# Gregory Median End Terminal (GMET)


SafeDirection
CRASH BARRIER SOLUTIONS

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## Leading Safety

Successfully crash tested to MASH Test Level 3

Complies with AS/NZS 3845.1:2015 Road safety barrier systems and devices

Nil detached elements observed during full-scale crash testing

Seven (7) successful MASH compliant crash tests

## Superior Design

Narrow system width

No blocking pieces required

Same C-Post profile as RamShield® Median C-Posts

End-on impact energy is dissipated by slotted w-beam guardrails

Simple connection of the rail assemblies at each C-Post

Reduced post embedment depth when compared to other designs

All steel construction

## Compatibility

Same system width as RamShield® Median

Same system height as RamShield® Median

## Fast Assembly

C-Posts are driven directly into the ground

No soil plates required for installation of the C-Posts

## 1.0 Introduction

The Gregory Median End Terminal (GMET) is an energy-absorbing median end terminal, designed to minimise the severity of impacts occurring at the end of the guardrail safety barrier system.

Developed by Gregory Highway of the USA, the GMET has been successfully crash tested in accordance with MASH Test Level 3 and is designed for direct attachment to back-to-back w-beam guardrail, including RamShield® Median.

The narrow width of the GMET prevents encroachment into adjacent traffic lanes, an important design consideration for installation in narrow medians.

## 2.0 Specifications

| | |
|---|---|
| **Crash Test Compliance** | MASH Test Level 3 |
| **Classification** | Gating, Re-directive |
| **System Length** | 13.43 m |
| **System Height** | 800 mm |
| **System Width** | 320 mm |
| **Impact Head Width** | 460 mm |
| **Point of Need** | Post #3 |

## 3.0 How the GMET Functions

During end on collisions, the impact head engages the bumper of the errant vehicle. This activates the sliding action of the w-beam rail assemblies which are fabricated with slots designed to tear when contacted by the threaded rod assemblies installed at each C-Post. The C-Posts feature joggle tabs which provide controlled release of the w-beam rail assemblies. When contact by an errant vehicle, the C-Posts yield by bending proximate to ground level.

Two (2) cable assemblies are secured by the ground anchor at the nose of the terminal and run the full length of the system behind the w-beam rail assemblies. The cable assemblies contribute to the tensile strength of the system, providing safe vehicle containment and redirection throughout the length-of-need section.

Crash test impacts with the GMET resulted in nil detached elements, demonstrating suitability for installation at high-risk median sites. MASH impact assessment also recorded minimum vehicle compartment damage due to the energy absorbing characterises of the terminal.

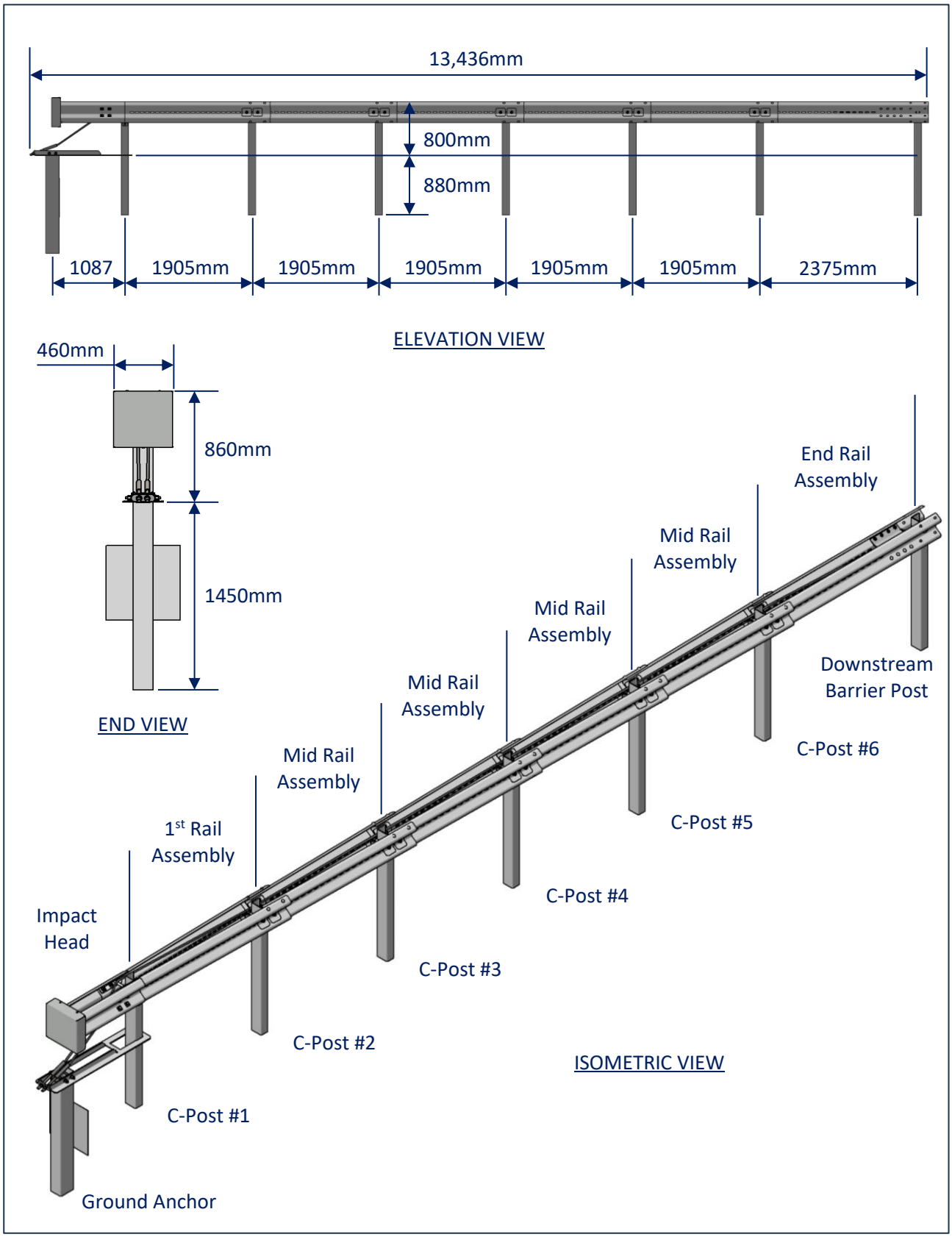



**Figure 1: GMET Layout**

## 4.0 Crash Test Performance

The GMET has been fully crash tested and evaluated according to the specifications for Test Level 3 (TL3) of the AASHTO Manual for Assessing Safety Hardware (MASH). The MASH specification is an update to and supersedes NCHRP Report 350 for the purposes of evaluating new safety hardware devices.

MASH is also the basis of testing procedures for road safety systems as stated in *AS/NZS 3845.1: 2015 Road Safety Barrier System and Devices.*

The introduction of MASH follows changes to the vehicle fleet, researching of real-life impact conditions and updated criteria for evaluating barrier performance.

The GMET is classified as a gating, re-directive terminal. Gating terminals are designed to allow vehicles impacting near the beginning or nose of the system to safely pass through the unit and travel behind the terminal.

The beginning length-of-need (BLON) is the location measured downstream from the nose of the terminal where vehicle redirection commences.

MASH TL3 crash testing is performed with a 1100kg passenger car (1100C) and 2270kg pick-up truck (2270P) travelling at 100km/h. Impacts with the 1100C primarily assesses occupant risk while the 2270P impacts evaluate the structural adequacy of the terminal.

**Table 1: GMET Crash Test Impacts**

| MASH Test Reference | Vehicle Type | Impact Speed | Impact Angle | Impact Location |
|---|---|---|---|---|
| 3-30 | 1100C | 100 km/h | 0 degrees | Nose of terminal, ¼ vehicle offset |
| 3-31 | 2270P | 100 km/h | 0 degrees | Nose of terminal, centreline of vehicle |
| 3-32 | 1100C | 100 km/h | 5 degrees | Nose of terminal |
| 3-33 | 2270P | 100 km/h | 5 degrees | Nose of terminal |
| 3-34 | 1100C | 100 km/h | 15 degrees | Critical impact point |
| 3-35 | 2270P | 100 km/h | 25 degrees | Beginning length of need |
| 3-37b | 1100C | 100 km/h | 25 degrees | Nose of terminal, reverse direction |

## 5.0 Material Traceability

Safe Direction operates a quality management system, independently certified to the requirements of ISO 9001:2015. A multi-stepped procedure is used by Safe Direction to verify the compliance of the material used in the production of GMET C-Posts and w-beam guardrail to AS/NZS 1594.

Mill certificates and independent third-party laboratory test results are verified against Australian Standard guidelines recording the steel heat numbers, mechanical results and chemical composition. Safe Direction product is then stamped during manufacture with a 4-digit number providing industry-leading traceability to the steel heat number. The format for stamping w-beam guardrails is:

Example: SD 9419 350 27

Where: SD = product from Safe Direction
9419 = the last 4 digits of the heat no.
350 = steel grade (i.e. HA 350)
27 = base metal thickness (i.e 2.7mm


**TEST CERTIFICATE** BLUESCOPE STEEL

### CHEMICAL ANALYSIS

Percentage of element by mass (L=Cast, P=Product, -S=Soluble, -T=Total, CF=Chemical Formula, n=Min, x=Max)

| Item No | Heat / Unit No | NATA Lab | L/P | C | P | Mn | Si | S | Ni | Cr | Mo | Cu | Al-T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | 6709419 | 0632 | L | .157 | .019 | .74 | <.005 | .015 | .016 | .035 | .004 | .042 | .034 |

| Item No | Heat / Unit No | NATA Lab | L/P | Ti | B-T | N | Nb | Sn | V | CF1 | CF2 | CF3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | 6709419 | 0632 | L | <.002 | <.0003 | .0045 | .001 | .002 | <.003 | .29 | .10 | .00 |

CF1=C+ (MN/6) + ((CR+MO+V)/5) + ((CU+NI)/15) CF2=NI + CR + CU + MO CF3=NB + TI + V

### MECHANICAL TESTING

**Tensile AS 1391**

| Item No | Heat No | Tested Unit | NATA Lab | Cat | Loc | THICK mm | ReH MPa | Rm MPa | Lo mm | ELONGN % |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | 6709419 | 1H1F9690 | 0631 | B | LQF | 2.70 | 420 | 520 | 80 | 25 |
| 0010 | 6709419 | 1H1F9845 | 0631 | B | LQF | 2.70 | 390 | 500 | 80 | 22 |

### ITEMS COVERED BY THIS CERTIFICATE

| Item No | Heat No | Ordered Dimensions (mm) | No of Units | Mass (Tonnes) | Unit Identities |
|---|---|---|---|---|---|
| 0010 | 6709419 | 740.0X2.70XCOIL | 6 | 24.030 | 1H1H9291AA 1H1H9291BA 1H1H9291CA 1H1H9291DA 1H1H9292AA 1H1H9292CA |

# 6.0 Set-Out

## 6.1 Site Grading Requirements

Grading around the area of a guardrail end terminal is an important consideration regardless of the specific terminal selected. The site grading should be considered from three perspectives; advance grading, adjacent grading and run-out grading.

### 6.1.1 Advance Grading

It is recommended that the area in advance of a terminal be limited to a grading of 10H:1V to ensure that the vehicle's suspension is neither extended nor compressed at the moment of impact.

### 6.1.2 Adjacent Grading

Adjacent grading refers to the surface on which the terminal is installed and the area immediately behind. It is recommended that this area be relatively flat (10H:1V) so that the terrain does not contribute to vehicle behaviour.

### 6.1.3 Run-Out Grading

Since all w-beam guardrail end terminals are gating, consideration should be given to the area parallel to and behind the safety barrier system. When struck at or near the nose at an angle, w-beam guardrail end terminals will typically yield, allowing a vehicle to continue into the area immediately behind and beyond the terminal.

The Austroads Safety Barrier Assessment Panel Technical Advice 21-003 recommends a run-out area be provided for all guardrail end terminals. The run-out area should:

- Contain no fixed hazards (e.g. poles and trees),
- Be traversable, with a lateral slope of 4:1 or flatter, and
- Measure 18.5m x 6m, measured from the point-of-need.

Generally, a risk evaluation would conclude that an end terminal installed without the required run-out area could be considered a lower risk than leaving a roadside hazard completely unshielded.

## 6.2 Point of Need

The MASH TL3 point-of-need is the location along the terminal that has demonstrated complete containment and re-direction of a 2,270kg pick-up truck travelling at 100km/h and impacting at 25°.

The GMET point-of-need is C-Post location 3, a distance of 4.9m downstream from the ground anchor.

## 6.3 Kerbs

Placing kerbs in front of terminals on high-speed roads is not recommended. As an alternative, a shallow gutter in front of the terminal or subsurface grated drainage should be considered.

If placement of the terminal behind a kerb cannot be avoided, all system components must be free to operate as per crash test conditions.

## 6.4 Placement on Curves

When the GMET is installed at the end of a median guardrail system following a curved alignment, the GMET must be installed along a straight alignment (using straight rails) over the length of the terminal.

## 6.5 Length between Terminals

To perform satisfactorily, safety barriers must have sufficient length to enable vehicle redirection. In addition, barrier terminals require sufficient support to perform (i.e. absorb energy) as designed and tested.

The Austroads Safety Barrier Assessment Panel Technical Advice 21-002 recommends a practical minimum length of 28m length-of-need for MASH TL3 w-beam safety barrier systems.

For roadways where 70km/h impacts are expected, the practical minimum length can be reduced to 24m.

## 6.6 Design Life

The durability of the finished hot dip galvanized coating is a function of the environment to which the article is exposed. According to industry standards, hot-dip galvanized coatings can last up to 50 years in rural environments and up to 25 years in more corrosive environments, such as coastal regions. These estimates are based on average environmental conditions, and the actual lifespan of a galvanized coating will depend on the specific conditions it is exposed to.

Example: The GMET C-Posts #2 to #6 have a thickness of 4.3mm. Hot dip galvanising will provide a minimum average coating thickness of 70µm. When installed in a C3 environment, the coating will provide approximately 33 years until first maintenance.

**Table 2: Coating Thicknesses, AS/NZS 4680**

| Article Thickness, mm | Average Coating Thickness, µm | Average Coating Mass, g/m$^2$ |
|---|---|---|
| ≤ 1.5 | 45 | 320 |
| > 1.5 ≤ 3 | 55 | 390 |
| > 3 ≤ 6 | 70 | 500 |
| > 6 | 80 | 600 |

**Table 3: Corrosivity Classifications, AS 4312**

| Corrosivity Category | |
|---|---|
| CX | Severe Surf Shoreline |
| C5 | Surf Seashore |
| C4 | Calm Seashore |
| C3 | Coastal |
| C2 | Arid/Urban Inland |
| C1 | Dry Indoors |

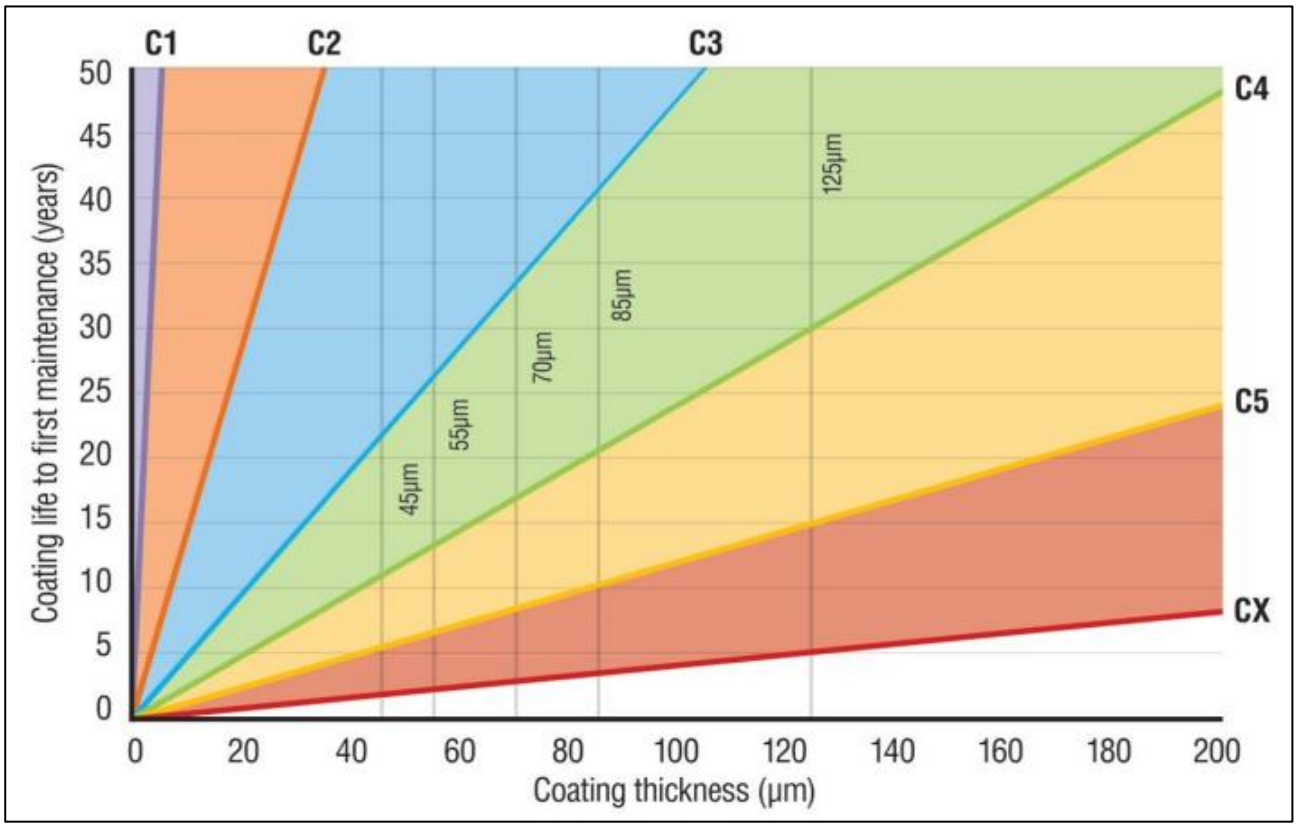
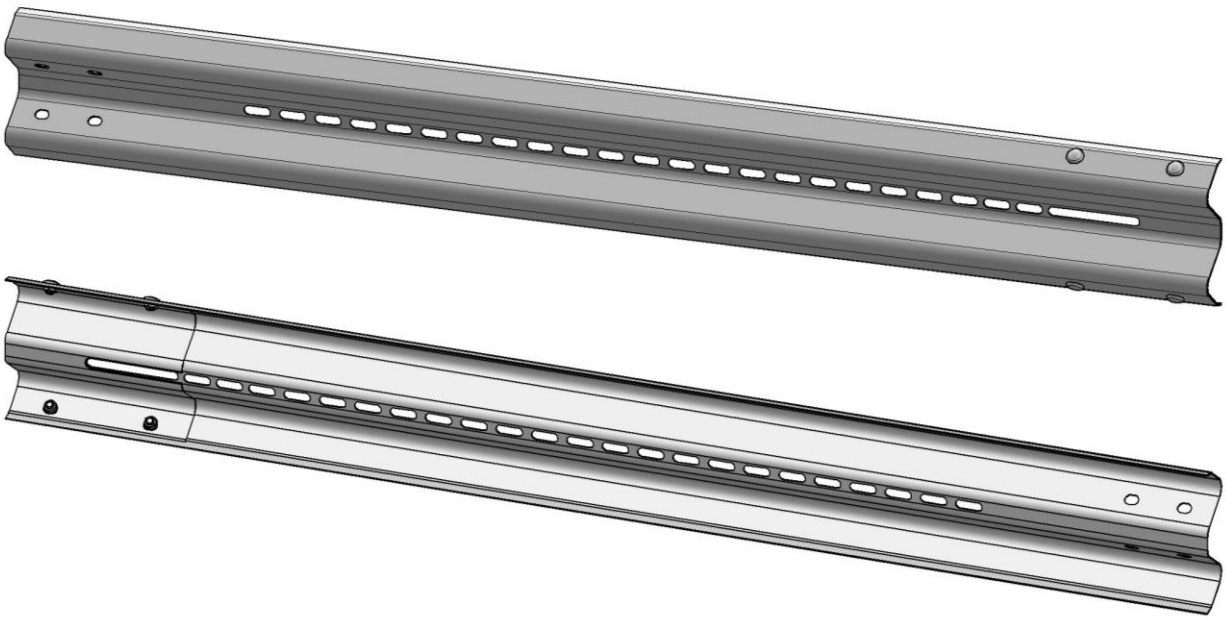



**Figure 2: Calculated Corrosivity Rates for Hot Dip Galvanised Coatings, AS/NZS 2312.2**

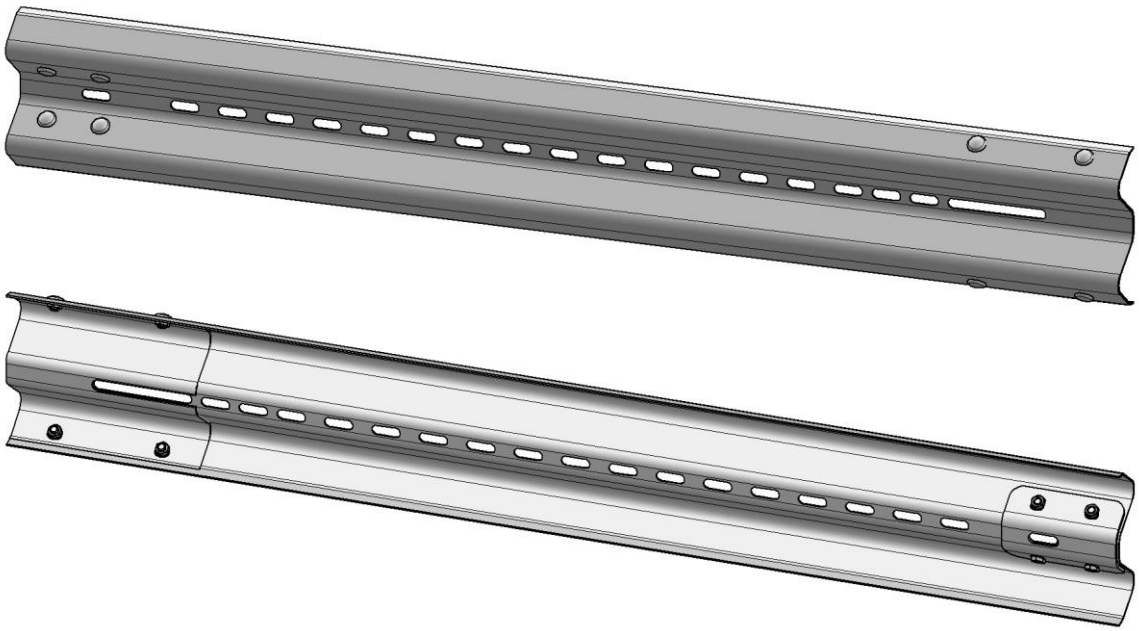
## 7.0 Bill of Materials

| Item Description | Item Quantity | Unit Weight (kg) |
|---|---|---|
| End Rail Assembly | 2 | 35.8 |
| Mid Rail Assembly | 8 | 28.6 |
| First Rail Assembly | 2 | 29.5 |
| Impact Head Assembly | 1 | 34.9 |
| Impact Head Cover | 1 | 4.1 |
| Cable Assembly Brace | 1 | 3.6 |
| Ground Anchor Post | 1 | 53.2 |
| Ground Anchor Assembly | 1 | 27.2 |
| Cable End Plate | 1 | 1.1 |
| Cable Assembly | 2 | 21.5 |
| Cable Anchor Bracket | 2 | 5.9 |
| C-Posts #2 to #6 | 5 | 20.9 |
| C-Post #1 | 1 | 15.0 |
| Joggle Tab | 10 | 0.1 |
| Slider | 20 | 1.0 |
| C-Post Angle Bracket | 2 | 0.2 |
| M20 x 270mm Threaded Rod, Grade 8.8 | 12 | 0.5 |
| Pipe Sleeve, 20 NB x 125mm | 10 | 0.3 |
| M20 Flanged Nuts | 24 | 0.1 |
| M16 x 50mm Hex Head Bolt/Nut | 8 | 0.2 |
| M16 Square Washer | 16 | 0.1 |
| M16 Round Washer | 16 | 0.1 |
| M16 x 32mm Mushroom Splice Bolt/Nut | 16 | 0.2 |
| M12 x 40mm Hex Bolt/Nut/Washer | 2 | 0.1 |
| M8 x 25mm Cup Head Bolt/Nut/Washer | 10 | 0.1 |
| M8 x 16mm Hex Set Screw | 3 | 0.1 |
| | **Total Mass** | **699 kg** |

## 8.0 Component Identification

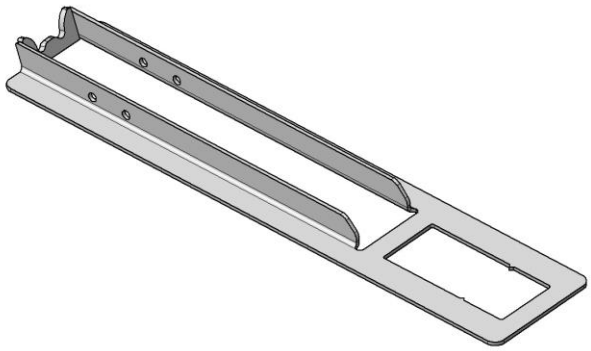


First Rail Assembly

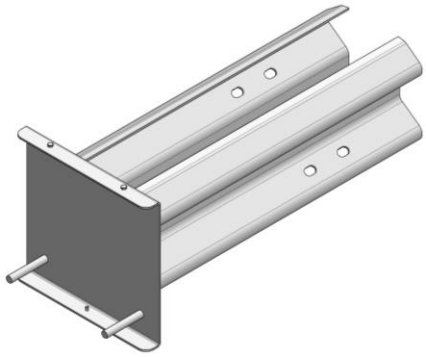


Mid Rail Assembly

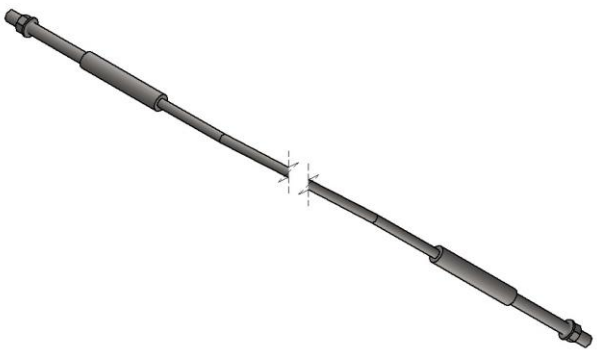
End Rail Assembly



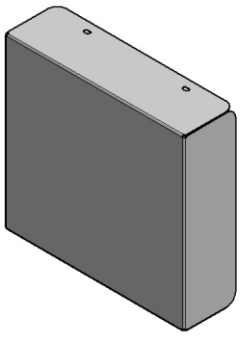
Ground Anchor Assembly



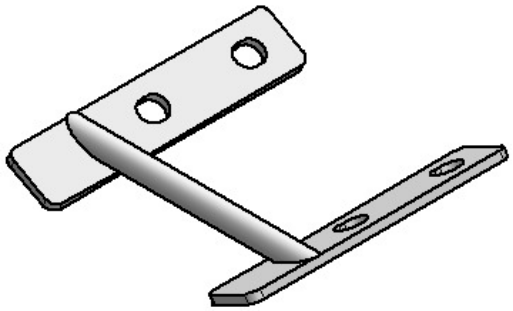
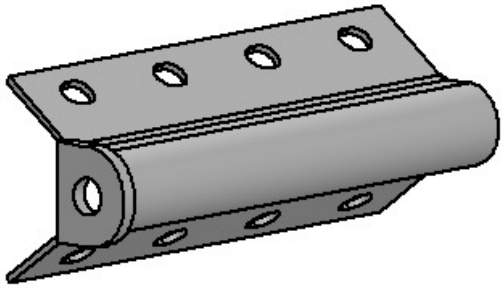
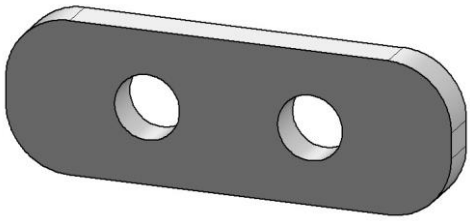
Impact Head Assembly

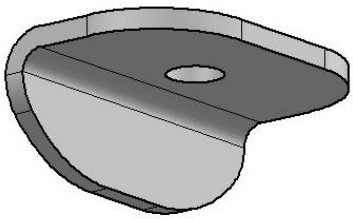
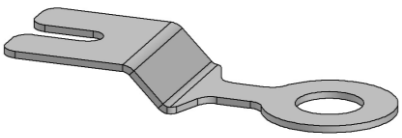
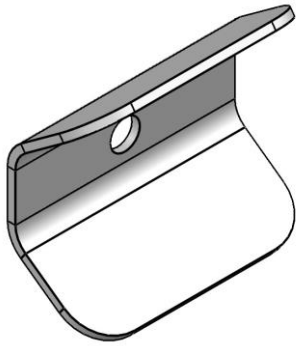
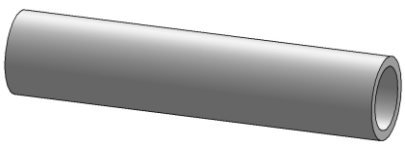
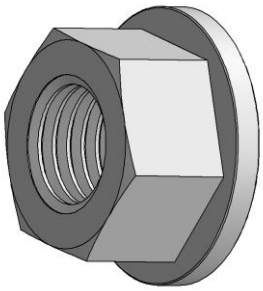
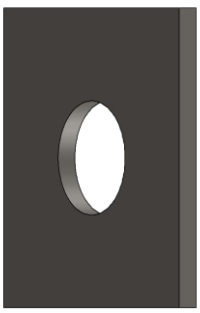


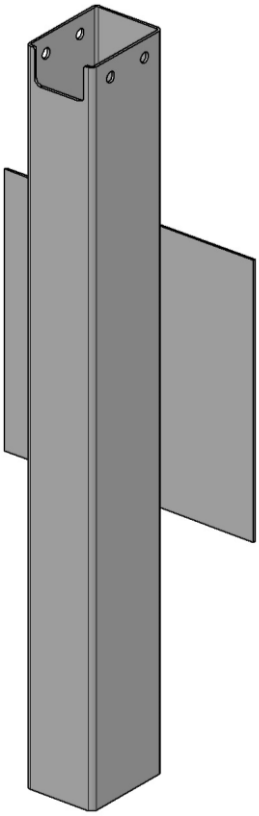
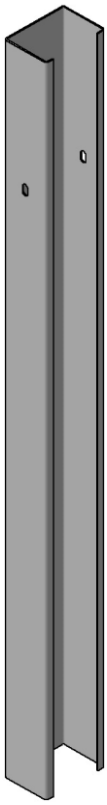
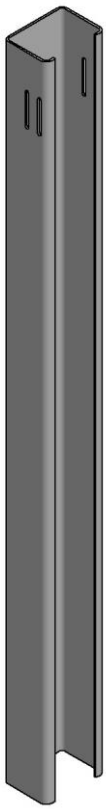
Cable Assembly

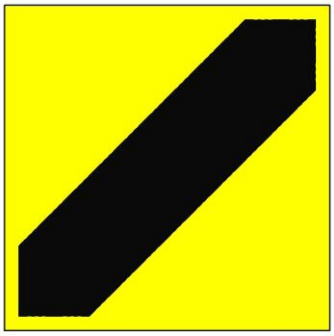


Impact Head Cover

| | |
|---|---|
|  |  |
| Cable Assembly Brace | Cable Anchor Bracket |
|  |  |
| M20 x 270mm Threaded Rod | Cable End Plate |

| | | |
|---|---|---|
|  |  |  |
| C-Post Angle Bracket | Joggle Tab | Slider |
|  |  |  |
| Pipe Sleeve | M20 Flange Nut | M16 Square Washer |

| | | |
|---|---|---|
|  |  |  |
| **Ground Anchor Post** | **C-Post #1** | **C-Posts #2 to #6** |

| | |
|---|---|
|  |  |
| **Delineation, Black on Reflective Yellow** | **Delineation, Reflective White on Black** |

## 9.0 Tools Required

Tools required for the installation of the GMET are the same as those used for the installation of standard guardrail. This includes:

- Post driving equipment or auger.
- Impact driver drill with attachments.
- String line.
- Tape measure.
- Slings or chains
- Vice grips.

### 9.1 Recommended PPE

It is recommended that the following personal protective equipment (PPE) be provided for the safe installation of the GMET

- Safety footwear.
- Gloves.
- Hearing protection.
- High visibility clothing.
- PPE as required for the use of post driving equipment

# 10.0 Site Establishment

## 10.1 Traffic Control

Prior to the commencement of any work, the site should be evaluated for risks to workers, pedestrians and other road users. The establishment of traffic control should provide safe travel for passing vehicles and/or pedestrians and appropriately protect workers near the roadside.

## 10.2 Underground Services

The installation of the GMET requires the supporting posts to be embedded into the ground. Prior to the installation of posts an investigation for potential underground hazards is recommended.

## 10.3 Overhead Obstructions

The site should be evaluated for potential overhead instructions that may present a risk during the installation process. These obstructions typically include power lines, signage or trees.

## 10.4 Unloading Exclusion Zone

Only appropriate load-rated slings and chains should be used for the safe unloading of product. It is recommended that an exclusion zone be maintained around the unloading process. This provides distance between moving machinery and workers in the event that goods or the machinery move unexpectedly.

Unloading and the storing of the product on a level surface is recommended. Storing product adjacent to the installation area eliminates the requirement for workers to carry items over long distances.

# 11.0 GMET Installation

Only components supplied by Safe Direction are to be used in the assembly of the GMET. Modifications made to the system during installation, or the use of non-genuine parts may adversely affect the performance of the system.

The major steps in the installation of the GMET are as follows:

- Set-out.
- Installing the C-Posts.
- Installing the Ground Anchor Post.
- Installing the Ground Anchor Assembly
- Attachment of the Rail Assemblies.
- Installing the Impact Head.
- Installing the Cable Assemblies.
- Tightening all fasteners and connections.

## 11.1 Set-out

It is recommended that a string line be used to establish the alignment of the terminal and the C-Post locations. When establishing the C-Post locations of the terminal, take care to note the following:

- The GMET does not require blocking pieces.
- The 1.905m spacing for the C-Posts throughout the terminal is different from the standard w-beam median barrier spacing of 2.0m.
- The Ground Anchor Assembly should be used as a template to establish the spacing between C-Post #1 and the Ground Anchor Post.

## 11.2 Installation of the C-Posts

***Potential Hazards**: Use of post driving equipment or auger, contact with underground hazards, excessive noise and hand injury from pinch points.*

***Recommended Control Measures**: Observe the safe work instructions as per machinery requirements, ensure the area has been inspected for underground hazards, wear appropriate hearing protection and wear gloves.*

The C-Posts are orientated with the open section facing towards the connection with the downstream median barrier. The C-Posts are 1650mm long and feature a cross-section dimension of 150 x 110mm. C-Post #6 is positioned 2375mm from the last/first post of the downstream median w-beam barrier. Each subsequent C-Post is spaced at 1905mm centres.

The C-Posts may be installed by:

- Driving with an appropriate driving head to the required depth, approximately 880mm, or
- Auguring a pilot hole approximately 880mm deep, and driving the post to the required depth with an appropriate driving head, or
- Auguring a hole approximately 880mm deep, placing the post in the hole and backfilling. The post hole should be large enough (e.g. 300mm diameter) to allow the backfill material to be placed in 150mm lifts and compacted with tampering equipment.

Once installed, the height from ground level to the top of each C-Post is 770mm ± 20mm.

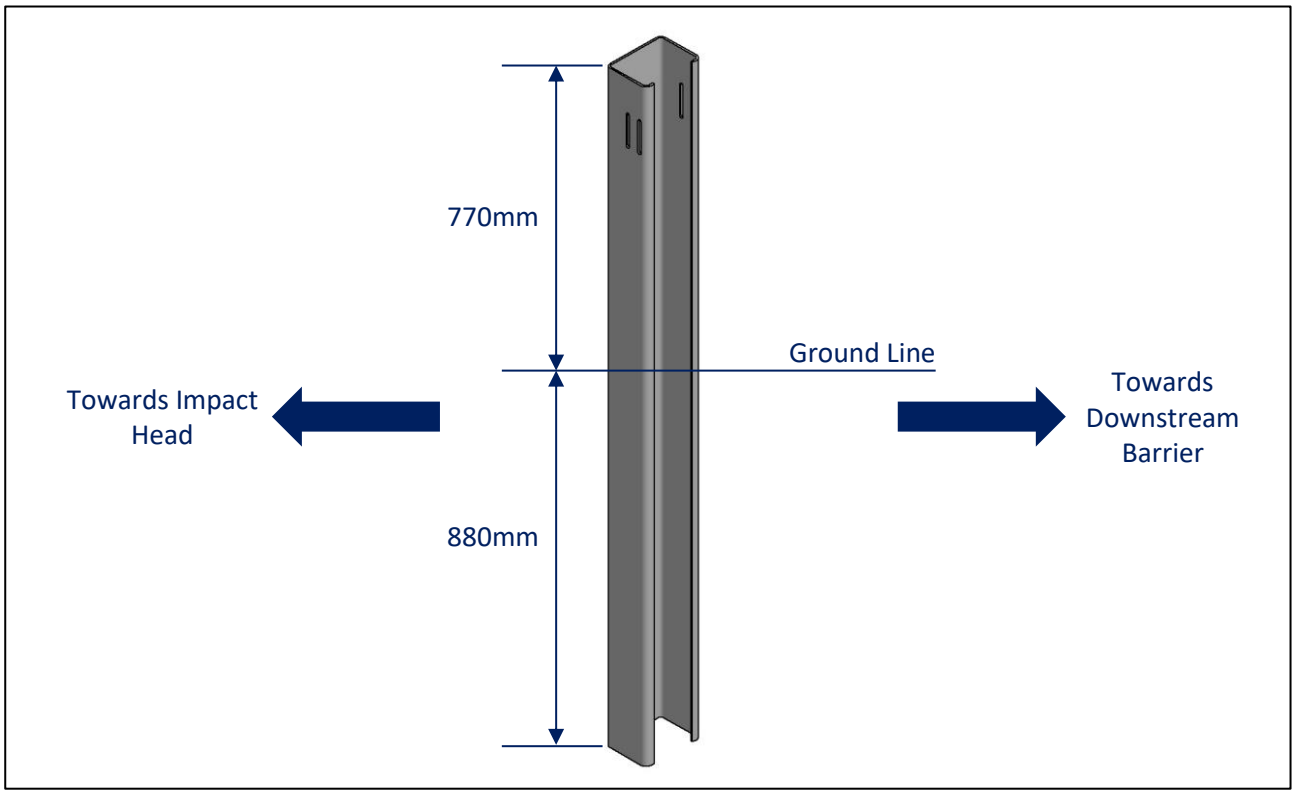



**Figure 3: Installation of C-Posts**

## 11.3 Installation of the Joggle Tabs

***Potential Hazards**: Hand injury from pinch points.*

***Recommended Control Measures**: Use an appropriately sized socket for tightening of the fasteners.*

Two (2) joggle tabs are installed on C-Posts #2 to #6. The Joggle tabs are orientated as shown in Figure 4 and secured with a M8 x 25mm Cup Head Bolt/Nut & Washer.

Once the Joggle Tabs are tightened, install a M20 x 270mm Threaded Rod with a Pipe Sleeve passing through the opening in each Joggle Tab as shown in Figure 4.

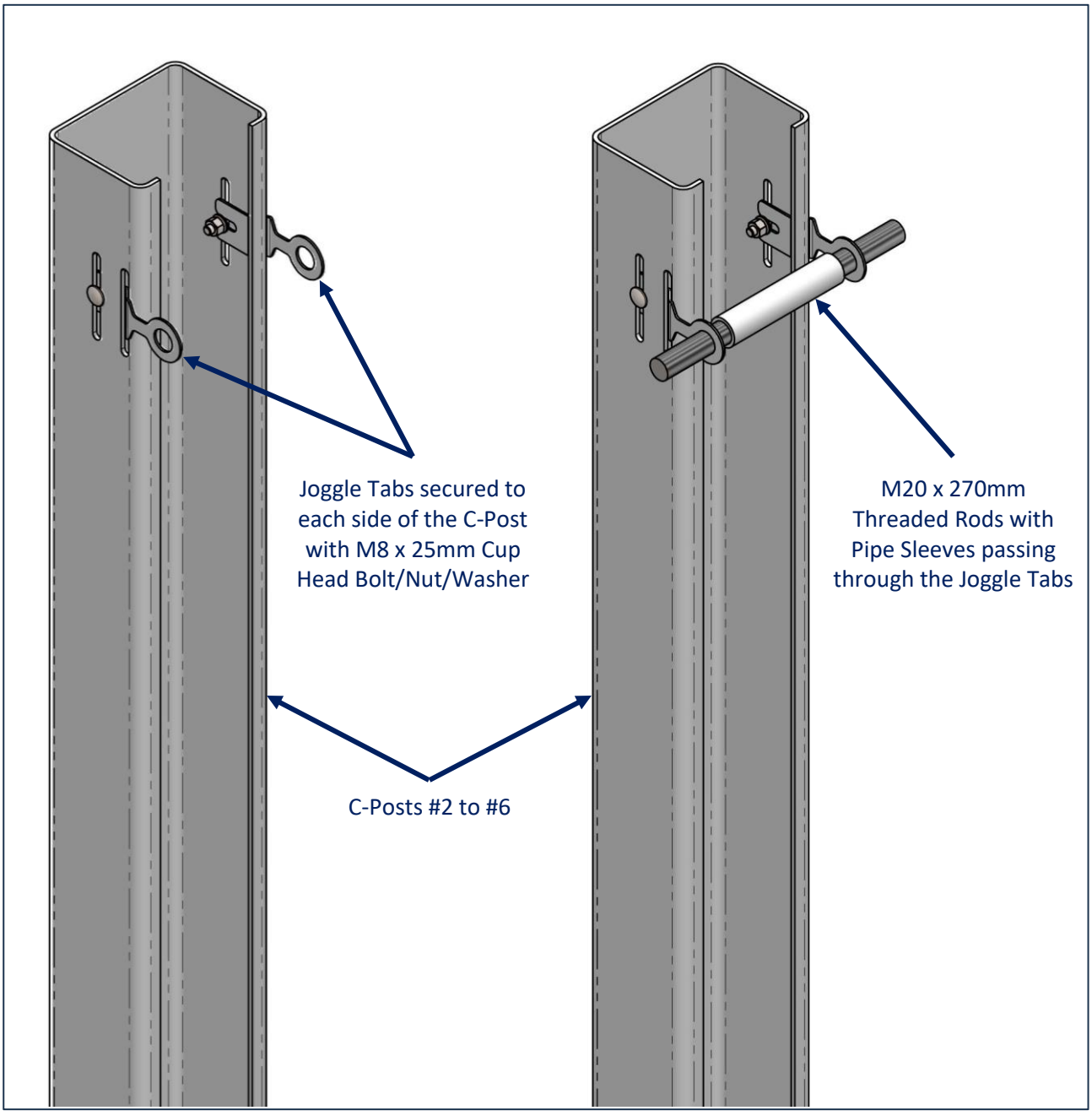



**Figure 4: Installation of Joggle Tabs and Threaded Rod**

## 11.4 Installation of the Ground Anchor Post

***Potential Hazards**: Use of post driving equipment or auger, contact with underground hazards, excessive noise, hand injury from pinch points and injury from movements and posture.*

***Recommended Control Measures:** Observe the safe work instructions as per machinery requirements, ensure the area has been inspected for underground hazards, wear appropriate hearing protection, wear gloves, observe correct techniques when lifting (bend at the knees), and use a team lift when installing the ground anchor post.*

Slide the Ground Anchor Assembly over C-Post #1 to establish the location of the Ground Anchor Post as shown in Figure 5 ensuring that the soil plate is orientated on the downstream side of the post i.e. away from the impact head. After marking the post location, remove the Ground Anchor Assembly.

The Ground Anchor Post may be installed by:

- Driving with an appropriate driving head to the required depth, approximately 1450mm, or
- Auguring a pilot hole approximately 1450mm deep, and driving the post to the required depth with an appropriate driving head, or
- Auguring a 600mm hole approximately 1450mm deep, placing the post in the hole and backfilling in 150mm lifts while compacting with tamping equipment.

Once the Ground Anchor Post is installed to full depth, slide the Ground Anchor Assembly over C-Post #1 and position over the Ground Anchor Post.

Secure the Ground Anchor Assembly with two (2) M20 x 270mm Threaded Rods as shown in Figure 5.

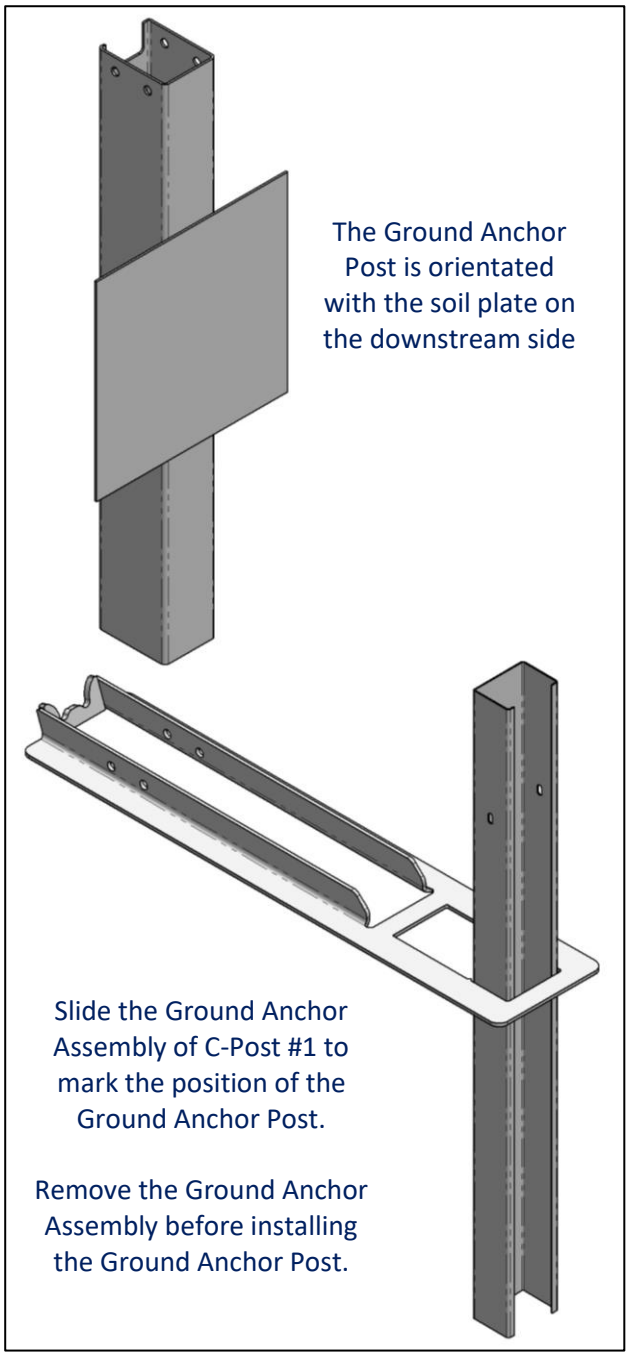



**Figure 5: Position of the Ground Anchor Post**

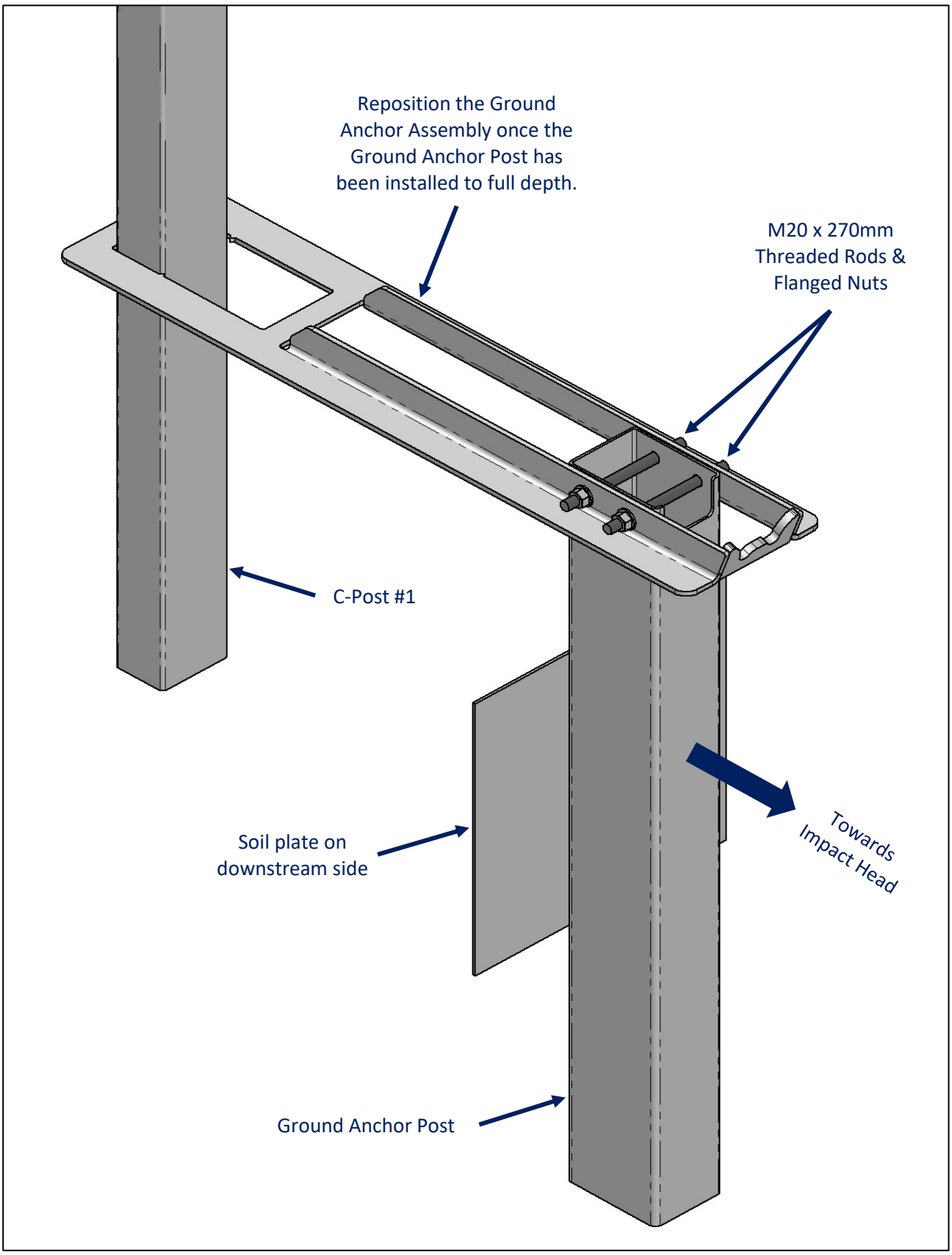



**Figure 6: Securing the Ground Anchor Post**

## 11.5 Installation of the C-Post Angle Brackets

***Potential Hazards**: Hand injury from pinch points.*

***Recommended Control Measures**: Use an appropriately sized socket for tightening of the fasteners.*

Secure one (1) Angle Bracket to each side of C-Post #1 with a M12 x 40mm Hex Bolt/Nut & Washer as shown in Figure 7.

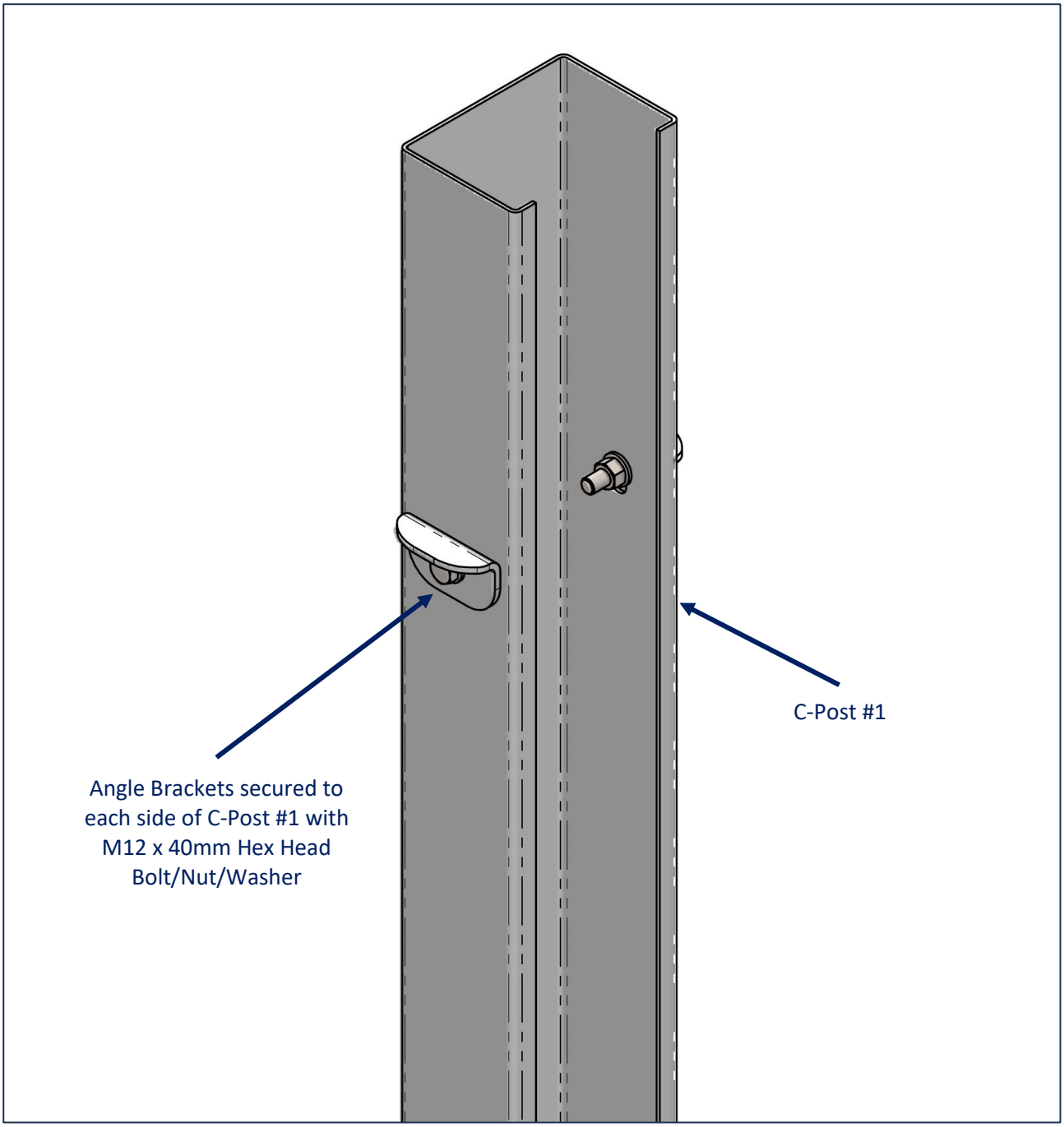



**Figure 7: Attachment of Angle Brackets**

## 11.6 Installing the Cable Anchor Brackets

***Potential Hazards:*** *Injury from movements and posture, hand injury from pinch points, strain to wrists from tightening bolts and excessive noise from use of impact driver.*

***Recommended Control Measures****: Observe correct techniques when lifting rails (bend at the knees), wear gloves, use an impact drill to tighten bolts and wear appropriate hearing protection.*

It is recommended that the Cable Anchor Brackets are attached to the End Rail Assemblies prior to securing the rails to the posts, facilitating ease of access.

With the End Rail Assemblies on the ground, place the Anchor Brackets on the inside face of the rails and secure the bracket with eight (8) standard M16 x 32mm Mushroom Head Bolts & Nuts as shown in Figure 8. There is no torque requirement for these bolts. They should be tightened to a snug position.

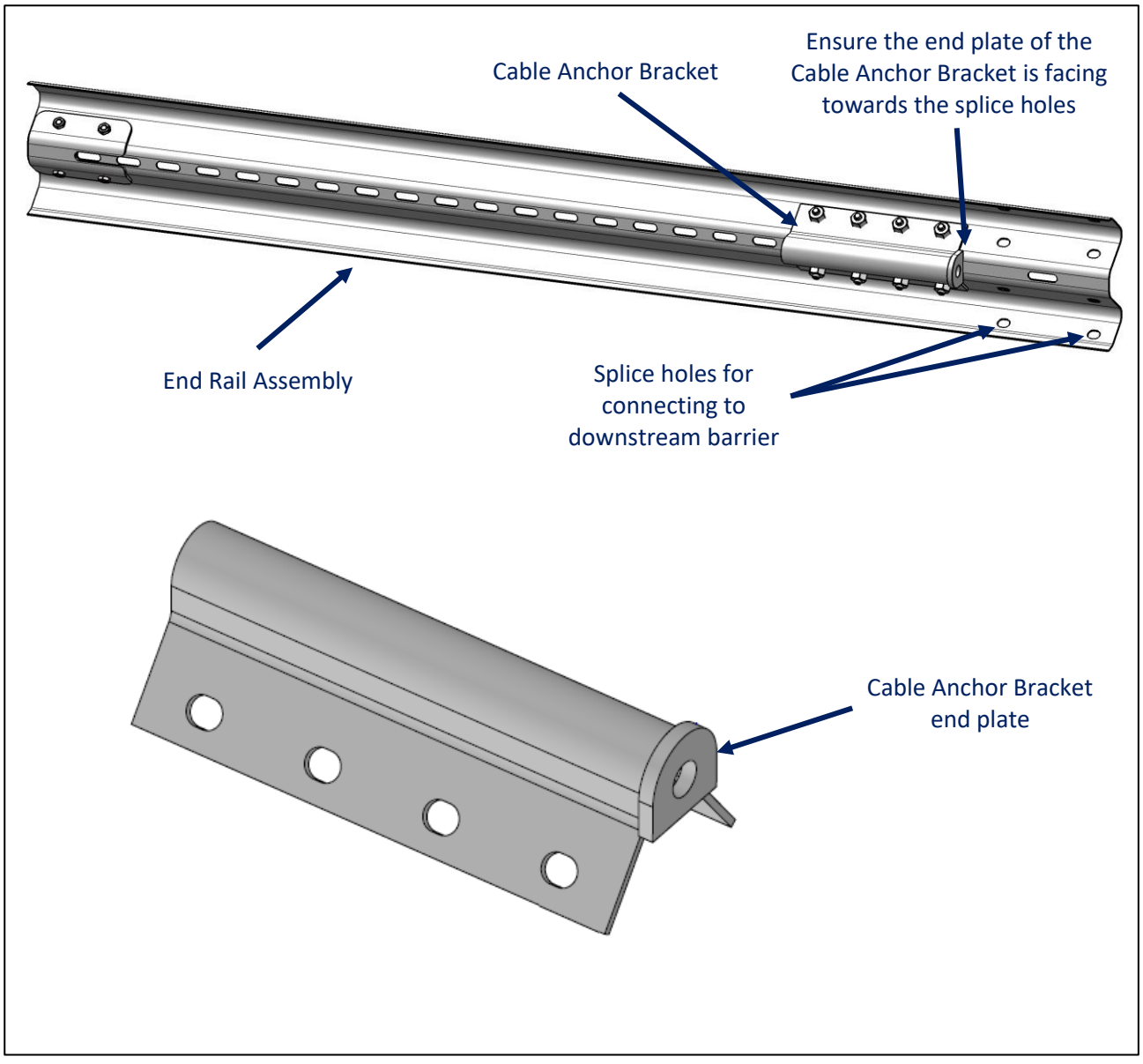



**Figure 8: Attachment of Cable Anchor Bracket**

## 11.7 Installing the Rail Assemblies

***Potential Hazards:*** *Injury from movements and posture, hand injury from pinch points, strain to wrists from tightening bolts and excessive noise from use of impact driver.*

***Recommended Control Measures****: Observe correct techniques when lifting rails (bend at the knees), wear gloves, use a pinch bar to align holes, use an impact drill to tighten bolts and wear appropriate hearing protection.*

The w-beam guardrails are pre-fitted with the upstream and downstream packers. There are twelve (12) Rail Assemblies as follows:

- 2 off End Rail Assemblies.
- 8 off Mid Rail Assemblies.
- 2 off First Rail Assemblies.

Starting with the End Rail Assemblies, secure to the downstream median barrier guardrail panel using eight (8) standard M16 x 32mm Mushroom Head Bolts & Nuts. The lapping of the End Rail Assemblies should be on the outside of the downstream guardrail panel. There is no torque requirement for these bolts. They should be tightened to a snug position.

The opposite end of the End Rail Assemblies are secured to the Threaded Rod passing through the Joggle Tabs secured to C-Post #6.

The next rail is a Mid Rail Assembly which is lapped over the End Rail Assembly and is placed on the same Threaded Rod passing thought the Joggle Tabs. The opposite end of this rail is secured to the Threaded Rod passing through the Joggle Tabs secured to C-Post #5.

This sequence is repeated (on both sides of the C-posts) through to C-Post #2.

At C-Post #2, the First Rail Assembly is lapped over the Mid Rail Assembly and placed on the same Threaded Rod passing through the Joggle Tabs. The opposite ends of First Rail Assemblies are placed on the Angle Brackets secured to C-Post #1.

Remaining Threaded Rods with Pipe Sleeves are installed at C-Posts #2 to #6 as shown in Figure 9.

Each end of the Threaded Rods passing through the Rail Assemblies are secured with a Slider and M20 Flange Nut. The Slider will rest in the valley of the w-beam profile. The nuts should be tightened to a snug position.

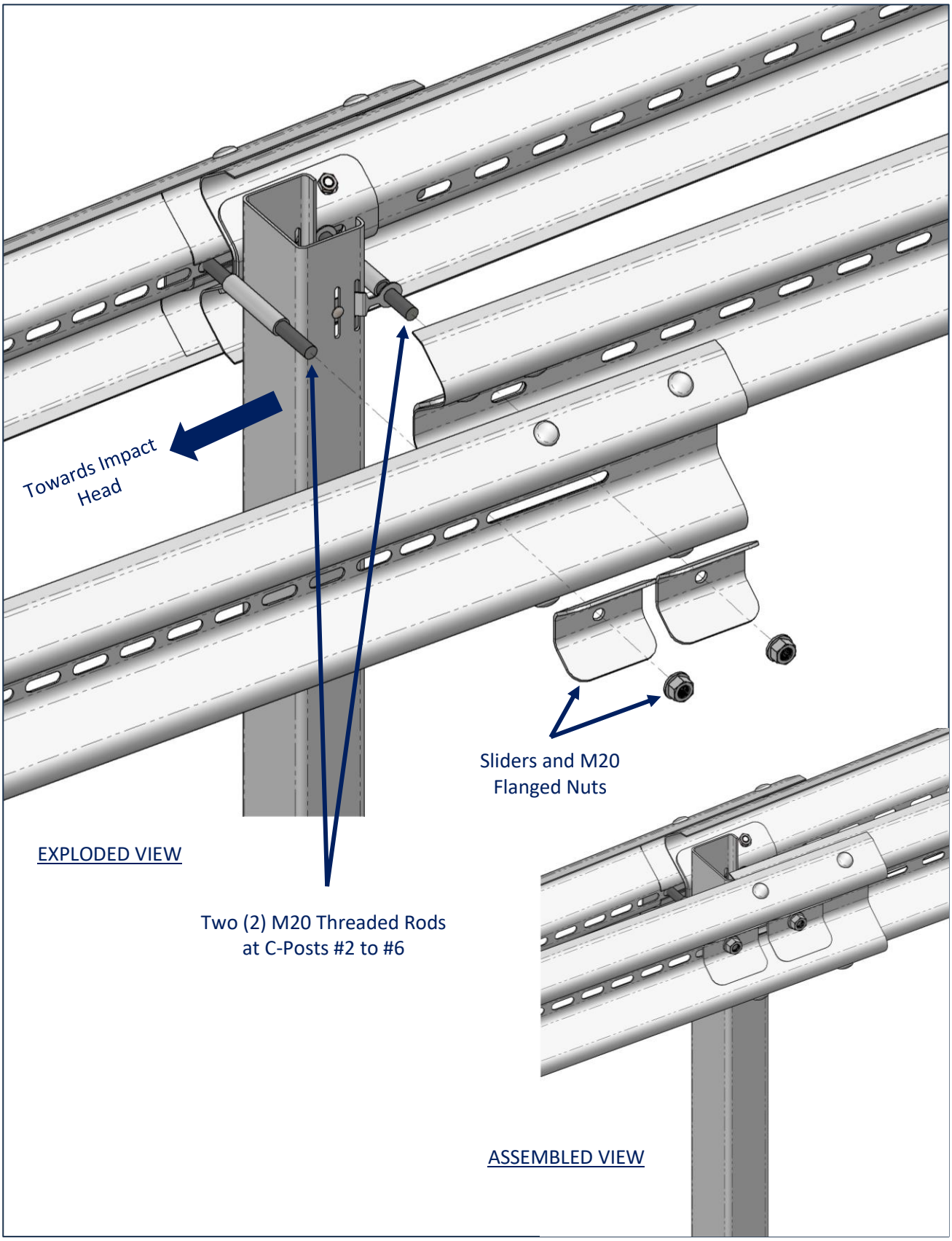



**Figure 9: Atachment of Rail Assemblies**

## 11.8 Installing the Impact Head Assembly

***Potential Hazards**: Injury from movements and posture and hand injury from pinch points.*

***Recommended Control Measures:** Observe correct techniques when lifting the impact head (bend at the knees), use a team lift, wear gloves and use a pinch bar to align impact head.*

The Cable Assembly Brace is positioned between the First Rail Assemblies and C-Post #1.

The Impact Head Assembly slides over the First Rail Assemblies until the splice holes align.

The Impact Head is secured through the upper splice holes to the First Rail Assemblies and Cable Assembly Brace with four (4) M16 x 50mm Hex Head Bolt/Nut & Washers. Each bolt assembly requires two (2) round washers and two (2) square washers as shown in Figure 10.

The Impact Head is secured through the lower splice holes to the First Rail Assemblies with four (4) M16 x 50mm Hex Head Bolt/Nut & Washers. Each bolt assembly requires two (2) round washers and two (2) square washers as shown in Figure 10.

Once secured, the top of the Impact Head should be measure 860mm ± 20mm above ground level.

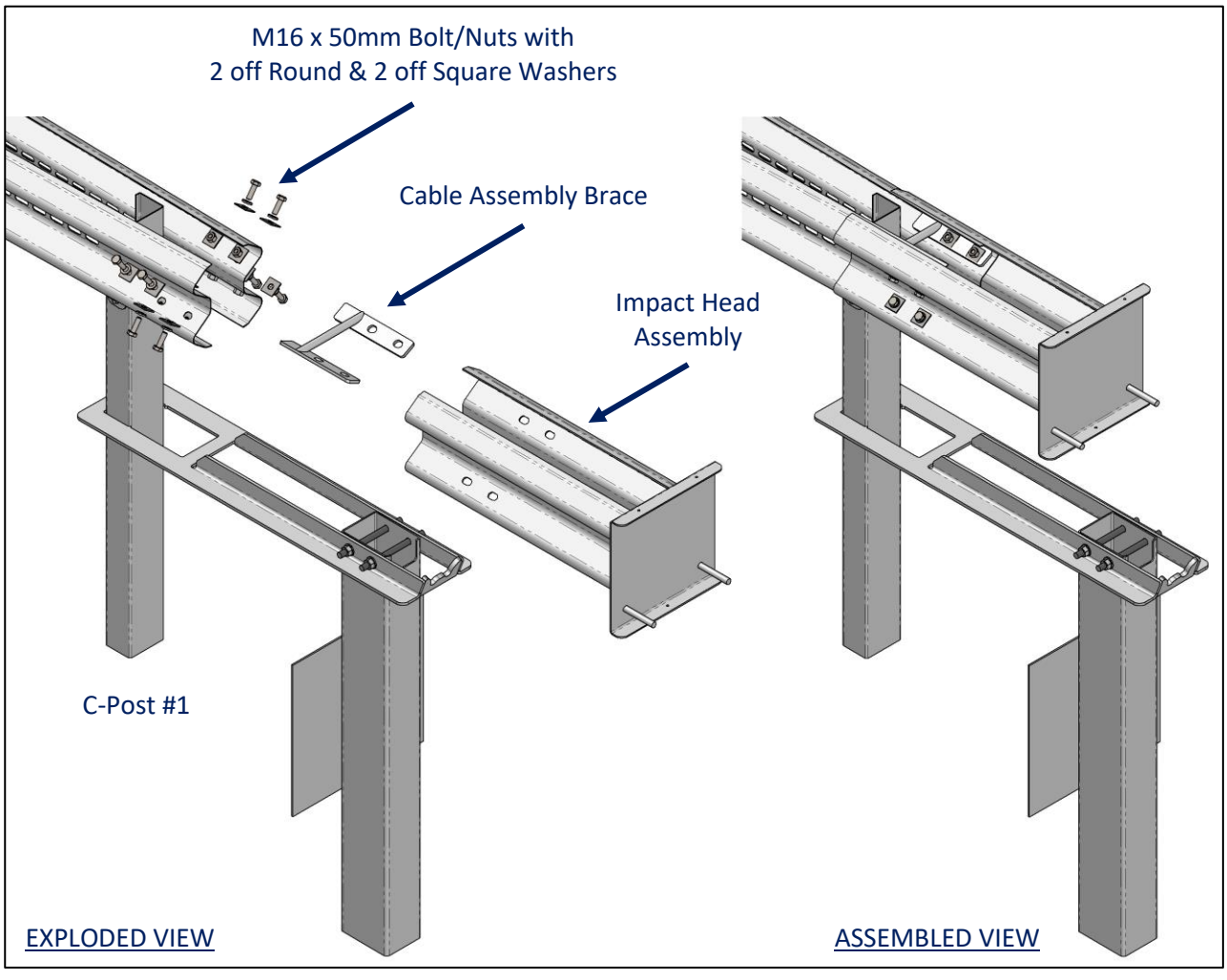



**Figure 10: Impact Head Installation**

## 11.9 Installing the Cable Assemblies

Two (2) Cable Assemblies are installed along the length of the terminal on each side of the C-Posts. Starting at the trailing end of the terminal, place the first Cable Assembly through the Anchor Bracket and secure as shown in Figure 11. Position the Cable Assembly on the inside of the Rail Assemblies between the C-Posts. Repeat this process with the second Cable Assembly and opposite Anchor Bracket as shown in Figure 12.

Approaching the nose of the terminal, each Cable Assembly passes over the Cable Assembly Brace as shown in Figure 13. Each Cable Assembly is secured at ground level using the Cable End Plate as shown in Figures 14 & 15.

Tighten the Cable Assemblies at each end and restrain using vice grips to prevent twisting. Upon completion of installation, each Cable Assembly should be taut.

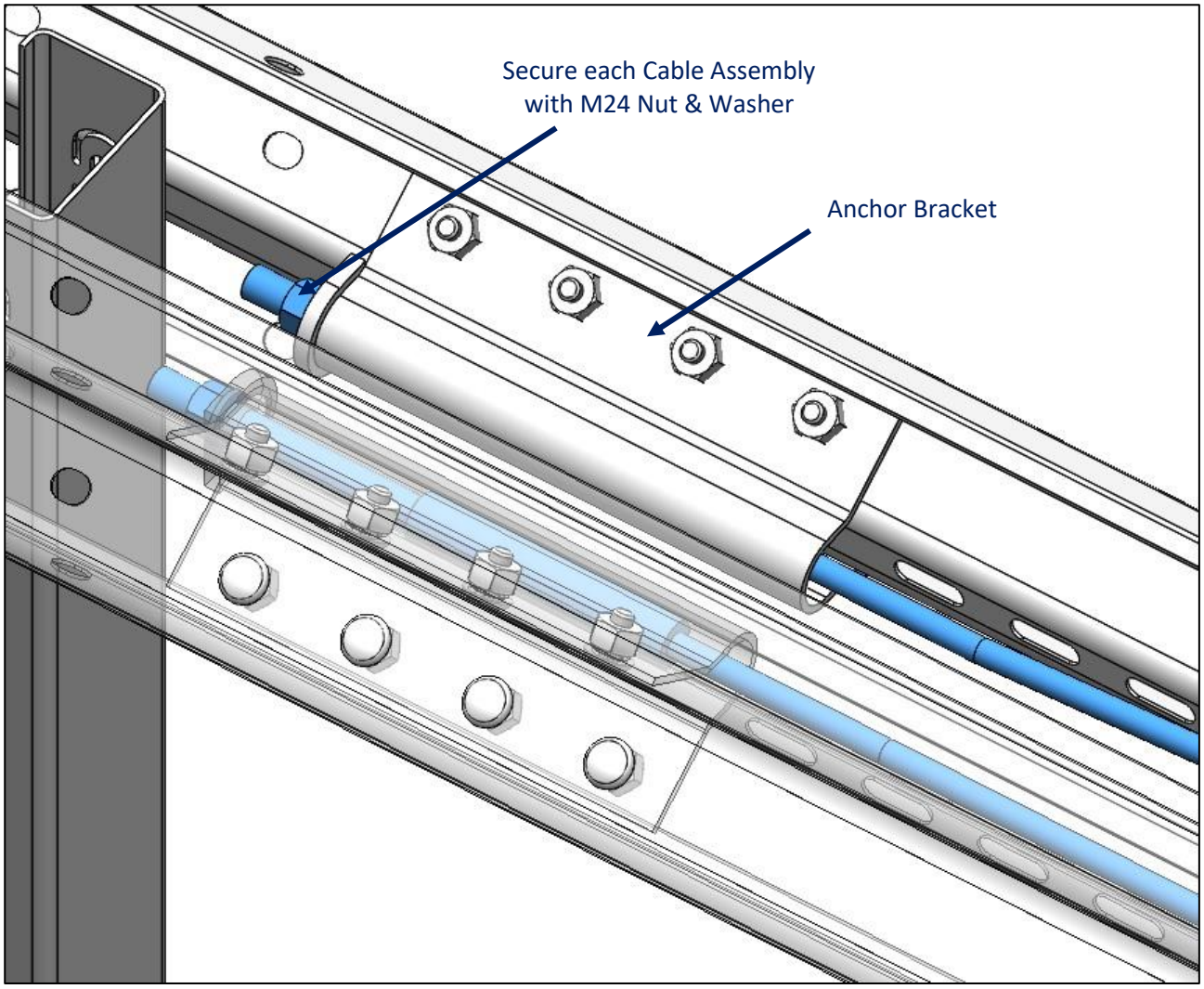



**Figure 11: Securing the Cable Assemblies to the Anchor Brackets**

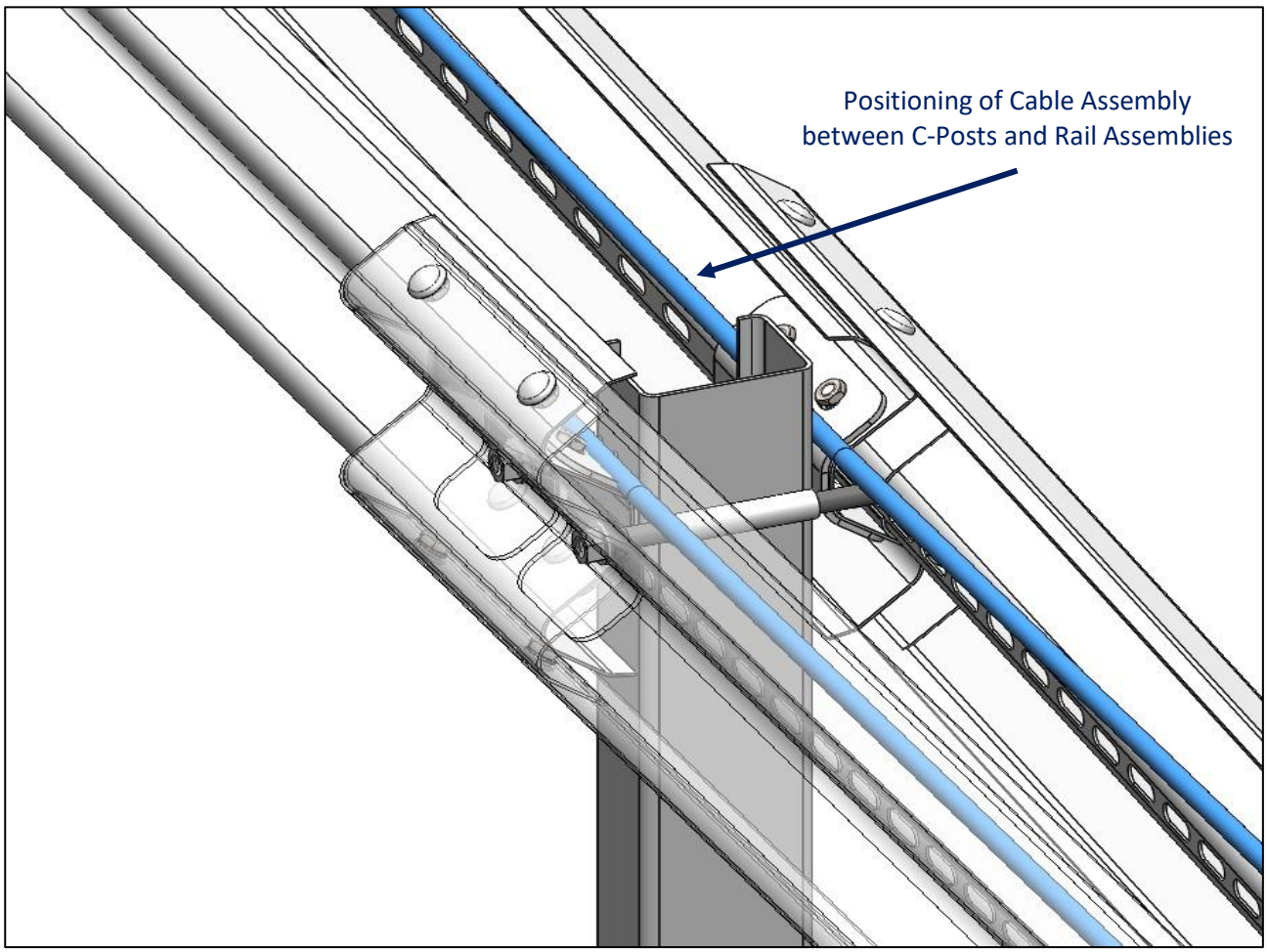



**Figure 12: Positioning of Cable Assemblies between C-Posts and Rail Assemblies**

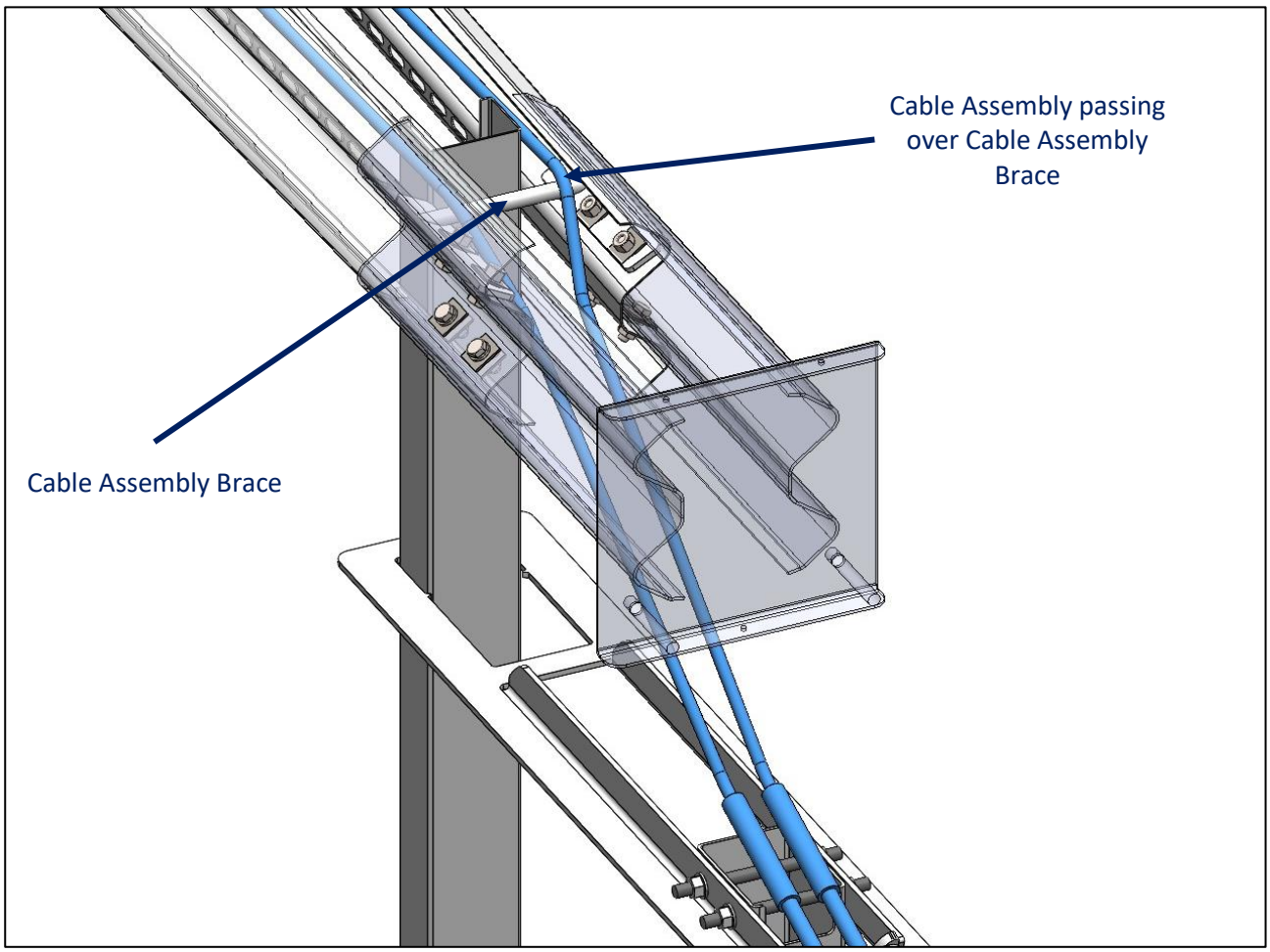



**Figure 13: Cable Assemblies Passing over Cable Assembly Brace**

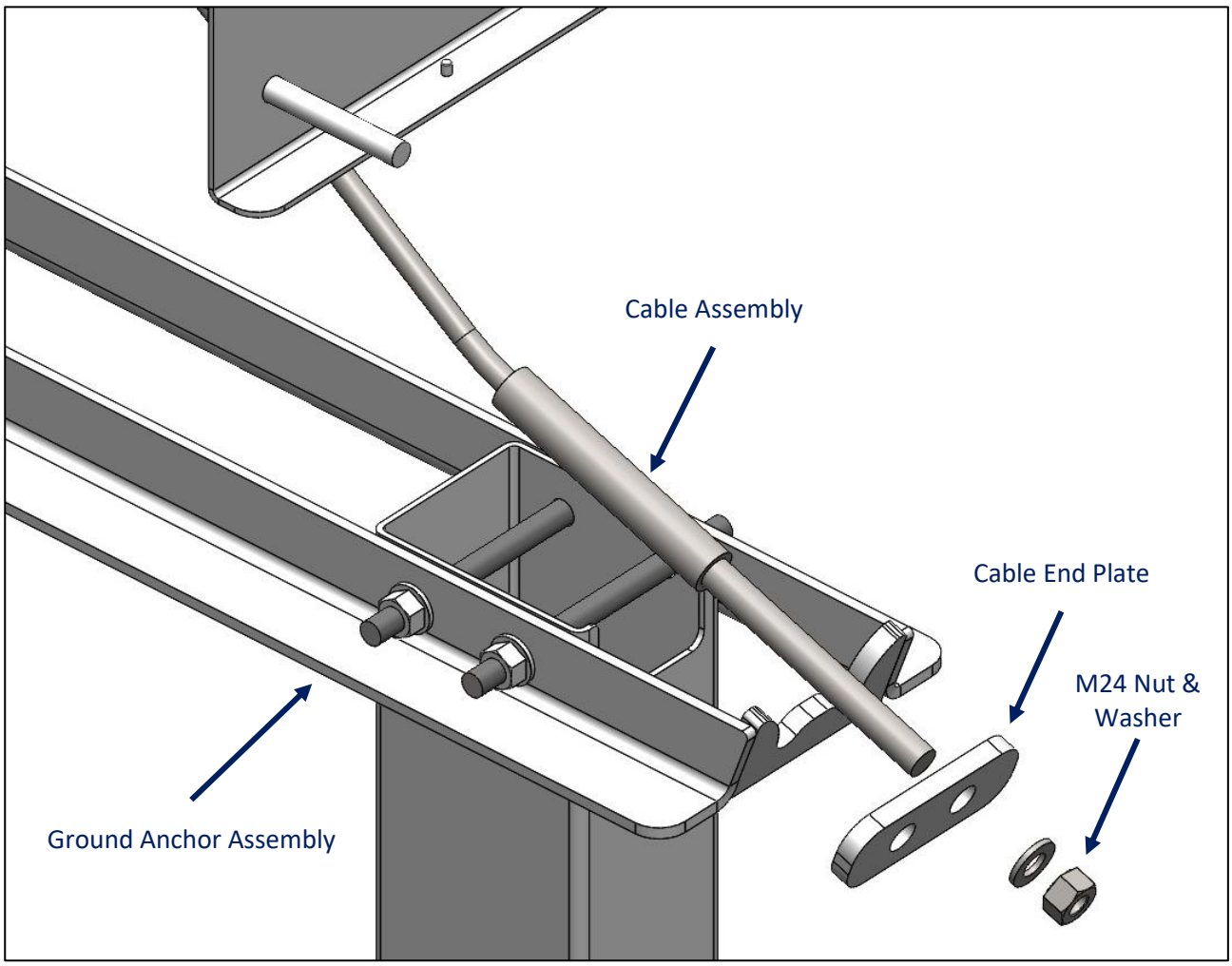



**Figure 14: Securing Cable Assembly at Nose of Terminal with the Cable End Plate**

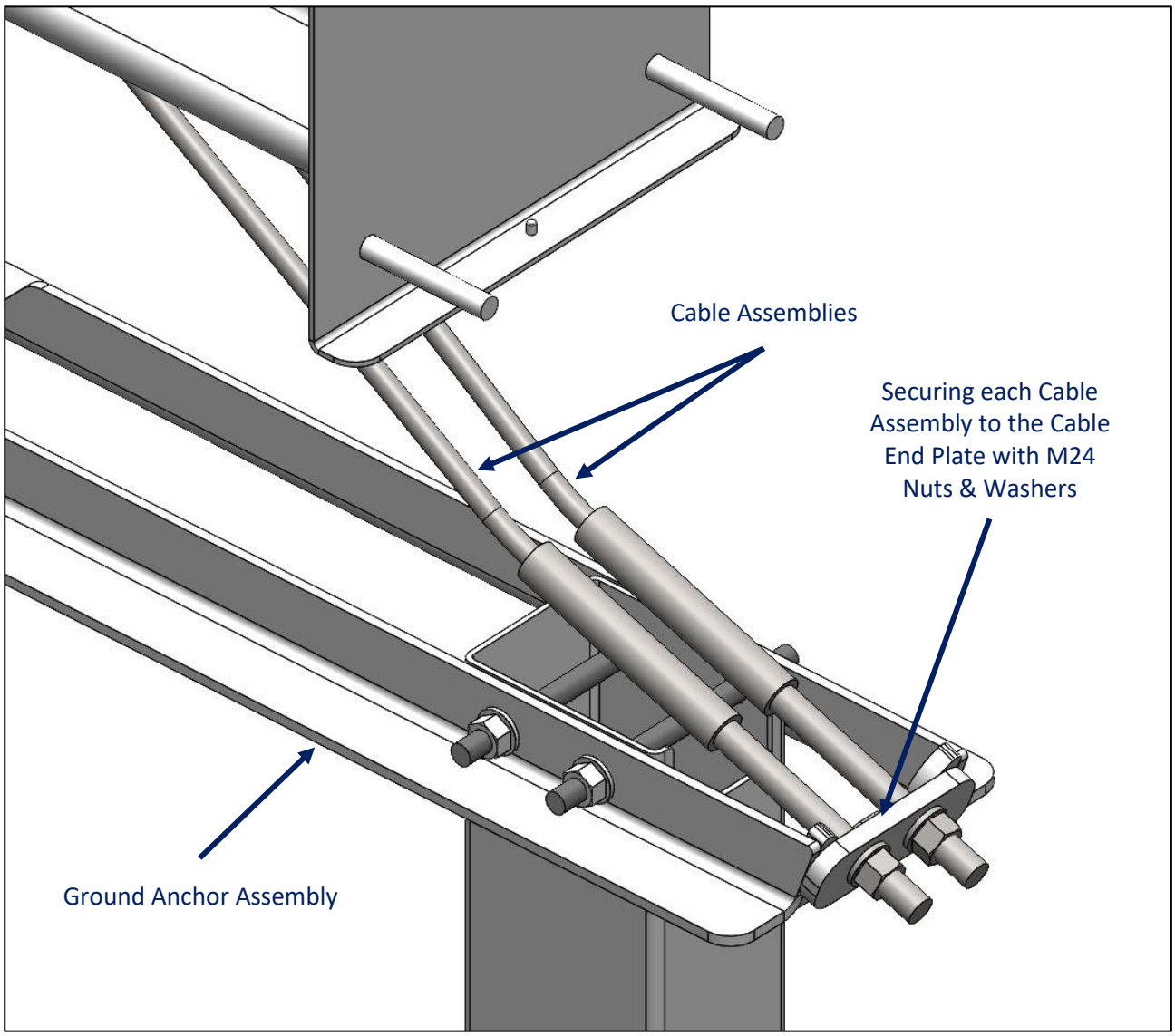



**Figure 15: Assembled View of Cable Assemblies at nose of terminal**

## 11.10 Installing the Impact Head Cover

The cover is placed over the Impact Head and secured with three (3) M8 x 16mm Hex Set Screws. There is no torque requirement for these bolts. They should be tightened to a snug position.

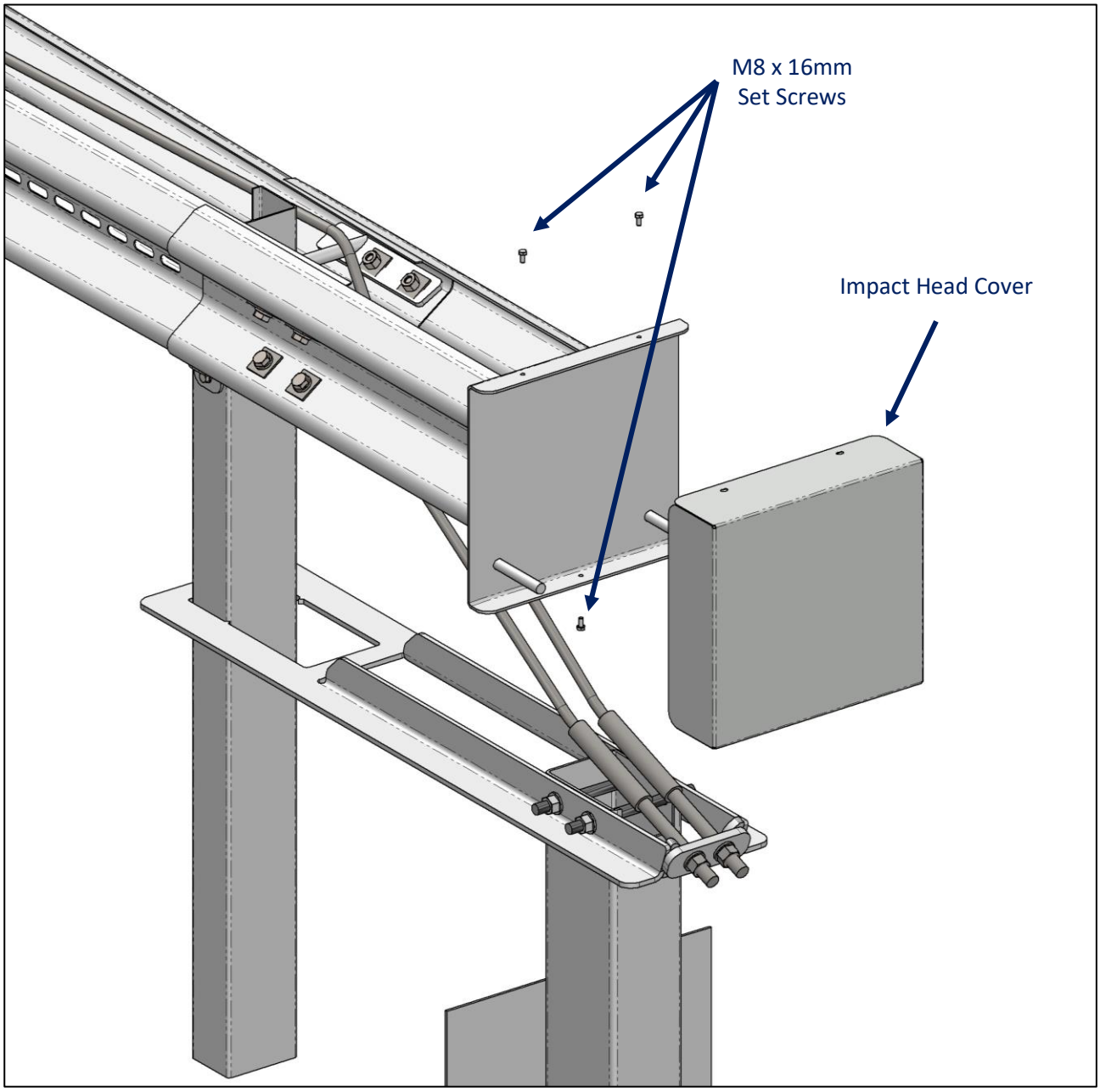



**Figure 16: Attachment of Impact Head Cover**

## 11.11 Attachment of Delineation

The style of delineation is dependent upon state road authority requirements. The delineator is an adhesive marker that attaches directly to the impact head cover.

# GMET Inspection Form

| | |
|---|---|
| **Inspection Date** | |
| **Client** | |
| **Project Reference** | |
| **Name of Inspector** | |
| **Company** | |

| | |
|---|---|
| ❑ Yes ❑ No | The height measured to the top of the rails is 800mm ± 20mm. |
| ❑ Yes ❑ No | The Rail Assemblies throughout the terminal are straight and not curved. |
| ❑ Yes ❑ No | C-Post #6 is positioned 2375mm from the first downstream median barrier post. |
| ❑ Yes ❑ No | C-Posts #2 to #6 are spaced at 1905mm centres. |
| ❑ Yes ❑ No | The C-Posts are orientated with the open section facing towards the connection with the downstream median barrier. |
| ❑ Yes ❑ No | Joggle tabs are attached to C-Posts #2 to #6. |
| ❑ Yes ❑ No | Angle Brackets are attached to C-Post #1. |
| ❑ Yes ❑ No | The End Rail Assemblies are secured to the downstream median barrier guardrail using eight (8) standard M16 x 32mm mushroom head bolts and nuts. |
| ❑ Yes ❑ No | The Rail Assemblies are correctly lapped. |
| ❑ Yes ❑ No | Two (2) threaded rod assemblies have been installed at C-Posts #2 to #6 |
| ❑ Yes ❑ No | The Rail Assemblies are secured to the threaded rods with Sliders and Flanged Nuts. |
| ❑ Yes ❑ No | The Impact Head Assembly is secured with eight (8) M16 x 50mm Hex Bolts/Nuts with two (2) Round & Square Washers. |
| ❑ Yes ❑ No | The Cable Assemblies are secured to the Anchor Brackets at the End Rail Assemblies. |
| ❑ Yes ❑ No | The Cable Assemblies are secured to the Ground Anchor Assembly using the Cable End Plates. |
| ❑ Yes ❑ No | The Cable Assemblies are taut. |
| ❑ Yes ❑ No | The Impact Head Cover is secured with three (3) M8 x 16mm Set Screws. |
| ❑ Yes ❑ No | Delineation is attached to the impact cover. |
| ❑ Yes ❑ No | All fasteners are tightened. |
| **Comments/Notes** | |
| | |
| | |
| | |
| | |

# 12.0 Maintenance

Except for repairs due to impacts, it is recommended that an annual inspection be undertaken to assess the following:

- The impact head is appropriately delineated.
- Debris has not accumulated around the terminal which may impede the function of the terminal.
- Vegetation around the terminal is appropriately maintained.
- Nuisance impacts have not gone undetected.
- The Cable Assemblies are taut.

## 12.1 Bushfire Damage

The GMET is constructed from hot dip galvanised steel components. The performance of hot dip galvanised components when subjected to a fire depends upon numerous factors such as flame duration, flame intensity and the characteristics of the galvanised finish.

Bushfires can produce high temperatures, however exposure of roadside structures to maximum flame intensity is generally for a short duration as the fire front moves forward. The combination of the reflectivity of the galvanised surface and the heat sink provided by the mass of the steel to which the hot dip galvanising is applied has shown galvanised steel to provide excellent performance during bushfires.

If it is observed that a bushfire has caused damage to the galvanised coating it is recommended that these item(s) be replaced.

# 13.0 Repair

In the event of a vehicle impact, damage to the terminal is to be assessed in accordance with Table 4. Typically, impacts with the GMET will require replacement of damaged Rail Assemblies and C-Posts. The Ground Anchor Post and Ground Anchor Assembly are often undamaged and reusable.

Similar to the installation sequence, it is recommended that the guidelines contained in Section 10.0 be observed in the establishment of traffic control and an unloading exclusion zone in addition to investigation for underground services and overhead obstructions

**Table 4: GMET Damage Assessment**

| Type of Damage | Description of the Damage | Remedial Action |
|---|---|---|
| Damage to the galvanised coating on the C-Posts. | The sum total of the damaged area does not exceed 60cm$^2$ (0.5% of the total surface area) and no individual damaged area exceeds 40cm$^2$. | An organic zinc rich paint is to be applied to the repair area in two coats. |
| | The sum total of the damaged area exceeds 60cm$^2$ (0.5% of the total surface area) or an individual damaged area exceeds 40cm$^2$. | The post is to be replaced. |
| Damage to the galvanised coating on the Rail Assemblies. | The sum total of the damaged area does not exceed 125cm$^2$ (0.5% of the total surface area) and no individual damaged area exceeds 40cm$^2$. | An organic zinc rich paint is to be applied to the repair area in two coats. |
| | The sum total of the damaged area exceeds 125cm$^2$ (0.5% of the total surface area) or an individual damaged area exceeds 40cm$^2$. | The rail is to be replaced. |
| Damage to the C-Posts. | The posts are bent or the slots are distorted. | The posts are to be replaced. |
| Damage to the Impact Head Assembly. | The Impact Head Assembly is bent or distorted. | The impact head is to be replaced. |
| Damage to the Rail Assemblies. | The rail is dented, twisted or flattened. | The rail is to be replaced. |
| | There are nicks in any part of the rail. | |
| | The perforated slots in the rail are distorted. | |
| Damage to bolts. | The body of the bolt is distorted. | The bolt is to be replaced. |
| | The thread of the bolt is damaged. | |
| Damage to the Cable Assemblies. | The thread of the swage fitting is damaged. | The Cable Assembly is to be replaced. |
| | There are nicks in any of the cable strands. | |
| Damage to the Joggle Tabs. | The Joggle Tab is bent or distorted. | The Joggle Tab is to be replaced. |
| Disturbance of material around the posts. | The material around a post is loose. | The material is to be suitably compacted. |

## 14.0 Dismantling

The GMET is designed for permanent installations. Dismantling will only be required for permanent removal or following an impact.

The dismantling sequence should follow the installation sequence in reverse observing the same *Potential Hazards* and *Recommended Control Measures*.

The GMET is manufactured from galvanised steel components which may be recycled.

When removing damaged C-Posts the ground material should be suitably compacted before a replacement post is installed. Upstream and downstream posts outside of the impact area should also be inspected for movement and the surrounding ground material recompacted if required.

SafeDirection

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