INGAL CIVIL PRODUCTS
A valmont COMPANY

SoftStop®

Tangent End Terminal

NZ Edition

Product Manual

Release 06/19

www.ingalcivil.co.nz

The SoftStop® System Tangent End Terminal ("SoftStop® System") has been tested to American Association of State and Highway Transportation Officials ("AASHTO") Manual For Assessing Safety Hardware ("MASH") criteria, as a Test Level 1, 2, & 3 Guardrail End Terminal.

MASH TL1 COMPLIANT **MASH TL2** COMPLIANT **MASH TL3** COMPLIANT

This Manual must be available to the worker overseeing and/or assembling the product at all times. For additional copies, contact Ingal Civil Products directly on (09) 920 6838 or visit www.ingalcivil.co.nz.

The instructions contained in this Manual supersede all previous information and Manuals. All information, illustrations, and specifications in this Manual are based on the latest SoftStop® System information available from the designers of the System to Ingal Civil Products at the time of printing. We reserve the right to make changes to this Manual at any time. Please contact Ingal Civil Products to confirm that you are referring to the most current instructions.

Important: These instructions are to be used only in conjunction with the assembly, maintenance, and repair of the SoftStop® System. These instructions are for standard assemblies specified by the appropriate highway authority only. In the event the specified system assembly, maintenance, or repair would require a deviation from standard assembly parameters, contact the appropriate highway authority engineer. Ingal Civil Products representatives are available for consultation if required.

Customer Service Contacts

Ingal Civil Products is committed to the highest level of customer service. Feedback regarding the SoftStop™ End Terminal, its assembly procedures, supporting documentation, and performance is always welcome. Additional information can be obtained from the contact information below:

Ingal Civil Products Corporate Contacts

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E-mail	sales@ingalcivil.co.nz
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Wellington Contact	Brendon Morgan 021 504 870	

Limitations and Warnings

Trinity Highway, in compliance with AASHTO MASH, contracts with FHWA approved and accredited testing facilities to perform and evaluate crash tests in accordance with AASHTO MASH.

The SoftStop® System has been deemed eligible for reimbursement by FHWA as meeting the requirements and guidelines of MASH. A component of MASH eligibility requirements include a variety of crash tests to evaluate product performance by simulating certain impact conditions involving lightweight cars (approx. 1100 kg [2420 lb.]) and full size pickup trucks (approx. 2270 kg [5000 lb.]).

The SoftStop® System is tested pursuant to the test matrix criteria of MASH as designated by AASHTO and FHWA. The FHWA AASHTO tests are not intended to represent the performance of systems when impacted by every vehicle type or in every impact condition existing on the roadway. Every departure from the roadway is a unique event.

Trinity Highway expressly disclaims any warranty or liability for injury or damage to persons or property resulting from any impact, collision or harmful contact with its products, other vehicles, or nearby hazards or objects by any vehicle, object or person, whether or not the products were assembled in consultation with Trinity Highway or by third parties.

The SoftStop® System is intended to be assembled, delineated, and maintained in accordance with specific state guidelines. It is the responsibility of the highway authority specifying the use of a highway product to select the most appropriate product configuration for its site specifications. A highway authority's careful evaluation of the site layout, vehicle population type and speed, traffic direction, and visibility are some of the elements that require evaluation in the selection of a highway product. For example, kerbs could cause an untested effect on an impacting vehicle.

After an impact occurs, the debris from the impact must be removed from the area immediately and the specified highway product must be evaluated and restored to its original specified condition or replaced as the highway authority determines as soon as possible. Product selection, approval, proper installation, and maintenance of any highway product is the sole responsibility of the specifying highway authority.

Safety Alert Symbols appear throughout this manual and indicate Danger, Warning, Important or Caution. Failure to read and follow these warnings could result in serious injury or death.

WARNING: Do not assemble, maintain, or repair the SoftStop® System until you have read this Manual thoroughly and completely understand it. Ensure that all Danger, Warning, Caution, and Important statements within the Manual are completely followed. Please call Ingal Civil Products on (09) 920 6838 if you do not understand any portion of these instructions or this manual.

WARNING: Safety measures incorporating appropriate traffic control devices and personal protective equipment (PPE) specified by the highway authority must be used to protect all personnel while at the assembly, maintenance, or repair site.

WARNING: Ensure that your assembly meets all appropriate Manual on Uniform Traffic Control Devices ("MUTCD") and/or local standards.

WARNING: Use only Trinity Highway or Ingal Civil parts that are specified by Trinity Highway for use with the SoftStop® System for assembling, maintaining, or repairing the SoftStop® System. Do not utilise or otherwise comingle parts from other systems even if those systems are other Trinity Highway systems. Such configurations have not been tested, nor have they been approved for use. Assembly, maintenance, or repairs using unspecified parts or accessories is strictly prohibited. Failure to follow this warning could result in serious injury or death in the event of a vehicle impact with such an UNACCEPTED system.

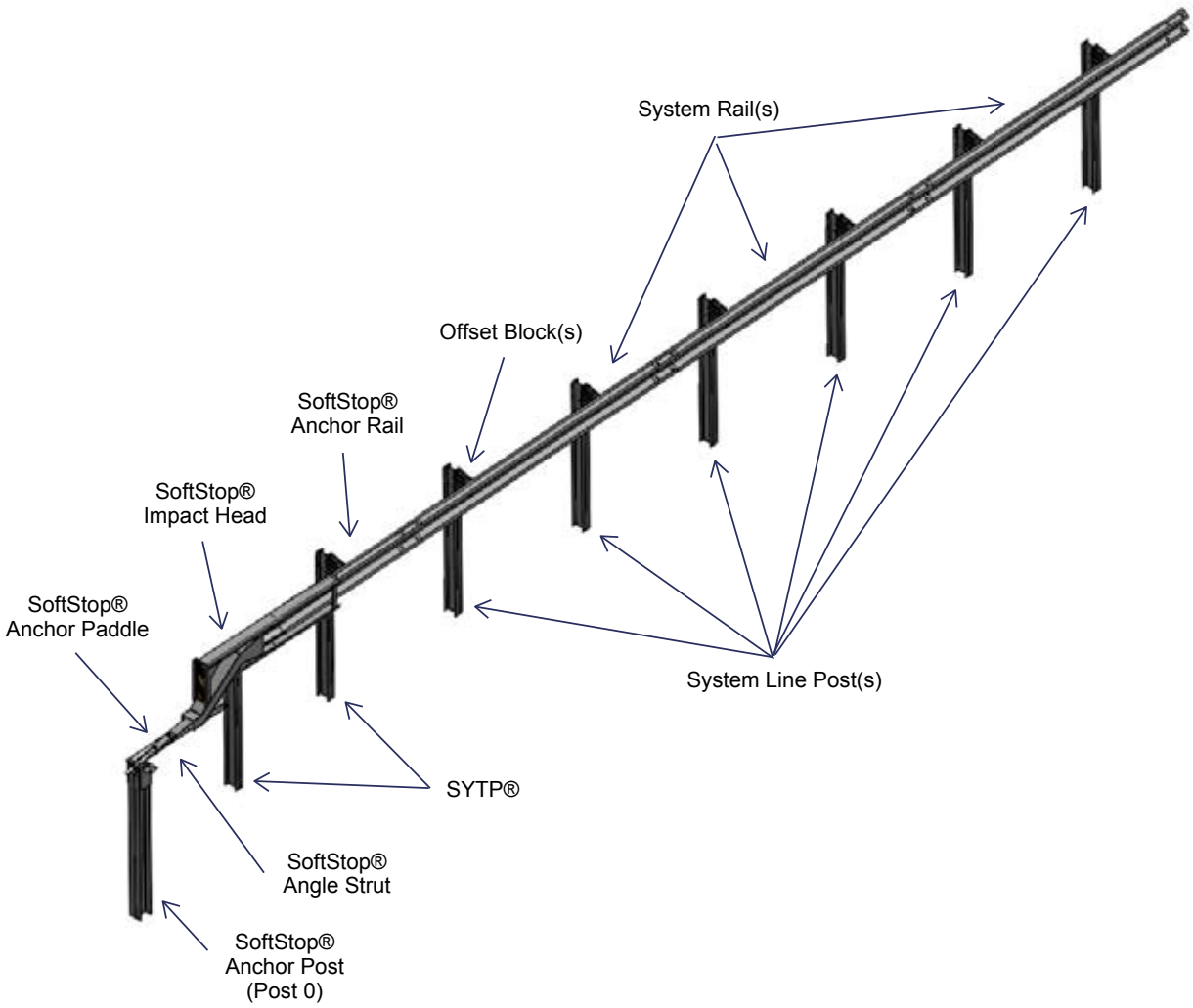
WARNING: Do NOT modify the SoftStop® System in any way.

IMPORTANT: Trinity Highway makes no recommendation whether use or reuse of any part of the SoftStop® System is appropriate or acceptable following an impact. It is the sole responsibility of the local highway authority and its engineers to make that determination. It is critical that you inspect the SoftStop® System after assembly is complete to make certain that the instructions provided in this Manual have been strictly followed.

1.0 Introduction

The SoftStop® System is a tangent, single-sided, energy-absorbing, redirective and gating end terminal system. The SoftStop® System is the first end terminal to meet the evaluation criteria set forth in the AASHTO MASH. The SoftStop® System is a 787 mm high (measured from top of rail to finished grade) end terminal used to shield 787 mm high post w-beam guardrail. The SoftStop® System may be used to terminate post W-beam guardrail measuring between 705 mm to 787 mm with state approved transition (see Appendix for example).

The SoftStop® System contains a SoftStop® Impact Head, SoftStop® Anchor Rail, SoftStop® Anchor Post (Post 0), SoftStop® Angle Strut, two (2) Steel Yielding Terminal Posts ("SYTP®") (Posts 1 & 2) and required hardware accessories. The remaining length of the system beyond Post 2 uses System Line Posts, Offset Blocks and System Rail.



Test Level 3 configuration with 3.81m panel option shown

The SoftStop® System can be assembled in a MASH Test Level 1, Test Level 2 or Test Level 3 configuration.
* Before installation, ensure the variant of highway safety barrier is accepted for use by the final asset owner.

SoftStop Assembly Configurations			
Test Level	**Design Speed**	**Required System Length**	**Posts**
Test Level 3	100 km/h	15.48m	Posts 0-8
Test Level 2*	70 km/h	11.67m	Posts 0-6
Test Level 1*	50 km/h	7.86m	Posts 0-4

Test Level 3 -15.48 m

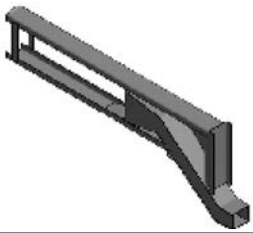
Test Level 2 -11.67 m

Test Level 1 -7.86 m

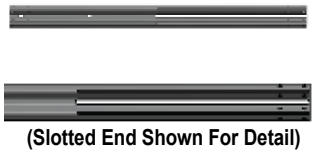
2.0 Inspection of Shipment

Before assembling the SoftStop® System, carefully unpack and inspect all components for signs of damage. Check the received parts against the packing list supplied with the system to verify that all parts were received. If parts are damaged or missing from the shipment or unspecified parts were part of the shipment, do not attempt to assemble the system; contact Ingal Civil immediately.
* Before installation, ensure the variant of highway safety barrier is accepted for use by the final asset owner.

ID	COMPONENT	PN	TL-3 QTY	TL-2 QTY*	TL-1 QTY*
A	SoftStop® Impact Head	10007538	1	1	1
B	SoftStop® Anchor Rail 3.810 m	10007536	1	1	1
C	W-Beam Rail 3.810 m	10007537	3	2	1
D	SoftStop® Anchor Post (Post 0)	10007543	1	1	1
E	SoftStop® SYTP® 1460 mm	10007539	1	1	1
F	SYTP® Post 1830 mm	10001402	1	1	1
G	System Line Post 1830 mm	10007540	6	4	2
H	Offset King Block	10001397	7	5	3
I	SoftStop® Anchor Paddle	10007542	1	1	1
K	SoftStop® Keeper Plate	10007545	1	1	1
L	SoftStop® Plate Washer	10007546	1	1	1
M	SoftStop® Anchor Angle	10007544	2	2	2
N	SoftStop® Angle Strut	10007547	1	1	1
O	M8 x 65mm Hex Bolt	10007552	2	2	2
P	M8 x 40mm Hex Bolt	10007553	1	1	1
Q	M20 x 65mm Hex Bolt	10001286	2	2	2
R	M16 x 230mm Hex Bolt	10007551	1	1	1
S	M16 x 45mm Hex Bolt	10007092	1	1	1
T	M16 x 250mm GR Bolt	10001300	7	5	3
U	M16 x 32mm GR Bolt	10007550	32	24	16
V	M25 Round Washer	10007548	1	1	1
W	M20 Round Washer	10001284	4	4	4
X	M16 Round Washer	10007095	4	4	4
Y	M8 Round Washer Wide	10007554	6	6	6
Z	1"Heavy Hex Nut	10007549	1	1	1
AA	M20 Heavy Hex Nut	10001285	2	2	2
BB	M16 Oversize Splice Nut	10001299	41	31	21
CC	M8 Hex Nut	10007555	3	3	3



SoftStop® Impact Head
ID: A PN: 10007538



SoftStop® Anchor Rail 3.810 m
ID: B PN: 10007536

System Rail 3.810 m
ID: C PN: 10007537

SoftStop® Anchor Post
ID: D PN: 10007543

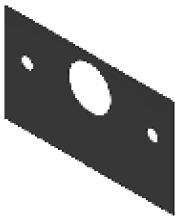
SoftStop® SYTP 1460 mm
ID: E PN: 10007539

SYTP® 1830 mm Post
ID: F PN: 10001402

System Line Post 1830 mm
ID: G PN: 10007540

Offset King Block
ID: H PN: 10001397

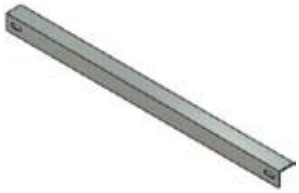
SoftStop® Anchor Paddle
ID: I PN: 10007542



SoftStop® Keeper Plate
ID: K PN:10007545

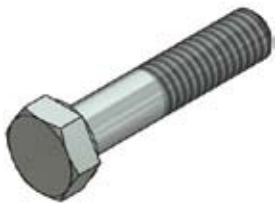
SoftStop® Plate Washer
ID: L PN: 10007546

SoftStop® Anchor Angle
ID: M PN: 10007544



SoftStop® Angle Strut
ID: N PN: 10007547

M8 x 65mm Hex Bolt
ID: O PN: 10007552



M8 x 45mm Hex Bolt
ID: P PN: 10007553

M20x 65mm Hex Bolt
ID: Q PN: 10001286

M16 x 230mm Hex Bolt
ID: R PN: 10007551

M16 x 45mm Hex Bolt
ID: S PN: 10007092

M16 x 250mm GR Bolt
ID: T PN: 10001300

M16 x 32mm GR Bolt
ID: U PN: 10007550

M25 Round Washer
ID:V PN: 10007548

M20 Round Washer
ID: W PN: 10001284

M16 Round Washer
ID: X PN: 10007095

M8 Round Washer Wide
ID: Y PN: 10007554

1" Heavy Hex Nut
ID: Z PN: 10007549

M20 Heavy Hex Nut
ID: AA PN: 10001285

M16 Oversize Splice Nut
ID: BB PN: 10001299

M8 Hex Nut
ID: CC PN: 10007555

3.0 Recommended Tools

Documentation
- Assembly Manual (Most Current Version)
- System Drawing (Most Current Version)

Personal protective equipment (PPE)
- Safety Glasses
- Work Gloves
- Safety-Toe Shoes
- Back Protection
- Hard Hat
- Reflective Vest
- Hearing Protection

Miscellaneous
- Traffic Control Equipment
- SAE Combination Wrench Set
- Socket Set & Socket Wrench
- Hammer
- Chalk Line
- Tape Measure
- Marking Paint and Pen
- Straight Edge
- Level
- Plumb Line
- Post Pounder (commonly used for driving posts)
- Auger
- Soil Tamper
- 5/8"AlignmentTool(DriftPin)
- Locking Pliers
- C-Clamps

Note: The above list of tools is a general recommendation only and should not be considered an exhaustive list.

Depending on specific site conditions and the complexity of the assembly (or repair) specified by the appropriate highway authority, additional or fewer tools may be required. Decisions as to what tools are needed to perform the job are entirely within the discretion of the specifying highway authority and the authority's selected contractor performing the assembly of the system at the authority's specified site.

4.0 SoftStop® System Site Preparation

The SoftStop® System is a tangent, single-sided, energy-absorbing, redirective and gating end terminal system that state/specifying agency specify for use as specified by the appropriate state/specifying authority in conjunction with W-beam guardrail on the shoulder or median of a roadway. The decision to specify the SoftStop® System for a particular project is the responsibility of the state/specifying agency design engineer who must ensure that the most appropriate end terminal has been selected for the specific site conditions.

Important: Do not attach the SoftStop® System directly to a rigid barrier (i.e. concrete barrier, wall or bridge pier) without the use of a state/specifying agency approved transition.

Important: Ensure that the SoftStop® System assembly conforms to the local road design standards.

Important: Ingal Civil Products does not direct grading. Proper site grading must be accomplished before assembly of the SoftStop® System in accordance with road controlling guidelines and requirements. Failure to follow this warning could result in serious injury or death in the event of a vehicle impact or collision.

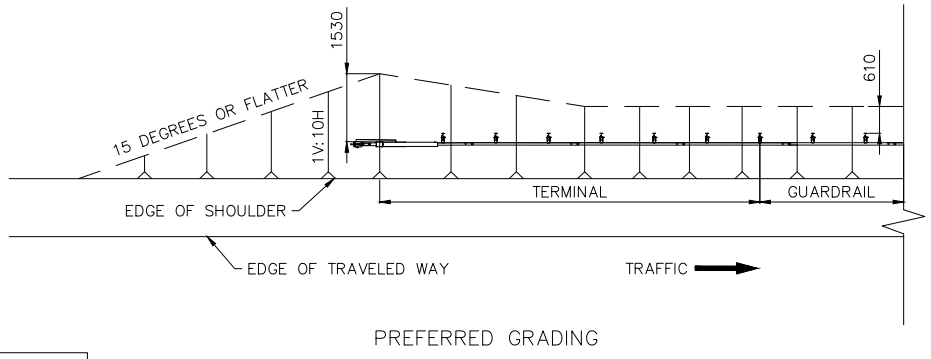


Figure 1: Preferred Grading (not to scale)

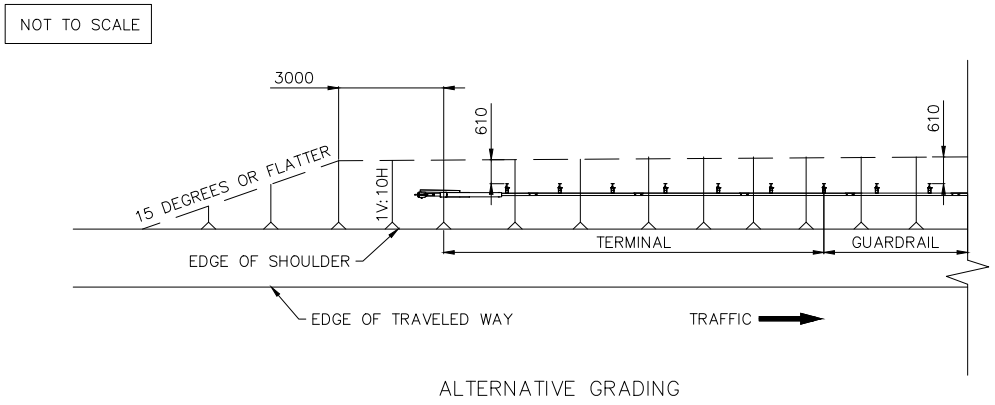


Figure 2: Alternative Grading (not to scale)

5.0 SoftStop® System Offset Requirements

The SoftStop® System is a tangent guardrail end treatment that is assembled parallel to the edge of shoulder. At the sole discretion of the state/specifying agency design engineer, the SoftStop® System may be offset away from the shoulder over the length of the entire system (from centre of last splice location of SoftStop® System to center of Post 0) per the following designer approved offsets:

Test Level 1 (TL-1)	Test Level 2 (TL-2)	Test Level 3(TL-3)
152 mm Maximum	305 mm Maximum	610 mm Maximum

Caution: Under no circumstances shall the rail within the SoftStop® System be curved.

5.1 Offset Requirements Within A Curve

When the guardrail is terminated within a curve (convex or concave) and a SoftStop® System is attached, the following instructions must be followed to ensure proper offset requirements within a curve for the SoftStop® System are met. If the conditions below cannot be achieved, it is recommended that the guardrail be extended past the curve until the conditions can be met. The offset requirements in a curve are calculated for the TL-3 SoftStop® System. If assembling a TL-1 or TL-2 SoftStop® System, an overall straight length of 15.48 m must be obtained (SoftStop® System + W-Beam Guardrail) for calculating offset requirements in a curve.

Note: Using an offset closer to 0 m on tighter curves (radii) will cause the terminal to encroach on to the shoulder.

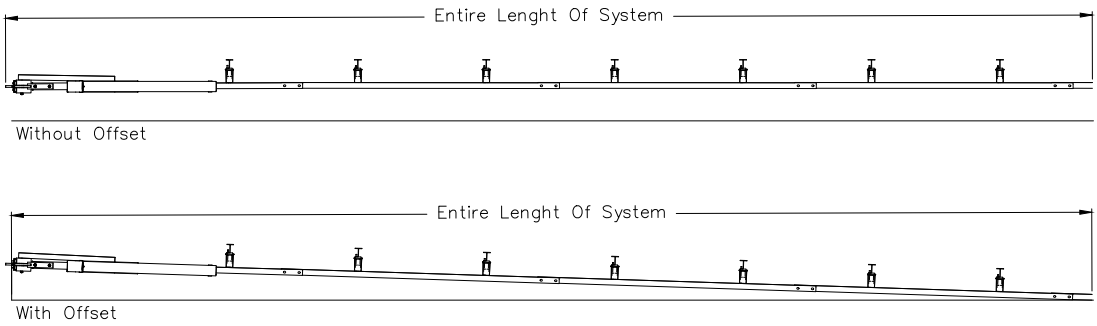


Figure 3: Entire Length of System

5.2 Convex Curve

For radii of 198 m or greater (flatter), the offset is 0 m to 610 mm.

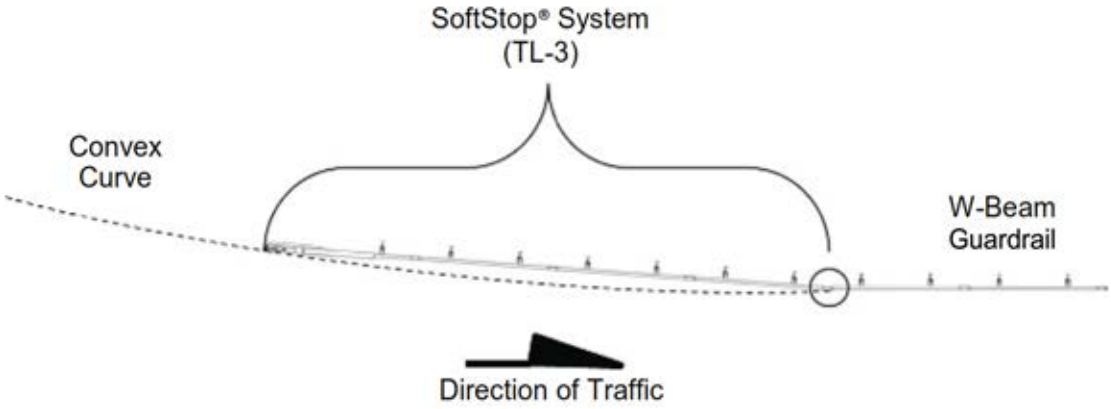


Figure 4: Convex curve

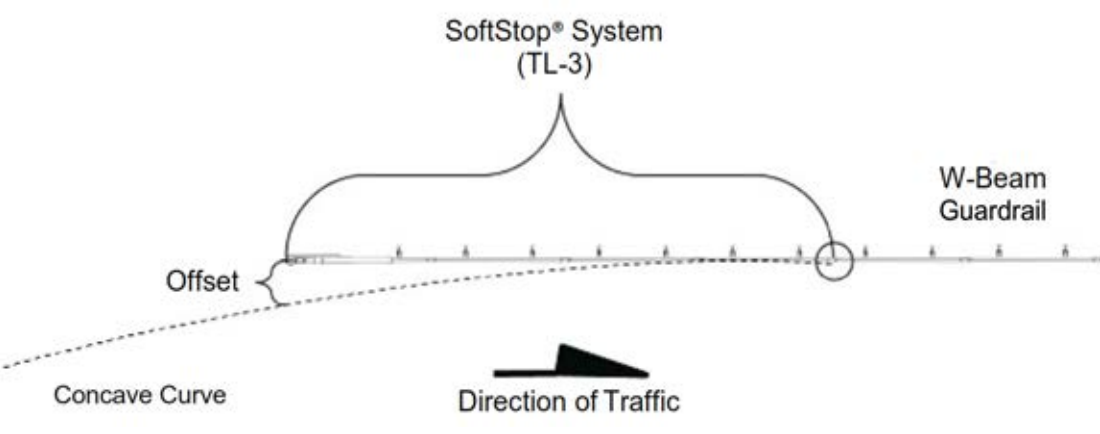


Figure 5: Concave curve

6.0 SoftStop® System Post Placement

Danger: Ensure all above & below ground utilities are located, marked and identified prior to using auger or post driving equipment in accordance with local specifying agency guidelines. Failure to follow this warning could result in serious injury or death.

6.1 Determine Post Locations

Place a level or straight edge on the face of downstream guardrail (i.e. traffic side) to the finished grade to create a reference line for face of guardrail. The reference line will be used to determine post location for the last post of the SoftStop®System.

The last post of the SoftStop® System will be located 272 mm from face of downstream guardrail to back of the last post of the SoftStop® System to accommodate an 190mm offset block and be spaced 1905 mm (typical) on center from the first post of the W-beam system (see drawing below). Refer to the post placement diagrams in this manual for remaining post locations.

The SoftStop® System posts may be inserted into the soil using an auger or impact hammer pile driver used for the placement of guardrail posts. If an auger is used, ensure diameter is large enough to allow for proper compaction of agency approved fill material. All SoftStop® System posts are to be assembled plumb. Proper compaction must be accomplished for all posts in accordance with state/specifying agency guidelines.

If rock is encountered at post locations 2-8, refer to the local specifying agency guidelines and the AASHTO Roadside Design Guide for requirements for embedment depth into the rock and size of the hole. If rock is encountered at post locations 0-1, auger a hole in the rock large enough for full post embedment and proper compaction of approved fill material.

If rigid pavement (e.g. concrete or asphalt) of any thickness is encountered at post locations 0-8, ensure a proper "leave-out" area is provided around the posts , refer Figures 6 and 7. This is filled with road controlling agency approved backfill material.

*Grout fill material must have a 28-day compressive strength of 120 psi (0.85 MPa) or less.

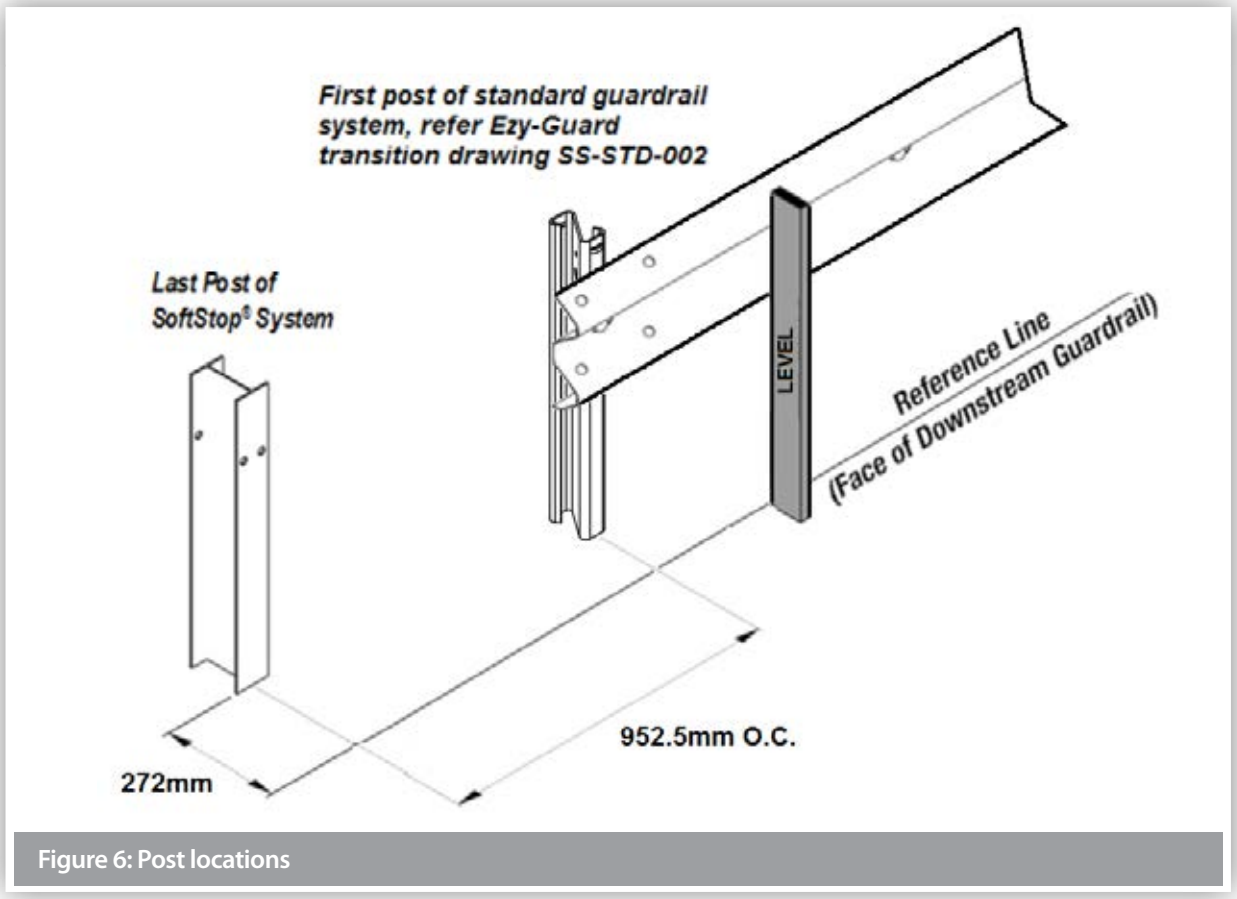


Figure 6: Post locations

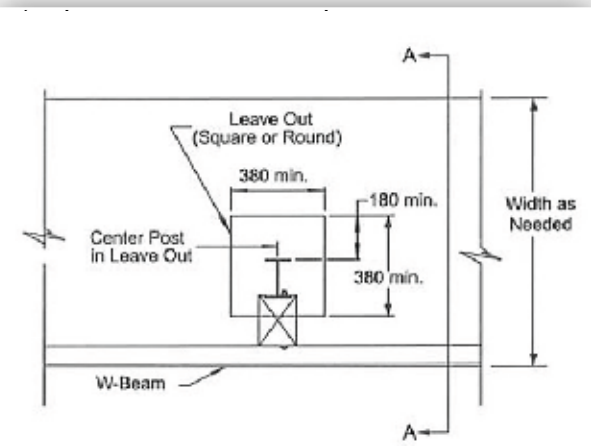


Figure 7: Steel Post Detail

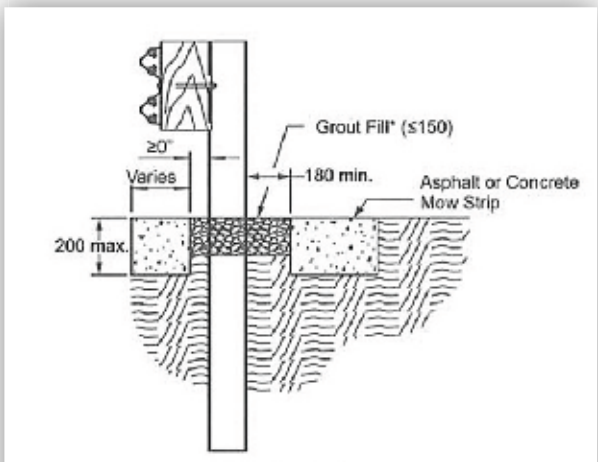


Figure 8: Section A-A

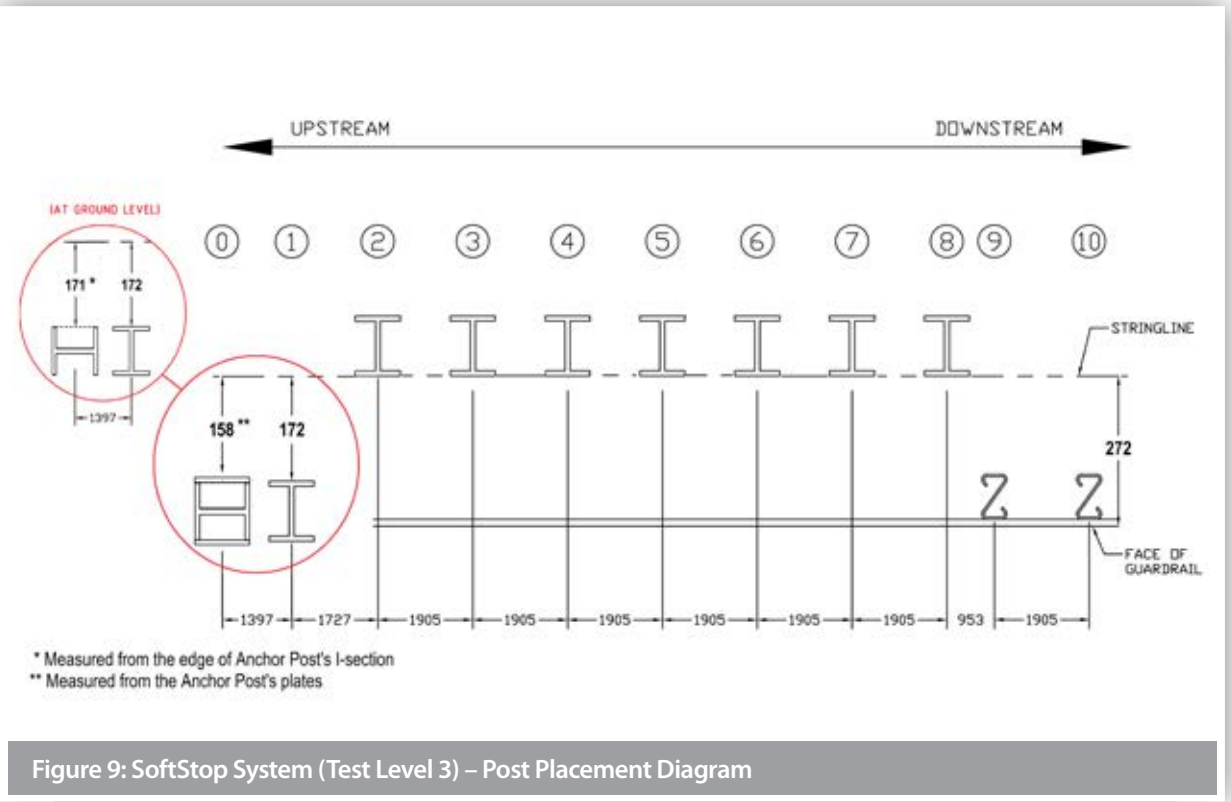


Figure 9: SoftStop System (Test Level 3) – Post Placement Diagram

Notes:
1. Post 0-8 part of SoftStop System TL3
2. Post 9 is first post of longitudinal w-beam system (not included with SoftStop System)
3. Spacing between posts is on centre as shown
4. All SoftStop System posts must be installed plumb
5. Guardrail splice joint located at Post 9

6.2 SoftStop® System Anchor Post (Post 0) Placement

The SoftStop® System Anchor Post (10007543) is the first post of the SoftStop® System and is designated as Post 0. The SoftStop®System Anchor Post is to be assembled plumb and oriented with the front side of post facing towards the upstream end.

A. When assembled to the correct depth, the SoftStop® System Anchor Post stub will protrude 89 mm above the finished grade line (see Step 2 of this Assembly Manual).

B. When fully assembled, the SoftStop® System Anchor Post (with Anchor Angles) will protrude 102 mm above the finished grade line (see Step 12 of this Assembly Manual).

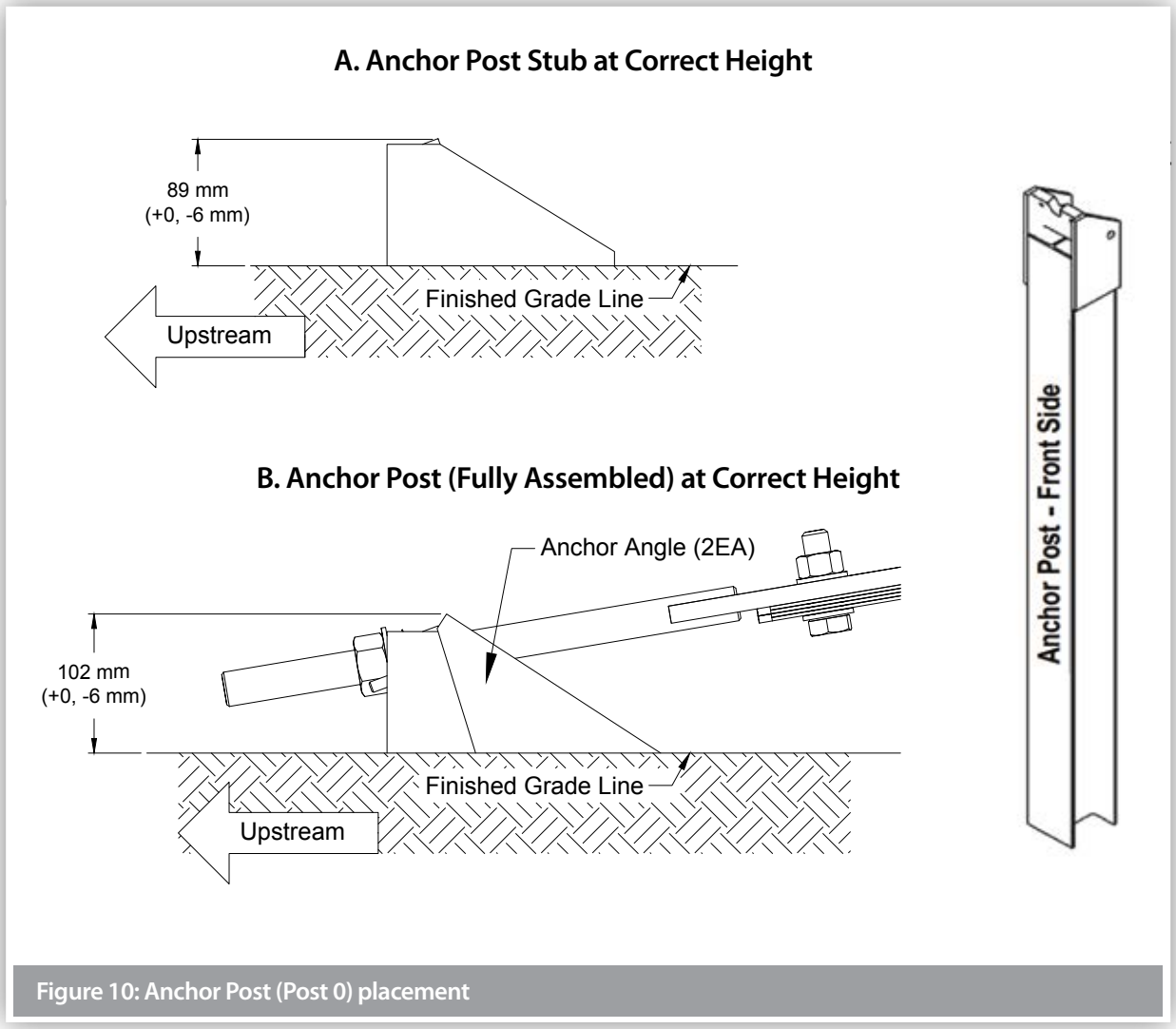


Figure 10: Anchor Post (Post 0) placement

6.3 SoftStop® System Impact Head

The SoftStop® Impact Head (10007538) component is symmetrical and can be assembled on the left or right shoulder. The diagram below lists some of the subcomponents of the Impact Head.

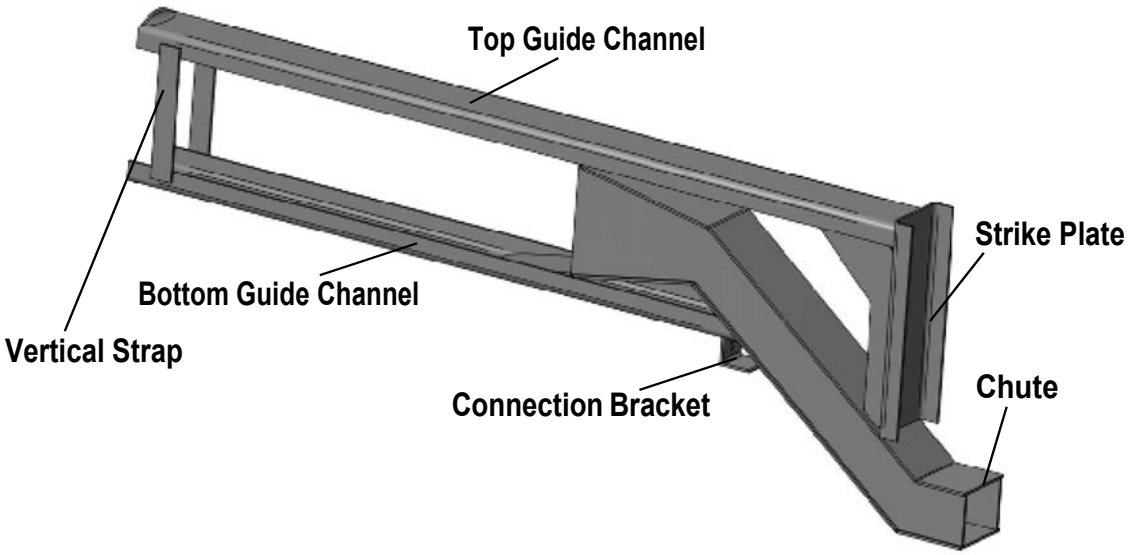


Figure 11: SoftStop® System Impact Head

When properly assembled, the SoftStop® Impact Head shall only be assembled parallel to the finished grade line or have an upward tilt (towards front of the system). The elevation of the Impact Head can vary a maximum of 58 mm higher at Point A relative to Point B. Point A is measured from the finished grade line to where the corner of the side plate connects with the top guide channel and Point B is measured from the finished grade line to where the inside corner of the vertical strap connects with the top guide channel.

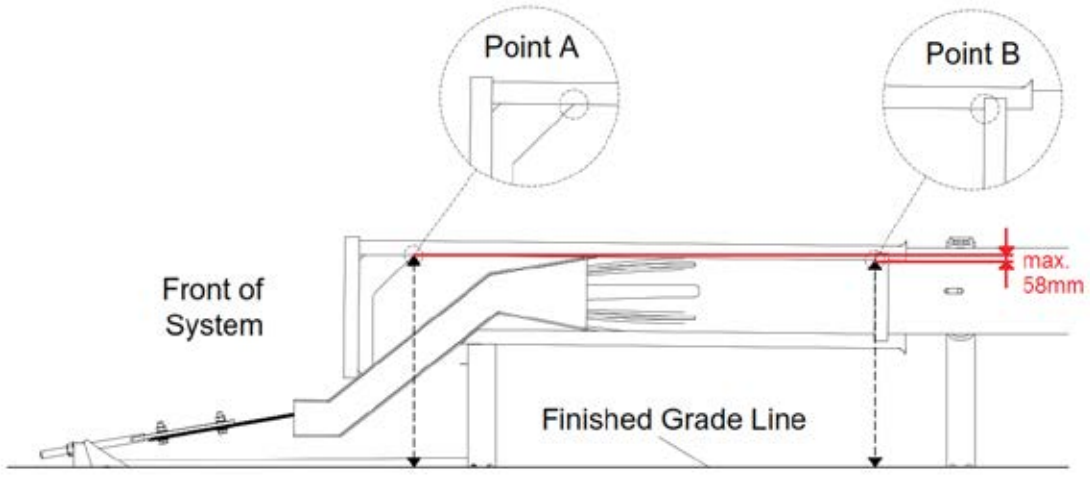
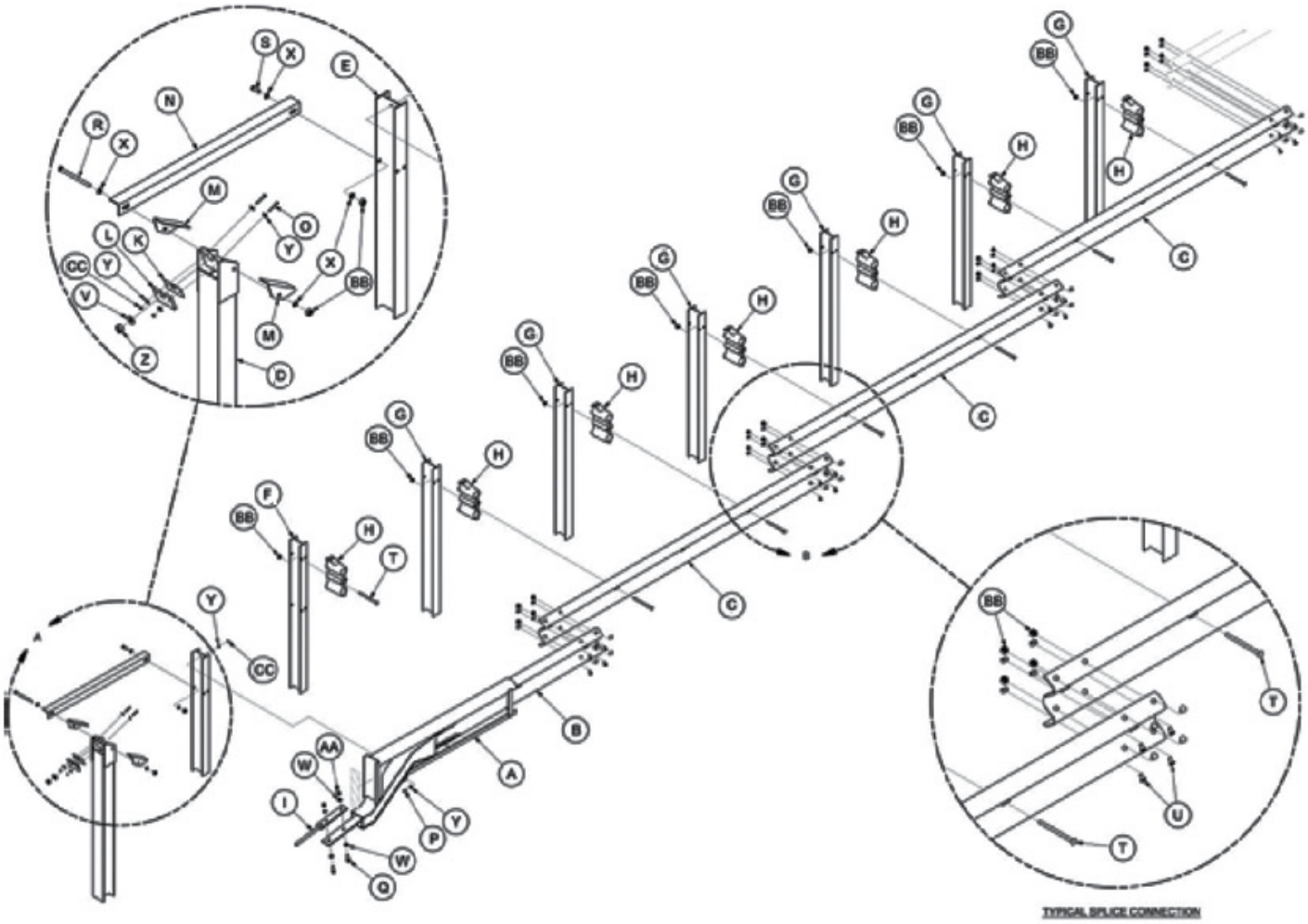


Figure 12: Correct assembly of the SoftStop Impact Head

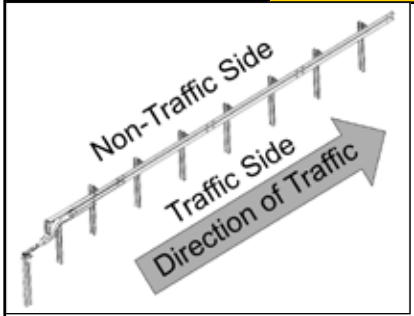
7.0 TEST LEVEL 3 ASSEMBLY STEPS

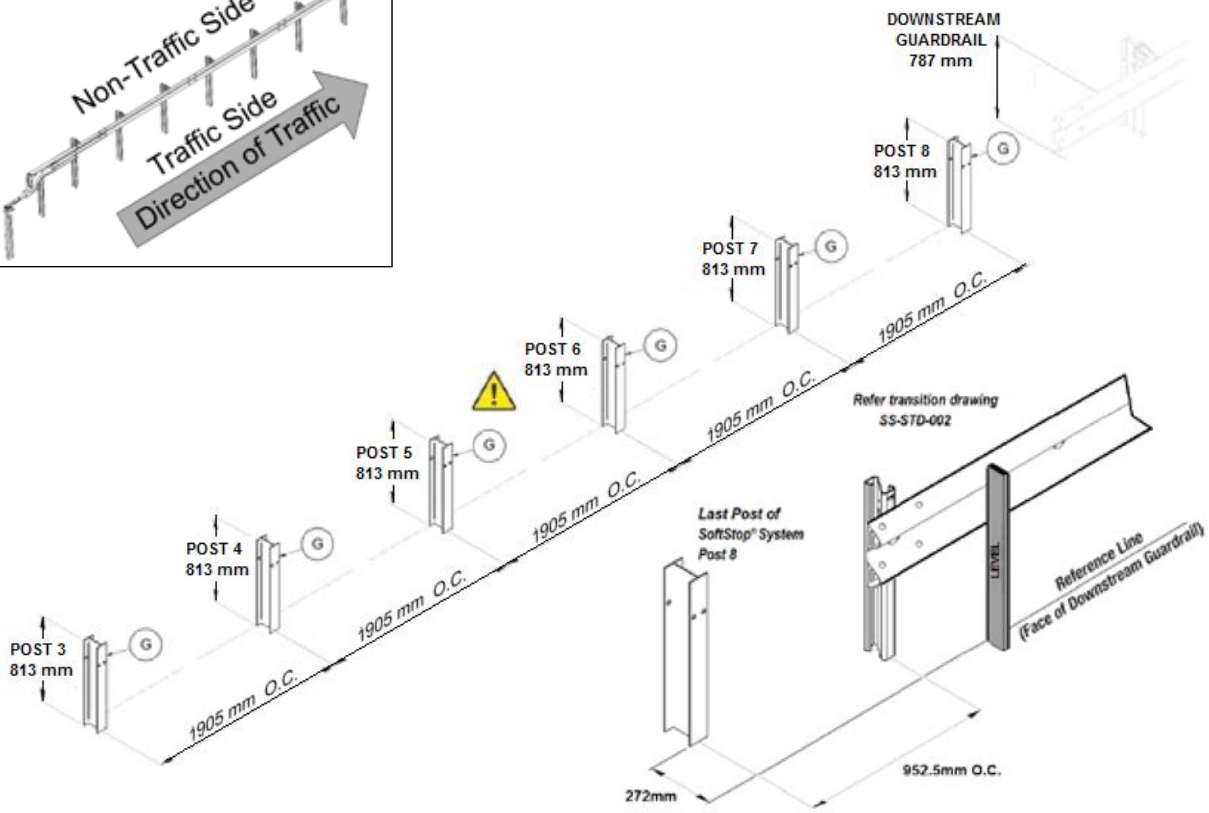
Important: Always use safety precautions when performing assembly, maintenance, repair and/or moving heaving equipment. Ensure proper personal protective equipment (PPE) is worn. Failure to follow this warning could result in serious injury or death.



8.0 INSTALLATION PROCEDURE

STEP 1 System Line Post Assembly (Posts 3-8)





PARTS		
G	10007540	6 EA

Use only Trinity Highway parts that are specified herein for the SoftStop® System for assembling, maintaining, or repairing the SoftStop® System. Do not utilise or otherwise comingle parts from other systems even if those systems are Trinity Highway systems.

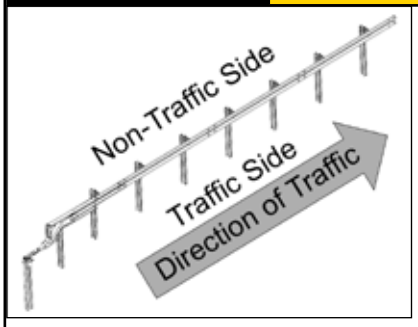
INSTRUCTIONS

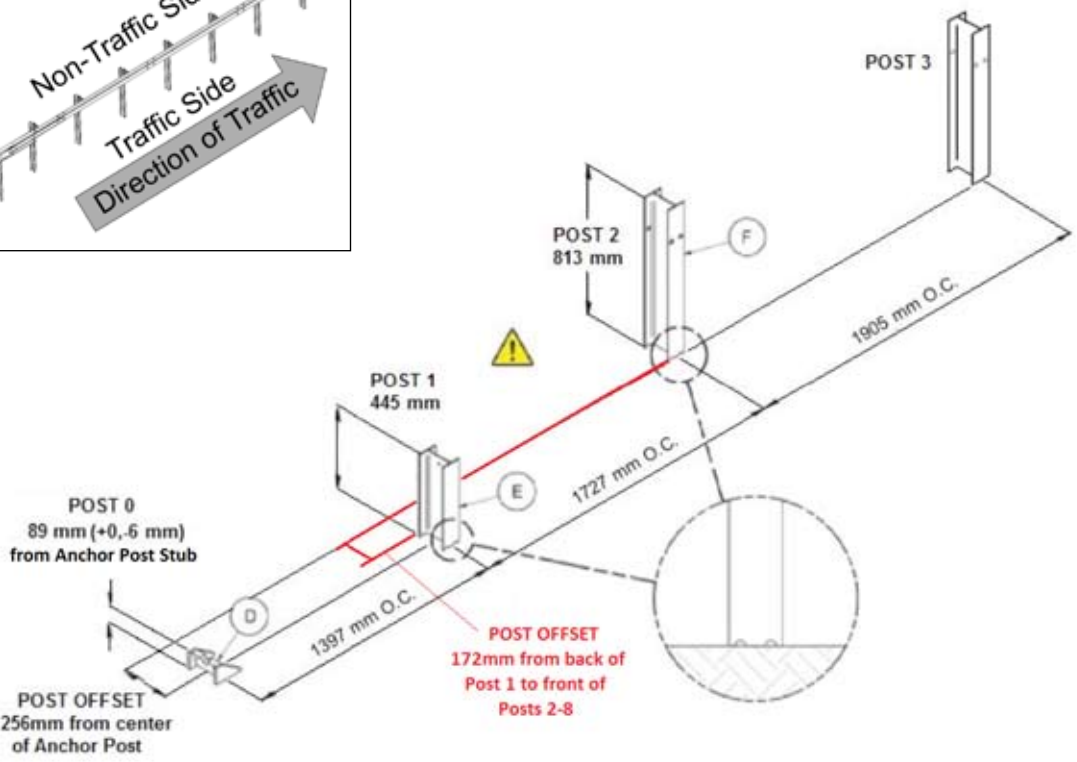
1. Assemble all parts in the configuration & orientation as shown in the above diagram.
2. The SoftStop® System must be attached to a w-beam guardrail that has been properly transitioned to 787 mm rail height per state/specifying agency (see Appendix for transition drawing example).
3. Establish the location of the last post of the SoftStop® System (Post 8) by placing a level on the face of downstream guardrail to the finished grade and applying offset and post spacing requirements shown above.
4. Ensure proper post spacing and post height is achieved for Posts 3-8 (Part G) per shown dimensions above.

WARNINGS

Proper site grading must be accomplished in accordance with local specifying agency guidelines. Failure to follow this warning could result in serious injury or death in the event of a vehicle impact or collision with the system.

STEP 2 Post Assembly (Posts 0-2)





PARTS

F	10001402	1 EA
E	10007539	1 EA
D	10007543	1EA

Use only Trinity Highway parts that are specified herein for the SoftStop® System for assembling, maintaining, or repairing the SoftStop® System. Do not utilise or otherwise comingle parts from other systems even if those systems are Trinity Highway systems.

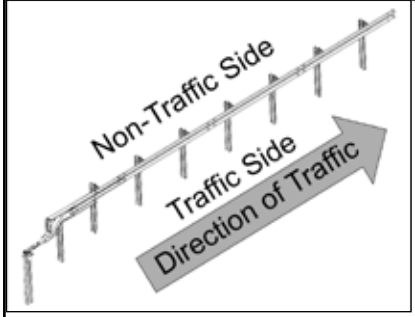
INSTRUCTIONS

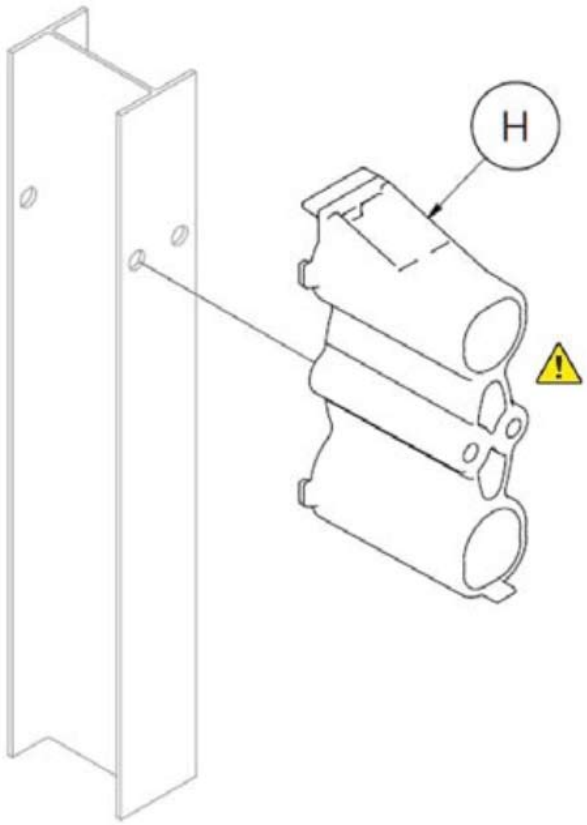
1. Assemble all parts in the configuration & orientation shown above.
2. Ensure proper offset for Post 0 (Part D) and Post 1 (Part E) is as shown on dimension above and on the Post Displacement Diagram (page 30).
3. Ensure center of yielding holes for Post 1 & 2 are approximately at finished grade, as shown.
4. Ensure Post 0 stub height does not exceed 89 mm above finished grade.
5. Ensure proper post spacing and post height is achieved per shown dimensions above.

WARNINGS

Proper site grading must be accomplished in accordance with local road authority guidelines. Failure to follow this warning could result in serious injury or death in the event of a vehicle impact or collision with the system.

STEP 3 Offset Block Assembly (Posts 3-8)





PARTS		
H	10001397	6 EA

INSTRUCTIONS

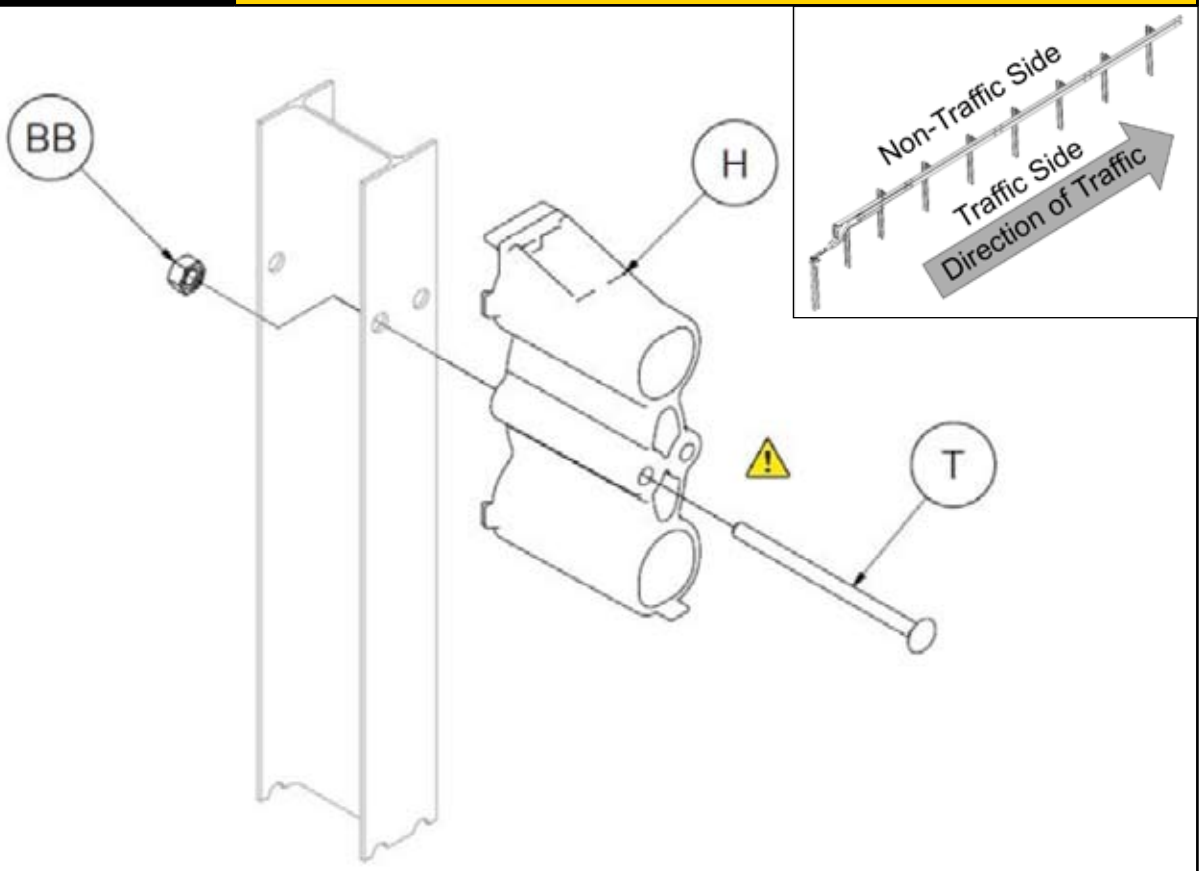
1. Assemble all parts in the configuration & orientation shown above.
2. Attach (1 EA) Offset Block (Part H) on traffic side of Posts 3-8. The Offset Block is equipped with a self-hanging mounting tab.

Use only Trinity Highway parts that are specified herein for the SoftStop® System for assembling, maintaining, or repairing the SoftStop® System. Do not utilise or otherwise comingle parts from other systems even if those systems are Trinity Highway systems.

WARNINGS

Do not use any Offset Block (Part H) if they show signs of damage. Seek replacement from Ingal Civil Products prior to assembly.

STEP 4 Offset Block Assembly (Post 2)



PARTS		
H	10001397	1 EA
T	10001300	1 EA
BB	10001299	1EA

INSTRUCTIONS

1. Assemble all parts in the configuration & orientation shown above.
2. Attach (1 EA) Offset Block (Part H) on traffic side of Post 2. The Offset Block is equipped with a self-hanging mounting tab.
3. Secure Offset Block to post with shown hardware.
4. Tighten all threaded hardware to a snug position with an appropriately sized wrench or socket.

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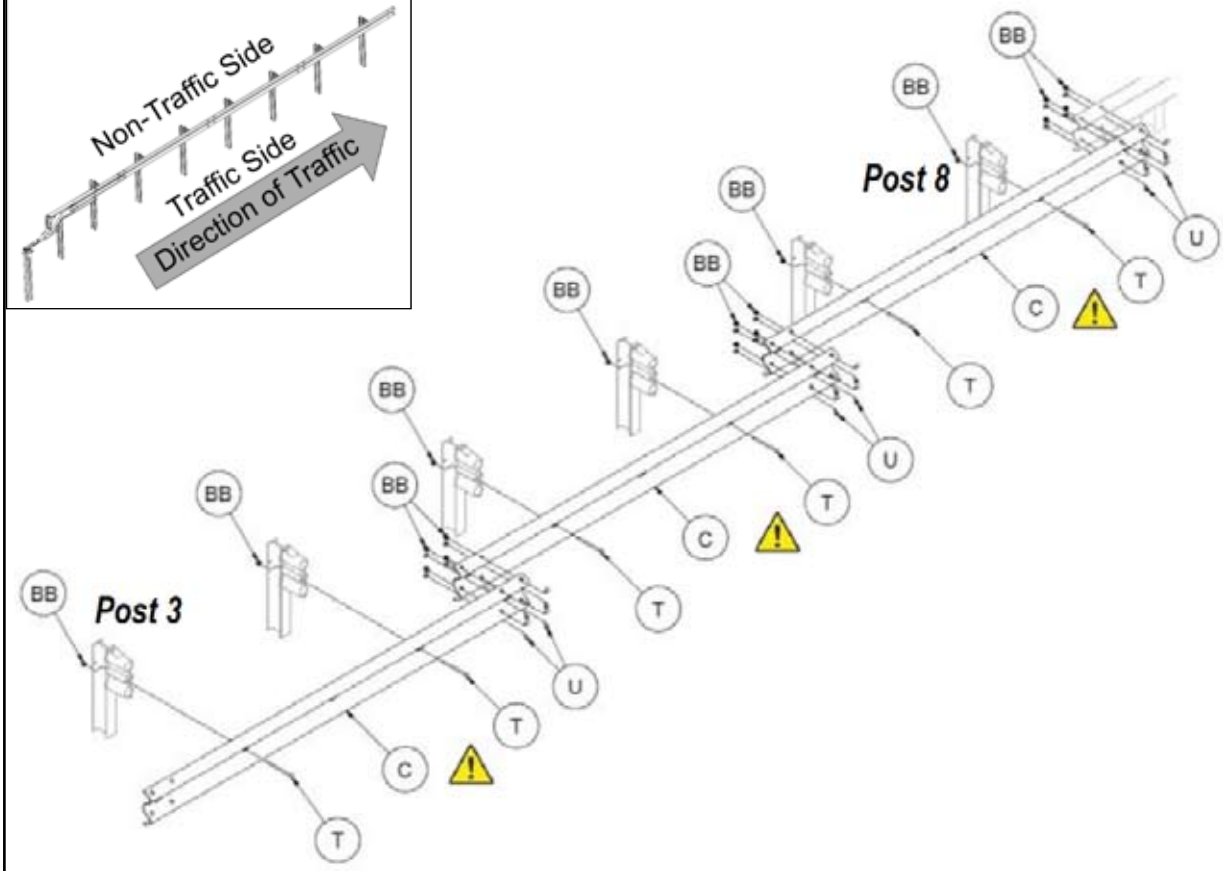
WARNINGS

Do not use any Offset Block (Part H) if they show signs of damage. Seek replacement from Ingal Civil Products prior to assembly.

STEP 5 — 3.81m System Rail Assembly (Post 3-8)



PARTS

C	10007537	3 EA
T	10001300	6 EA
U	10007550	24 EA
BB	10001299	30 EA

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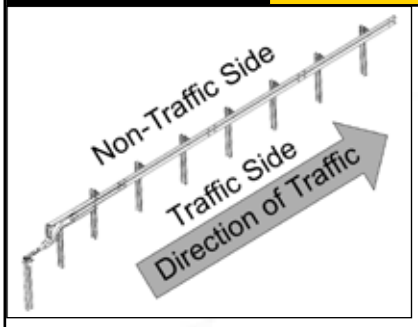
INSTRUCTIONS

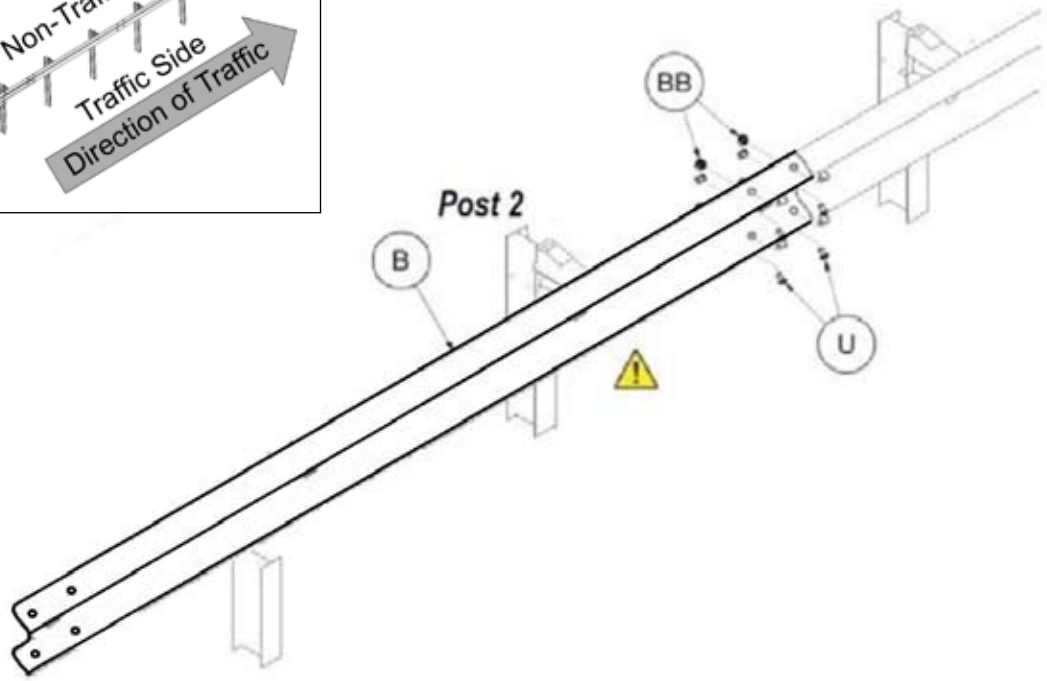
1. Assemble all parts in the configuration & orientation shown above.
2. Place all System Rail panels (Part C) on the traffic side of the posts and lap all System Rail panels in the direction of traffic as shown above using shown hardware.
3. Tighten all threaded hardware to a snug position with an appropriately sized wrench or socket.

WARNINGS

Do not place anything between any post bolt head and the SoftStop® System Rail that would prevent the bolt from pulling through (i.e. no rectangular washers or delineators). Failure to follow this warning could result in serious injury or death in the event of a collision.

STEP 6 Anchor Rail Assembly





PARTS		
B	10007536	1 EA
U	10007550	8 EA
BB	10001299	8 EA

INSTRUCTIONS

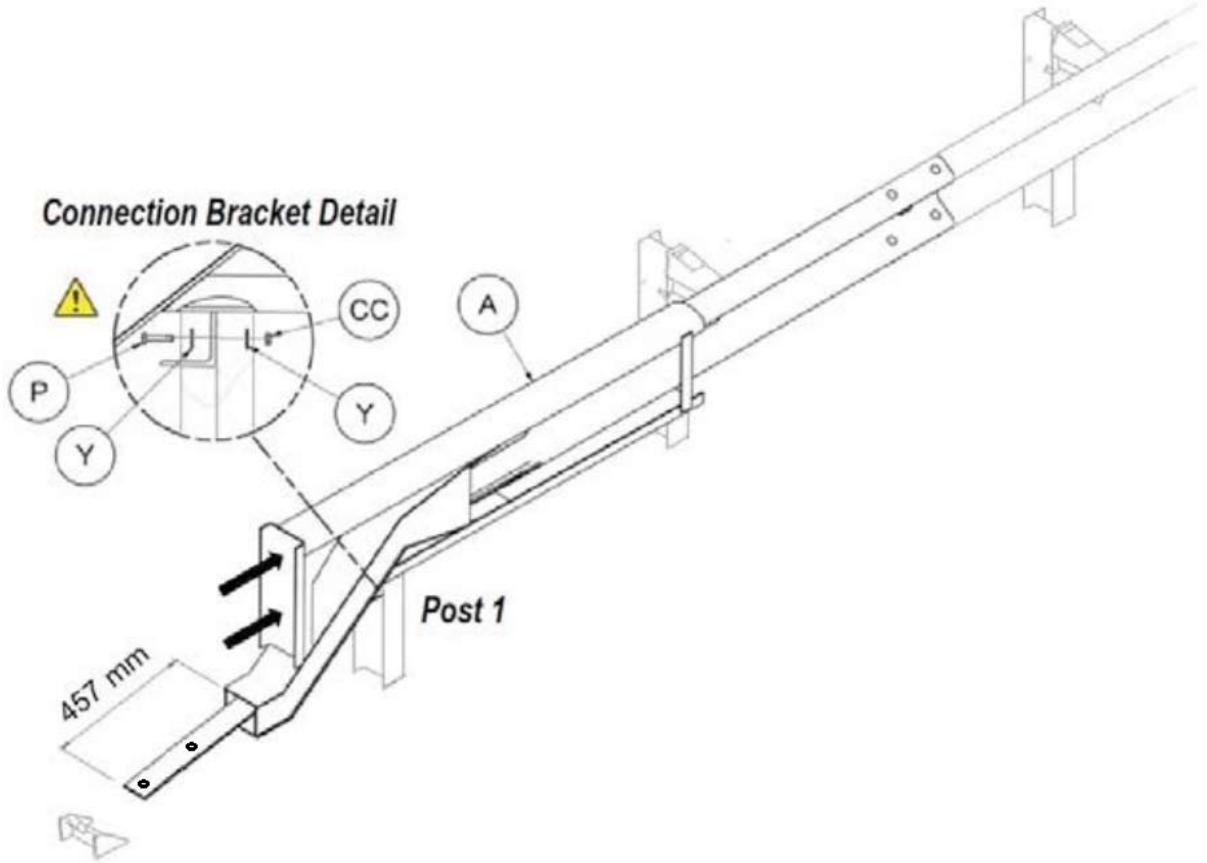
1. Assemble all parts in the configuration & orientation shown above.
2. Place SoftStop® Anchor Rail (Part B) on the traffic side and lap in the direction of traffic as shown above using shown hardware.
3. Tighten all threaded hardware to a snug position with an appropriately sized wrench or socket.

Use only Trinity Highway parts that are specified herein for the SoftStop® System for assembling, maintaining, or repairing the SoftStop® System. Do not utilise or otherwise comingle parts from other systems even if those systems are Trinity Highway systems.

WARNINGS

Do not bolt the SoftStop® Anchor Rail to Post2. Failure to follow this warning could result in serious injury or death in the event of a collision.

STEP 7 Impact Head Assembly



PARTS		
A	10007538	1 EA
P	10007553	1 EA
Y	10007554	2 EA
CC	10007555	1EA

INSTRUCTIONS

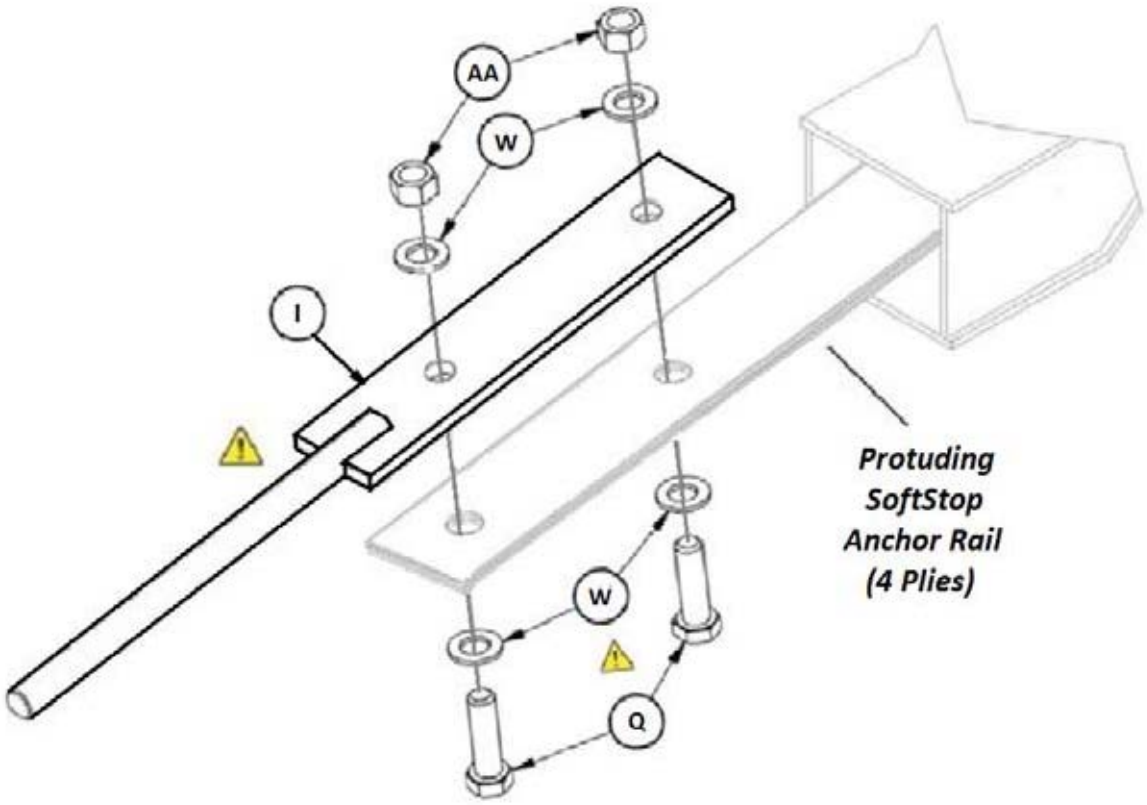
1. Assemble all parts in the configuration & orientation shown above.
2. Mechanically push the SoftStop® Impact Head (Part A) until its Connection Bracket rests against Post 1 and a minimum 457 mm of the SoftStop® Anchor Rail is protruding out the Chute.
3. Fasten Post 1 and the Connection Bracket together with shown hardware (Parts P, Y, & CC) and tighten. See Connection Bracket detail.
4. Mechanically lift the exposed Anchor Rail until it aligns with the slot in the Anchor Post (Post 0) when at rest.

Use only Trinity Highway parts that are specified herein for the SoftStop® System for assembling, maintaining, or repairing the SoftStop® System. Do not utilise or otherwise comingle parts from other systems even if those systems are Trinity Highway systems.

WARNINGS

The SoftStop® Impact Head Connection Bracket must rest against the front side of Post#1 (between Posts 0-1) as shown in the Connection Bracket Detail above.

STEP 8 Anchor Paddle Assembly



PARTS

I	10007542	1 EA
W	10001284	4 EA
AA	10001285	2 EA
Q	10001286	2 EA

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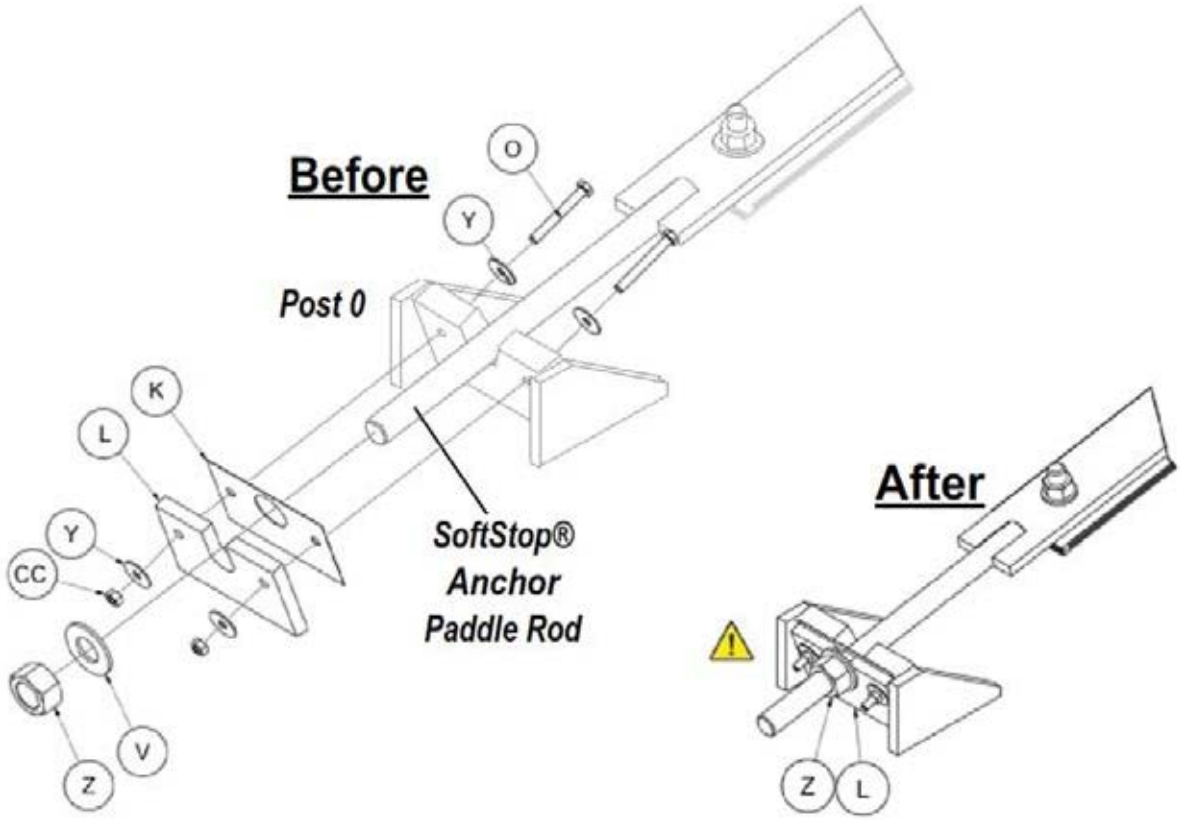
INSTRUCTIONS

1. Assemble all parts in the configuration & orientation shown above.
2. Flatten the exposed Anchor Rail, line up holes using an alignment tool onto the rail and insert the hex bolts and bottom washers as shown above. The Anchor Paddle (Part I) is assembled on the top side of the four (4) plies of the protruding Anchor Rail. Place the top washers and nuts onto the hex bolt as shown above. The use of locking pliers or c-clamps will aid the assembly process.
3. Tighten all threaded hardware to a snug position with an appropriately sized wrench or socket.

WARNINGS

The SoftStop® Anchor Paddle (Part I) must be placed on the topside of the SoftStop® Anchor Rail. Failure to follow this warning could result in serious injury or death in the event of a collision.

STEP 9 Anchor Post Assembly (Post 0)



PARTS		
Y	10007554	4 EA
CC	10007555	2 EA
Z	10007549	1 EA
V	10007548	1EA
L	10007546	1 EA
K	10007546	1 EA
O	10007552	2 EA

Use only Trinity Highway parts that are specified herein for the SoftStop® System for assembling, maintaining, or repairing the SoftStop® System. Do not utilise or otherwise comingle parts from other systems even if those systems are Trinity Highway systems.

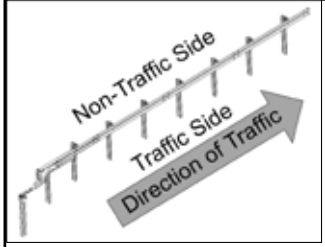
INSTRUCTIONS

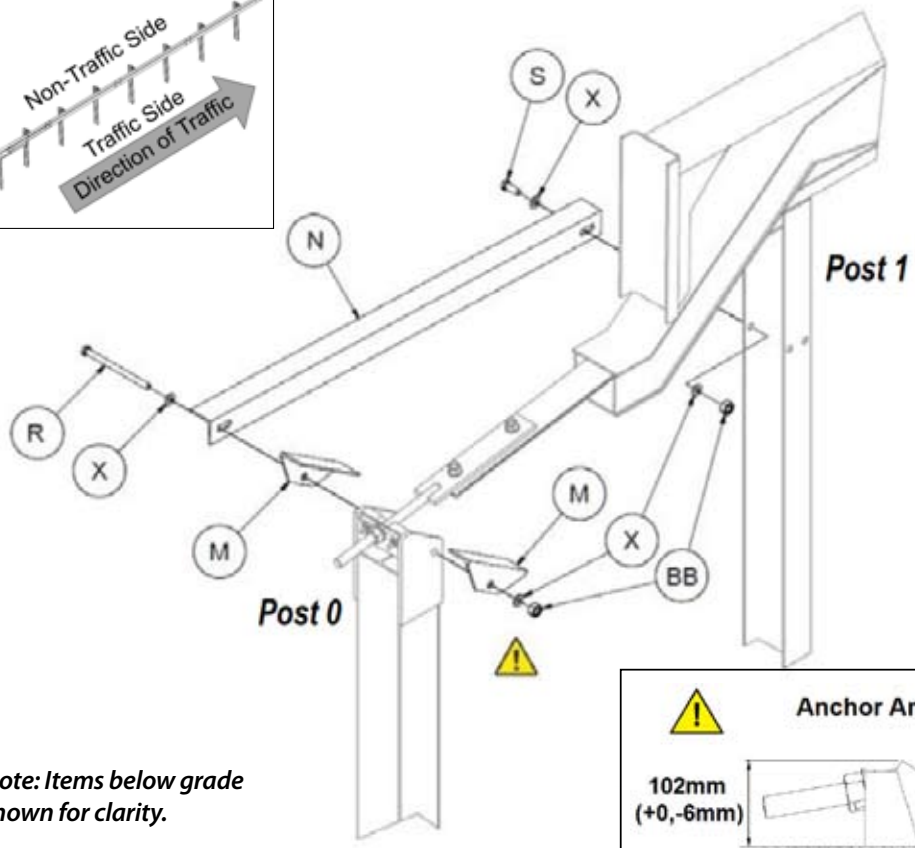
1. Assemble all parts in the configuration & orientation shown above.
2. Place the rod portion of the SoftStop® Anchor Paddle in the notch of Post 0.
3. Place the SoftStop® Keeper Plate (Part K) and SoftStop® Plate Washer (Part L) onto the SoftStop® Anchor Paddle Rod and fasten to Post 0 using shown hardware (Part O, Y, CC).
4. Place washer (Part V) then nut (Part Z) on the SoftStop® Anchor Paddle Rod.
5. Tighten all threaded hardware to a snug position with an appropriately sized wrench or socket.

WARNINGS

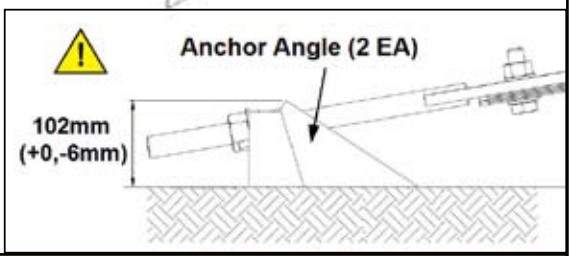
Ensure the 1" Hex Nut (Part Z) has been fully tightened against the SoftStop® Plate Washer (Part L). Failure to follow this warning could result in serious injury or death in the event of a collision.

STEP 10 Angle Strut Assembly (Posts 0-1)





Note: Items below grade shown for clarity.



PARTS

BB	10001299	2 EA
X	10007095	4 EA
R	10007551	1 EA
M	10007544	2 EA
N	10007547	1 EA
S	10007092	1 EA

Use only Trinity Highway parts that are specified herein for the SoftStop® System for assembling, maintaining, or repairing the SoftStop® System. Do not utilise or otherwise comingle parts from other systems even if those systems are Trinity Highway systems.

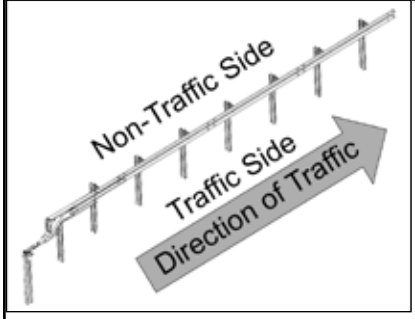
INSTRUCTIONS

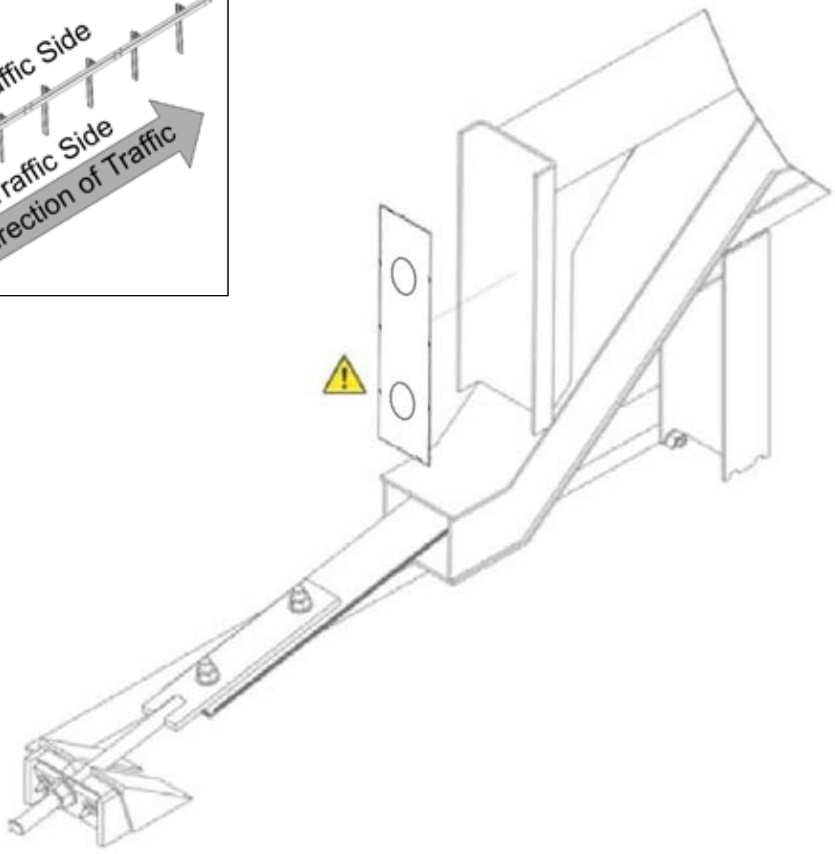
1. Assemble all parts in the configuration & orientation shown above.
2. It will be necessary to make a shallow valley/trough between Post 0 & 1 for the SoftStop® Angle Strut (Part N) and SoftStop® Anchor Angles (Part M), since a portion will be below the finished grade.
3. Position the SoftStop® Anchor Angles (Part M) onto Post 0 and place SoftStop® Angle Strut on the non-traffic side with short leg down and fasten to Post 0 & 1 using shown hardware (Part R, S, X, BB).
4. Tighten all threaded hardware to a snug position with an appropriately sized wrench or socket.

WARNINGS

Ensure fully assembled SoftStop® Anchor Post height (with SoftStop® Anchor Angles) does not exceed 102mm above finished grade line.

STEP 11 Delineation Assembly





PARTS			INSTRUCTIONS
BY OTHERS			
			1. Assemble all parts in the configuration & orientation shown above.
			Note: Manufacturer suggests that user provide delineation (reflective sheeting) of the terminal.

Use only Trinity Highway parts that are specified herein for the SoftStop® System for assembling, maintaining, or repairing the SoftStop® System. Do not utilise or otherwise comingle parts from other systems even if those systems are Trinity Highway systems.

WARNINGS

Ensure delineation (reflective sheeting) used on SoftStop® System meets road authority specifications for proper delineation. Use of steel delineator posts are not permitted within 1m of the SoftStop® System.

9.0 SoftStop Installation Checklist

Customer:

Project:

Barrier ID: Terminal Type: ☐ MASH TL2 ☐ MASH TL3

Checked By: Signed: Date:

Is the assembled Anchor post installed in the correct orientation with the sloped side facing the terminal and within tolerance (102 +0/-6 mm measured from ground level to the top of the Anchor Angles)	☐ Yes	☐ No
Is Anchor Keeper Plate installed in correct configuration on Anchor post (Step 9)	☐ Yes	☐ No
Have Anchor post Angles been correctly bolted to the Anchor post (Step 10)	☐ Yes	☐ No
Is the Ground Strut bolted to the Anchor post and post 1 (Step 10)	☐ Yes	☐ No
The SoftStop head is bolted to post 1 (Step 7)	☐ Yes	☐ No
Are SYT posts positioned at locations 1 & 2, with yield holes approximately centred at finished grade line	☐ Yes	☐ No
Are posts 2 through 8 at the correct height of 813mm ±20mm above ground level	☐ Yes	☐ No
Are the rails secured to posts 3 through 8 (posts 3 and 4 for the TL2 configuration)	☐ Yes	☐ No
Ensure first rail is NOT secured to post at location 2	☐ Yes	☐ No
Have the rails been joined with M16x32mm splice head bolts	☐ Yes	☐ No
Are all splice bolts, post bolts and other fasteners snug tight	☐ Yes	☐ No
Do the standard W-Beam rails form a smooth line vertically and horizontally when viewed along the system, with no curved rails	☐ Yes	☐ No
Is all back-filled material around each post suitably compacted	☐ Yes	☐ No
Is the area below the guardrails free from hazards so that the SoftStop head can travel freely upon impact	☐ Yes	☐ No
Ensure any minor damage been repaired using two coats of an organic zinc rich paint	☐ Yes	☐ No
When installed on a flare, ensure flare rate is no greater than 1:25 (610mm offset from straight barrier over full length for TL3 configuration, 305mm for TL2 configuration)	☐ Yes	☐ No
Ensure SoftStop impact head has no more than 58mm of upward tilt, measured over length of impact head (points A & B - refer to Figure 12, page 15).	☐ Yes	☐ No

Disclaimer:
Important Note: The conformity of the installation is the responsibility of the installation contractor, and Ingal Civil Products accepts no liability for or in connection with any installation that is outside of the specifications of this manual or the Road Controlling Authority. For more information, please refer to our Standard Terms and Conditions of Sale available on our website: www.ingalcivil.co.nz.

10.0 Maintenance and Repair

Except for repairs due to impacts, there is virtually no maintenance required for the system. It is recommended that annual inspections be performed to ensure the following;

- The terminal is appropriately delineated.
- Debris has not accumulated around the terminal that may impede the travel of the extruder head.
- The anchor cable is taut and the nuts have not been removed from the cable.
- The blocking pieces have not rotated (post bolts tight).
- Nut on Anchor Paddle is snug tight.

10.1 Bush Fire Damage

All steel items used for the assembly of the SoftStop are hot dip galvanized. The performance of galvanized coatings when subjected to fires depends upon a number of factors, such as flame duration, intensity and the characteristics of the galvanized coating.

Typical bushfire conditions may expose steel structures to an air temperature of 800°C for periods of up to 120 seconds, however zinc coatings are generally reflective and will not absorb heat at the same rate as an uncoated steel surface. Depending on the section thickness of the steel, the actual steel surface temperature may not exceed 350°C.

Typically, the bushfire flame duration and intensity are not high enough to compromise the structural strength of the steel. The hot dip galvanized coating will also typically remain unaffected through a bushfire event. If the bushfire causes damage to the galvanized surface, then the item(s) shall be replaced. It is recommended that the blocking pieces be replaced at these locations.

If an item to be replaced is a post or rail, it is recommended that the blocking pieces be replaced at these locations.

10.2 Damage Assessment

In the event of a vehicle impact, damage to the terminal is to be assessed in accordance with Table 2. A Safe Work Method Statement is available upon request to assist in the safe repair of the SoftStop. Only items purchased from Ingal shall be used for the repair of the SoftStop.

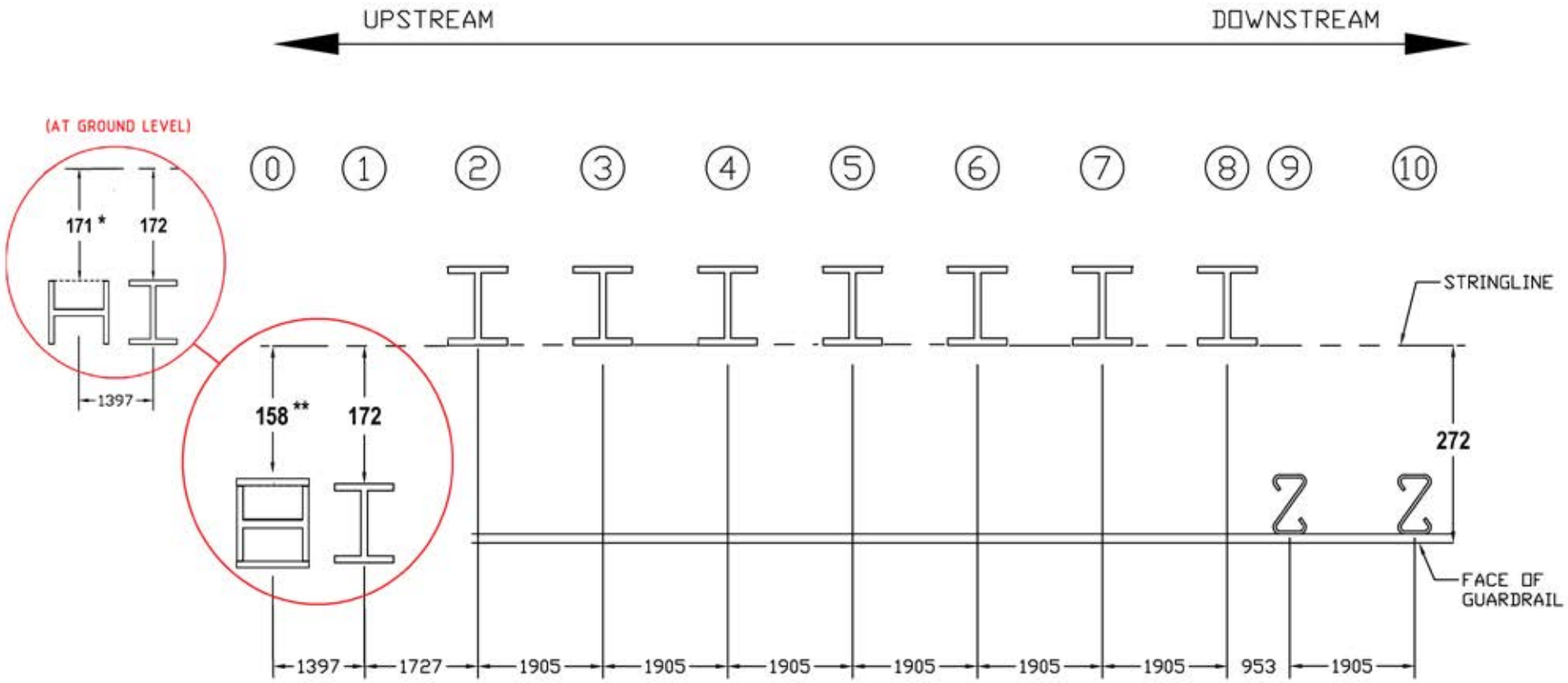
When replacing posts, ensure that the disturbed foundation material is suitably compacted prior to the installation of replacement posts.

Damage Assessment of SoftStop

Type of Defect	Description of the Defect	Action to be Taken
Galvanizing damage on Posts.	The sum total of the damaged area does not exceed 45cm^2 (0.5% of the total surface area) and no individual damaged area exceeds 40cm^2 . The sum total of the damaged area exceeds 45cm^2 (0.5% of the total surface area) or an individual damaged area exceeds 40cm^2 .	A zinc metal spray in accordance with ISO2063 or AS/NZS 2312 is to be applied to the repair area. The post is to be replaced
Galvanizing damage on rails.	The sum total of the damaged area does not exceed 200cm^2 (0.5% of the total surface area) and no individual damaged area does not exceed 40cm^2. The sum total of the damaged area exceeds 200cm^2 (0.5% of the total surface area) and/or an individual damaged area exceeds 40cm^2.	A zinc metal spray in accordance with ISO2063 or AS/NZS 2312 is to be applied to the repair area. The rail is to be replaced.
Mechanical damage on blocking pieces	The blocking piece has chips or cracks.	The blocking piece is to be replaced.
Mechanical damage on SYT or line posts.	The post is bent.	The post is to be replaced.
Mechanical damage on impact head	The impact head has minor damage that will not prevent its travel along the rail. The impact head is bent which will prevent its travel along the rail. The delineation tape is damaged.	The impact head may be reused. The impact head is to be replaced. The delineation tape is to be replaced.
Mechanical damage on rail.	The rail is dented, twisted or flattened. There are nicks in any part of the rail. The slots in the rail are distorted.	The rail is to be replaced. The rail is to be replaced. The rail is to be replaced.
Mechanical damage on bolts.	The body of the bolt is distorted. The thread of the bolt is damaged.	The bolt is to be replaced. The bolt is to be replaced.
Disturbance of material around posts.	The material around the post is loose or uncompacted.	Any disturbed pavement or material around a post shall be left dense, tight and smooth so that resistance to water penetration is similar to that of the adjacent surface.

Note: If the SoftStop terminal has been involved in an end-on impact, the impact head shall be replaced.

SoftStop System Test Level 3 (Posts 0-8) – Post Placement Diagram

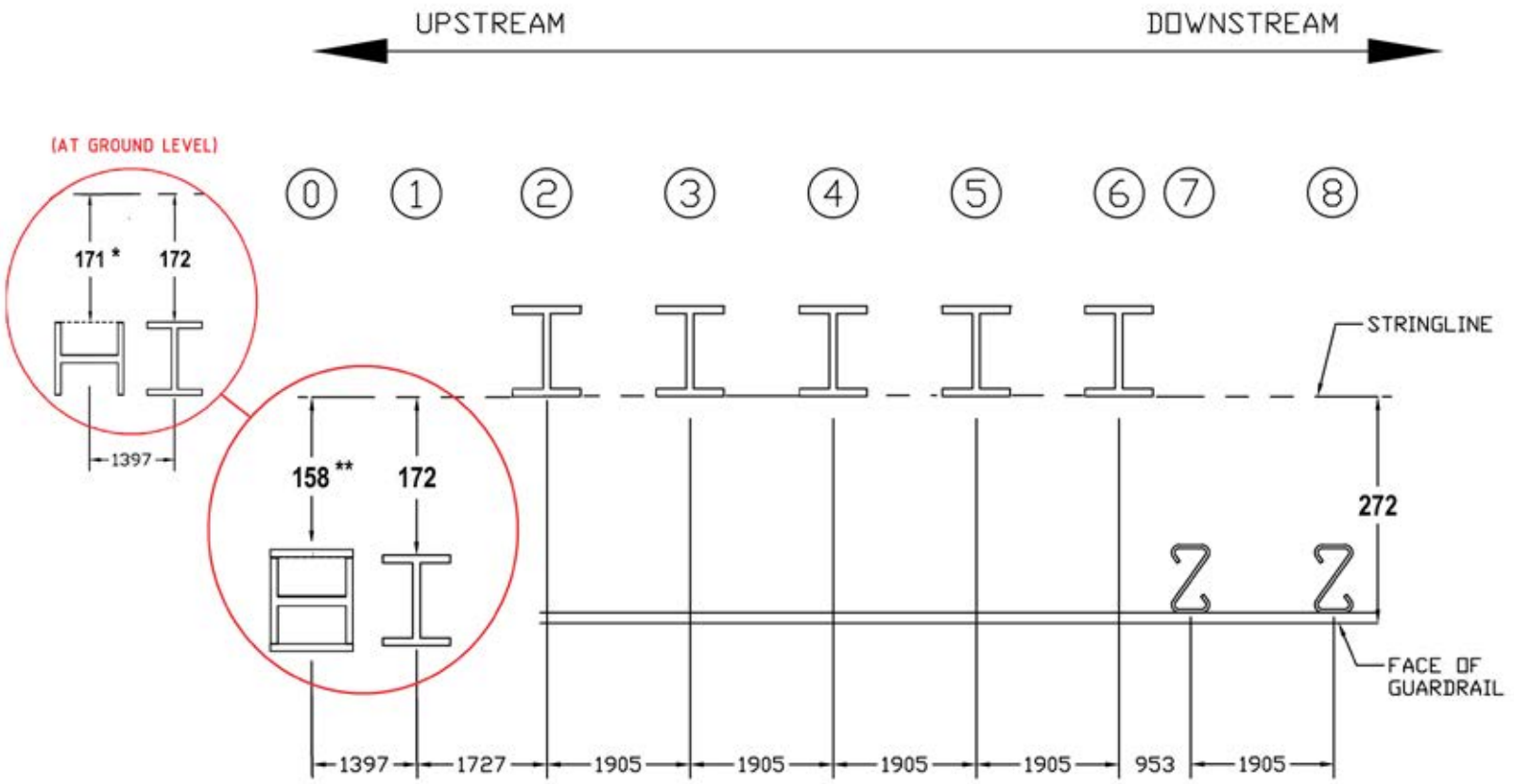


* Measured from the edge of Anchor Post's I-section
** Measured from the Anchor Post's plates

TRAFFIC DIRECTION

NOTES:
1. Post 0-6 part of SoftStop® System TL2
2. Post 7 is first post of longitudinal w-beam system (not included with SoftStop® System)
3. Spacing between posts is on centre as shown
4. All SoftStop® System posts must be installed plumb
5. Guardrail splice joint located at Post 7
6. Before installation, ensure the variant of highway safety barrier is accepted for use by the final asset owner.

SoftStop System Test Level 2 (Posts 0-6) – Post Placement Diagram

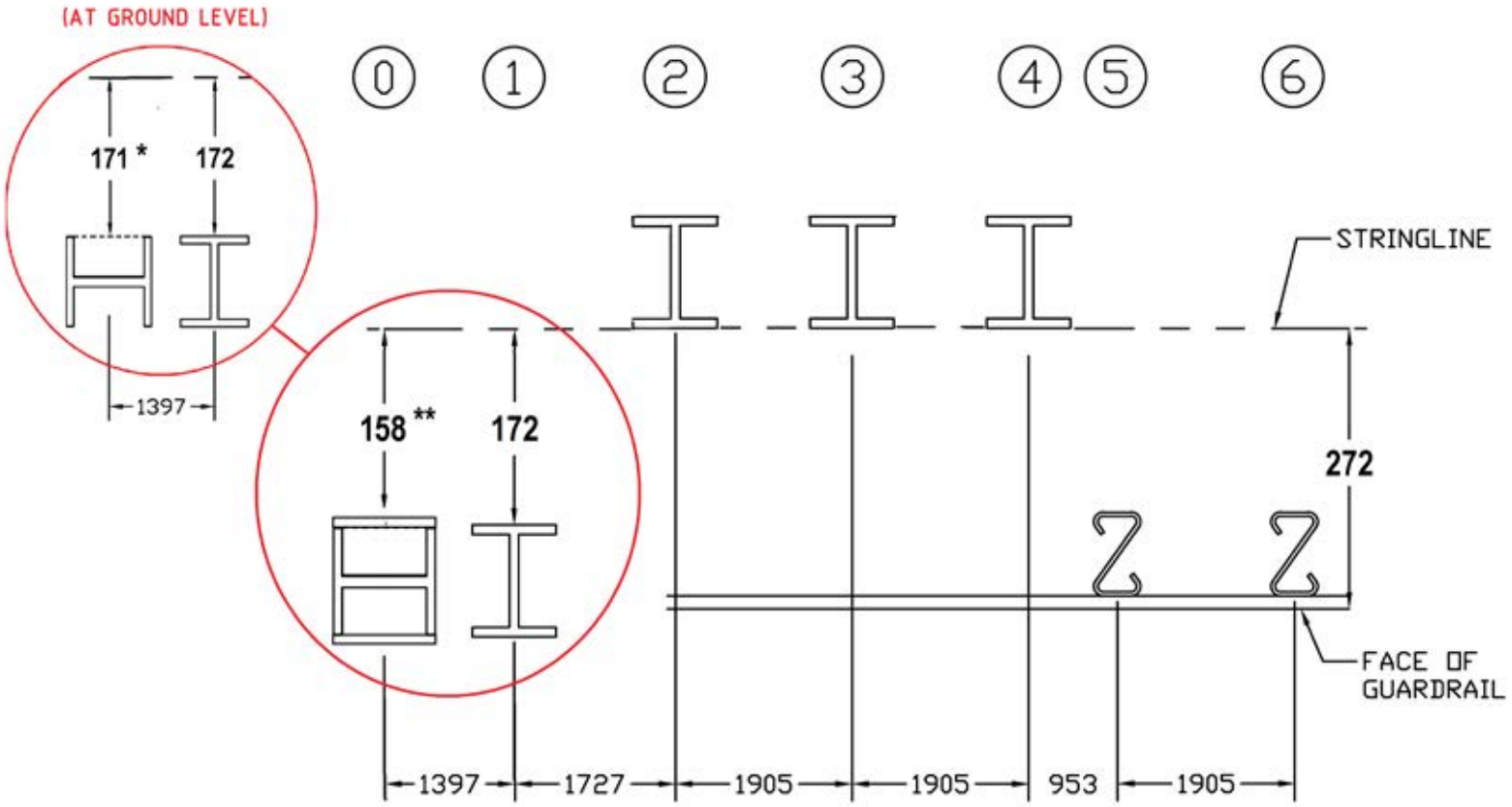


* Measured from the edge of Anchor Post's I-section
** Measured from the Anchor Post's plates

TRAFFIC DIRECTION

NOTES:
1. Post 0-4 part of SoftStop® System TL1
2. Post 5 is first post of longitudinal w-beam system (not included with SoftStop® System)
3. Spacing between posts is on centre as shown
4. All SoftStop® System posts must be installed plumb
5. Guardrail splice joint located at Post 5
6. Before installation, ensure the variant of highway safety barrier is accepted for use by the final asset owner.

SoftStop System Test Level 1 (Posts 0-4) – Post Placement Diagram



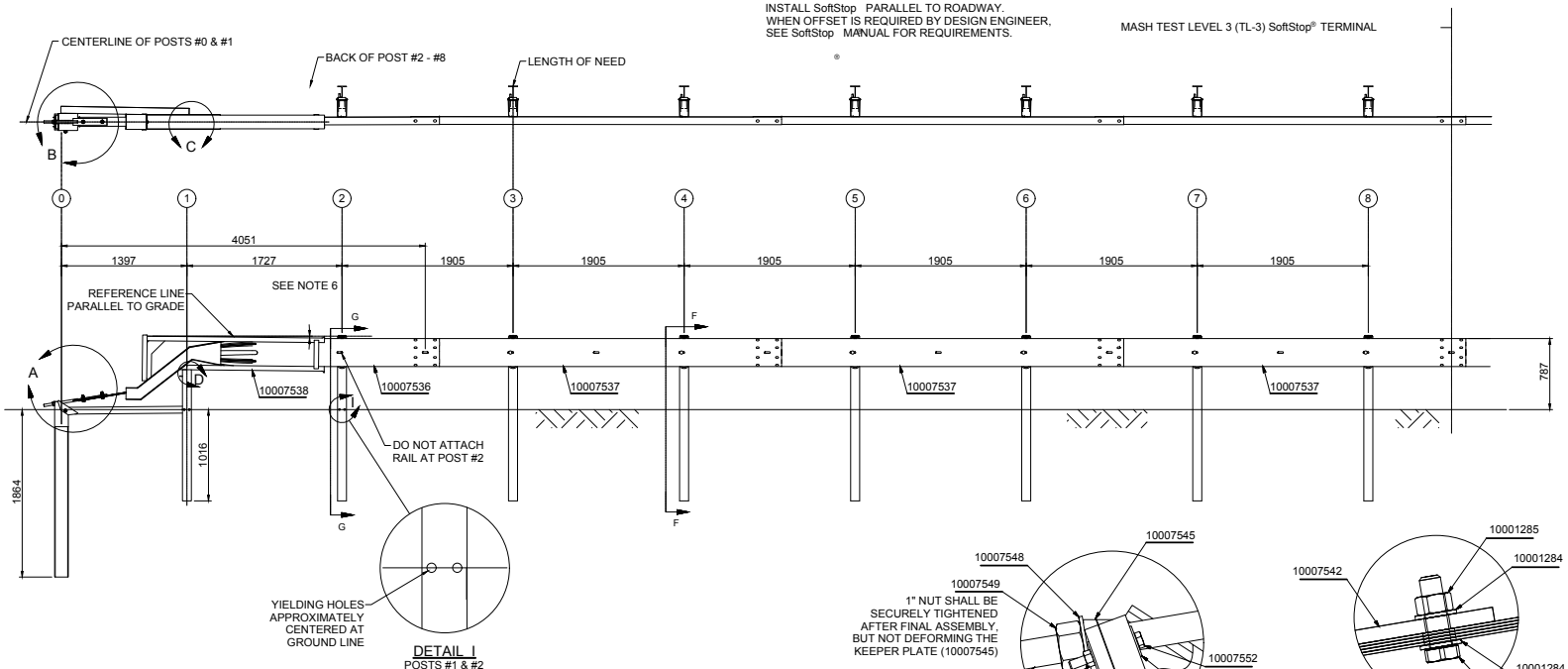
* Measured from the edge of Anchor Post's I-section
** Measured from the Anchor Post's plates

TRAFFIC DIRECTION

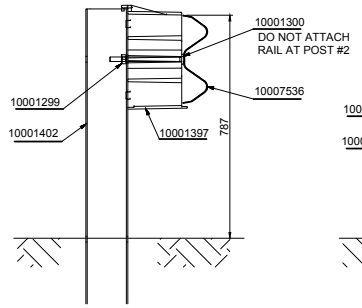
NOTES:
1. Post 0-6 part of SoftStop® System TL2
2. Post 7 is first post of longitudinal w-beam system (not included with SoftStop® System)
3. Spacing between posts is on centre as shown
4. All SoftStop® System posts must be installed plumb
5. Guardrail splice joint located at Post 7
6. Before installation, ensure the variant of highway safety barrier is accepted for use by the final asset owner.

PARTS LIST			
PART NO.	QTY.	DESCRIPTION	
10007537	3	SoftStop Terminal Guardrail	000011
10007540	6	SoftStop Line Post 1830mm	000533
10001397	7	KING BLOCK	006777
10001402	1	SFST SYT Post #2 1830mm	015000
10007536	1	SFST-ANCHOR G.RAIL	015200
10007544	2	SFST-ANCHOR ANGLE	015201
10007547	1	SFST-ANGLE STRUT	015202
10007539	1	SFST-POST#1 SYTP	015203
10007542	1	SFST-ANCHOR PADDLE	015204
10007543	1	SFST-POST#0	015205
10007546	1	SFST-PLATE WASHER	015206
10007545	1	SFST-KEEPER PLATE	015207
10007538	1	SFST-IMPACT HEAD	015208
		~ HARDWARE ~	
10007554	6	5/16 ROUND WASHER WIDE	003240
10007555	3	5/16 HEX NUT	003245
10001299	41	5/8" GR HEX NUT	003340
10007550	32	5/8"X1.25" GR BOLT	003360
10007092	1	5/8"X1.75" HEX BOLT A325	003391
10001300	7	5/8"X10" GR BOLT A307	003500
10001284	4	3/4" ROUND WASHER F436	003701
10001285	2	3/4" HVY HEX NUT A563 DH	003704
10001286	2	3/4"X2.5" HEX BOLT A325	003717
10007549	1	1" HVY HEX NUT A563 DH	003908
10007095	4	5/8" WASHER F436	004372
10007551	1	5/8"X9" HEX BOLT A325	004489
10007548	1	1" ROUND WASHER F436	004902
10007552	2	5/16"X2.5" HEX BOLT GRD 5	105285
10007553	1	5/16"X1.5" HEX BOLT GRD 5	105286

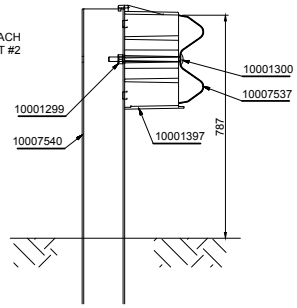
NOTE:
INSTALL SoftStop PARALLEL TO ROADWAY.
WHEN OFFSET IS REQUIRED BY DESIGN ENGINEER,
SEE SoftStop MANUAL FOR REQUIREMENTS.



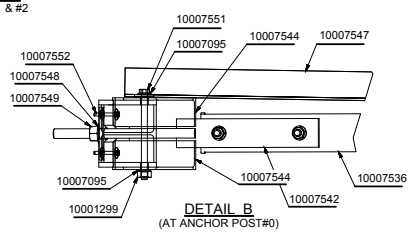
DETAIL I
POSTS #1 & #2



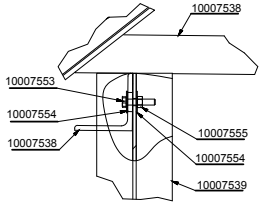
SECTION G-G
(POST #2)



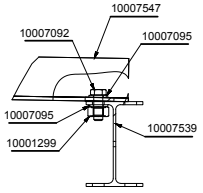
SECTION F-F
(POST #3 - #8)



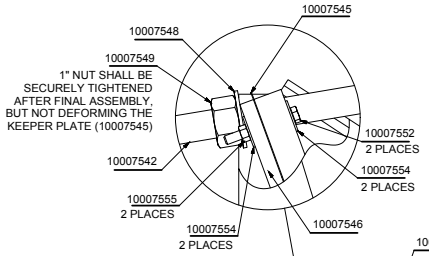
DETAIL B
(AT ANCHOR POST#0)

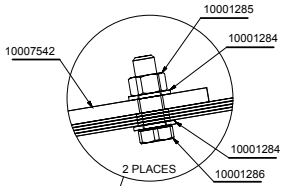


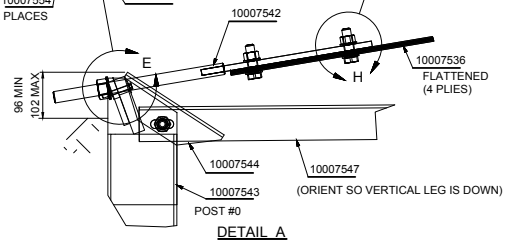
DETAIL D
(POST #1)



DETAIL C
(POST #1, SHOWN NEAR GROUND)







DETAIL A

NOTES:
1. REFER TO SoftStop® ASSEMBLY MANUAL.
2. PROPER SITE GRADING SHOULD BE ACCOMPLISHED IN ACCORDANCE WITH LOCAL SPECIFYING AGENCY GUIDELINES AND THE AASHTO ROADSIDE DESIGN GUIDE.
3. DO NOT ATTACH THE SoftStop® DIRECTLY TO A RIGID BARRIER.
4. UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE SoftStop® BE CURVED.
5. MANUFACTURER SUGGESTS CUSTOMER TO PROVIDE REFLECTORIZATION OF THE TERMINAL.
6. IT IS ACCEPTABLE TO INSTALL THE SoftStop® IMPACT HEAD PARALLEL TO THE GRADE LINE OR WITH AN UPWARD TILT. SEE SoftStop® ASSEMBLY MANUAL FOR SPECIFIC DETAILS.

REVISIONS

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED
4	04-06-2019	HEIGHT OF ANCHOR ANGLES UPDATED	VB	LG	LG
3	04-02-2019	MIRRORED DRAWING TO MATCH LEADING TERMINAL	VB	LG	LG
2	25-07-2016	DRAWING LAYOUT UPDATED	MC	SE	LG
1	01-10-2015	BOM UPDATED	LG	SE	LG

REFERENCES

DRAWING NUMBER	REFERENCE DRAWINGS

	NAME	DATE
DRAWN	TRIN	14-11-2012
CHECKED	LG	28-05-2015
APPROVED	LG	28-05-2015
SCALE	N.T.S. @ A3	
ISSUE FOR	INFORMATION ONLY	

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PROJECT

TITLE
GUARDRAIL END TERMINAL
SOFTSTOP
GENERAL ARRANGEMENT

INGAL CIVIL PRODUCTS PART No.
10007556

DRAWING No.
SS-STD-001

Rev: 4

J:\SALES & MARKETING\DRAWINGS\SOFTSTOP\SS-STD-001 - SOFTSTOP GA - R3.DWG

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A valmont COMPANY

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