

# MEMORANDUM

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20 Beatrice Circle  
Belmont, MA 02478

May 18, 2021

To: Chairman Nicholas Iannuzzi  
Belmont Zoning Board of Appeals  
Office of Community Development  
Homer Municipal Building, 2<sup>nd</sup> Floor  
19 Moore Street  
Belmont, MA 02478

RE: 91 Beatrice Circle  
Transportation Peer Review & Applicant Response

Dear Chairman Iannuzzi and Members of the Belmont ZBA:

I share the common goal, with the Town of Belmont, and with the 91 Beatrice Circle applicant, that Belmont needs more affordable housing. And affordable housing must be safe for residents.

In their original application, the developer cited the American Association of State Highway and Transportation Officials' (AASHTO's) standard measures of traffic safety for required sight distances, which ensure adequate stopping ranges, and intersection safety, relative to the entrance to the proposed development (Comprehensive Permit Application, Nov. 20, 2020, TAB 17, Traffic Report, pp. 6-8).

The two nationally recognized measures of Stopping Sight Distance (SSD) and Intersection Sight Distance (ISD) are not in question. Both the developer and the traffic peer reviewer (BSC Group) use the same AASHTO standards. The applicant is not requesting a waiver from these standards: **all parties are in agreement that this national standard of safety must be met.**

In fact, the Code of Massachusetts Regulations, governing Chapter 40B development, notes that, if a proposal is denied, and appealed to the Housing Appeals Committee, a community may present evidence according to the Balancing Criterion, based on the Local Needs of the community. **Specifically, “the weight of the Local Concern will be commensurate with the degree to which the health and safety of occupants or municipal residents is imperiled.”**

(760 CMR 56.07.3.b.2)

The critical question is then: Are the sight distances sufficiently long to meet the AASHTO national standard of safety?

This question has two key elements: How is the minimum required stopping distance computed? And what are the available sight line distances?

### **Minimum Stopping Distances.**

In order to compute the Stopping Sight Distance, the Reaction Distance and Brake Distance are added together (as shown in the “Response to the Peer Traffic Review”, prepared by MDM Transportation Consultants, April 26th). Their derivations are in the “Sight Distance Calculations” appendix (pp. 28 and 29 of the pdf document). The formulas are from the AASHTO standards.

In these calculations, it is important to note that Reaction Distance increases when the travelling speed of cars on the road is higher, and that the Braking Distance increases the steeper the road is. The steepness of the road is measured by the grade of the road.

### **The assumption of a less steep road grade will result in a shorter required Braking Distance, and thus a shorter SSD.**

In response to the BSC peer traffic report, MDM computed the SSD by assuming a 7.2% road grade. They present Exhibits 1 and 2, in their reply, as evidence of the road grade determination. Assuming this road grade, along with an 85<sup>th</sup> percentile speed on the road of 48 mph, they compute an SSD of 454.8 feet. However, in the Comprehensive Permit application, the developers used a road grade steepness of 8%. (See the Comprehensive Permit Application, Supplemental Materials, Traffic Report-- Full, in the Attachments, pp. 39 and 40 of the pdf file; note that “Grade equals -0.08” means that an 8% grade was assumed.)

MDM states that the plans presented in Exhibits 1 and 2 of their reply are “based on supplemental ground survey along the Frontage Road and the proposed driveway grading.” The applicant does not provide convincing evidence as to why their assumption about road grade changed since their original application. No detail is provided as to how driveway grading has changed; in fact, in the original application, there are no plans measuring sight lines, and thus there is no basis for comparison of these supplemental plans. Further, Exhibits 1 and 2, which present diagrams of sight lines, have notes at the bottom that state that they are “intended for discussion purposes only; [they are] not intended for construction.” These drawings do not appear to be detailed surveys of the topology of the land, particularly on the approach to the site from the west. **I urge the Town to retain an external peer reviewer to conduct a professional survey of the road grade, as this measurement is a critical element of determining safe stopping distance.**

### **I re-calculated the minimum Stopping Sight Distance using the same 85<sup>th</sup> percentile speed as the developer’s representative (MDM), but changing the road grade to 8%, instead of 7.2%, and found that the *minimum required distance increases to 463.2 feet from 454.8 feet.***

(My calculations are in Appendix A of this memo.)

The Intersection Sight Distance (ISD) is a more straightforward calculation; it depends on the road speed and a standard time gap measure, but not on the road grade. In MDM’s response letter, using the 85<sup>th</sup> percentile speed of 48 mph, they state (on p. 31 of the pdf reply), that the formula indicates an ISD of approximately 440 feet. However, there appears to be a computational error in their equation. (See my calculations in Appendix B.)

### **I re-calculated the ISD, using the same assumptions on each value that MDM used, and found a *minimum required distance of 458.64 feet (as compared to their reported 440 feet).***

**Available Sight Lines.**

Once the required minimum sight distances are computed, they are compared to the Available Sight Line distances. In their response letter of April 26th, MDM uses the same plans (Exhibits 1 and 2, noted above), along with Exhibits 3 and 4, to demonstrate the SSD and ISD available distances. For both measures, MDM claims, in the plans, that the available sight distance is 475 feet. However, on p. 5 of their letter, MDM describes the speed data collection process in April, by the independent third party Precision Data Industries (PDI), as having been conducted “approximately 450 feet west of the driveway”, noting “This measurement location corresponds to the available sight line for vehicles approaching the site driveway and is consistent with the measurement position” that MDM used in their own earlier traffic study.

The external peer reviewer (BSC), however, in their report of March 29th (p. 4), states that “[o]ur site visit indicates that available sight distance is approximately 435 feet.”

*Even by the minimum sight distances reported by MDM, the peer reviewer’s estimate of available sight distance does not meet the minimum AASHTO distance requirements.*

**I urge the Town to obtain an external, independent peer review, to verify the applicant’s claim, as shown in Exhibits 1-4, of an available sight distance of 475 feet.**

In my view, this analysis should involve a professional topographic survey, including representation of the land elevations and natural land features. These important measurements and contextual information are notably absent in the plans presented by MDM (Exhibits 1-4), especially for the property immediately abutting the site to the west. In fact, the plans suggest a clear line of sight from the top of Beatrice Circle to the site. For your reference, I have included a photo, taken from my car, approaching the top of Beatrice Circle along the Frontage Road.

While MDM’s plans do not precisely indicate where they propose the available sight line begins, as their plans are for discussion purposes only (as noted previously), **the picture I’ve included in Appendix C shows the importance of accurately accounting for, and measuring, the road grade, curvature, topography, natural vegetation and other barriers to sight lines, in determining an accurate measure of available sight distances approaching the site.**

Safe sight distances are established to allow sufficient stopping ranges for drivers to prevent collisions. Nationally established standards provide the benchmarks for determining whether these distance requirements are met. The developer agrees with these standards.

**I urge the Zoning Board of Appeals to seek external peer review to verify the road grade, and the available sight distance,** as these are absolutely critical elements of ensuring that the industry-standard level of safety is met for the future residents of this development.

If these national standards are not satisfied, I urge the Board to deny the Comprehensive Permit for this project.

## Appendix A. Computation of Stopping Sight Distance, with 8% Grade Assumption

Formula to find SSD

SSD = Reaction Distance + Brake Distance

Reaction Distance =  $1.47 \times t \times V$

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

Variable Definitions:

t = reaction time (sec)

V = travel speed

G = roadway grade

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

Inputs (from MDM Response Memo, April 26<sup>th</sup>, p. 29 of pdf file)

V is 48 mph (from Precision Data Industries speed survey, 85<sup>th</sup> percentile)

t is 2.5

a is 11.2

Change in assumption:

G is -0.080 (instead of -0.072)

Computations:

Brake Distance =  $(48)^2 / (30((11.2/32.2) - .08)) = 286.8$

Reaction Distance =  $1.47 \times 2.5 \times 48 = 176.4$

SSD =  $286.8 + 176.4$

**SSD = 463.2 feet, with 8% grade**

## Appendix B. Error in Calculating Intersection Sight Distance in MDM Response Letter

See April 26, 2021 response, pdf file p. 31

The MDM equation states:

ISD =  $1.47 \times 48 \times 6.5$

This formula is correct for computing ISD. MDM states this equals 440 feet.

However, when calculated, this product equals 458.64.

**Thus, ISD is 458.64 feet, rather than the reported 440 feet.**





**Appendix C. Approaching Top of Beatrice Circle (Arrow Indicates Top of Beatrice Circle)**