



**GREEN INTERNATIONAL AFFILIATES, INC.**

239 LITTLETON ROAD, SUITE 3, WESTFORD, MA 01886  
TEL (978) 923-0400 FAX (978) 923-0404

April 28, 2017

Mr. Adam Duchesneau, AICP  
Town Planner  
Town of Boxborough  
29 Middle Road  
Boxborough, MA 01719

Subject: **Engineering Peer Review Services for  
Traffic Access at the Proposed  
“Regency at Boxborough” at  
800 Massachusetts Avenue**

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Dear Mr. Duchesneau:

On behalf of the Town of Boxborough, Green International Affiliates, Inc. (Green) is submitting this letter report of the findings from our engineering peer review of the application package for the proposed “Regency at Boxborough” at 800 Massachusetts Avenue. The scope of our review included a review of the traffic study and the proposed site plans, as they relate to vehicular access, pedestrian access, traffic circulation, and parking at the proposed site.

This review included an examination of the following documents submitted in support of the proposed project:

- Report titled “Traffic Impact and Access Study” – Regency at Boxborough, Massachusetts Avenue, Boxborough, Massachusetts”, prepared by Bayside Engineering, dated December 12, 2016; and
- Plan titled “Site Plan for Regency at Boxborough, 700-800 Massachusetts Avenue, Boxborough, Massachusetts”, prepared by Stamski and McNary, Inc., dated December 22, 2016 and containing 30 sheets.

The proposed project consists of the construction of 100 age-restricted townhouse units (two units in each of 50 duplex buildings). Access to the site is proposed to be provided by way of a driveway connecting with the south side of Massachusetts Avenue approximately 900 feet west of the intersection with Stow Road/Middle Road. An emergency access road is proposed to Stow Road.

In addition to the above documents, Green visited the project site and the surrounding roadways on March 2, 2017 to gain a better understanding of the existing conditions and the context of the proposed project. Our review evaluated the documents for consistency with MassDOT’s “Transportation Impact Assessment (TIA) Guidelines” (March 13, 2014), the guidelines published by the Institute of Transportation Engineers (ITE), typical industry practice for traffic studies, the Town of Boxborough’s Zoning Bylaw and Traffic and Parking Regulations. Also reviewed was the EOEA Certificate of the Secretary on the project, in which it was determined that an Environmental Impact Report (EIR) will be required and describes the scope.

In reviewing the traffic study, the following areas of study were evaluated for adequacy:

- Study area,
- Data collection,
- Traffic forecasts,
- Analysis results, and
- Access and proposed mitigation.

The following paragraphs summarize the review.

### **Study Area**

1. The TIAS included the following five study intersections:

- Massachusetts Avenue at Stow Road/Middle Road
- Massachusetts Avenue at Burroughs Road/Hill Street
- Stow Road at Sheriff's Meadow Driveway
- Stow Road at Burroughs Road
- Burroughs Road at Priests Lane

The study area and intersections included in the TIAS are reasonable for a development project of this size based on the amount of traffic expected to be generated by the development project, and is consistent with current MassDOT guidelines.

### **Data Collection**

2. Traffic count data were collected on weekdays from February 23-25, 2016 during appropriate time periods. The February data was increased by 7% to adjust for seasonal variation based on four MassDOT count stations located in Marlborough. While this is a reasonable methodology, we note that the monthly traffic volume data used to determine the seasonal adjustment is from the years 2005-2009 and reflects travel patterns during the recession. MassDOT provides more recent continuous count station data on their website. We noted that monthly traffic data are provided on Route 2 in Acton for the year 2016, and recommend that the applicant review the latest traffic volume data available to verify that a 7% seasonal adjustment factor is appropriate.
3. Crash data at the study intersections were presented from information provided by the MassDOT Highway Division Safety Management/Traffic Operations Unit for the five-year period, 2009-2013. Green notes that MassDOT released their 2014 crash data in July 2016, prior to the submission of the TIAS. We note that there was one crash at the Massachusetts Avenue/Stow Road/Middle Road intersection in 2014, two crashes at the Massachusetts Avenue/Burroughs Road/Hill Street intersection in 2014, and one crash at the Stow Road/Burroughs Road intersection in 2014. While the 2014 crash data indicates a small number of reported crashes, it would be useful to update Table 2 by adding in 2014 and deleting 2009 data.

### **Traffic Forecasts**

4. Future traffic volumes were projected seven years to the year 2023, consistent with MassDOT's TIA Guidelines. The future traffic volume projections included traffic from two other specific development projects noted in the Appendix (593 Massachusetts Avenue and Jefferson at Beaver Brook). Based on historical count data from the MassDOT, an annual background growth rate of 1% was also applied to the existing traffic volumes to develop the future volume forecasts. We concur with this methodology for future traffic volume projections.

5. The ITE Land Use Code 230 – Residential Condominium/Townhouse was used in the trip generation calculations. We note that the ITE Land Use Code 251 – Elderly Housing – Detached also could have been used since the proposed residences are age-restricted, but using Land Use Code 230 is acceptable and likely provides a conservative estimate of actual traffic conditions.

### **Network Development**

6. The TIAS used a trip distribution of 65% of project trips to and from the west and 35% to and from the east. Traffic to and from the east was then split further to and from the north and south at the Massachusetts Avenue / Stow Road / Middle Road intersection. The existing traffic patterns documented in the ATR and TMC data indicate that the trip distribution is closer to a 50/50 split between traffic to/from the east and the west including during the weekday peak commuting hours. This measured split is likely because Boston is a major destination to the east via Massachusetts Avenue and Route 2, while I-495 and the towns and cities along its length are significant traffic generators to the west.

However, it is noted that revising the trip distribution to a 50/50 split would only add nine (bidirectional) vehicle trips during each peak hour at the Massachusetts Avenue/Stow Road/Middle Road intersection and subtract nine (bidirectional) vehicle trips during each peak hour from the Massachusetts Avenue/Hill Road/Burroughs Road intersection. This change is unlikely to change any conclusions or recommendations reached in the TIAS.

### **Traffic Analysis**

7. In the intersection capacity analysis (Synchro) worksheets, all of the pages (including for the No-Build and Build analyses) were labeled “Existing” and none of the pages specified the peak hour (AM or PM) corresponding to the analysis. This makes it difficult to verify that the analysis results shown in Table 9 are correct. Furthermore, we suggest that all STOP-controlled movements be included in Table 9 (not just the movements from one side street approach) to facilitate a comparison of how these movements operate under Existing, No Build, and Build conditions.
8. There is a typographical error in the Synchro analysis for the eastbound right turn at the Massachusetts Avenue at Stow Road/Middle Road intersection under No-Build weekday afternoon peak hour conditions. The 18 right turning vehicles should be 28 right turning vehicles to be consistent with Figure 5. However, this would not have any significant effects on the results of the analysis as right turns are generally not a critical movement at unsignalized intersections.
9. In the intersection capacity analysis, different peak hour factors (PHF’s) were used for each approach. According to the HCM 6,<sup>1</sup> a single PHF based on peak hour traffic volumes at the entire intersection should be used for intersection capacity analyses. This is because it is unlikely that multiple approaches will experience peak volumes within the same 15-minute interval (within the peak hour). However, the applicant’s use of approach PHF’s for the analysis is also acceptable and generally results in a conservative analysis and actual operating conditions are likely to be better than stated.

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<sup>1</sup> Transportation Research Board, Highway Capacity Manual, 6<sup>th</sup> Edition, 2016.

10. Limited sight distance is of significant concern in allowing direct access to Massachusetts Avenue from the development project site at the proposed driveway location. Looking to/from the west, the TIAS notes that the available sight distance is 375 feet. Green verified the available sight distance to/from the west, and we generally concur with the measurement of 375 feet.

However, the TIAS did not consider the roadway grade when calculating minimum and desirable sight distances. Based on Figure 10 in the report, the roadway grade over the 375 feet shown is approximately 4 percent. For vehicles approaching from the west, this would increase the minimum required SSD at the 46 mph 85th percentile speed to 398 feet. **Therefore, when roadway grade is taken into consideration, the available stopping sight distance looking from the west does not meet the minimum distance for vehicles traveling at the 85<sup>th</sup> percentile speed.** Similarly, the desirable ISD looking to the west from the site driveway is 560 feet when considering the roadway grade. The applicant should evaluate the scope of the regrading work necessary to achieve acceptable ISD and SSD. The applicant should also confirm that it is not feasible to relocate the site drive intersection with Massachusetts Avenue to the east to improve sight distances looking toward and approaching from the west. Relocating the access point to the west is not advisable due to sight distance restrictions created by the horizontal and vertical curvature in that direction.

11. Green also verified the available sight distance at the proposed site driveway looking to/from the east. We note that the measured 375 feet of available sight distance documented in the TIAS is an estimate based on the anticipated future conditions, with the proposed regrading of a portion of the berm along the south side of Massachusetts Avenue.

While Figure 9 of the Traffic Impact and Access Study is drawn correctly to show SSD for vehicles approaching from the east, the **minimum required ISD** for drivers exiting the development project site driveway looking to the east must be provided as well. The minimum required ISD is the same as the minimum required SSD. An exiting driver's eyes are assumed to be positioned approximately 15 feet back from the edge of the traveled way and therefore, the sightline shown in Figure 9 needs to start at a point approximately 15 feet back from the edge of the traveled way at the proposed site driveway location. This may increase the area on-site that will need to be regraded and maintained for sight distance.

12. Related to the crash analysis and sight distance concerns in the proximity of the proposed site drive, it is recommended that the applicant evaluate crashes that occurred along a section of Massachusetts Avenue near the proposed site driveway location to determine if the proposed site driveway location would exacerbate any existing safety concerns. According to MassDOT's Crash Data Portal, several crashes occurred within 700 feet of the proposed site driveway location during the study period. The applicant should review recent crash reports near the proposed site driveway location, preferably from the local police department.

### **Proposed Mitigation**

13. The applicant has committed to constructing a sidewalk along the south side of Massachusetts Avenue between the Site Drive and the intersection with Stow Road/Middle Road to provide a pedestrian connection to existing sidewalks at that intersection.

Green recommends that the following additional pedestrian improvements be implemented to complete the pedestrian connections:

- Reconstruct the curb ramps on the southwest, southeast, and northeast corners of the intersection at the intersection of Massachusetts Avenue / Stow Road / Middle Road to be ADA-compliant.
- Restripe the marked crosswalk across the east leg of Massachusetts Avenue at the intersection with Stow Road and striping a crosswalk across Stow Road to provide high-visibility ladder-style markings.
- Provide pedestrian warning signage at the marked crosswalk across the east leg of the intersection facing each direction of Massachusetts Avenue traffic.

It is also recommended that the applicant remove the existing pedestrian crossing warning sign assembly approximately 90 feet west of the Massachusetts Avenue/Stow Road/Middle Road intersection since there is no marked crosswalk at that location. All of the pedestrian improvements within the Massachusetts Avenue layout will require MassDOT approval, as the roadway is under state jurisdiction.

### **Site Plan Review**

In addition to our review of the traffic study, we completed a review of the proposed site plan. This review primarily considered the site drive intersection with the public way, the internal roadway width, the movement of large vehicles, and the adequacy of the parking supply.

14. The applicant should provide vehicle turning paths to demonstrate that emergency vehicles (and other large vehicles) can safely and efficiently access the site and maneuver within the project site.
15. In addition to the primary site driveway, two emergency access roads are proposed to connect to Stow Road and Priest Lane. It is appropriate to provide multiple access points to a project of this size. The applicant should coordinate with the Town's public safety officials to ensure that the proposed emergency access roads are sufficient and satisfies any concerns raised by the Fire Chief.
16. Each unit is provided with a two-car garage, which meets Town Zoning Bylaw requirements. However, only 36 parking spaces are proposed at the clubhouse. This is not consistent with Town Zoning Bylaws Section 6006, which states that the minimum off-street parking ratio for clubs, lodges, and association buildings is one space per two memberships, which in this case would be 50 parking spaces for this site. We recommend that the applicant either revise the site plan or provide justification for the reduced parking supply.
17. At the clubhouse parking lot, the aisle circulation width and all parking space dimensions meet or exceed Town zoning requirements and typical industry practice. The applicant has also provided an appropriate number of accessible parking spaces.

18. The 24-foot-wide internal drives are consistent with Town Zoning Bylaw requirements.
19. With the internal roadway width of 24 feet, it is recommended that on-street parking be prohibited within the proposed development project at minimum on one side. Curbside parking along the internal roadways could inhibit or impact the flow of emergency vehicles as well as other movements. Areas of restricted on-street parking should be identified on the site plans. In addition to restricting on-street parking, the applicant could explore providing small areas of “visitor parking” scattered at strategic locations within the development. We recommend that the applicant install signs to communicate the parking restriction to residents and visitors of the site.
20. We recommend that the applicant provide bicycle parking adjacent to the clubhouse to encourage multimodality.

### **Conclusions and Recommendations**

In conclusion, the Applicant’s engineer has completed a traffic impact study for the proposed project and it has generally followed the appropriate methods and guidelines. However, there are some critical areas of analysis or plan development. The most significant of these pertains to the available sight distances along Massachusetts Avenue relative to the proposed site drive. These are noted below as well as may be stated in the above comments:

21. Provide a detailed plan evaluation including plan profiles of the stopping sight distances and the intersection sight distances in relation to the proposed site access drive. The applicant must clearly demonstrate that safety criteria is satisfied and if it requires proposed actions within the road layout or on the proposed development property, the type of work must be clearly defined.
22. Based on the applicant’s data and our research, this section of Massachusetts Avenue is characterized by relatively high travel speeds, sight distance constraints and has a crash history (to be further confirmed and evaluated by the Applicant’s engineer – see above comment). Actions that could improve the overall safety of this affected section of road and that could potentially become part of the project’s mitigation program should be given thought and outlined.
23. It is recommended that the applicant confirm that STOP lines and STOP signs are proposed at the following locations as they are shown but not clearly labeled on the plan:
  - Facing Private Drive C at the intersection with Private Drive A
  - Facing Private Drive A at the intersection with Private Drive B
24. At the proposed marked crosswalk across Private Drive A to the southeast of the intersection with Private Drive C, it is recommended that pedestrian crossing warning signage be installed facing each direction of traffic on Private Drive A, and ADA-compliant curb ramps with detectable warning panels. It is recommended that a crosswalk be striped across Private Drive A at the intersection with Private Drive B.
25. The applicant has committed to constructing a sidewalk network on one side of each internal street throughout the development project. It is recommended that a sidewalk be also constructed along the west side of Private Drive A between the clubhouse parking lot and the intersection with Massachusetts Avenue. A marked crosswalk could then be provided across Private Drive A at the intersection with Massachusetts Avenue to connect with the proposed sidewalk along the south side of Massachusetts Avenue easterly to the intersection with Stow Road. This would benefit

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**April 28, 2017**

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residents and visitors who may wish to walk from the clubhouse to downtown Boxborough, which is located to the east on Massachusetts Avenue.

26. The applicant should address the parking issues noted in the above comments including providing bicycle parking facilities at the clubhouse.
27. The applicant should confirm with the fire and police chiefs in regards to the manner of design and operations of the emergency access roadway.

Should you have any questions regarding this Peer Review please do not hesitate to contact me.

Sincerely,

***Green International Affiliates, Inc.***



Jason S. Sobel, P.E., PTOE  
Project Manager

cc: *W. Scully, Green International Affiliates*