the existing ice rink and the high school, as well as providing a safe crossing for people that park along the south side of Concord Avenue that need to cross.
- A pedestrian signal is located east of Orchard Street, which also provides an exclusive pedestrian phase upon pushbutton actuation. This crossing provides access to the east side of the high school property's frontage along Concord Avenue.
- Exclusive bicycle lanes are provided along both sides of Concord Avenue.

The existing pedestrian and bicycle facilities are shown in Figure 4.

Public Transportation Facilities

Three bus routes operated by the Massachusetts Bay Transportation Authority (MBTA) run along Concord Avenue adjacent to the Project site. Bus stops are located along Concord Avenue at Orchard Street, Myrtle Street, and Cottage Street. Additionally, a no parking zone that is used as a school bus loading area is located along the westbound side of Concord Avenue adjacent to the existing ice rink, west of Cottage Street. The existing public transportation facilities are also shown in Figure 4.

Future Conditions

As previously described, the Town of Belmont is currently in the process of undertaking major renovations and additions to the existing high school. The high school project also proposes several modifications to the transportation infrastructure along Concord Avenue. Major modifications that have an impact on the ice rink/athletic field project include the following:

- Enhanced pedestrian connections throughout the high school property, including a potential connection between the school and the ice rink/athletic fields
- Enhanced bicycle facilities on the high school site, including connections to the community path that runs parallel the MBTA commuter rail right-of-way
- A new driveway will be located opposite Goden Street and will be placed under traffic signal control

The proposed modifications related to the high school project have been incorporated into this evaluation.

Proposed Project

The athletic fields and ice rink will be redeveloped and are the subject of this study. The Town is currently developing design alternatives for the layout of the ice rink and athletic fields, which will include a new building with one and a half sheets of ice, athletic fields to support baseball, softball, and soccer, and requires 110 on-site parking spaces. A total of 90 parking spaces will be reserved for students during school hours. Outside of school hours, all 110 parking spaces will be available for rink uses. The existing Site access has yet to be determined and is the subject of this evaluation. The following describes three alternatives for site access locations:

Option 1 – Cottage Street Location

Option 1 will locate the site driveway directly opposite Cottage Street, forming a fourth leg of the intersection and is presented in Figure 5. The driveway will accommodate two-way travel and the approach to Concord Avenue will be placed under STOP-sign control. This option will require upgrades to the existing pedestrian traffic signal, minor modifications to the median to allow for upgraded crosswalks, and the installation of additional curb ramps.

The curbside regulations along the north side of Concord Avenue do not currently allow on-street parking in the location of the driveway due to the existing traffic signal, crosswalk, and existing driveway that currently serves the ice rink and athletic fields. This option will have minimal impact to the existing curbside activity.

Option 2 – East of Cottage Street Location

Option 2 will locate the site driveway at the eastern portion of the site, close to Harris Field. Option 2 is presented in Figure 6. The driveway's specific location can shift as needed to support the needs of the site programming. The driveway will accommodate two-way travel and the approach will be placed under STOP-sign control. This option will serve right-in and right-out movements only due to the median along Concord Avenue, which will require some vehicles to make u-turn maneuvers at Cottage Street and Goden Street for access and egress. Alternatively, the median can be opened to provide full access in and out of the driveway to and from both directions along Concord Avenue.

The curbside regulations in the area of the proposed Option 2 driveway are existing ADA accessible parking spaces and a no-parking zone that is currently used as a school bus loading zone. As part of the high school

project, the bus loading will be relocated on-site and the existing on-street zone is likely to be removed. Impacts to the on-street curbside activity will be minimal with Option 2.

Option 3 – West of Cottage Street Location

Option 3 will locate the site driveway west of Cottage Street, near the western portion of the site and is presented in Figure 7. As with Option 2, the driveway's specific location can be shifted as needed to support the needs of the site. This driveway will also accommodate two-way travel and will be placed under STOP-sign control. This option will also serve right-in/right-out movements due to the median, with the option of opening the median to serve all movements. Should the median not be opened under this option, u-turns will be necessary at Cottage Street to accommodate all access and egress maneuvers.

The curbside regulations in the area of the Option 3 driveway consist of on-street parking spaces. It will be necessary to remove the equivalent of 3 to 4 on-street parking spaces under Option 3.

Future Traffic Volumes

A review of the June 2018 traffic study conducted for the high school project was conducted to determine the future traffic volumes to develop a baseline scenario to evaluate and compare each of the options to a “No-Build” scenario. The No-Build scenario includes future traffic volumes, projected to the year 2021 (expected completion date of the high school project), with the traffic pattern changes related to the high school and without the redevelopment of the ice rink/athletic fields site. The No-Build scenario also includes other modifications such as the installation of a traffic signal at the intersection of Concord Avenue at Goden Street and right-turn restrictions during the weekday morning peak hour along Concord Avenue eastbound.

The 2021 No-Build traffic volumes are presented in Figures 8 and 9 for the weekday morning and afternoon peak hours, respectively.

Trip Generation and Assignment

To assess the traffic-related impacts of the Project, trip generation for both the existing site and the proposed site were estimated. The ice rink and athletic fields are expected to generate the most activity during the weekday afternoon peak hour. Minimal activity is expected during the weekday morning peak hour. Trip generation estimates for the weekday afternoon peak hour were calculated using data from the Institute of Transportation Engineers (ITE) Trip Generation Manual (10th Edition) and are presented in Table 2. For comparison purposes, empirical trip generation data from ice rinks in Middleton, MA and Marlborough, MA was obtained from a traffic study conducted for a project in Wellesley, MA¹ and are also presented in Table 2. Due to the lack of additional information and an understanding of any specific events during the data collection related to the empirical trip generation, the ITE data was used for analysis purposes in this evaluation.

¹ *Traffic Impact and Access Study: Proposed Sports Complex – 900 Worcester Street Wellesley, MA*; MDM Transportation Consultants, Inc.; May 2017.

Table 2
Trip Generation Estimates

Time Period	Existing Uses¹	Proposed Uses²	Net Increase	Empirical Data³
<i>Weekday Morning Peak Hour</i>				
Enter				20
<u>Exit</u>	ITE Data Not Provided for weekday morning peak hour			<u>130</u>
Total				150
<i>Weekday Afternoon Peak Hour</i>				
Enter	28	42	+14	67
<u>Exit</u>	<u>17</u>	<u>26</u>	<u>+9</u>	<u>56</u>
Total	45	68	+23	123
<i>Saturday Midday Peak Hour</i>				
Enter	63	95	+32	64
<u>Exit</u>	<u>50</u>	<u>75</u>	<u>+25</u>	<u>58</u>
Total	113	170	+57	122

1 Based on ITE Land Use Code 465 – Ice Skating Rink (1 rink)

2 Based on ITE Land Use Code 465 – Ice Skating Rink (1.5 rinks)

3 As presented in the May 2017 traffic study for a Sports Complex in Wellesley, MA and based on two ice rinks

As shown in Table 2, the Project is expected to generate up to 68 vehicle trips during the weekday afternoon peak hour. This represents an increase of 23 trips when compared to the existing uses. These trip generation estimates represent an average day with typical ice rink programming. The estimates do not consider special programming events such as tournaments or other functions that may occur at the facilities.

The empirical data shows that the two rinks for which data was collected will result with slightly higher trip generation estimates during the afternoon peak hour and lower estimates during the Saturday midday peak hour.

While it is expected that there will be some weekday morning trip generation at the proposed facility, most of it will occur prior to the commuter peak periods (before 7:00 AM) when traffic volumes are lighter and Concord Avenue and the intersecting roadways have sufficient capacity to process the minor increase in traffic volumes traveling to the facility. A weekday morning peak hour analysis is not provided in this evaluation due to the minimal impact during this time period. Similarly, the Saturday midday peak is not considered to be the peak of traffic operations along Concord Avenue and an analysis of this time period was not conducted.

The traffic volumes expected to be generated by the new ice rink were assigned to the study area intersections based on existing travel patterns along Concord Avenue and the intersecting roadways. The traffic volumes related to the existing facility were also removed from the study area network to develop the future 2021 Build traffic volumes for the weekday afternoon peak hour. The access and egress paths and the future 2021 Build traffic volumes are presented in Figures 10 through 15 for each of the three site access options.

Traffic Operations Analysis

To assess the quality of traffic flow, capacity analyses were conducted at the study area intersections for the weekday morning, weekday afternoon, and Saturday midday peak hours. Analyses were conducted using the Synchro 10 traffic analysis software, which is based on methods defined in the Highway Capacity Manual 2010¹.

A primary result of capacity analyses is the assignment of a Level of Service (LOS) to traffic facilities under various traffic flow conditions. Six Levels of Services are defined for each type of facility. They are given letter designations from A to F, with LOS A representing the best operating conditions with little delay and LOS F representing the worst, with the most delay.

The average delay per vehicle approaching an intersection is used to quantify the LOS at a particular intersection. The LOS designations are defined below in Table 3. Average delay measures the mean stopped delay experienced by vehicles entering an intersection during the analysis period. Average delay is measured for each individual turning movement that must yield the right of way and for the intersection as a whole, if signalized.

Table 3
Level of Service Designations

Level of Service	Average Delay (seconds/vehicle)	
	Unsignalized	Signalized
A	0.0 - 10.0	0.0 - 10.0
B	>10.0 – 15.0	>10.0 – 20.0
C	>15.0 – 25.0	>20.0 – 35.0
D	>25.0 – 35.0	>35.0 – 55.0
E	>35.0 – 50.0	>55.0 – 80.0
F	>50.0	>80.0

Source: Transportation Research Board, *Highway Capacity Manual*, National Research Council, 2010.

Table 4 shows the operating conditions of the study intersections for the weekday afternoon peak hour for the following scenarios:

- 2019 Existing Conditions
- 2021 No-Build Conditions
- 2021 Build Conditions (3 options)

Table 4 presents the operations analysis for the study area intersections. The analysis shows that the intersection of Concord Avenue at Common Street currently experiences significant delay and queuing related to the overall traffic volumes and traffic control.

The analysis shows that when compared to the 2021 No-Build conditions, the Project will have minimal impact. The analysis also shows there are some movements that currently operate with moderate to

¹ *Highway Capacity Manual* 2010; Transportation Research Board; Washington, DC; 2010.

significant delays that will continue in the future without improvements. The analysis assumes that there will be no break in the median for Options 2 and 3 and incorporates the increase in u-turning movements at Cottage Street and Goden Street.

Based on the metrics presented in the operations analysis, all three options are generally similar related to impacts on intersection operations. The analysis does identify that there are difficulties for movements exiting both Cottage Street and Goden Street, which is due to the high levels of traffic along Concord Avenue during the peak periods.

Parking

The Project will require 110 parking spaces on the site. A total of 90 spaces will be allocated for student parking during school hours. Outside of school hours, all spaces will be reserved for ice rink uses. Currently, there are approximately 30 usable parking spaces in the driveway along Concord Avenue in the southern portion of site that serve the ice rink and athletic fields. The on-street parking along Concord Avenue and neighborhood roadways serve the additional parking demand for the existing site during events or other periods of increased activity. By locating additional parking on the site and providing efficient access, the Project will have a positive impact on the surrounding neighborhood's on-street parking supply during events. Additionally, as part of the high school project, parking will be located toward the north portion of the site, adjacent to the community path. The Project will have access to these parking areas outside of school hours to use for special events and parking management, further reducing the demand for on-street parking.

Table 4
Traffic Operations Analysis

Intersection/Movement	2019 Existing			2021 No-Build			2021 Build Option 1			2021 Build Option 2			2021 Build Option 3		
	Delay ¹	LOS ²	Queue ³	Delay	LOS	Queue	Delay	LOS	Queue	Delay	LOS	Queue	Delay	LOS	Queue
Concord Avenue/Common Street															
Common Street EB L	21.7	C	7	25.8	D	8	26.1	D	8	26.1	D	8	26.1	D	8
Common Street EB T	0.0	A	0	0.0	A	0	0.0	A	0	0.0	A	0	0.0	A	0
Concord Avenue WB T	0.0	A	0	0.0	A	0	0.0	A	0	0.0	A	0	0.0	A	0
Concord Avenue WB R	0.0	A	0	0.0	A	0	0.0	A	0	0.0	A	0	0.0	A	0
Concord Avenue SB L	>50.0	F	>20	>50.0	F	>20	>50.0	F	>20	>50.0	F	>20	>50.0	F	>20
Concord Avenue SB R	14.3	B	4	15.1	C	4	15.1	C	4	15.1	C	4	15.1	C	4
Concord Avenue/Cottage Street															
Concord Avenue EB T	0.0	A	0	0.0	A	0	0.0	A	0	0.0	A	0	10.3	B	1
Concord Avenue WB T	0.0	A	0	0.0	A	0	0.0	A	0	0.0	A	0	0.0	A	0
Cottage Street NB L/R	41	E	4	>50.0	F	6	>50.0	F	10	>50.0	F	7	>50.0	F	7
Driveway SB R	--	--	--	--	--	--	>50.0	F	2	--	--	--	--	--	--
Concord Avenue/Goden Street															
Concord Avenue EB L/T/R	0.0	A	0	6.7	A	7	7.1	A	8	7.5	A	8	7.5	A	8
Concord Avenue WB L/T/R	9.0	A	1	23.1	C	21	25.6	C	21	24.1	C	21	24.1	C	21
Goden Street NB L/T/R	>50.0	F	12	34.2	C	8	32.8	C	8	36.9	D	8	36.9	D	8
School Driveway SB L/T/R	--	--	--	17.7	B	3	17.4	B	3	17.7	B	3	17.7	B	3

1 Average delay measured in seconds

2 Level-of-Service

3 95th percentile queue measured in number of vehicles

Conclusions and Recommendations

This evaluation presents a review of existing conditions, a description of the context of the Project in relation to the ongoing high school project, and an analysis of three different options for site access. The evaluation focuses on an average day for operations at the ice rink and does not provide quantitative analyses for special events that will require additional management of traffic flow and parking.

Conclusions

The following presents a review of the benefits and constraints of each option for site access related to circulation, pedestrian safety, vehicular safety and operations, and impacts to the surrounding environment.

Option 1 – Cottage Street Location

Option 1 would locate the proposed site access point opposite Cottage Street and would be incorporated into the existing pedestrian signal.

- This option provides the best traffic circulation and access by eliminating the need for u-turns along Concord Avenue.
- Impacts to on-street curbside regulations and on-street parking are negligible.
- Pedestrian safety is maximized under this option due to the lack of necessary u-turns for site access and egress.
- Tree removal will not be necessary under this option.
- Upgrades to the existing pedestrian traffic signal are required, which carry an additional cost when compared to the other two options.
- This option would locate the driveway close to the center of the site, which may limit the options for design of the site.

Option 2 – East of Cottage Street Location

Option 2 would locate the proposed site access point east of Cottage Street, approximately 350 feet west of the proposed traffic signal at Goden Street.

- This option provides a good location for optimal site design by locating the driveway at the far east edge of the site.
- Impacts to on-street curbside regulations will be minimal, but will require the modification of the existing no parking/bus loading zone along Concord Avenue, although this zone should be removed with the overall high school project.
- Tree removal will not be necessary under this option.
- The existing pedestrian signal at Cottage Street will not require modifications.
- Vehicular circulation will require u-turns at Cottage Street or further west along Concord Avenue to accommodate exiting vehicles traveling east if the median is not opened for full access.
- Vehicular circulation could result in u-turns at Goden Street to accommodate entering vehicles traveling from the west if the median is not opened for full access.
- Tree removal along the median will be necessary should it be opened to provide full access.
- Pedestrian and vehicular safety may decrease with the additional u-turn movements along Concord Avenue.
- This option may require the removal of ADA accessible spaces along Concord Avenue.

Option 3 – West of Cottage Street Location

Option 3 would locate the proposed site access point west of Cottage Street at the western edge of the site.

- This option also provides a good location for optimal site design by locating the driveway at the western edge of the site.
- The existing pedestrian signal at Cottage Street will not require modifications.
- Vehicular circulation will require u-turns west of Cottage Street along Concord Avenue to accommodate exiting vehicles traveling east if the median is not opened for full access.
- Vehicular circulation will require u-turns at Cottage Street to accommodate entering vehicles traveling from the west if the median is not opened for full access.
- Tree removal along the median will be necessary should it be opened to provide full access.
- Pedestrian and vehicular safety may decrease with the additional u-turn movements along Concord Avenue.

All options are not expected to have any material impact on the surrounding roadway network based on the operations analysis and the relatively low trip generation estimates.

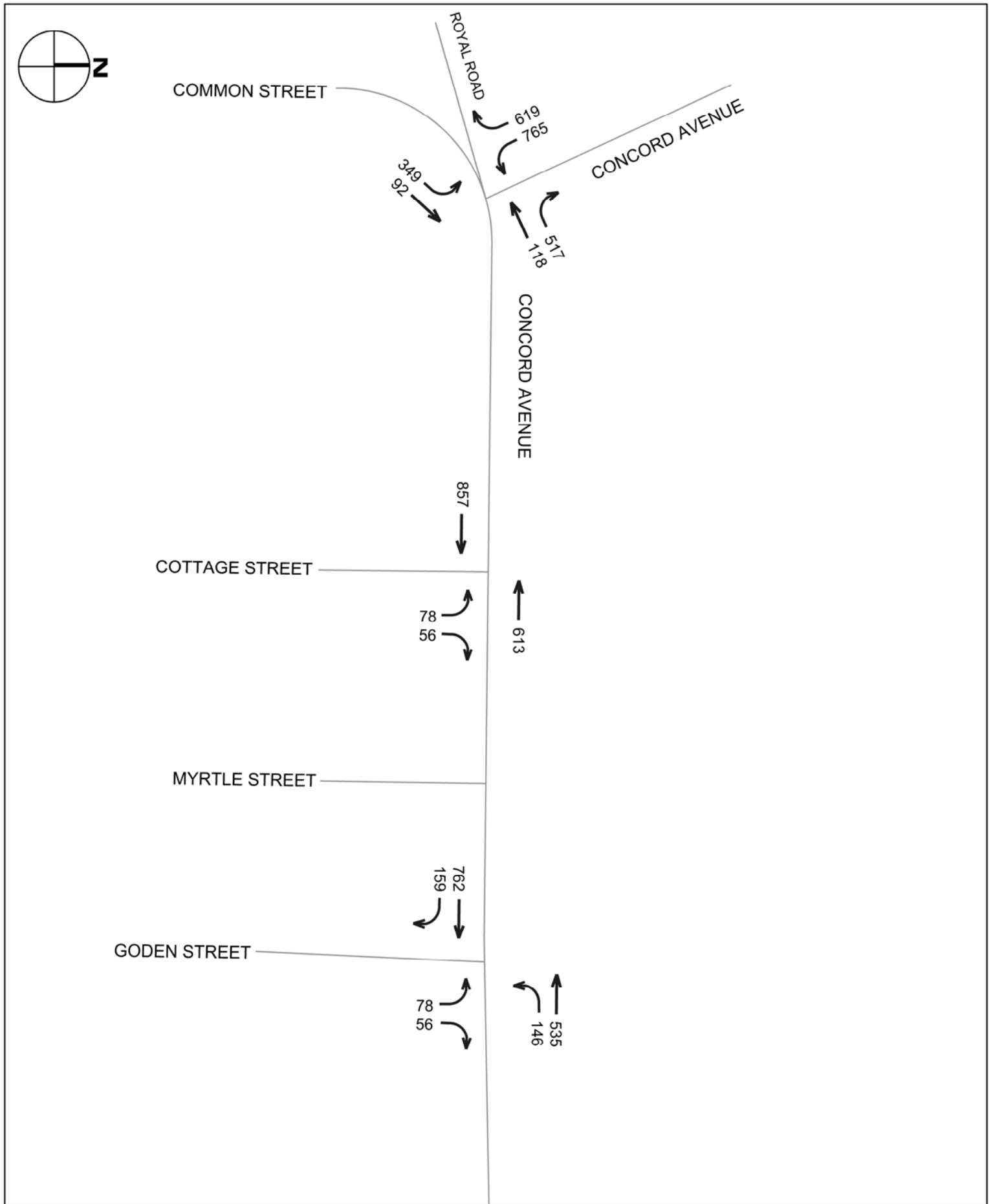
Recommendations

This evaluation provides a review of three options for site access for the Project. Based on the analyses and the information presented in this memorandum, the following recommendations are provided:

- Option 1 provides the safest and most efficient access to and from the site. While operations are not expected to vary much between options on a typical day, providing full access and allowing left-turns in and out of the site at an existing intersection will maximize efficiency during special events that may generate significant entering and exiting traffic.
- Options 2 and 3 should consider opening the median if either one is selected due to site constraints to eliminate the need for u-turns along Concord Avenue.
- The pedestrian traffic signal at Cottage Street should be interconnected with the proposed signal at Goden Street for all options.
- The Town should require the rink operator to provide traffic and parking management plans for special events.
- Shared parking with the high school site to the east should be strongly considered for overflow parking to eliminate impacts to on-street parking on the surrounding neighborhood street.
- This evaluation is intended to provide the Town of Belmont with information and guidance on the location of the driveway that will serve the site and should be revisited upon a preferred site design to ensure safe and efficient access is implemented.
- Changes to on-street parking regulations will not be necessary to support the Project other than the removal of parking spaces related to Options 2 and 3.

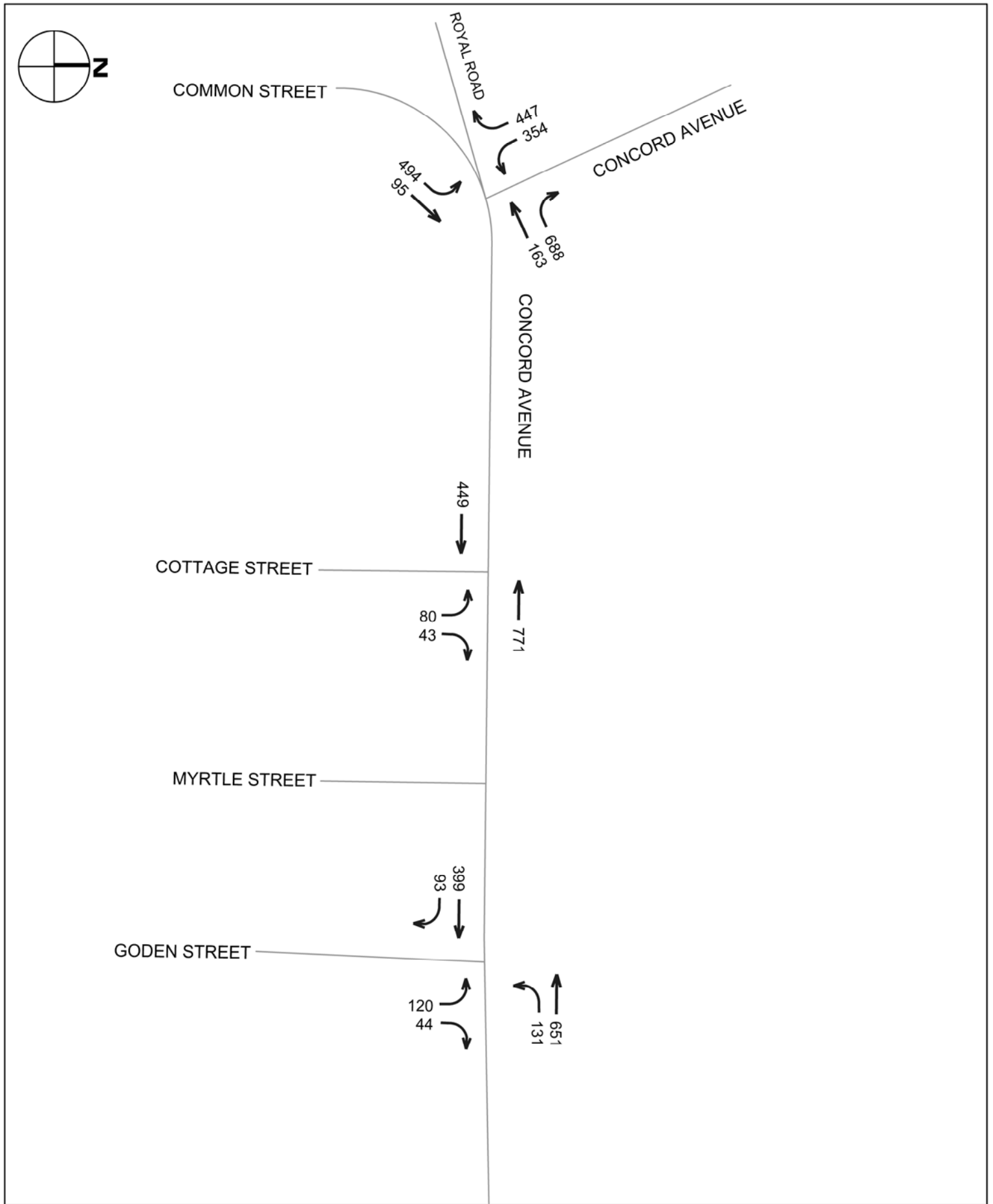


Project Locus Map
Belmont Ice Rink Study
Belmont, MA



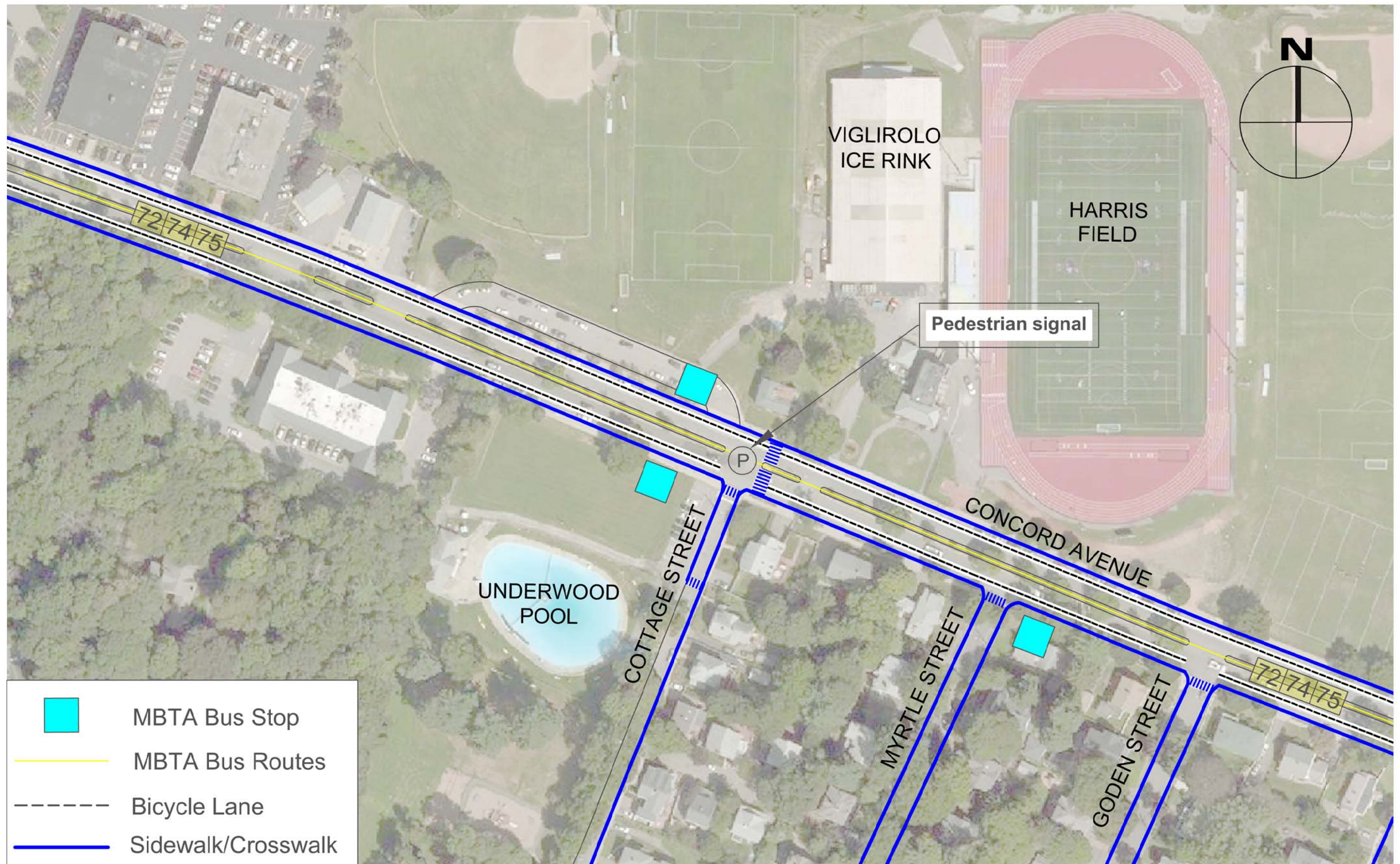
2019 Existing AM Peak Hour Traffic Volumes
Belmont Ice Rink Study
Belmont, MA

Figure 2
Not to Scale



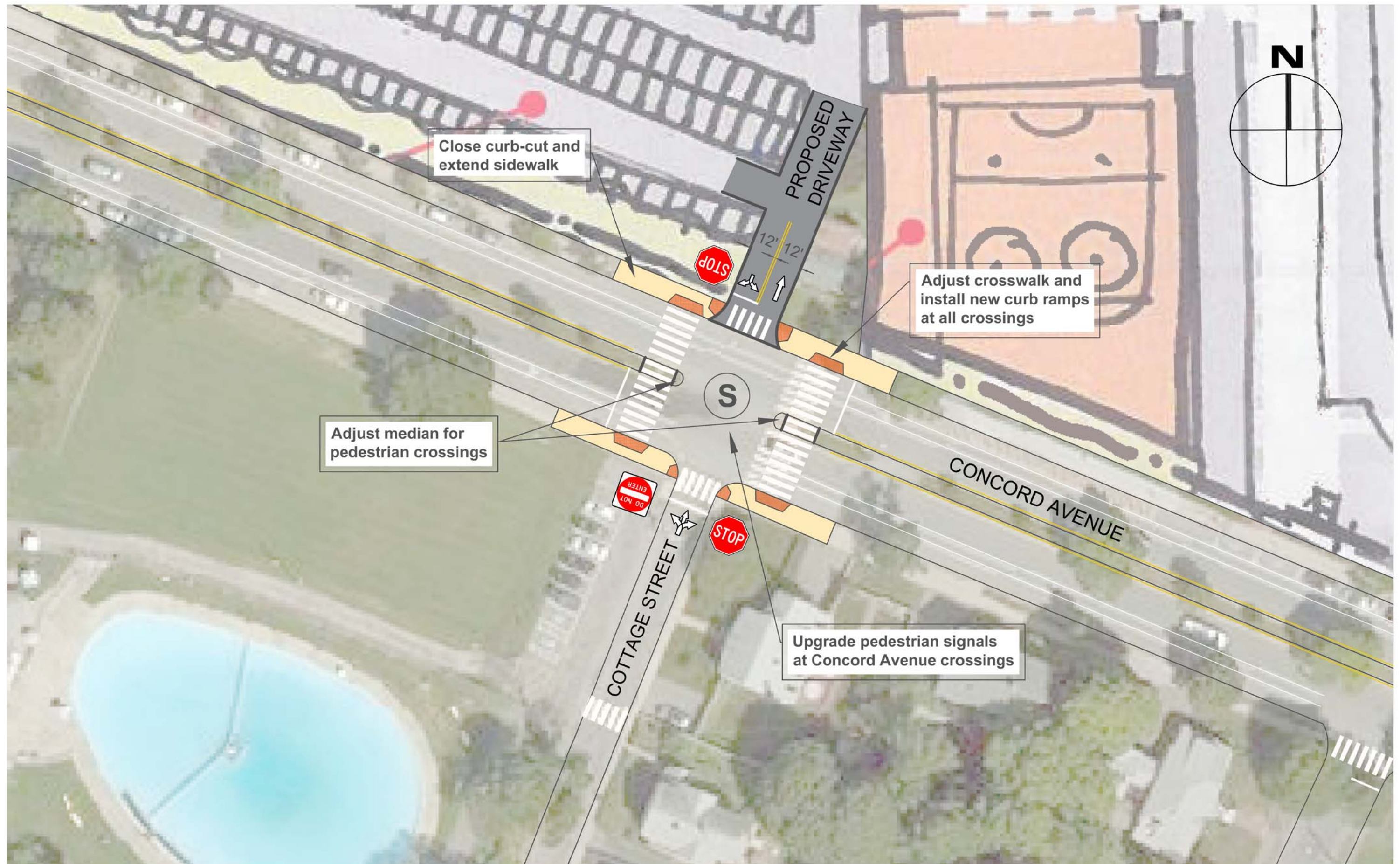
2019 Existing PM Peak Hour Traffic Volumes
 Belmont Ice Rink Study
 Belmont, MA

Figure 3
 Not to Scale



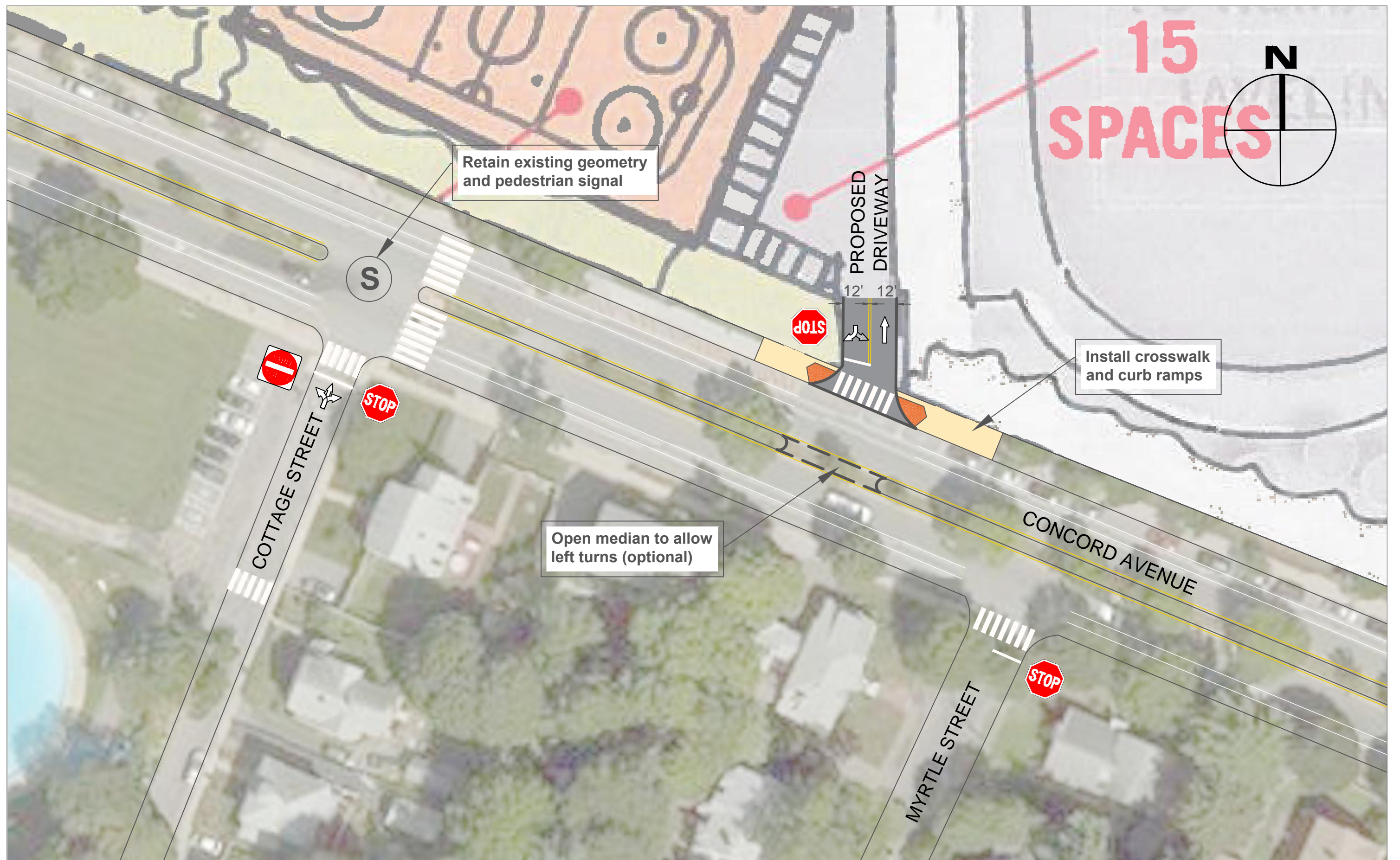
Pedestrian, Bicycle, and Transit Facilities
 Belmont Ice Rink Study
 Belmont, MA





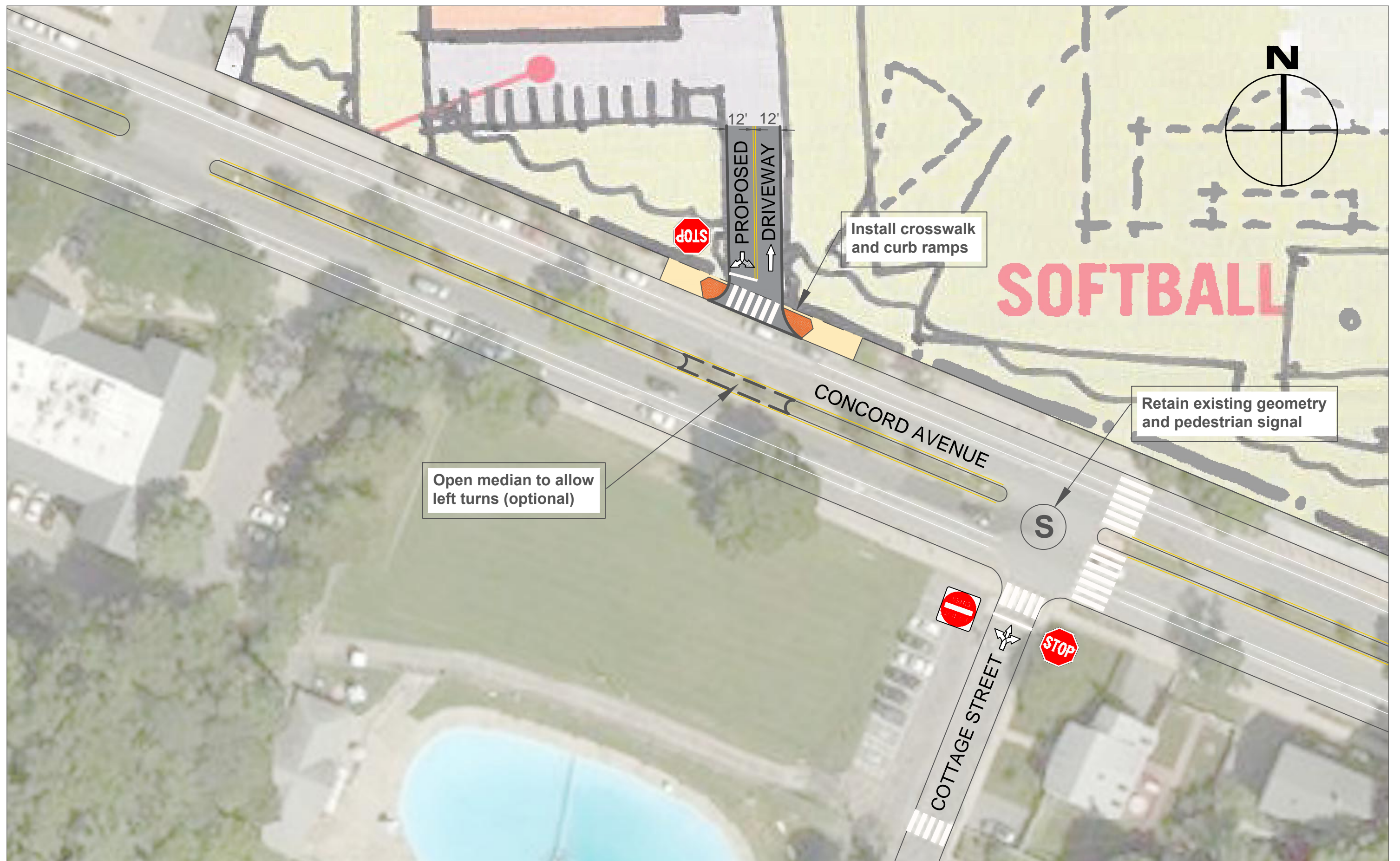
Proposed Ice Rink Driveway - Option 1
 Belmont Ice Rink Study
 Belmont, MA





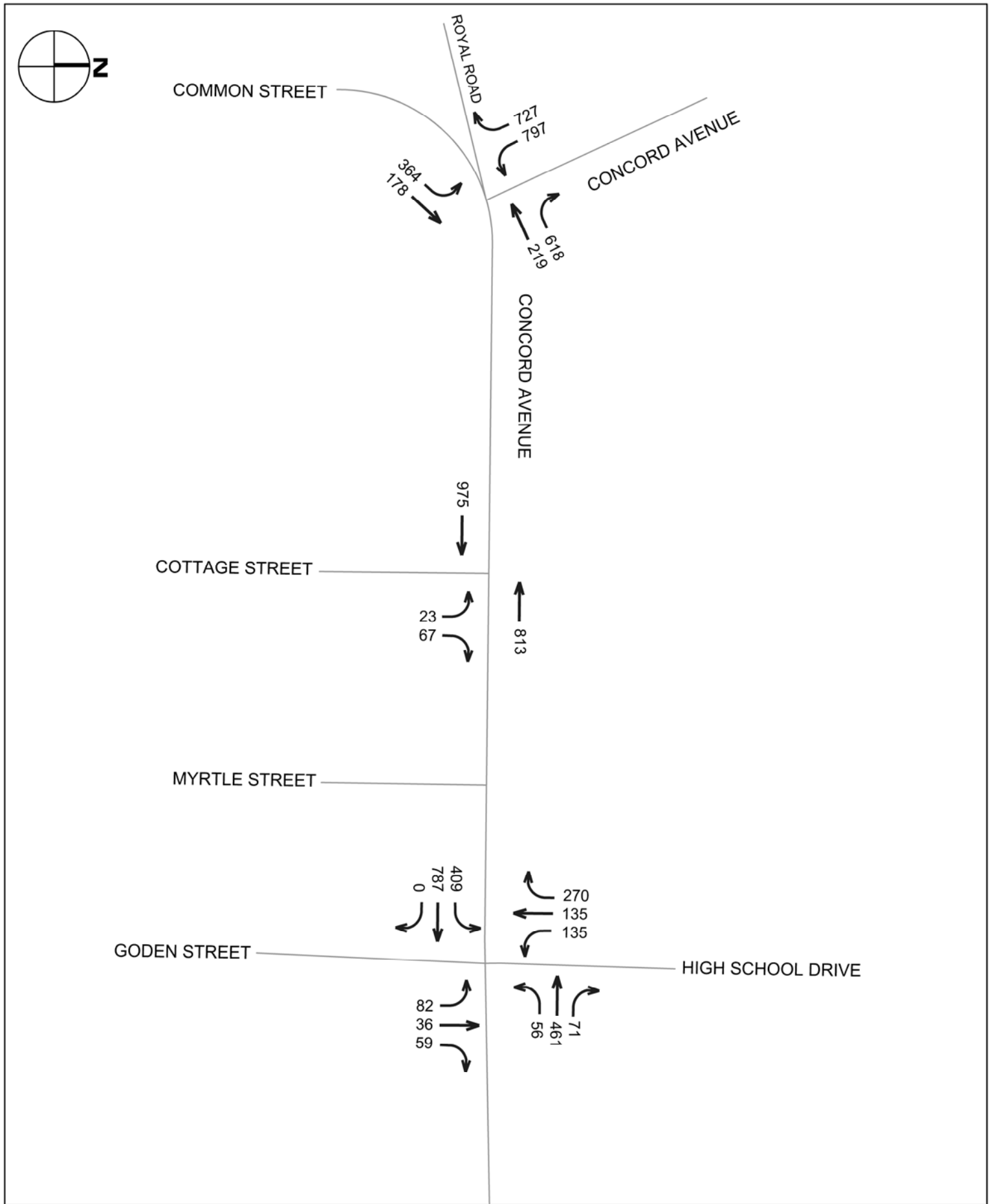
Proposed Ice Rink Driveway - Option 2
Belmont Ice Rink Study
Belmont, MA

Figure 6



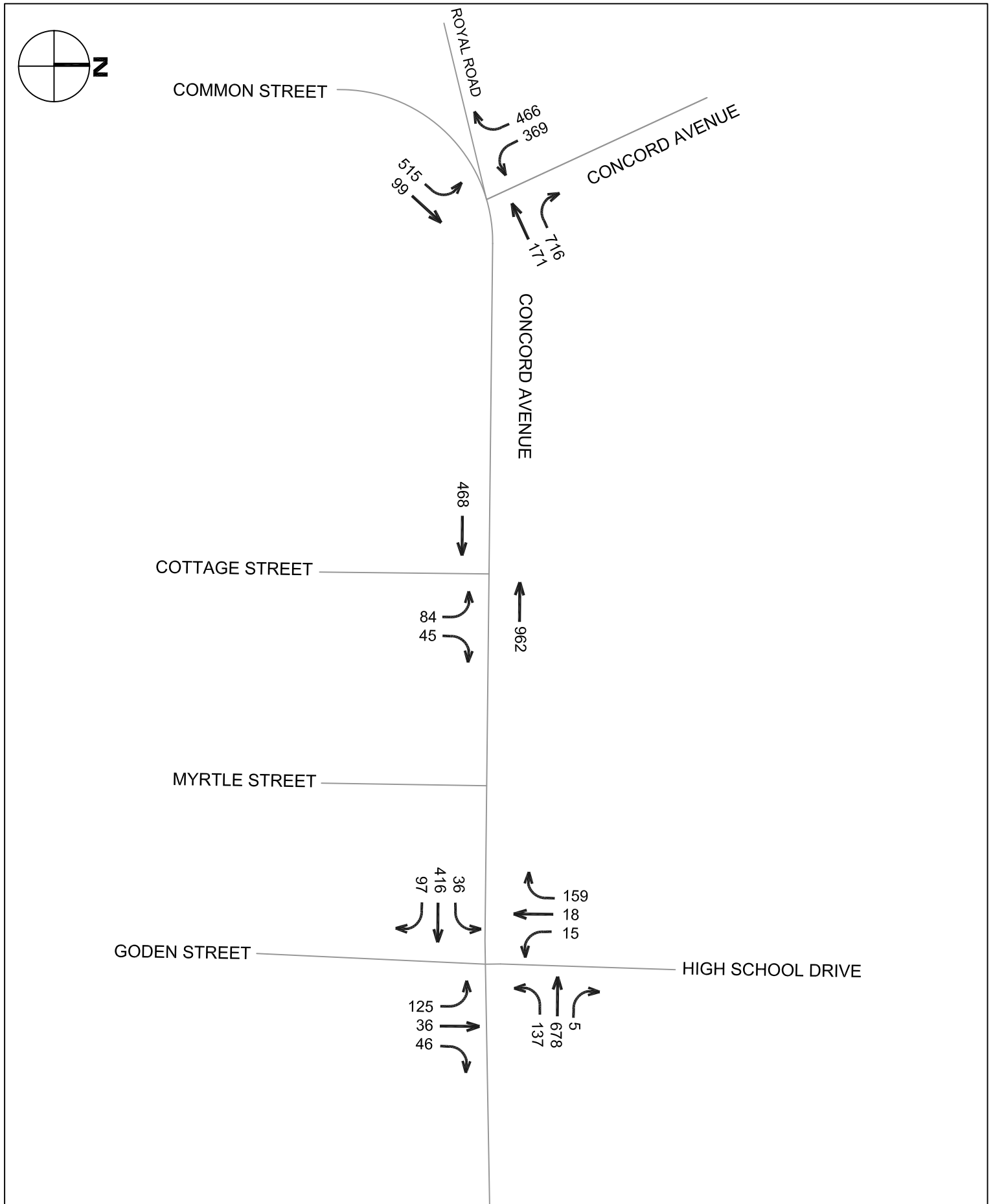
Proposed Ice Rink Driveway - Option 3
 Belmont Ice Rink Study
 Belmont, MA

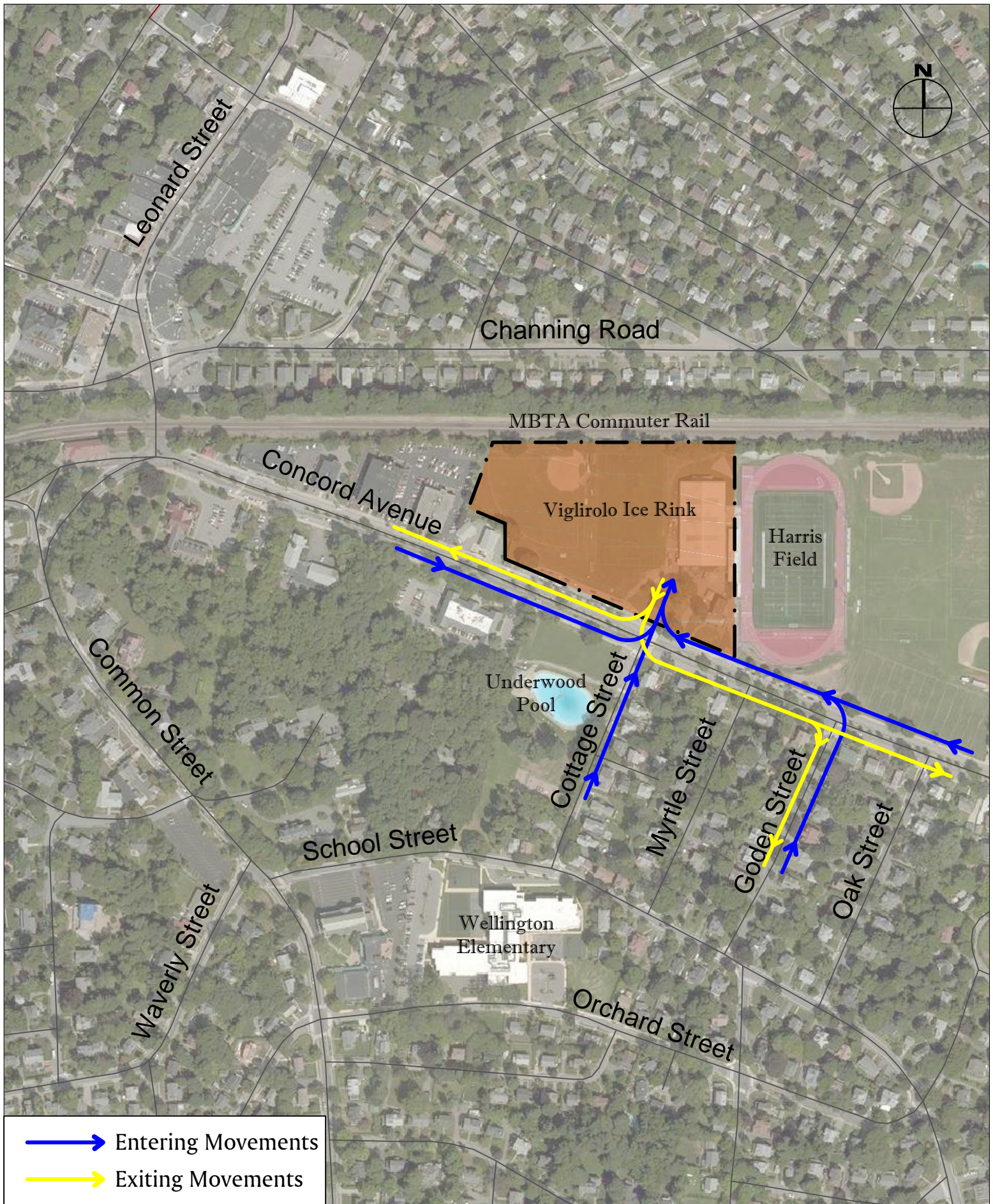
Figure 7



2021 No-Build AM Peak Hour Traffic Volumes
Belmont Ice Rink Study
Belmont, MA

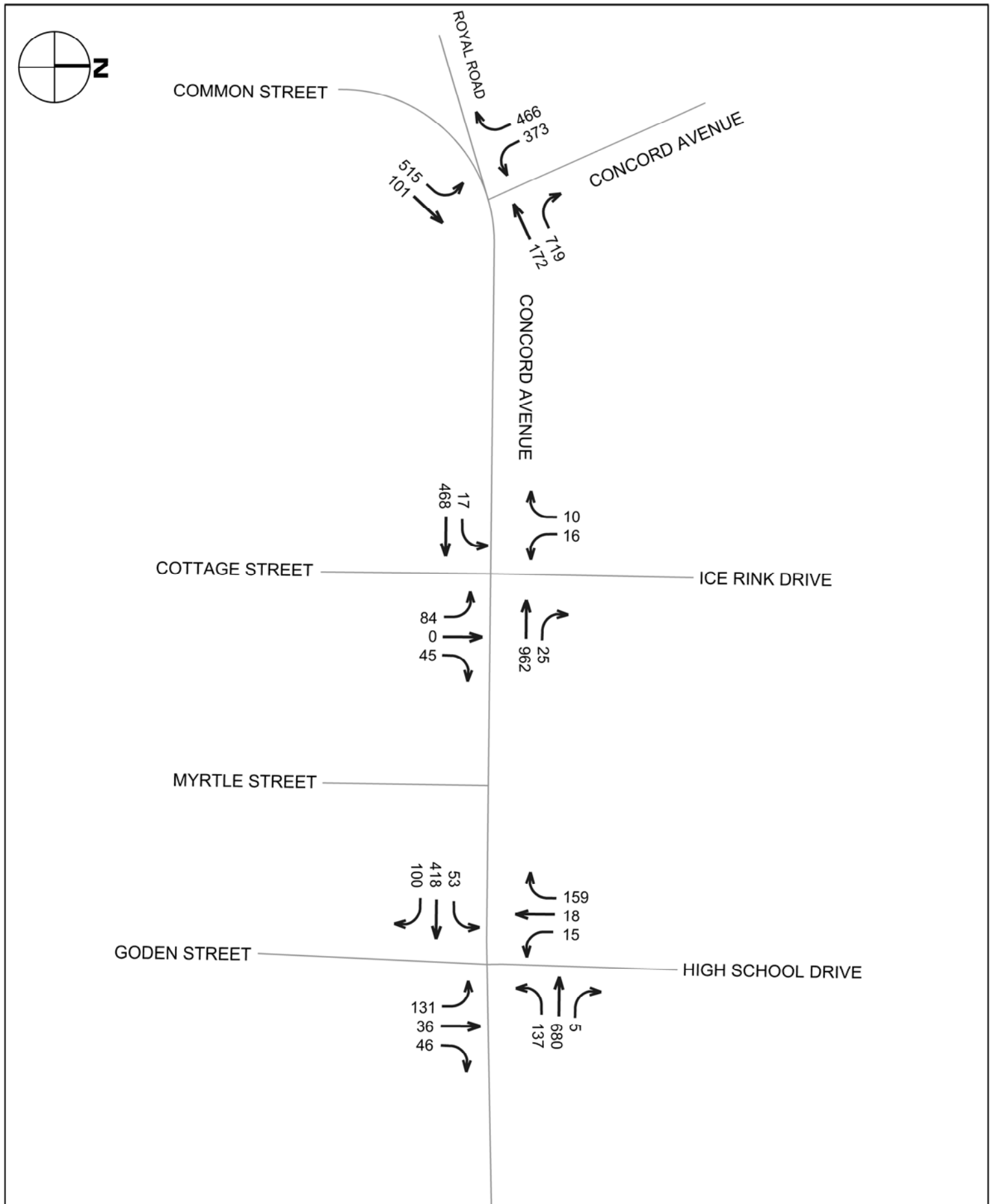
Figure 8
Not to Scale





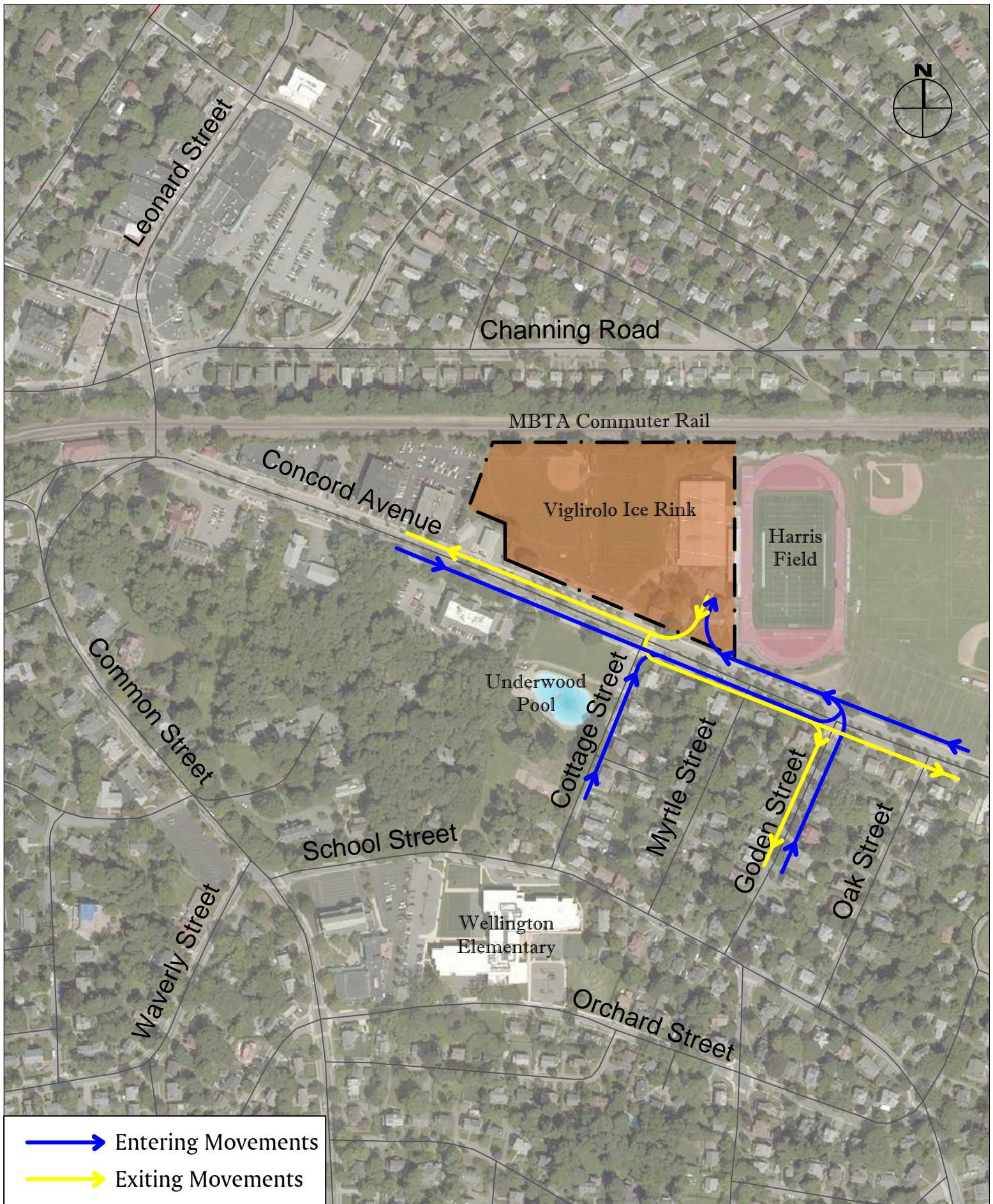
Access & Egress Movements - Option 1
Belmont Ice Rink Study
Belmont, MA

Figure 10
Not to Scale



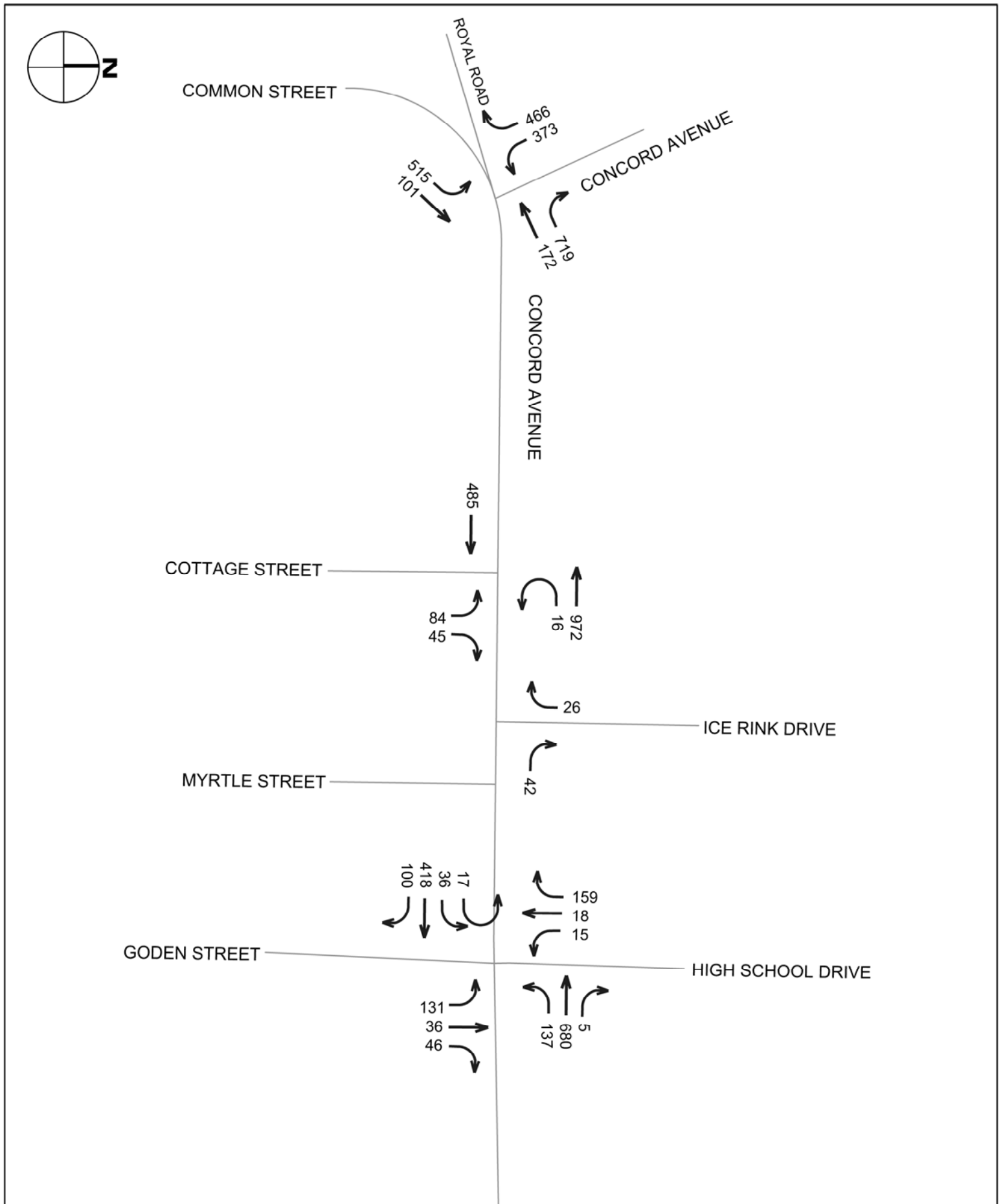
2021 Build PM Peak Hour Traffic Volumes - Option 1
 Belmont Ice Rink Study
 Belmont, MA

Figure 11
 Not to Scale



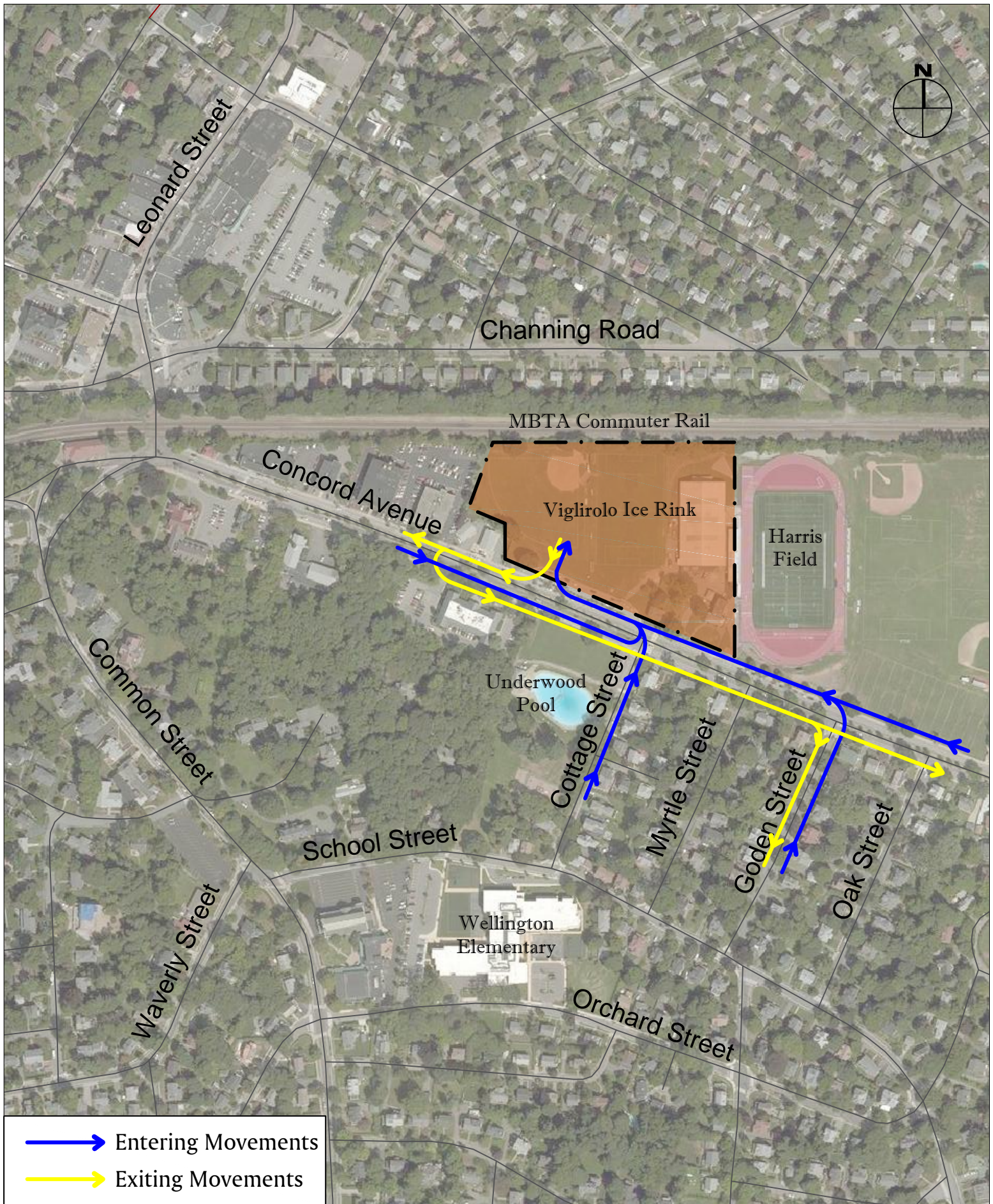
Access & Egress Movements - Option 2
Belmont Ice Rink Study
Belmont, MA

Figure 12
Not to Scale



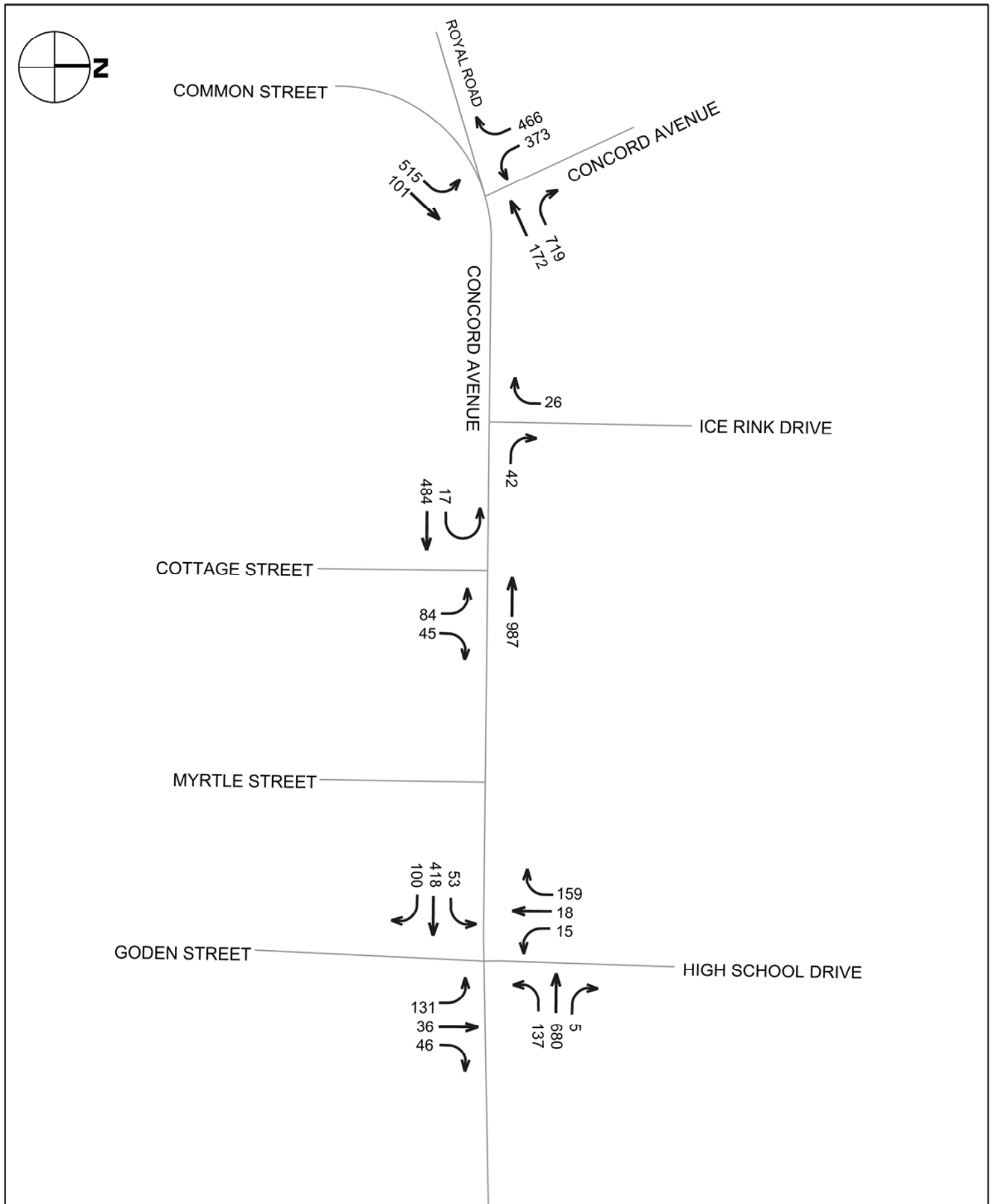
2021 Build PM Peak Hour Traffic Volumes - Option 2
 Belmont Ice Rink Study
 Belmont, MA

Figure 13
 Not to Scale



Access & Egress Movements - Option 3
Belmont Ice Rink Study
Belmont, MA

Figure 14
Not to Scale



2021 Build PM Peak Hour Traffic Volumes - Option 3
 Belmont Ice Rink Study
 Belmont, MA

Figure 15
 Not to Scale