1. **Existing Guide Rail Type:** The existing SBGR system is 99.06 m in length (26 standard rail elements)and consists of a standard wooden post system with wooden offset blocks with post spacing at 1.905 m.

2. **Existing Guide Rail Condition:** The existing SBGR is in overall poor condition with corrosion of rails, rotting of wooden posts / offset blocks, and significant post rotation and heaving. The guide rail requires replacement.

3. **Existing Vegetation:** There is some dense vegetation located along the backside of the existing SBGR installation that could impact performance of the system during an impact.

4. **Residential Fencing:** There is a homemade driftwood fence attached to the backside of the existing wooden SBGR posts for approximately 26.67 m length (attached to 15 SBGR posts); this will need to be removed as part of the SBGR removal. You confirmed that you have already discussed the removal of this fencing with the property owner.

5. **Roadside Hazards:** North of the existing SBGR installation there is a hydro pole (O/S 2.4 m from EP) and two CSP crossing culverts (O/S 2.2 m from EP) located within the desirable clear zone offset. The SBGR could be extended to shield these roadside hazards.

The following points highlight the proposed design assessment:

1. **Design Speed:** According to City of Mississauga Standard No. 2211.010, Geometric Design Standards for Roads, the design speed for a local residential road is 50 km/h; this design speed will be used to confirm the guide rail design.

2. **Desirable Clear Zone Offset:** MTO RDM Table 2-2: Desirable Clear Zone Values: For Design Speed of 60 km/h or less, desirable clear zone = 3 m for AADT < 750.

3. **Hazard Identification for Length of Need (LON) Confirmation:**

    a. Second Line West is a two-lane undivided roadway; traffic in both directions would be considered for LON
    b. The west roadside is beyond the desirable clear zone offset for northbound traffic since the southbound lane width, 3 m, is equal to the desirable clear zone offset. Therefore, roadside hazards will only be assessed for southbound traffic
    c. The Severity Index (SI) for SBGR is 2.1 for a Design Speed = 50 km/h per MTO RDM page A-57
    d. Foreslopes that are steeper than 3H:1V are considered to be "critical slopes" and may require shielding depending on the SI based on height and design speed because run-off-road vehicles have a higher probability of rolling over
    e. Along the existing SBGR installation, the foreslopes are steeper than 3H:1V up to approximately 2H:1V
    f. The Severity Index for a 2H:1V foreslope is 2.1 for a height of 0.3 m and 2.2 for a height of 0.6 m; therefore, the beginning point for length of need should be the point where the 2H:1V foreslope exceeds a height of 0.6 m (foreslope SI > SBGR SI)
    g. Based on a review of the design cross sections the slope steeper than 3H:1V extends northerly to approximately Sta. 1+340

4. LON Calculation for Embankment Slope

a. Approach End Only (southbound traffic): La = E(1 – A/B)
    i. E = Runout Length per MTO RDM Table 2-15 = 21 m
    ii. A = Distance from Edge of Travel Way to Face of Barrier = 0.1 m (proposed SBGR is right at the edge of lane with no offset)
    iii. B = Distance from Edge of Travel Way to Back of Obstacle or Area of Concern. B should not exceed Desirable Clear Zone according to Table 2-2 = 1.5 m to bottom of slope at Sta. 1+340
b. La = 21 (1 – 0.1 / 1.5) = 19.6 m
c. New SBGR needs to be extended a minimum of 19.6 m

5. LON Calculation for Hydro Pole at Sta. 1+360

The proposed extension would place the end terminal adjacent to an existing hydro pole. Since Steel Beam Energy Attenuating Terminals (SBEATs) are "gating" systems, a vehicle impacting the system on an angle near the end of the system will "gate" or pass through into the area behind the SBEAT. As such, this area should be traversable and free of fixed objects. The hydro pole should be relocated or the SBEAT should be shifted further upstream based on the LON for the hydro pole:

a. Approach End Only (southbound traffic): La = E(1 – A/B)
    i. E = Runout Length per MTO RDM Table 2-15 = 21 m
    ii. A = Distance from Edge of Travel Way to Face of Barrier = 0.1 m (proposed SBGR is right at the edge of lane with no offset)
    iii. B = Distance from Edge of Travel Way to Back of Obstacle or Area of Concern. B should not exceed Desirable Clear Zone according to Table 2-2 = 2.625 m to back of hydro pole at Sta. 1+360
b. La = 21 (1 – 0.1 / 2.625) = 20.2 m
c. New SBGR needs to be extended a minimum of 20.2 m

6. LON Calculation for CSP Crossing Culverts at Sta. 1+380

The proposed extension would place the end terminal adjacent to existing CSP crossing culverts. Since Steel Beam Energy Attenuating Terminals (SBEATs) are "gating" systems, a vehicle impacting the system on an angle near the end of the system will "gate" or pass through into the area behind the SBEAT. As such, this area should be traversable and free of fixed objects. The SBEAT should be shifted further upstream based on the LON for the CSP crossing culverts:

a. Approach End Only (southbound traffic): La = E(1 – A/B)
    i. E = Runout Length per MTO RDM Table 2-15 = 21 m
    ii. A = Distance from Edge of Travel Way to Face of Barrier = 0.1 m (proposed SBGR is right at the edge of lane with no offset)
    iii. B = Distance from Edge of Travel Way to Back of Obstacle or Area of Concern. B should not exceed Desirable Clear Zone according to Table 2-2 = 3.0 m since CSPs extend beyond the desirable clear zone
b. La = 21 (1 – 0.1 / 3.0) = 20.3 m

c. New SBGR needs to be extended a minimum of 20.3 m

7. Approach End SBEAT Location:

Based on the LON analysis completed above, the SBGR should be extended to approximately Sta. 1+400. The approach SBEAT should be placed in advance of Sta. 1+400. Based on a review of the proposed design cross sections, this is an ideal location for the SBEAT based on the traversable foreslope at this location. Delineation of the SBEAT should be provided according to OPSD 984.201. The system will be installed at a 50:1 flare rate to position the impact head off the travelled portion of the roadway (i.e., 0.3 m offset at Post 1). The City's preference is to install a MASH SoftStop terminal due to its narrower cross section at the impact head relative to other options.

8. Leaving End SBEAT Location:

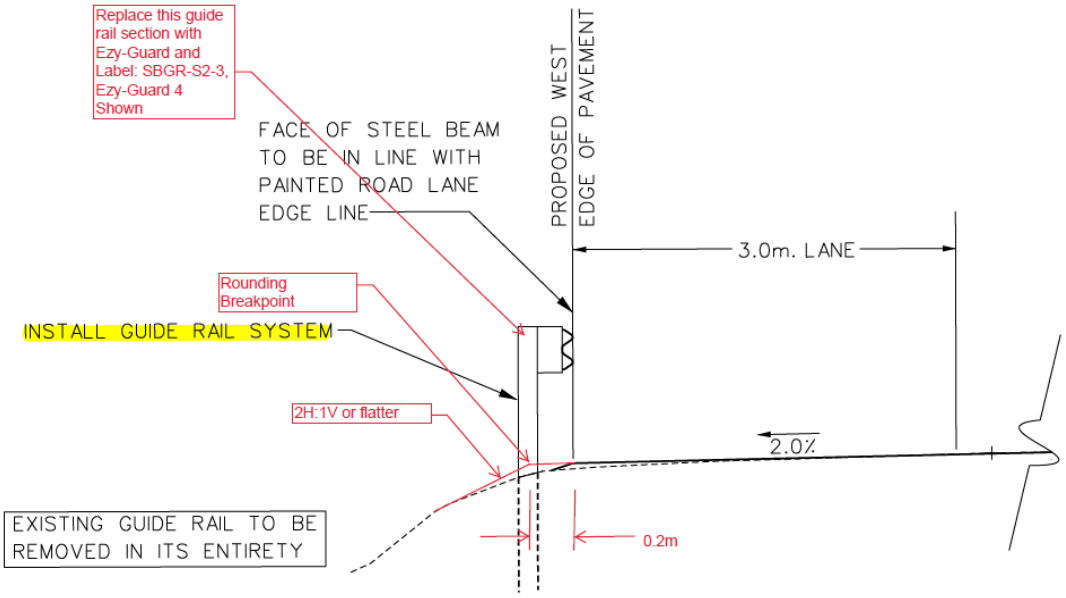
The proposed SBGR installation will end at the private driveway entrance located at 7080 Second Line West. A crashworthy end terminal is recommended for the leaving end of guide rail installations for two-way undivided roadways. It is recommended that the SBEAT be positioned to allow sufficient space between the end of the SBEAT and the driveway for the installation of an object marker and snow plow marker sign post, 2 m downstream of the system's impact head according to OPSD 984.202. The system will be installed at a 50:1 flare rate to position the impact head off the travelled portion of the roadway (i.e., 0.3 m offset at Post 1). The City's preference is to install a MASH SoftStop terminal due to its narrower cross section at the impact head relative to other options.

9. Selection of Guide Rail Type / Guide Rail Offset:

Sheet 4 of the contract drawing set includes a typical "Guide Rail Detail" (cross section taken at Sta. 1+280). This detail shows the guide rail post installed on a slope, which is not acceptable according to current standards. In addition, the proposed surface drops off abruptly in front of the guide rail. Generally, the surface in front of the guide rail post should be a maximum of 10%.

To accommodate the field conditions, it is recommended that a blockless SBGR system be used to accommodate the narrow roadway platform resulting from the proposed cross section. The blockless SBGR systems are 200 mm in width. The post for the blockless system must remain on the traffic side of the rounding breakpoint. Currently, there are two blockless SBGR systems accepted for use by MTO: Ezy-Guard 4 and ACP Sentry. Borth systems meet AASHTO MASH Test Level 3. We will reference the current MTO Standard Special Provision (SSP) 721S09 to specify the blockless SBGR systems and this will be noted on the drawing.

It is recommended that the "Guide Rail Detail" on Sheet 4 be updated to reflect the blockless SBGR system. In addition, it is recommended that the proposed cross sections be updated to provide a minimum 0.2 m extension of the roadway platform with granular A shouldering and 2H:1V slope to tie into existing slope. SRE will include an updated version of the typical section below as part of our drawing set per the markups noted below.



The following is a brief summary of the design:

- Installation of 137 m of MASH Blockless SBGR including post mounted reflectors from Sta. 1+258 to Sta. 1+395
- Installation of two 15 m long MASH SoftStop End Terminals from Sta. 1+395 to Sta. 1+410 and from Sta. 1+243 to Sta. 1+258
- Installation object marker and snow plow marker signs in advance of the end terminal systems

SRE will prepare the SBGR installation contract drawings on SRE plates that will be referenced from the main contract sheets as part of the contract addendum. The tender items, specification references, and quantities for the SBGR installation will be summarized in a spreadsheet for submission with the drawings.

Should you have any questions or concerns, please do not hesitate to contact me.

Kind Regards,

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