Traffic Impact and Access Study
VOLUME 1 OF 2

Proposed Music Center
at Indian Hill
Old Ayer Road
Groton, Massachusetts

Stantec

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EXECUTIVE SUMMARY

The attached study was prepared to document projected traffic impacts from the Music Center at Indian Hill (MCIH) proposed for a 33.5-acre site on Old Ayer Road. On average, the site should generate approximately 765-945 vehicle trips per day -- an overall relatively small amount of new traffic -- though its trip making levels will be quite variable, depending on scheduled events.

Project Description

Indian Hill Music is widely known for its outstanding music educational and outreach programs culminating in outstanding public performances. It serves over 90 communities in Massachusetts and Southern New Hampshire. Its compressed 3.23-acre Littleton site requires Indian Hill Music to hold its larger concerts off campus at the adjacent Littleton High School Performing Arts Center. The Littleton High School venue can seat approximately 700 patrons. The largest existing Indian Hill Music recital space, Blackman Hall, can seat approximately 200 patrons.

MCIH will include several interconnected function spaces totaling approximately 115,000 gsf. These spaces will not only serve classroom activities, but provide exceptional venues for all scheduled events. A 1,000-seat concert hall and 300-seat recital hall will be integrated into the facility. On-site surface parking will be sufficient to accommodate up to 775 vehicles on site simultaneously, including just under 675 paved parking spaces and ±100 unpaved overflow parking spaces within the site's perimeter road. Two site access driveways are proposed along with sensitively placed sidewalk connections. The main access drive will be off Old Ayer Road, approximately 200 feet south of its intersection with Peabody Street. A secondary driveway egress, generally closed by a gate, is proposed for occasional use at the end of large performances only. This exit-only driveway will tie into Peabody Street opposite Temple Drive.

The site plan incorporates a loop road and a comprehensive sidewalk system. Both will be designed to provide stunning views of the site facilities for all site visitors. Truck loading activities will be accommodated at two loading spaces out of normal view to be located behind the facility entrance area.

MCIH will have lessons and classes that begin at 9 AM and conclude at 10 PM seven days a week. Performances will occur year round.

This traffic impact study analyzes three types of MCIH operations defined as follows:

- *Typical* - analyzing Peak School Day operations. It is important to understand that regular School Day traffic volumes are 40% lower than Peak School Day operations.

- *Large* – are essentially evening concert performance scenarios. For analysis purposes, occasional 1,000-patron and rare 2,300-patron performances were evaluated for a worst case Friday when regular School Day operations will be occurring.

- *Festival* - a rare scenario assuming 2,300 patrons incorporating day long multiple concert performances and with typical school operations assumed occurring on a Saturday using indoor and outdoor facilities.

Study Area

The study area, developed in consultation with Groton officials, included the existing Indian Hill Music site and large concert venue in Littleton, Massachusetts plus the following nine intersections within the Town of Groton:

- Old Ayer Road South at Boston Road (State Route 119/225)
- Old Ayer Road North at Main Street (State Route 119/225)
- Lowell Road (State Route 40) at Main Street and Broadmeadow Road
- Main Street at Hollis Road/Court Street
- Farmers Row (State Route 111) at Higley Street
- Farmers Row at Peabody Street
- Farmers Row at Culver Road
- Peabody Street at Higley Street
- Peabody Street at Old Ayer Road

Existing Traffic Volumes and Operations

Two weeklong counts were performed on Boston Road, south of Old Ayer Road, and on Old Ayer Road, just south of the future MCIH from March 12-18, 2016.

Two-day counts were also performed on Long Hill Road (Route 225) west of Farmers Row, Peabody Street west of Old Ayer Road, Farmers Row (Route 111) from March 14-15, 2016. Additionally, to ensure accuracy, two days of video camera unit counts were performed at the Indian Hill Music Driveway. All two-day counts were performed on Monday March 14 to Tuesday March 15, 2016 to capture the existing high day of Monday, plus a typical day at Indian Hill Music.

Additionally, video camera unit counts were performed at the Littleton High School driveway on March 12 to capture traffic patterns of an existing Saturday concert performance.

Turning movement counts, also using video camera units, were conducted at the nine intersections cited above in the Groton study area. These counts were performed from 4:45 PM to 10:45 PM on a typical weekday to coincide with projected peak hours for days that are *Typical* and *Large*. Saturday counts were performed from 11:00-1:00 PM to evaluate occasional mid-day *Festival* events.

In an attempt to evaluate operational conditions of most concern from a traffic impact perspective, four different MCIH operational 'what-if' scenarios were evaluated assuming site generation for each operational scenario. To obtain comparative information on MCIH operations and events, a total five different existing peak hours were evaluated:

- 4:45 -5:45 PM and 6:00-7:00 PM to coincide with *Typical* Peak Day School peak hour operations.

- 6:15 -7:15 PM and late 9:30-10:30 PM peak hours to coincide with worst case *Large*, for analysis purposes assuming 1,000 and 2,300 patrons attending similar concert start and finish times. While Fridays represent worst-case traffic analysis results, *Large* days will most commonly occur on Saturdays or Sundays.

- 11:00 AM-12 Noon Saturday mid-day peak hour of a possible *Festival* event.

Festivals are likely to culminate in a very large evening concert, assumed to end at 10:30 PM. After the last concert, Saturday peak hour *MCIH traffic generation* will be comparable to assumed late Friday *Large* (2,300 patrons 'what-if' scenario) peak hour MCIH traffic generation. However, as Saturday background traffic at Study Area intersections from 10-11 PM *will be lower than* comparable Friday background traffic from 9:30-10:30 PM, it was unnecessary to analyze the 10-11 PM late Saturday peak hour, as conditions will be comparable to, but slightly lower than, the Friday analysis results.

At six of the nine intersections, existing year 2016 peak hour traffic operations were found to be acceptable. However, at the three unsignalized intersections with Boston Road/Main Street, peak hour congestion was found on side street approaches concurrent with daily Indian Music School peak hours from 4:45-5:45 PM and 6:00-7:00 PM.

Congestion was also found on the Hollis Street approach to Main Street during Friday

6:15-7:15 PM, one of the *Large* arrival peak hour scenarios. Existing congestion was also found at Lowell Road and Hollis Street intersections with Main Street during the 11 AM-12 Noon *Festival* mid-day peak hour.

Historical Crash Data

Historical crash records indicate *that none of the intersections* in the study area exceed the average crash rates for similar unsignalized intersections in MassDOT District 3, Groton's MassDOT District or Statewide. The location with the highest crash rate, and most frequent number of crashes, was the stop-controlled intersection of Lowell Road (Route 40) at Main Street and Broadmeadow Road.

Future 2024 No-Build

Within the context of historical traffic volumes and trends expected over the next several years, background traffic growth unrelated to MCIH is expected to occur at approximately 0.5% per year for a cumulative 4% growth rate over the next eight years.

Where appropriate, traffic from two known approved developments on Boston Road, a Hindu Temple and a medical office building, was added to background traffic growth without the MCIH.

Proposals by Groton School and MassDOT to enhance sidewalks on Peabody Street and Boston Road, respectively, were assumed as part of the year 2024 No-Build infrastructure. Lawrence Academy's plan to alter the location of its main entrance was also assumed, though not specifically evaluated as one of the Study Area intersections.

Projected 2024 Build

Usage of the MCIH is expected to grow slowly over time. By the year 2024, school-related traffic is expected to grow approximately 50% over what was measured at the Indian Hill Music site during 2016. While presently occurring on Mondays at Indian Hill Music, MCIH may in the future consider moving Youth Orchestra rehearsal days to another day of the week. Youth Orchestra rehearsal days will remain the busiest for normal School operations. *Typical* Peak School parking demands, excluding scheduled concerts, are expected to range from 70-115 occupied parking spaces. On most days that are *Large*, MCIH peak parking demands are expected to be below 500 vehicles. On occasional *Festivals* and *Large* days, parking demands will exceed the site paved space capacity of just under 675 spaces. No more than 100 overflow parking spaces will be available for use within the site perimeter loop road only.

Using available metrics provided by MCIH, projected year 2024 MCIH daily trip generation will be quite variable on a day-to-day basis. On an overall basis, the average annual daily traffic generated by the MCIH will range 765-945 vehicle trips per day, with many of the days averaging between 500-600 vehicle trips per day. However, during a rare weekend day, *Festivals* with normal school operations MCIH could generate up to 3,100 vehicle trips on a single day.

Peak hour MCIH trip generation demands will also vary widely. On an average annual basis, year 2024 peak hour traffic demands should range from 150-200 vehicle trips, combined in and out. Traffic operating conditions, focusing on worst cases from a traffic perspective, were evaluated for two *Typical* peak hours on a School Peak Day, two peak hours each for 1) occasional *Large* 1,000-patron events and 2) rare 2,300-patron *Large* days, as well as a rare 2,300-patron Saturday mid-day peak hour assumed on a *Festival* day.

With or without the MCIH, congested traffic conditions are projected during one or more of the site peak hours at three unsignalized intersections with Main Street/Boston Road (State Route 119/225) – Old Ayer Road, Lowell Road, and Hollis Street.

From 70-75% of site generated trips will pass through the intersection of Old Ayer Road at Boston Road/Main Street. Old Ayer Road to and from the south is expected to attract 15-20% of site-generated trips, with the remaining traffic distributing in other directions.

Mitigation Measures

Carpools, which always reduce vehicle trip-making, will constitute the vast majority of trips to and from the MCIH. The existing site's known propensity for carpooling represents a substantial trip reduction mitigation measure.

From a site access perspective, the most critical intersection of concern is Boston Road (Route 119/225) at Old Ayer Road. *With or without* the MCIH, mitigation measures are warranted at this intersection. On an annual basis, MCIH will add approximately 2-3% of new traffic to this intersection. The vast majority of future traffic passing through this intersection will be unrelated to MCIH. But MCIH will generate a wide range of peak hour and daily volumes, the occasional and rare largest of which will be noticeable at this intersection.

We understand the Town proposed, but did not implement, alterations to this intersection several years ago. If mitigation measures are to be implemented, it is essential that the Town of Groton provide a leadership role in cooperation with MassDOT and the Groton Parks Commission, to do so. Potential traffic operations and

safety measures are identified in this report to assist the Town in determining whether, or if, it desires to address future operations/safety at this intersection.

To mitigate MCIH contributions to traffic volumes, police control at Old Ayer Road with Main Street/Boston Road intersection may be necessary before or after occasional and rare *Large* and *Festival* events only.

Additional police control is not proposed at the Lowell Road and Hollis Street intersections on Main Street, as both intersections already experience congestion and MCIH will add less than 2% traffic, overall, to these intersections.

We recommend MCIH install a new ADA mid-block crosswalk just east of Temple Drive to connect its sidewalk system to the Peabody Street sidewalk proposed by the Groton School. The sidewalk system to MCIH will then be accessible from Groton Center and Groton School.

We recommend MCIH incorporate exterior bicycle racks at the building to encourage site bicycle access.

In addition to a site sign at the main driveway entrance, we recommend MCIH consider installation of at least two potential way-finding signs - one on Main Street approaching Old Ayer Road North, and the other on Boston Road approaching Old Ayer Road South.

MCIH should contact MassDOT about using its future logo on existing I-495 "Attractions" signs in the vicinity of Exit 31. Way-finding signs on I-495 in advance of Exit 31 in both directions would be beneficial to direct long distance regional traffic to the MCIH. We note an existing "Attractions" sign in the westbound direction of I-495 prior to Exit 31 has room for an additional logo, so it may not be necessary to add a new physical sign, just the future site logo to existing signs in both directions.

I. INTRODUCTION

Indian Hill Music has been in continuous operation since 1985 and its core mission is:

"Sharing the transformative power of music through teaching

and performing, and giving music generously when there is need."

Indian Hill Music proposes to relocate from its current site from 36 King Street in the Town of Littleton to Old Ayer Road in Groton, Massachusetts. To be known as the Music Center at Indian Hill, or MCIH, it intends to expand and consolidate its important music educational resources.

Source: Indian Hill Music

The future MCIH site is located approximately 7.2 miles northwest of the existing Indian Hill Music site or approximately 12-13 minutes on available access routes.

Regionally, during 2015, the Indian Hill Music drew students from 83 communities, while concerts and lectures at the School and other locations in Littleton and Groton drew attendees and performers from nearly 75 communities. Left is a summary illustration of the Indian Hill Music regional service area for the school, concert, and outreach program.

MCIH retained a renowned team of designers, architects, and landscape architects to prepare a detailed plan (refer to Figure 1) to relocate the School and consolidate its music education and performing arts venues onto a single 33.5-acre site including approximately 115,100 of building space in Groton, Massachusetts.

Source: Beals Associates, Inc. 3/29/16 Progress Print

Music Center at Indian Hill
Groton, Massachusetts

Preliminary Site Plan

Figure 1

Stantec Consulting Services Inc.

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Within the larger service area, listed in alphabetical order, approximately 3/4 of the Indian Hill Music school and concert attendees live within the top ten communities of Acton, Ayer, Boxborough, Chelmsford, Concord, Groton, Harvard, Littleton, Pepperell and Westford. Indian Hill Music's largest performances are held off site at the adjacent Littleton High School Performing Arts Center. Indian Hill Music staff leaders and the Project Team have provided a tremendous amount of information on the School and its vision for its future services framing how such activities will affect future traffic characteristics of the MCIH. Also provided was detailed existing information on the communities of origin for Indian Hill Music student, outreach, and concert activities.

MCIH will have many concert performance options with or without its normal school operations. This study analyzes three types of future MCIH operations defined as follows:

- *Typical* - analyzing Peak School Day operations. It is important to understand that regular School Day traffic volumes are 40% lower than Peak School Day operations.
- *Large* – are essentially evening concert performance scenarios. For analysis purposes, occasional 1,000-patron and rare 2,300-patron performances were evaluated for a worst case Friday when regular School Day operations will be occurring.
- *Festival* - a rare scenario assuming 2,300 patrons incorporating day long multiple concert performances and with typical school operations assumed occurring on a Saturday using indoor and outdoor facilities. When a rare *Festival* occurs on a Sunday, school operations would not be coincidental with it.

The proposed MCIH site is bounded by Peabody Street to the north, the Nashua River Rail Trail to the west, and Old Ayer Road to the east. Figure 2 illustrates the site location on a USGS map base, while Figure 3 shows the site location on an aerial base. Primary driveway access will be via Old Ayer Road. Motorists and bicyclists will be able to use this access. A secondary, generally gated, motor vehicle egress will be provided on Peabody Street for *exiting* traffic only during the most traffic intensive *Large* and *Festival* events. Pedestrians and bicyclists will access the site via a sidewalk connection to a mid-block crosswalk on Peabody Street. All site-generated truck deliveries will enter and leave the site via the main driveway off Old Ayer Road, circulating via the proposed site loop road shown on Figure 1. Service loading docks will be designed to accommodate two trucks simultaneously. Roadways are being designed to accommodate emergency vehicles and the largest trucks the site will be generating.

Base Map Source: Executive Office of Environmental Affairs MassGIS USGS Data Layer

Music Center at Indian Hill
Groton, Massachusetts

Project Vicinity Map

Figure 2

Stantec Consulting Services Inc.

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Base Map Source: Executive Office of Environmental Affairs MassGIS Orthophotos

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Music Center at Indian Hill
Groton, Massachusetts

Aerial of Site Vicinity

Figure 3

a. Study Methodology

'Typical' Traffic Generation Factors Do Not Apply

At the outset, we recognized this traffic impact and access study required a unique approach to estimating traffic generation. Traffic generated by the Music Center at Indian Hill cannot be estimated from the typical industry resource, the Institute of Transportation Engineer's *Trip Generation*[1] report.

Our goal, to the extent possible, was to conform to MassDOT's Traffic Impact and Access Guidelines, and provide enough information to understand future traffic implications of the new MCIH.

As the MCIH will be a unique land use, it was therefore necessary to count traffic volumes not only in Groton at intersections near the future site, but also at the *existing* Indian Hill Music site to obtain a reasonable basis for future trip generation projections, trip distribution patterns, and traffic impacts.

"New" vs. "Trips already on the Roadway network"

From a trip generation perspective, typically we would examine how many trips are considered "new" vs. "already on the roadway network." Because Indian Hill Music is an existing site with a regional draw of site users approximately 7.2 miles away, it is clear that some proportion of the trips that will be relocated to the Groton site are not "new" to the area, but will be re-directed to the new site. From a regional perspective, trips originating north and west will have shorter distances to travel and times to travel, while trips originating south and east of the site will have longer distances and times to travel.

For analysis purposes, it is not possible to accurately separate out the "new" vs. "already on the network" trips. Therefore, we assumed *all* vehicle trips to the MCIH site will be "new" to the roadway network even though we acknowledge that this overstates the number of vehicle trips– which results in a conservative "high side" traffic impact analysis, especially when one considers vehicle miles of travel and the main route of travel – Main Street/Boston Road (Routes 119/225).

[1] Trip Generation Manual, 9th Edition, Institute of Transportation Engineers, 2012.

Selection of Peak Hours to Analyze

Typically, a traffic impact and access study reviews AM and PM peak hour site related traffic impacts and daily traffic generation. This will not be the case with the MCIH, as its peak hours will generally occur during the afternoon/evenings. We evaluated six different peak hours, four during the Monday-Friday period and one during a Saturday mid-day, which has higher background traffic volumes than a typical Sunday.

The School will typically operate Monday-Friday between the hours of 9 AM and 10 PM and Saturdays from 9 AM to 5 PM. The school may also operate on Sundays. During regular school days, most usage occurs during the late afternoon early evening hours in its after school program. Larger concerts will typically occur either on Friday evenings, Saturday afternoons or evenings, or on Sunday afternoons or evenings. Potential day long extra large events will typically occur on a Saturday or Sunday.

Because the MCIH expects to open by 2019, as MassDOT Traffic Impact Analysis Guidelines (TIAG) recommend, we evaluated traffic conditions for opening year plus five years or the year 2024. Based on various Build site-related peak hour operations scenarios discussed further on, Existing (2016), No- Build (2024), and Build (2024) traffic operating conditions were evaluated for the following peak hour intervals:

- *Typical* MCIH school peak day peak hours:[2]
  - 4:45-5:45 PM and 6:00-7:00 PM
- *Large* MCIH peak hours (occasional 1,000 patron and rare 2,300 patron analysis scenarios):
  - 6:15-7:15 PM and 9:30-10:30 PM
- *Festival* MCIH Saturday mid-day peak hour (rare 2,300 patron analysis scenario):
  - 11:00 AM -12:00 Noon[3]

To summarize, existing, No-Build, and Build traffic operations analyses included:

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[2] At the present time, Indian Hill Music's peak day is Monday, when its Youth Orchestra performs. MCIH could change this in the future to another day.

[3] MCIH indicates its Saturday Festival hours are most likely to end later in the evening at 10:30 PM, *A 10:30 PM end time will typically produce analyses slightly better than the Friday late night concert peak hour from 9:30-10:30 PM assuming 2,300 patrons.*

- Five (5) year 2016 peak hours representing existing conditions concurrent with future site-related operations peak hours.

- Five (5) year 2024 No-Build peak hours were the same as those analyzed with existing conditions. !

- Seven (7) year 2024 Build peak hours during the same hours listed above. Two additional analyses conditions were needed because the same 6:15-7:15 PM and 9:30- 10:30 PM peak hours are associated with the two analysis concert scenarios -- one evaluating an occasional 1,000-patron evening concert and the second evaluating a rare 2,300-patron evening concert events. Background conflicting traffic for the late evening Saturday all day event peak hour will be slightly lower than that evaluated with the late peak hour for the rare Friday 2,300-patron concert, so only a Friday late peak hour was evaluated. MCIH indicates that most attendees for future Saturday or Sunday day long Festivals will stay for the finale evening concert ending at 10:30 PM.

Seasonal Adjustments

Traffic study counts were performed during mid-March, 2016. The most recent available monthly seasonal factors[4] for Massachusetts's roadways indicate March traffic volumes are representative of typical average annual traffic conditions, but may be approximately 4% higher than average annual traffic volumes for roadways and intersections evaluated. Furthermore, MCIH anticipates that the majority of its *Large* and *Festival* days will occur during the summer months when background seasonal traffic volumes, are *even lower than* during average annual months. Counted traffic volumes were not reduced to reinforce that the study analysis results are likely to be conservative, or high side.

Crash and Sight Line Analyses

Historical crash data was evaluated at the nine identified study area intersections using available MassDOT crash data. More recent Town of Groton crash data was also reviewed. Future sight lines were also evaluated at the two proposed new site driveways. Both

[4] MassDOT 2011 Weekday Seasonal Factors.

stopping and intersection sight lines were evaluated in accordance with requirements for stopping and intersection sight distance.

Site Plan Parking System and Pedestrian Accommodations

Refer to Figure 1 on page 3 for a site plan. While an in-progress print, it illustrates proposed on-site circulation and parking system at the time this report was prepared. The site Design Team's goal is to accommodate all of the site's parking demands on site providing just under 675 permanent spaces plus the potential to accommodate up to 100 additional spaces within the site perimeter roadway. The site plan includes a comprehensive network of sidewalks to provide access from Peabody Street in coordination with Peabody Street sidewalk plans being proposed by the Groton School. The cross-site pedestrian spine is sensitive to site grades that slope downward north to south.

b. Study Area and Count Program

Prior to undertaking this study, a coordination meeting to identify the Study Area and prospective count program components was held on February 23, 2016 with the Town of Groton – including key planning, highway, police, and fire department representatives. Resulting from this meeting, a total of nine (9) intersections within the Town of Groton plus the Indian Hill Music and adjacent Littleton High School Performing Arts Center sites were identified for peak hour analysis. In all cases, counts included trucks, bicycles and pedestrians.

Another eight roadway segments, seven of which are in Groton and the other at the Indian Hill Music driveway were identified as requiring two-day to seven-day automatic traffic recorder (ATR) counts. Of the eight identified ATR roadway segments, six were performed in connection with this study. ATRs on Main Street and Lowell Road recently counted during September 2015 by Bayside Engineering on behalf of Lawrence Academy were not recounted. Six were 48-hour or two-day ATR's. The two additional locations – Boston Road and Old Ayer Road – were weeklong or seven-day ATR control counts.

Selection of count intervals was closely coordinated with Indian Hill Music to include those hours deemed consistent with future School/event peaks.

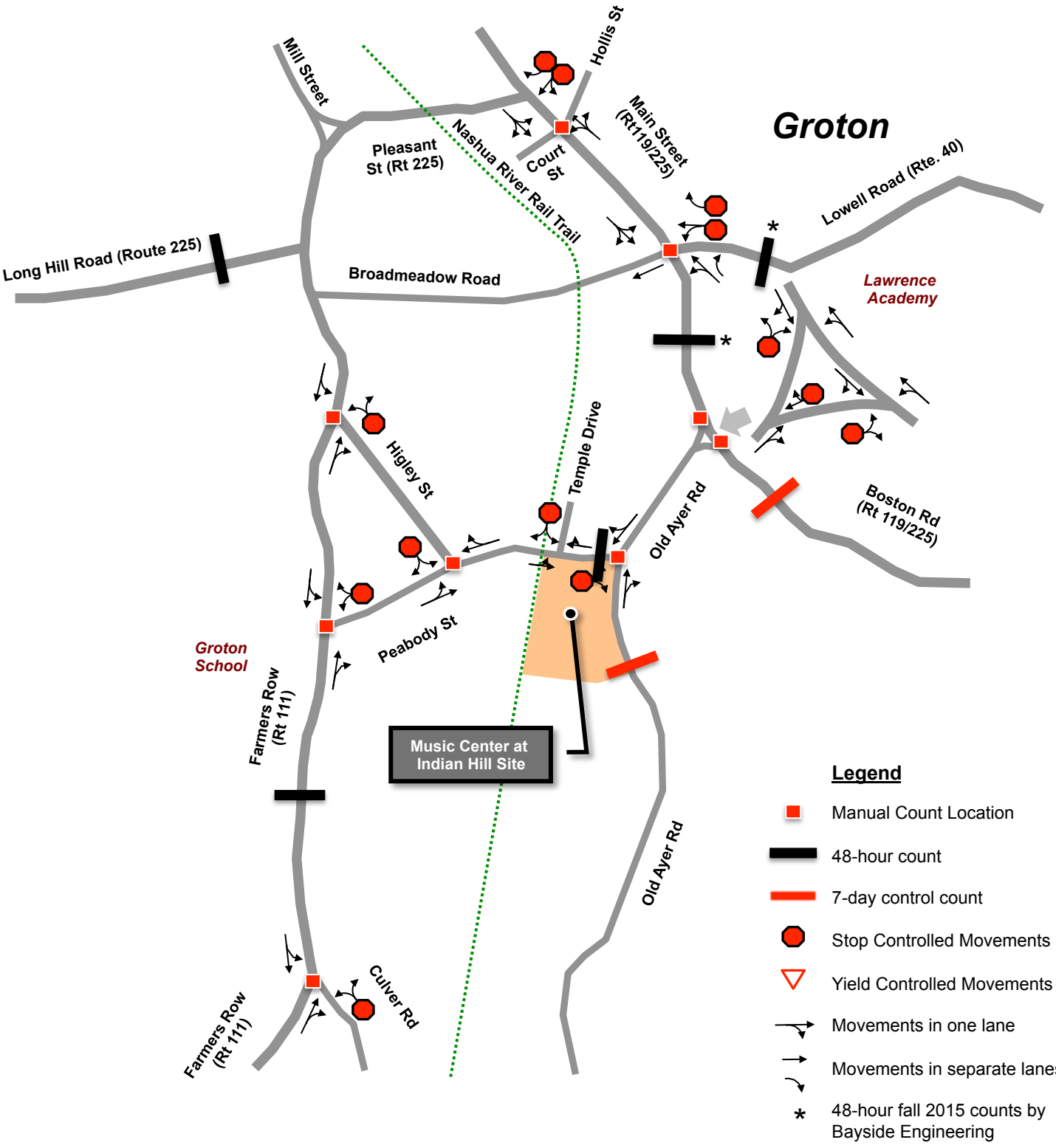
Figure 4 illustrates the Groton Count Program including manual and automatic count locations. Existing traffic lanes and traffic controls are also illustrated for the nine intersections evaluated in this study. To assist in evaluation of off-site mitigation measures, the Town of Groton provided plans prepared by others that affect the MCIH off-site study area. These plans included:

- *Groton School*, located just west of the project site on Farmers Row is proposing to create or enhance sidewalks on Peabody Street, adjacent to the MCIH site, and Old Ayer Road to provide a better and safer walking environment between the School and downtown Groton activity centers (VAI plans for Groton School November 2015).

- *Lawrence Academy,* located northeast of the Project site, is enhancing its access characteristics by relocating a site driveway and restriping Main Street between Old Ayer Road (north) and Lowell Road (State Route 40). As noted above, counts performed, are less than a year old and recent enough to be considered in lieu of new automatic counts on Main Street and Lowell Road adjacent to the Lawrence Academy site.[5]

- MassDOT, consistent with the Town's 2011 Master plan, is undertaking a sidewalk enhancement plan on the west side of Boston Road (State Route 119/225) to provide a continuous sidewalk between Old Ayer Road and the US Post Office as well as the Groton CVS Plaza.

[5] TIS by Bayside Engineering and site plans by Ducharme and Dillis Civil Design Group, January 7, 2016.



Schematic Diagram:
Not to Scale

Music Center at Indian Hill
Groton, Massachusetts

Study Area Traffic Counts

Existing Traffic Controls and Lane Configurations

Stantec Consulting Services Inc.

Figure 4

II. EXISTING CONDITIONS

a. Circulation Network Summary

The MCIH site is adjacent to two local Groton Streets, Old Ayer Road and Peabody Street. The site itself has an unpaved access road serving existing farm buildings on Old Ayer Road and a paved residential driveway that will remain for emergency access.

Around the site, the circulation network primarily consists of narrow two-lane paved roadways with double yellow centerlines and white edge lines offset from the edge of pavement by a foot or less. At present, no sidewalks directly abut the site. The only sidewalk in the vicinity of the site is located just west of and opposite it on the north side of Peabody Street near the Nashua River Rail Trail. The Groton School is proposing to tie into this sidewalk within the next few years, ultimately connecting to an existing sidewalk on the north side of Old Ayer Road that in turn connects to a sidewalk on the west side of Main Street approaching Groton Center. Following is a summary of the Study Area roadways, the Nashua River Rail Trail, and intersections included in the Study Area (refer to Figure 4).

Old Ayer Road

With an approximate paved width of 20-22 feet, Old Ayer Road is functionally classified by MassDOT as a Rural Minor Collector and is within a Town of Groton layout approximately 62-63' in width. It is posted for a 40 miles per hour speed limit just south of the site. It is marked by a double yellow centerline and white edge lines along the site's easterly frontage. Old Ayer Road generally has a north to south orientation. It originates to the south at the Ayer Town line and ends to the north after turning easterly at Boston Road (Routes 119/225). While Old Ayer Road provides access the Nashoba Valley Medical Center at the Groton/Ayer line, open undeveloped land is located opposite the MCIH site. Its pavement is typically in fair/good condition.

Old Ayer Road
Looking south from MCIH site

Peabody Street

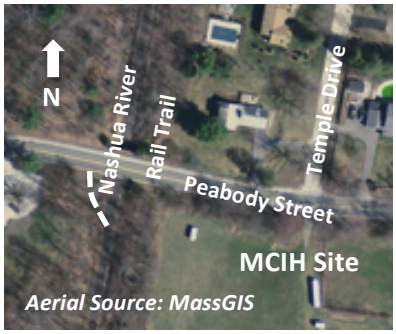
Peabody Street

Looking west from MCIH site

Like Old Ayer Road, Peabody Street has a similar paved width of 20-21 feet. Functionally classified by MassDOT as a local street, it lies within a typical layout of approximately 50 feet.

Its posted speed limit is 30 miles per hour and it is also marked by a double yellow centerline along the site's northerly frontage. It originates to the west at Farmers Row (Route 111) and ends to the east at Old Ayer Road. A short sidewalk is provided on the north side of Peabody Street across the Nashua River Rail Trail. The north side of Peabody Street is bounded by low-density single- family homes. Its pavement is in fair/ good condition.

Nashua River Rail Trail (NRRT)



Adjacent to the west side of the future MCIH, the NRRT is a generally north-south two lane paved multi-use path approximately 10-12 feet in width. It extends approximately 11 miles along an abandoned railroad right of way between Ayer, Massachusetts and Nashua, New Hampshire and traverses through Groton.

Peabody Street is grade separated over the NRRT in the study area. An informal pathway from the south side of Peabody Street connects it to the NRRT just to the west of the bridge.

Peabody Street at Old Ayer Road

Peabody Street approaches Old Ayer Road slightly downhill and is stop controlled at its intersection with Old Ayer Road. There is no stop line on Peabody Street to let motorists know where to stop. An uncurbed median, supplemented by a Keep Right sign, divides the eastbound and westbound directions.

The intersection processes traffic in 10-11 foot lanes. While sidewalks are non-existent, the Groton School plans to address this issue in the near future by creating a new sidewalk on the north side of Peabody Street and continuing it along the west side of Old Ayer Road north toward Main Street (Routes 119/225).

Peabody Street

Looking east to Old Ayer Road

Old Ayer Road South at Boston Road and Main Street (Routes 119/225)

Old Ayer Road is stop controlled, including a stop line, at its intersection with Boston Road. It approaches the intersection in a 12- foot lane at a southbound skew such that motorists have to crane their necks to the left to see oncoming southbound traffic on Main Street next to Prescott Park. The triangular park is controlled by the Commonwealth's Article 97 parklands legislation. Main Street and Boston Road approach lanes are approximately 11-12 feet wide. Few left turns are made heading north on Main Street, as these demands are typically processed at via Old Ayer Road North at its separate intersection with Main Street.

Boston Road

Looking north to Old Ayer Road (S)

MassDOT functionally classifies Boston Road as a Rural Minor Arterial. To the south of its intersection with Old Ayer Road South, Boston Road lies within a State Highway Layout. North of the intersection, Boston Road becomes Main Street and lies within a Town of Groton layout. Besides Prescott Park, single-family residences and the Country Day School of the Holy Union abut the intersection.

Old Ayer Road North at Main Street (Routes 119/225)

Old Ayer Road South at Boston Road, Old Ayer Road North is stop controlled without an existing stop line at its skewed intersection with Main Street (Routes 119/225). All approach lanes are 11-12 feet in width

The very shallow skew of Old Ayer Road North is undesirable for motorists making left turns from Old Ayer Road North onto Main Street, who must crane their heads far to the right to view oncoming northbound traffic coming from Boston Road.

Old Ayer Road North

Looking northeast to Main Street

Similarly, the skew presents a hazardous crossing for any pedestrians who may be using the sidewalk on the west side of Main Street to cross to Prescott Park. There is no crosswalk or walkway traversing from west side of Main Street to the park to benefit Boston Road pedestrians who desire to travel to and from the south.

Old Ayer Road North at Old Ayer Road South

Old Ayer Road North has a north to east T alignment at its intersection with Old Ayer Road South. Westbound Old Ayer Road South is controlled by a stop sign and stop line.

Old Ayer Road

Looking east at N/S split

This intersection was indirectly counted as all the southbound traffic on Old Ayer Road North continues southbound. Westbound traffic on Old Ayer Road South is known, as all westbound traffic continues westerly on Old Ayer Road. Lanes 11-12' wide are provided on all approaches.

Lowell Road (Route 40) at Main Street (Routes 119/225) and Broadmeadow Road

Lowell Road approaches Main Street in a downhill two-lane configuration, though the two-lane approach is relatively short, roughly three-four car lengths. Lawrence Academy is located southeast of the intersection which is in the heart of Groton Center. Like Main Street, Lowell Road is functionally classified as a Rural Minor Arterial. It provides an important though meandering east-west access through Groton, passing through Westford, ultimately connecting at an interchange to State Route 3 in Chelmsford. Its speed limits vary from 25-35 miles per hour, but are generally lower than those found along Boston Road.

Lowell Road

Looking west to Main Street

The northbound Main Street approach to Lowell Road forms a right turn lane channelized by a triangular landscaped island. It is wide enough for traffic to pass to the right around left turning motorists. Sidewalks are provided on all sides except the east side of Main Street and the south side of Lowell Road. Approach lanes are typically 11-12 feet in width.

Hollis Street at Main Street and Court Street/Mayfield Drive

Like Old Ayer Road, Hollis Street is functionally classified as a Rural Major Collector. It provides a

potential regional connection to locations northeast of the MCIH site, while Main Street provides a regional connection to locations northwest of the site.

Hollis Street approaches Main Street in a two short 11-foot wide lanes perpendicular to Main Street, one a left through lane and the other an exclusive right lane. Sidewalks are provided on the west side of Hollis Street and both sides of Main Street. A crosswalk is provided on the north leg of the intersection connecting Hollis Street sidewalk to the sidewalk on the south side of Main Street. The intersection is surrounded by residential and commercial uses.

Hollis Street

Looking southwest to Main Street

Higley Street at Peabody Street

Higley Street is a two lane local street connecting as a shortcut between Farmers Row and Peabody Street. It has a landscaped right turn channelization median at its stop-controlled T intersection approach to Peabody Street. The intersection has a few single-family homes in its vicinity. Its predominant traffic movements are south to east and west to north.

At this time, there are no sidewalks at the intersection, although the Groton School plans to construct a sidewalk on Peabody Street in the future. This is discussed further on in the No-Build section of this study.

Higley Street

Looking southeast to Peabody Street

Higley Street at Farmers Row (Route 111)

Higley Street forms a four-way intersection with Farmers Row (Route 111), opposite a single-family driveway. Higley Street and Farmers Row provide single lane approaches on all legs. Farmers Row is within a Groton layout and is functionally classified as a Rural Minor Arterial extending between Pleasant Street in Groton Center and Ayer where it becomes Groton School Road. A sidewalk is provided only on the east side of Farmers Row to and from Broadmeadow Road to the north.

Higley Street

Looking northwest to Farmers Row

Peabody Street at Farmers Row (Route 111)

Peabody Street forms a T intersection with Farmers Row (State Route 111). Both northbound and southbound Farmers Row approaches operate in single 10-11-foot lanes. However, the Peabody approach has an uncurbed channelizing island that allows approaching traffic to go left or right on either side of the island, producing a confusing approach.

Peabody Street

Looking west to Farmers Row

A sidewalk is provided on the east side of Farmers Row to and from Broadmeadow Road to the north. Groton School plans to simplify and make safety improvements to this intersection while creating a new sidewalk on the south side Peabody Street at this intersection. The No-Build section of this study describes Groton School's planned sidewalk enhancements to Farmers Row, Peabody Street, and Old Ayer Road.

Culver Road at Farmers Row (Route 111)

Culver Road is a two-lane local road providing a connection between Old Ayer Road and Farmers Row via Smith Street. Culver Road forms a shallow Y intersection with Farmers Row, making some turning movements difficult.

This intersection has no sidewalks and is abutted by open space and single-family homes.

Culver Road

Looking northwest to Farmers Row

b. Existing (2016) Traffic Volumes

To evaluate the future traffic impacts associated with the proposed MCIH, it was necessary to measure existing traffic characteristics of roadways and intersections included in the study area identified previously on Figure 4.

Turning Movement Counts

Town representatives [6] recommended MCIH provide manual turning movement, pedestrian, and bicycle counts at the following intersections:

- Old Ayer Road South at Boston Road (State Route 119/225)
- Old Ayer Road North at Main Street (State Route 119/225)
- Lowell Road (State Route 40) at Main Street (State Route 119/225) and Broadmeadow Road
- Main Street at Hollis Road/Court Street
- Farmers Row (State Route 111) at Higley Street
- Farmers Row (State Route 111) at Peabody Street
- Farmers Row (State Route 111) at Culver Road
- Peabody Street at Higley Street
- Peabody Street at Old Ayer Road

To make sure we obtained anticipated site peak hours concurrent with road peak hours, the above intersections were counted from 4:45-10:45 PM on Tuesday, March 15, 2016. Counts were performed using video camera units that allow accurate tabulation of all turning movements as well as pedestrian and bicycle counts.

The Town also requested counts at the existing Indian Hill Music School and at a large Indian Hill Music Concert at the Littleton High School Performing Arts Center. Indian Hill Music school counts were performed on Monday March 14, 2016 from 4:45-8:45 PM.

[6] Including representatives of planning, police/fire, Town Highway Surveyor at a February 23, 2016 meeting.