NEW YORK STATE OF OPPORTUNITY. Department of Transportation	ENGINEERING INSTRUCTION	EI 23-029

Title: **GUIDANCE ON THE USE OF 4-CABLE MID-TENSION CABLE GUIDE RAIL**

SUPERSEDED BY EB 26-015 EFFECTIVE 12/31/26

Approved:

Richard D. Wilder, P.E.
Deputy Chief Engineer, Design

12/21/2023
Date

ADMINISTRATIVE INFORMATION:

- Effective Date: This Engineering Instruction (EI) is effective beginning with projects submitted for the letting on or after May 1, 2024.
- Superseded Issuances: This EI supersedes EI 22-017, "*NYSDOT Mid-Tension Cable Barrier – Design Guidance*".
- Superseded Shelf Notes/Special Notes: None
- Disposition of Issued Materials: The guidance on the use of mid-tension cable guide rail will be incorporated into Chapter 10 of Highway Design Manual as part of a subsequent HDM update.
- This EI is being issued in conjunction with EI 23-031, "*Revisions to Standard Sheet 606-03 – 4-Cable Mid-Tension Cable Guide Rail"* and EI 23-030, "*Specifications for the Use of 4-Cable Mid-Tension Cable Guide Rail".*

PURPOSE: To issue guidance on the use of mid-tension cable guide rail and its MASH-compliant terminal.

TECHNICAL INFORMATION:

New Information

- Crash-testing research sponsored by NYSDOT recently resulted in the development of a MASH-compliant, TL-3 terminal for our Mid-Tension Cable Guide Rail system. The TL-3 designation indicates the system has been evaluated for 62 mph impacts and is considered acceptable for use on high-speed highways.

Overview:

- The Department has developed a MASH-compliant cable guide rail run. The NYSDOT 38-inch cable barrier is a non-proprietary medium-tension cable barrier for use in TL-3, TL-2, or TL-1 situations. Effectively, its use is not restricted by design speed.
- The run has four cables spaced 7 inches apart vertically with the top cable at a height of 38 inches. The normal post spacing is ten feet.
- The system is classified as a mid-tension system as the tension in each cable is to be 1370 pounds for temperatures between 70 and 79 degrees, while the tensions for proprietary high-tension cable systems in that temperature range are 3500 to 5200 pounds.
- The 4-cable mid-tension cable guide rail does not use spring compensators.

Deflection:

- The 4-cable mid-tension cable run has been successfully MASH tested to TL-3 and had a working width deflection of 9 feet for a 10-foot post spacing.
- The TL-3 deflection for a five-foot post spacing may be conservatively assumed to be 7 feet.

Length:

- The minimum length of the total cable run, between the outer ends of the terminals should be no less than 500 feet.
- The maximum length of a cable run should be no more than 2,000 feet. In the past, longer runs were achieved by interlacing ends. However, such an interlaced transition has not yet been designed or crash tested.

Curvature:

- The 4-cable mid-tension guide rail should not be used on roads with horizontal curvature of *less* than 440 feet.

Terminals:

- There are two terminal options for the 4-Cable Mid-Tension Cable Guide Rail.
    a. Approach End Terminal – This twelve-post cable-releasing terminal has been successfully tested for the full range of MASH impact directions. It should be used whenever the terminal will be within the clear zone for traffic approaching the run. This terminal includes an upright cable-release lever. When struck, this lever pries the cable ends out of the anchor bracket so the inclined cables will not be able to act as a ramp which might lift small cars and increase the chances of them proceeding to a rollover.
    b. Departure End Terminal – This two-post terminal has only been tested for vehicles departing the run. Therefore, it should only be used on the downstream ends of cable runs on one-way highways or where the terminal will be outside the clear zone for opposite direction traffic.

Anchor Blocks:

- The previously recommended large anchor block design for all mid-tension cable runs has been temporarily set aside. Crash testing was conducted using the normal anchor blocks which have a 4'-9" by 3'- 9" base with inclined sides, a height of 3', with an anchor bolt pattern that is different from the 3-cable guide rail's anchor block design.
- Crash testing with a 5000-pound pickup impacting the cable run at a speed of 62 mph and an angle of 25 degrees did not cause any appreciable movement of the anchor blocks. However, if designers are concerned about potential movement due to weak, sandy soils, high water tables, or an increased likelihood of large truck impacts, the excavation space of minimum of one foot surrounding the anchor blocks may be backfilled with dry-mix concrete to improve the fixity of the block. A special specification will be needed to pay for such an anchor block. Real life crashes involving large trucks have shown that the cables are not likely to release from the end anchors.

Cost:

- The generic 4-cable mid-tension cable guide rail used with the new generic terminals is expected to be less than the cost of proprietary 4-cable systems.
- for TL-2, the 4-cable system will still be significantly less expensive than Box Beam or Heavy-Post Blocked-Out (HPBO) corrugated beam guide rail. The four-cable TL-3 system

is estimated to be less than a third of the cost of box beam and less than half the cost of HPBO.

- Due to the large cost differential and the improved capturing behavior of the cable guide rail, designers are encouraged to use cable guide rail when:
    a. The location will accommodate its deflection,
    b. Impacts are not expected to be frequent (AADT<25,000), and
    c. The amount of heavy vehicular traffic is not high. e.g. less than 5% trucks.

Traditional 3-Cable Guide Rail:

- The 606-01 Standard Sheets show the previous 29-inch-tall, three-cable NYSDOT cable design. This will remain acceptable for use on TL-2 (where the posted speed limit is 35 to 45 mph) and TL-1 roads.
- The traditional transition between box beam and 3-cable guide rail may be used for locations where the posted speed is 45 mph or less. The details are included on Standard Sheet 606-19, sheet 1.

Cable Guide Rail Usage Guidelines:

<table>
<tr><th>Activity/Project Type</th><th>Posted Speed ≤ 45 mph</th><th>Posted Speed > 45 mph</th></tr>
<tr><td>Impact Repair on 3-cable Run w/o Anchor Reset</td><td colspan="2">Repair in kind</td></tr>
<tr><td>Repair Needing Anchor Reset</td><td>Repair in kind</td><td>Use MASH-compliant system*</td></tr>
<tr><td>1R</td><td colspan="2">Retain 3-Cable</td></tr>
<tr><td>2R, 3R on Freeway</td><td colspan="2">Use a MASH-compliant System</td></tr>
<tr><td rowspan="3">2R, 3R
Non-Freeways</td><td rowspan="3">Retain 3-Cable</td><td>AADT>2000, use MASH*</td></tr>
<tr><td>New Anchor or 50% posts replaced, use MASH*</td></tr>
<tr><td>Keep Anchor and <50% posts replaced, retain 3-Cable</td></tr>
</table>

*Use MASH compliant system, whether cable or other.

Cable Median Barriers

- A new generic 4-Cable Mid-Tension Cable Median Barrier design is being evaluated. It is anticipated that it will have more deflection than the roadside design. Until that system has been evaluated and guidance issued, designers should specify a proprietary high-tension cable median barrier where one is needed in a TL3 situation.

IMPLEMENTATION:

For contracts let with the Standard Specifications adopted January 1, 2024; the Engineer may authorize end terminal changes to the “Approach End/Departure End” terminals in accordance with the design guidance above and at no additional cost to the State and document the change in accordance with the Contract Administration Manual (CAM) §90 Record Keeping Procedures.

For projects submitted for the letting on or after May 1, 2024; Designers may begin specifying the “Approach End/Departure End” terminals in accordance with the design guidance above.

BACKGROUND: Due to the higher impact energies at higher speeds, crash testing indicated that

greater cable tension, an additional cable at a height of 38 inches, and closer post spacing were needed to reduce deflections and still prevent tripping of taller vehicles. Because these changes increased the cost of the resulting TL-3 tested, mid-tension, 4-cable cable guide rail system, it was decided to retain the three-cable system for use on the lower speed TL-2 highways. That earlier design had passed MASH TL-3 crash testing but with an unacceptable deflection distance due to the high impact speed. The Department will now have two generic cable guide rail designs. The mid-tension four-cable may be used for all speeds, while the three-cable should only be installed for highways with a posted speed of 45 mph or less.

CONTACT: Direct questions regarding this issuance to Terry Hale of the Design Quality Assurance Bureau at (518) 485-7009 or via e-mail at Terry.Hale@dot.ny.gov.