

June 29, 2021

Ms. Jane Fisher Carlson, Chair
Weston Zoning Board of Appeals
Weston Town Hall
11 Town House Road
P.O. Box 378
Weston, MA 02493

Re: Residential Development – 40B
518-540 South Avenue, Weston, MA

Dear Ms. Carlson and Members of the Board:

On behalf of concerned abutters of the proposed 40B residential development at 518-540 South Avenue, I have reviewed traffic and site details for the proposed project.

Documents reviewed include:

- Updated Traffic Impact and Access Study (TIAS) by Vanasse & Associates, Inc., Revised May 2021
- Site Plans by Tetra Tech, dated 4/27/21
- Various comments submitted to the Weston Zoning Board of Appeals

In addition, I reference "A Policy on Geometric Design of Highways and Streets" by the American Association of State Highway and Transportation Officials (AASHTO) 7th Edition published in 2018 (AASHTO Guide). The AASHTO publications are the industry-standard guides used extensively in highway design.

I have also conducted a site inspection of South Avenue in the area of the proposed project, referred to below as the study area, and adjacent roadways.

Executive Summary

Although the proponent has prepared the impact report generally in compliance with the Institute of Transportation Engineers (ITE), Massachusetts Environmental Protection Act (MEPA), and industry standards, there are problems regarding the methodology and findings in some areas.

Study area: The study area chosen by the developer includes the immediate roadway system as shown below:

- South Avenue at Wellesley Street
- South Avenue at Highland Street
- South Avenue at Winter Street

Existing conditions: It appears the turning movement counts were conducted in March of 2019 and those peak hour volumes as shown on Figure 3 of the TIAS appear reasonable. The description of the roadway network adjacent to the site was well documented. The proponent has reviewed crash data through 2016. Although 2017 data is now available,

this data would not be expected to change the level of safety issues within the Route 30 corridor. Roadway geometry has been generally described but obstructions to good sight distance were not well documented in their report.

No-Build condition: In reviewing the Future No-Build volumes reported in the TIAS, it appears that volumes associated with the Riverside Campus redevelopment project as well as a one percent per year normal growth rate was adopted and is therefore acceptable.

Site trip generation and distribution: I concur with the proponent's directional distribution of new trips.

Operational capacity analysis: A review of the capacity calculation worksheets in the Appendix of the TIAS indicates that if signals are installed at the intersection of South Avenue and Winter Street, operational capacity would not be a problem at that intersection. However, the signalized intersection of South Avenue at Wellesley Street is inherently dangerous with long delay at an "F" level of service during both AM and PM peak hours. The Highland Street approach to South Avenue currently operates, and will continue to operate, at a poor "F" level during both peak hours. The site driveway itself is expected to operate at an "E" level at capacity during the morning peak hour and at a "D" level during the evening peak hour. This is a concern since a poor site driveway level of service and excessive delay often lead motorists leaving the site to accept shorter gaps than what would be considered safe and adequate in the South Avenue traffic stream, thereby creating a safety issue.

Sight distance at main site driveway: Sufficient stopping sight distance at the main site driveway (540 South Avenue) cannot be achieved without major widening and clearing southwest of the access driveway. Moreover, at the main site drive, the proponent should be designing for intersection sight distance of about 429 feet.

Offset of main site driveway with Highland Street: The proposed main site driveway at 540 South Avenue is approximately 180 feet from the Highland Street eastbound intersection with South Avenue. For safe operation, many designers require the minimum stopping sight distance to be met in this situation, and I recommend it here. For conditions in this area, that distance would be 360 feet.

Sight distance at emergency access driveway: Both stopping sight distance and intersection sight distance are deficient at the emergency access driveway (518 South Avenue). Additionally, the turning radius at this driveway does not appear sufficient to allow emergency vehicles to safely enter and exit the site.

The primary concerns of insufficient sight distance at both proposed site driveways, as well as the offset of the main site driveway with Highland Street, pose significant public safety issues. The remainder of this letter examines those deficiencies in more detail.

Existing Conditions

South Avenue is characterized as a rolling terrain with a combination of both horizontal and vertical curves in this area. The area of South Avenue in the vicinity of the proposed project site is characterized by a significant curvature of the roadway and a split intersection with Highland Street, with westbound traffic entering Highland Street via a branching off of South Avenue toward the right slightly west of the proposed main site driveway at 540 South Avenue, and eastbound traffic exiting Highland Street onto South Avenue via an intersection approximately 180 feet west of the proposed main site driveway.

A second site driveway located east of the main site drive is located at 518 South Avenue. This east site drive is designated as emergency access and is constrained by a stream and wetlands immediately to the east and a private property (526 South Avenue) immediately to the west.

Sight distance refers to the distance, measured from a point, along a road surface over which a driver of a vehicle has a clear, unobstructed view of stationary or moving objects in the roadway. It is relevant to drivers of vehicles on a roadway who must react to objects in the roadway (such as vehicles entering the roadway), as well as drivers in vehicles attempting to enter the roadway who must assess when it is safe to enter the roadway.

To assess existing conditions, I conducted a field measurement of existing sight distances at the proposed site driveways. I positioned a raised orange traffic cone 3 ½ feet high 14 ½ feet back (per AASHTO guidelines) from the southerly white edge line on the centerline of each of the proposed driveways. The pictures below show visuals of the existing sight distance west of the main site drive looking toward the east, and east of the emergency access drive (518 South Avenue) looking toward the west. The measurements of available existing sight distance were obtained by walking the arc of the roadway with a four-foot circumference measuring wheel and recording the wheel indicator's length. The field measurements of available existing sight distances I obtained are:

- West of main site driveway at 540 South Avenue (looking left from drive): **280 feet** of available sight distance
- East of main site driveway (looking right from drive): approximately **470 feet**
- West of emergency access driveway at 518 South Avenue (looking left from drive): approximately **400 feet**
- East of emergency access driveway (looking right from drive): approximately **200 feet**

The available sight distance at each site driveway is insufficient to meet standards outlined in the AASHTO Guide.



*Looking east to Main Site Drive (540 South Ave) with **existing 280 ft. of available sight distance***



Looking west to Site East Drive (518 South Ave) with **existing 200 ft. of available sight distance**

The east drive sight distance toward the west is inadequate and will require clearing within the right-of-way. A sight distance sketch should be provided for this location as well. This easterly drive is restricted by a stream which may prevent sufficient clearing. Moreover, the corner radius needs to be enlarged to accommodate vehicles making turns. State Law allows left-turning from driveways but does not specifically allow right-turning vehicles to cross the South Avenue double yellow line. That may be problematic without a sufficient corner radius. Although this site driveway is to be gated, it would not be safe for fire apparatus leaving the site without major improvements to the limited sight distance.

Technical Sight Distance Calculations

Stopping Sight Distance (SSD)

A critical aspect of sufficient sight distance is that an approaching vehicle on South Avenue must be able to stop in time to avoid making contact with a vehicle emerging from either a side street or a new residential driveway. This is known as stopping sight distance (SSD). For the proposed project, one must consider the SSD for vehicles on South Avenue encountering vehicles emerging from a site driveway. The required stopping sight distance is obtained from the AASHTO Guide.

The points at which sight distance is measured are critical. Page 9-43 of the AASHTO Guide states “The vertex (decision point) of the departure sight triangle on the minor road should be taken 4.4m [14.5 feet] from the edge of the major road traveled way”. The AASHTO Guide explains “This represents the typical position of the minor-road, or driveway, driver’s eye when a vehicle is stopped relatively close to the major road. Field observations of vehicle stopping positions found that, where needed, drivers will stop with the front of their vehicle 2.0 m [6.5 feet] or less from the edge of the major-road traveled way.” Further, on page 9-43 the AASHTO Guide states: “Measurements of passenger cars indicate that the distance from the front of the vehicle to the driver’s eye for the current U.S. passenger car population is nearly always 2.4 m [8 feet] or less.” Thus, we calculate the decision point of the departure sight triangle on the site driveways 14.5 feet from the edge of South Avenue.

Unlike the minimum safe stopping distance along a section of roadway, stopping sight distance at a minor street is not measured along either the center line or gutter line of a roadway. On page 9-35 of the AASHTO Guide, it is stated “If the available sight distance for an entering or crossing vehicle (at an intersection corner) is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions.”

Thus, the sight distance required for vehicles exiting either of the site driveways is directly related to the stopping sight distance for vehicles traveling on South Avenue. The departure sight triangle on the site driveway must show available sight distance that is at least equal to the appropriate stopping sight distance for vehicles traveling along South Avenue.

The calculation of SSD depends in part on vehicle speed. Notwithstanding the posted Speed Limit of 40 MPH, the State of Massachusetts website shows the Special Permitted speed in accordance with MGL Chapter 90, Section 18, on South Avenue is 45 miles per hour (mph). In the past, this Special Speed Limit was set by a representative of the State Department of Public Works travelling with an officer of the Massachusetts Registry of Motor Vehicles in a sedan equipped with a ball-bank indicator. With an understanding of the roadway's 85th percentile, they would drive the roadway with an eye on the ball-bank indicator to ensure the ball did not rise too high on the arc and they established a speed that was safe on roadways with horizontal curves.

In essence, the established Special Speed Limit of 45 was initially based on an 85th percentile years ago. Moreover, the proponent had acquired his 85th percentile speed from an Automatic Traffic Recorder (ATR) set by PDI, Inc. of Framingham, a very credible data provider.

In light of the proponents and State both using 45 mph, I feel that 45 mph should be adopted as the criteria for establishing sight distance requirements for any new driveway on South Avenue. This 85th percentile characteristic is commonly used as the roadway design speed. The 45 mph speed is applicable to both proposed site driveways.

The calculation of the SSD is as follows. The motorist leaving a side street or driveway has an eye height of 3.5 feet and he must be able to see another object (approaching vehicle) with a driver's height of 3.5 feet from a point 14.5 feet back from the travel way. The edge of vehicle travel way in this case is the white edge line or shoulder line. Therefore, the required stopping sight distance for the South Avenue driveways is computed based on the formula on page 3-5 of the AASHTO Guide as shown below:

$$d = \frac{5,280 \text{ ft } V t}{3,600 \text{ sec.}} + 1.075 \frac{V^2}{a}$$

Where: V = Speed (mph)

t = perception & Reaction time (2.5 seconds)

a = deceleration of vehicle (11.2 ft/sec.²)

An 85th percentile speed of 45 mph would require 360 feet stopping sight distance looking west or east as computed as follows:

$$d = 1.47 * 45 * 2.5 + 1.075 * \frac{(45)^2}{11.2}$$

$$d = 165.0 + 194.4 = 359.4 \text{ or } \mathbf{360 \text{ feet SSD required}}$$

Intersection Sight Distance (ISD)

This AASHTO Guide also identifies a characteristic called "Intersection Sight Distance or (ISD)". ISD is addressed in Chapter 9, Tables 9-6 and 9-8 of the AASHTO Guide for left and right turns respectively. On page 9-43, the AASHTO Guide states "Intersection sight distance criteria for stop-controlled intersections are longer than stopping sight distance to allow for the intersection to operate smoothly. Minor-road vehicle operators can wait until they can proceed safely without forcing a major-road vehicle to stop."

The ISD in each direction is calculated using the 85th percentile vehicle speed and the applicable time gap shown on either Table 9-6 or 9-8 in the AASHTO Guide, to comply with the roadway designers’ intention as follows:

$$ISD = 1.47 V_{Major} t_g$$

Where: V = roadway design speed or 85th percentile, and t_g = time gap for driveway maneuver
 T_g = 7.5 seconds for Left Turn from Stop, t_g = 6.5 seconds for Right Turn from Stop

Therefore, the Left-Turn (drivers looking toward the east) ISD = 495 feet
 Similarly, the Right-Turn (drivers looking toward the west) ISD = 429 feet

Thus, the minimum ISD for drivers looking east out of the site driveway is 495 feet, which provides for a 7.5 second time gap allowing for smooth and safe turns out of the site driveway. Similarly, the minimum ISD for drivers looking west out of the driveway is 429 feet, which provides for a 6.5 second time gap allowing for smooth and safe turns out of the site driveway.

Sight Distance Summary

The sight distance at each site driveway is summarized as follows (**insufficient sight distances highlighted**):

WEST SITE DRIVEWAY – 540 SOUTH AVENUE (MAIN SITE DRIVE)		
	West (Left) of Drive	East (Right) of Drive
Existing Available Distance (Field Measurements)	280 ft	≈ 470 ft
Required SSD	360 ft	360 ft
Minimum ISD	429 ft	495 ft

EAST SITE DRIVEWAY – 518 SOUTH AVENUE (EMERGENCY ACCESS)		
	West (Left) of Drive	East (Right) of Drive
Existing Available Distance (Field Measurements)	≈ 400 ft	≈ 200 ft
Required SSD	360 ft	360 ft
Minimum ISD	429 ft	495 ft

As can be seen in the previous tables, sight distance needs to be improved at both driveways. Given the roadway curvature, vehicle speeds, and varying topography, achieving adequate sight distance will be challenging. The proponent has offered to improve the stopping sight distance at the main site driveway, however, details submitted to date do not provide sufficient information to adequately assess the plans. Achieving a safe sight distance may require, in part, a significant removal of vegetation and grading contiguous to the edge of pavement in front of and/or upon private residential properties.

- I suggest the proponent identify the exact elevations and limits of stone walls to be removed to understand whether that measure would provide the site lines required to achieve a safe sight distance.
- Moreover, the emergency access drive (518 South Ave) sight distance toward the east is also inadequate and will also require clearing to achieve a safe sight distance. A sight distance plan showing changes to the proposed site driveway and surrounding configurations should be provided for this location as well.

Offset of Main Site Driveway from Highland Street

In discussing sight distance, the offset of the main site driveway at 540 South Avenue with the eastbound intersection of Highland Street and South Avenue must be considered. The new site driveway is only about 180 feet from the

eastbound Highland Street intersection with South Avenue. This limited distance will be problematic if two left-turning motorists emerged at the same time after looking to the right.

- Many designers require the minimum SSD of 360 feet between the intersections for safe operation, and I recommend it here.
- The proponent should provide detailed operational analysis of the interplay between these intersections.

Summary and Conclusion

Sight distance at both proposed site driveways is deficient and poses significant public safety issues. Both stopping sight distance (SSD) and intersection sight distance (ISD) must be met to ensure safe operations.

At the main site drive (540 South Avenue) sight distance is insufficient as follows:

- Existing available sight distance to the left (west) of the main site driveway is 280 feet.
 - Required SSD is 360 feet – ***80 feet deficient.***
 - ISD is 429 feet for drivers looking toward the left (west) – ***149 feet deficient.***
- Existing available sight distance to the right (east) of the main site driveway is approximately 470 feet.
 - ISD is 495 feet for drivers looking toward the right (east) – ***25 feet deficient.***

At the emergency access drive (518 South Avenue) sight distance is insufficient as follows:

- Existing available sight distance to the left (west) of the emergency access driveway is approximately 400 feet.
 - ISD is 429 feet for vehicles looking toward the left (west) – ***29 feet deficient.***
- Existing available sight distance to the right (east) of the emergency access driveway is 200 feet.
 - Required SSD is 360 feet – ***160 feet deficient.***
 - ISD is 495 feet for vehicles looking toward the right (east) – ***295 feet deficient.***

Insufficient distance exists between the main site drive and the intersection of Highland Street eastbound with South Avenue.

- Existing available distance between the site drive and Highland Street is approximately 180 feet.
- Many designers require SSD (in this situation 360 feet) for adequate safety, which I recommend – ***180 feet deficient.***

The proponent should provide more detailed analysis and plans to demonstrate how safe sight distances can be achieved at these locations.

Sincerely,
GILLON ASSOCIATES



John T. Gillon


