U.S. Department of Transportation
Federal Highway Administration

1200 New Jersey Ave., SE
Washington, D.C. 20590

July 9, 2025

In Reply Refer To:
HSST-1/CC-184

Don Monin
SPIG Industry, LLC
14675 Industrial Park Road
Bristol, VA 24202

Dear Mr. Monin:

We received your initial correspondence on March 8, 2024, requesting issuance of a Federal-aid reimbursement eligibility letter under the Federal-aid highway program for the roadside safety system, device, design, product, or hardware (collectively "device") described below. On June 11, 2024, we received a complete set of files needed to complete our review. We write to inform you that the device SGET End Terminal is eligible for Federal-aid reimbursement. This letter is assigned Federal Highway Administration (FHWA) control number CC-184.

ELIGIBILITY LETTERS

The FHWA issues Federal-aid reimbursement eligibility letters for new roadside safety devices that are crash tested in accordance with the industry standard of the American Association of State Highway and Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH).

FHWA, the Department of Transportation, and the United States (government) do not regulate roadside safety devices, crash test facilities, or the manufacturing industry. Issuance of eligibility letters is discretionary and provided only as a service to the states. FHWA may, at its discretion, decline to issue, revise, or rescind an eligibility letter. Eligibility letters are only issued by the FHWA headquarters Office of Safety.

Eligibility letters are issued only as notice to the states that a device is eligible for reimbursement under the Federal-aid highway program. They do not establish approval or certification for any other purpose. Issuance of an eligibility letter is not a prerequisite or requirement for state transportation agencies seeking to use Federal-aid funds for roadside safety devices. State agencies may use a device for which an eligibility letter has not been issued and seek Federal-aid reimbursement.

FEDERAL-AID REIMBURSEMENT

The request for issuance of this letter certified the device was crash tested in accordance with the industry standard of AASHTO's MASH. This eligibility letter is based on that certification and the material offered in support of its issuance. The device described below is eligible for reimbursement under the Federal-aid highway program.

Name of system: SGET End Terminal
Type of system: Crash Cushions, Attenuators, & Terminals
Test Level: TL-3
Testing conducted by: Applus IDIADA KARCO Engineering, LLC
Date of request: March 8, 2024

Information about the device, including material such as the eligibility request, crash test reports, drawings, or images are included in one or more attachment(s) to this letter.

Eligibility letter CC-184 is inapplicable to devices, optional equipment, alternate materials, or other features that were not crash tested in accordance with AASHTO's MASH.

This letter is issued only for the subject device as crash tested under AASHTO's MASH. Later modification(s) of the device are not eligible for Federal-aid reimbursement under this letter. Notice of later modification(s) should be given to transportation agencies, facility owners, and operators (collectively "agencies").

Agencies should be provided appropriate information about the device's design, installation, maintenance, materials, and mechanical properties.

Issuance of this letter is discretionary, and it may be revised or rescinded at FHWA's discretion. This letter is not a determination of compliance with the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) or ownership of any intellectual property rights.

This eligibility letter is not a determination by the government that a crash involving the subject device will result in any particular outcome. It is limited to only the device's eligibility for Federal-aid reimbursement.

INTELLECTUAL PROPERTY

Issuance of this eligibility letter does not convey property rights of any sort nor any exclusive privilege. This letter is not authorization or consent by the government for the use, manufacture, or sale of any patented or proprietary system, device, design, product, or hardware for which the requester is not the patent owner. Eligibility letters are not an expression of any view, position, or determination by the government as to the validity, scope, or ownership of any intellectual property rights to a specific device. These letters do not grant, impute, suggest, or otherwise establish any ownership, distribution, or licensing rights to the requester. The government expresses no opinion about the intellectual property rights relating to any device for which this or any other eligibility letter is issued.

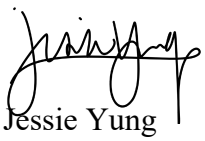
PUBLIC DISCLOSURE

To prevent any misunderstanding, and as discussed above, this Federal-aid eligibility letter is assigned FHWA control number CC-184. It should only be reproduced in full with its attachment(s). This Federal-aid eligibility letter and the material offered by the requester

supporting its issuance is public information. All eligibility letters and supporting material are subject to public disclosure under the Freedom of Information Act (FOIA). Eligibility letters are available to the public at https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/.

If you have any questions please contact Paul LaFleur at Paul.LaFleur@dot.gov.

Sincerely,



Jessie Yung
Director, Office of Safety Technologies
Office of Safety

Enclosures

Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

Submitter			
	Date of Request:	March 08, 2024	◉ New ○ Resubmission
	Name:	Don Monin	
	Company:	SPIG Industry, LLC	
	Address:	14675 Industrial Park Road, Bristol, VA. 24202	
	Country:	United States of America	
	To:	Michael S. Griffith, Director FHWA, Office of Safety Technologies	

I request the following devices be considered eligible for reimbursement under the Federal-aid highway program.

Device & Testing Criterion - Enter from right to left starting with Test Level

! - ! - !

System Type	Submission Type	Device Name / Variant	Testing Criterion	Test Level
'CC': Crash Cushions, Attenuators, & Terminals	◉ Physical Crash Testing ○ Engineering Analysis	SGET End Terminal	AASHTO MASH	TL3

By submitting this request for review and evaluation by the Federal Highway Administration, I certify that the product(s) was (were) tested in conformity with the AASHTO Manual for Assessing Safety Hardware and that the evaluation results meet the appropriate evaluation criteria in the MASH.

Individual or Organization responsible for the product:

Contact Name:	Don Monin	Same as Submitter ☒
Company Name:	SPIG Industry, LLC	Same as Submitter ☒
Address:	14675 Industrial Park Road, Bristol, VA. 24202	Same as Submitter ☒
Country:	United States of America	Same as Submitter ☒

Enter below all disclosures of financial interests as required by the FHWA `Federal-Aid Reimbursement Eligibility Process for Safety Hardware Devices' document.

SPIG Industry, LLC is the manufacturer and marketer of device.

Applus IDIADA KARCO Engineering, LLC (IDIADA KARCO) is an independent research and testing laboratory having no affiliation with any other entity. IDIADA KARCO is actively Involved In data acquisition and compliance/certification testing for a variety of government agencies and equipment manufacturers. The principals and staff of IDIADA KARCO have no past or present financial, contractual or organizational interest in any company or entity directly or indirectly related to the products that KARCO tests. If any financial interest should arise, other than receiving fees for testing, reporting, etc., with respect to any project, the company will provide, In writing, a full and immediate disclosure to the FHWA.

PRODUCT DESCRIPTION

(●) New Hardware or Significant Modification ( ) Modification to Existing Hardware

The SPIG Gating End Terminal (SGET) is an energy absorbing guardrail end treatment designed to reduce the severity of end on impacts with W-beam guardrail. When impacted the SGET feeds the rail through the impact head and exits to the non-traffic side of the system. The SGET system was composed of one (1) impact head, one (1) post 1 assembly, one (1) cable anchor system, one (1) specialty panel, and seven (7) yielding posts. The posts were spaced 75.0 in. (1.9 m) on centers with the rail splices located at the posts. The total terminal length was 50.0 ft. (15.2 m). The system was attached to 106.3 ft. (32.4 m) of standard guardrail with splices placed midspan. The system can be installed with a top rail height of 31 in. ± 1 inch. The as-tested system was installed with a rail height of 30.0 in. (762 mm) to increase the risk of vehicle override. The system was tested with an RFID chip attached to the impact head.

CRASH TESTING

By signature below, the Engineer affiliated with the testing laboratory, agrees in support of this submission that all of the critical and relevant crash tests for this device listed above were conducted to meet the MASH test criteria. The Engineer has determined that no other crash tests are necessary to determine the device meets the MASH criteria.

Engineer Name:	Alex Beltran	
Engineer Signature:	 Digitally signed by Alex Beltran DN: cn=Alex Beltran, o=IDIADA KARCO, ou=Lab, email=Alex.Beltran@idiada.com, c=US Date: 2024.03.05 17:08:54 -08'00'	
Address:	9270 Holly Rd, Adelanto, CA 92301	Same as Submitter ☐
Country:	United States of America	Same as Submitter ☐

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-30 (1100C)	KARCO Test No. P38034-01. An 1100C test vehicle impacting the termincal end on at a nominal speed of 62 mph and 0 degrees, respectively, with the quarter point of the vehicle aligned with the centerline of the terminal. This test was primarily intended to evaluate occupant risk and vehicle trajectory. A 2013 Hyundai Accent 4-door sedan with a test inertial mass of 2,393.1 lbs (1,085.5 kg) impacted the SGET terminal at a speed and angle of 63.48 mph (102.16 km/h) and 0.3 degrees, respectively. The vehicle pushed the impact head just past the fifth post. The vehicle rotated clockwise about its yaw axis and exited the system. The vehicle damage was concentrated at its front end. The occupant compartment deformation limits were not exceeded and there was no potential for penetration. The system was damaged from post 1 through post 5. The Occupant Impact Velocities (OIV) were 25.6 ft/s (7.8 m/s) in the x-direction and 1.6 ft/s (0.5 m/s) in the y-direction. The Ridedown Acceleration in the x- and y- direction were 8.0 g and 3.6 g, respectively. Both the OIV and Ridedown Acceleration were below the preferred values. The SGET terminal met all the requirements for MASH16 Test 3-30.	PASS

Required Test Number	Narrative Description	Evaluation Results
3-31 (2270P)	KARCO Test No. P38108-01. A 2270p test vehicle impacting the terminal end on at a nominal speed of 62 mph and 0 degrees, respectively, with the centerline of the vehicle aligned with the center of the terminal. This test was primarily intended to evaluate occupant risk and vehicle trajectory. A 2012 RAM 1500 4-door pickup truck with a test inertial mass of 4,989.0 lbs (2,263.0 kg) impacted the SGET terminal at a speed and angle of 62.53 mph (100.63 km/h) and 0.6 degrees, respectively. The vehicle pushed the impact head just past the fifth post. The rail buckled and allowed the vehicle to pass through to the traffic side of the system. The vehicle damage was concentrated at its front end and passenger side. The occupant compartment deformation limits were not exceeded and there was no potential for penetration. The system was damaged from post 1 through post 8. The Occupant Impact Velocities (OIV) were 18.4 ft/s (5.6 m/s) in the x-direction and 1.3 ft/s (0.4 m/s) in the y-direction. The Ridedown Acceleration in the x- and y-direction were 6.0 g and 4.4 g, respectively. Both the OIV and Ridedown Acceleration were below the preferred values. The SGET terminal met all the requirements for MASH16 Test 3-31.	PASS

3-32 (1100C)	KARCO Test No. P38107-01. A 1100C test vehicle impacting the terminal end on at a nominal speed of 62 mph and 5 degrees, respectively, with the centerline of the vehicle aligned with the nose of the terminal. This test was primarily intended to evaluate occupant risk and vehicle trajectory. A 2013 Kia Rio 4-door sedan with a test inertial mass of 2,417.3 lbs (1,096.5 kg) impacted the SGET terminal at a speed and angle of 61.56 mph (99.07 km/h) and 4.8 degrees, respectively. The vehicle pushed the impact head just to the fifth post. The rail buckled at the downstream end of the impact head and the vehicle came to rest still in contact with the impact head. The vehicle damage was concentrated at its front end. The occupant compartment deformation limits were not exceeded and there was no potential for penetration. The system was damaged from post 1 through post 5. The Occupant Impact Velocities (OIV) were 24.9 ft/s (7.6 m/s) in the x-direction and 0.0 ft/s in the y-direction. The Ridedown Acceleration in the x- and y- direction were 8.5 g and 3.9 g, respectively. Both the OIV and Ridedown Acceleration were below the preferred values. The SGET terminal met all the requirements for MASH16 Test 3-32.	PASS

3-33 (2270P)	KARCO Test No. P38109-02. A 2270P test vehicle impacting the terminal end on at a nominal speed of 62 mph and 5 degrees, respectively, with the centerline of the vehicle aligned with the nose of the terminal. This test was primarily intended to evaluate occupant risk and vehicle trajectory. A 2013 RAM 1500 4-door pickup truck with a test inertial mass of 4,998.9 lbs (2,267.5 kg) impacted the SGET terminal at a speed and angle of 61.60 mph (99.14 km/h) and 5.1 degrees, respectively. The vehicle pushed the impact head just past the fourth post. The rail buckled and allowed the vehicle to pass through to the non-traffic side of the system. The vehicle damage was concentrated at its front end and passenger side. The occupant compartment deformation limits were not exceeded and there was no potential for penetration. The system was damaged from post 1 through post 7. The Occupant Impact Velocities (OIV) were 18.7 ft/s (5.7 m/s) in the x-direction and 1.6 ft/s (0.5 m/s) in the y-direction. The Ridedown Acceleration in the x- and y-direction were 5.6 g and 2.8 g, respectively. Both the OIV and Ridedown Acceleration were below the preferred values. The SGET terminal met all the requirements for MASH16 Test 3-33.	PASS
3-34 (1100C)	KARCO Test No. P38106-01. A 1100C test vehicle impacting the terminal at a nominal speed of 62 mph and 15 degrees, respectively, with vehicle impacting the critical impact point. The critical impact point was 32.0 in. downstream from post 1. This test was primarily intended to evaluate occupant risk and vehicle trajectory. A 2013 Hyundai Accent 4-door sedan with a test inertial mass of 2,451.5 lbs (1,112.0 kg) impacted the SGET terminal at a speed and angle of 61.93 mph (99.67 km/h) and 14.8 degrees, respectively. The vehicle was contained and redirected by the guardrail. The vehicle damage was concentrated at its front-right side. The occupant compartment deformation limits were not exceeded and there was no potential for penetration. The system was damaged from post 1 through post 6. The Occupant Impact Velocities (OIV) were 17.1 ft/s (5.2 m/s) in the x-direction and 13.8 ft/s (4.2 m/s) in the y-direction. The Ridedown Acceleration in the x- and y-direction were 9.2 g and 4.9 g, respectively. Both the OIV and Ridedown Acceleration were below the preferred values. The SGET terminal met all the requirements for MASH16 Test 3-34.	PASS

3-35 (2270P)	KARCO Test No. P38032-01. A 2270P test vehicle impacting the terminal at a nominal speed of 62 mph and 25 degrees, respectively, with vehicle impacting the beginning of the length-of-need. This test was primarily intended to evaluate structural adequacy and vehicle trajectory. A 2012 RAM 1500 4-door pickup truck with a test inertial mass of 5,006.6 lbs (2,271.0 kg) impacted the SGET terminal at post 3 at speed and angle of 59.63 mph (95.97 km/h) and 25.2 degrees, respectively. The vehicle was contained and redirected by the guardrail. The vehicle exited within the exit box and tracked back towards the system, impacting the installation a second time around post 17. The vehicle damage was concentrated at its front-right side. The occupant compartment deformation limits were not exceeded and there was no potential for penetration. The system was damaged from post 1 through post 6. The Occupant Impact Velocities (OIV) were 14.1 ft/s (4.3 m/s) in the x-direction and 13.8 ft/s (4.2 m/s) in the y-direction. The Ridedown Acceleration in the x- and y-direction were 5.8 g and 7.8 g, respectively. Both the OIV and Ridedown Acceleration were below the preferred values. The SGET terminal met all the requirements for MASH16 Test 3-35.	PASS
3-36 (2270P)	MASH Test Designation 3-36. A 2270P test vehicle impacting the terminal at a nominal impact speed and angle of 62 mph and 25 degrees, respectively, with the corner of the vehicle bumper aligned with the critical impact point (CIP) with respect to the transition to the stiff barrier or backup structure. This test is primarily intended to evaluate the performance of the terminal when connected to a stiff barrier or a backup structure.As a W-beam guardrail terminal, the SGET terminal is designed to attach to W-beam barrier, transitions to alternative barriers downstream of the terminal will require case-by-case evaluation.	Non-relavant test, not conducted

3-37 (2270P)	KARCO Test No. P38033-01. A 1100C test vehicle impacting the terminal at a nominal impact speed and angle of 62 mph and 25 degrees, respectively, at Post 3 in the reverse direction. This test is intended to evaluate the performance of a terminal for a reverse-direction impact. A 2012 Kia Rio 4-door sedan with a test inertial mass of 2,398.6 lbs (1,088.0 kg) impacted the SGET terminal at a speed and angle of 62.30 mph (100.26 km/h) and 25.2 degrees, respectively. The terminal allowed the vehicle to safely pass through the system. The vehicle damage was concentrated at its front end. The occupant compartment deformation limits were not exceeded and there was no potential for penetration. The system was damaged from post 1 through post 4. The Occupant Impact Velocities (OIV) were 32.2 ft/s (9.8 m/s) in the x-direction and 9.2 ft/s (2.8 m/s) in the y-direction. The Ridedown Acceleration in the x- and y-direction were 10.0 g and 9.8 g, respectively. The SGET terminal met all the requirements for MASH16 Test 3-37.	PASS
3-38 (1500A)	MASH Test Designation 3-38. A 1500A test vehicle impacting the terminal end-on at a nominal impact speed and angle of 62 mph and 0 degree, respectively, with the center line of the vehicle aligned with the center line of the terminal. This test is primarily intended to evaluate the performance of the staged attenuator/terminal when impacted by a mid-size vehicle.The SGET terminal is not a staged device, because the force required to move the impact head down the rail does not change.	Non-relevant test, not conducted
3-40 (1100C)	Test for non-redirective crash cushions, not applicable for terminals.	Non-relevant test, not conducted
3-41 (2270P)	Test for non-redirective crash cushions, not applicable for terminals.	Non-relevant test, not conducted
3-42 (1100C)	Test for non-redirective crash cushions, not applicable for terminals.	Non-relevant test, not conducted
3-43 (2270P)	Test for non-redirective crash cushions, not applicable for terminals.	Non-relevant test, not conducted
3-44 (2270P)	Test for non-redirective crash cushions, not applicable for terminals.	Non-relevant test, not conducted
3-45 (1500A)	Test for non-redirective crash cushions, not applicable for terminals.	Non-relevant test, not conducted

Full Scale Crash Testing was done in compliance with MASH by the following accredited crash test laboratory (cite the laboratory's accreditation status as noted in the crash test reports.):

Laboratory Name:	Applus IDIADA KARCO Engineering, LLC.	
Laboratory Signature:	Digitally signed by Alex Beltran DN: cn=Alex Beltran, o=IDIADA KARCO, ou=Lab, email=Alex.Beltran@idiada.com, c=US Date: 2024.03.05 17:09:10 -08'00'	
Address:	9270 Holly Road, Adelanto, CA,92301	Same as Submitter ☐
Country:	United States of America	Same as Submitter ☐
Accreditation Certificate Number and Dates of current Accreditation period :	TL 371: April 27, 2022 - April 27, 2025	

Submitter Signature*: Donald L Monnig Jr.

Submit Form

ATTACHMENTS

Attach to this form:

1) Additional disclosures of related financial interest as indicated above.
2) A copy of the full test report, video, and a Test Data Summary Sheet for each test conducted in support of this request.
3) A drawing or drawings of the device(s) that conform to the Task Force-13 Drawing Specifications [Hardware Guide Drawing Standards]. For proprietary products, a single isometric line drawing is usually acceptable to illustrate the product, with detailed specifications, intended use, and contact information provided on the reverse. Additional drawings (not in TF-13 format) showing details that are relevant to understanding the dimensions and performance of the device should also be submitted to facilitate our review.

FHWA Official Business Only:

Eligibility Letter		
Number	Date	Key Words

MASH 2016 Test 3-30 Summary

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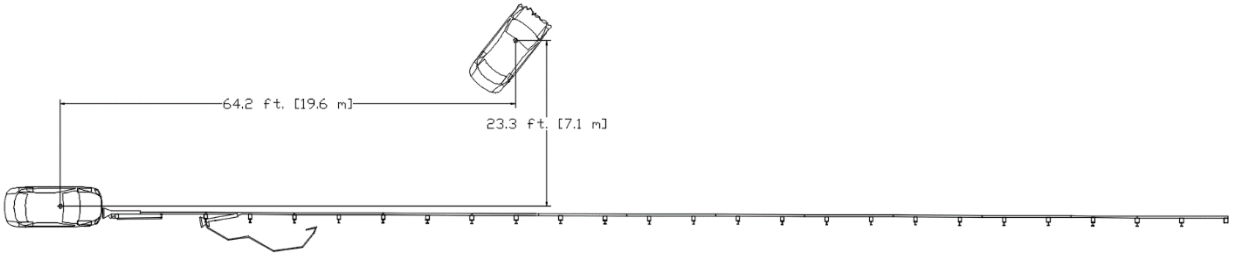


GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO Engineering, LLC.
KARCO Test No	P38034-01
Test Designation	3-30
Test Date	4/10/18

TEST ARTICLE

Name / Model	SGET End Terminal
Type	End Terminal
Installation Length	156.3 ft. (47.6 m)
Terminal Length	50.0 ft. (15.2 m)
Road Surface	Medium to Fine Silty Soil

TEST VEHICLE

Type / Designation	1100C
Year, Make, and Model	2013 Hyundai Accent
Curb Mass	2,400.8 lbs (1,089.0 kg)
Test Inertial Mass	2,393.1 lbs (1,085.5 kg)
Gross Static Mass	2,393.1 lbs (1,085.5 kg)

Impact Conditions

Impact Velocity	63.48 mph (102.16 km/h)
Impact Angle	0.3°
Location / Orientation	18.5 in. (470 mm) left
Kinetic Energy	322.4 kip-ft (437.1 kJ)

Exit Conditions

Exit Velocity	11.4 mph (18.4 km/h)
Exit Angle	91.3°
Final Vehicle Position	64.2 ft. (19.6 m) Downstream 23.3 ft. (7.1 m) Traffic side
Vehicle Snagging	None
Vehicle Pocketing	None
Vehicle Stability	Satifactory
Maximum Roll Angle	-8.8 °
Maximum Pitch Angle	-21.0 °
Maximum Yaw Angle	-135.0 °

Occupant Risk

Longitudinal OIV	25.6 ft/s (7.8 m/s)
Lateral OIV	1.6 ft/s (0.5 m/s)
Longitudinal RA	-8.0 g
Lateral RA	3.6 g
THIV	25.6 ft/s (7.8 m/s)
PHD	8.0 g
ASI	0.8

Test Article Deflections

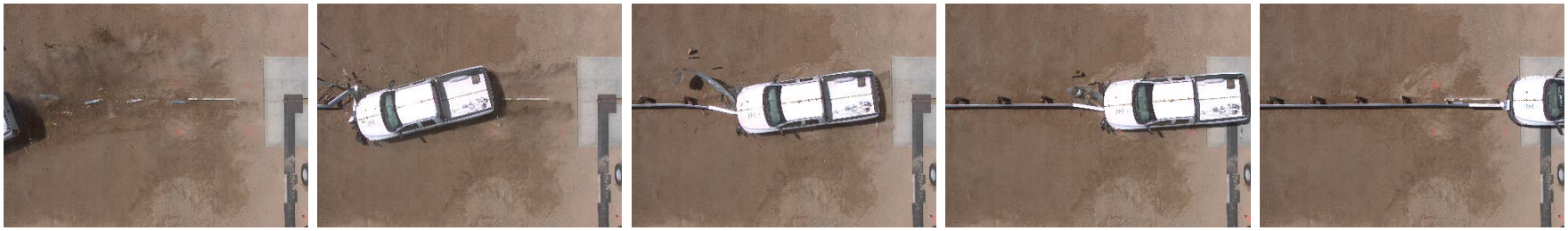
Static	5.4 ft. (1.6 m)
Dynamic	9.1 ft. (2.8 m)
Working Width	9.1 ft. (2.8 m)
Debris Field	28.8 ft. (8.8 m) Downstream 28.6 ft. (8.7 m) Right

Vehicle Damage

Vehicle Damage Scale	12FZEW1
CDC	12-FR-2
Maximum Intrusion	Negligible

Figure 2 Summary of Test 3-30

MASH 2016 Test 3-31 Summary



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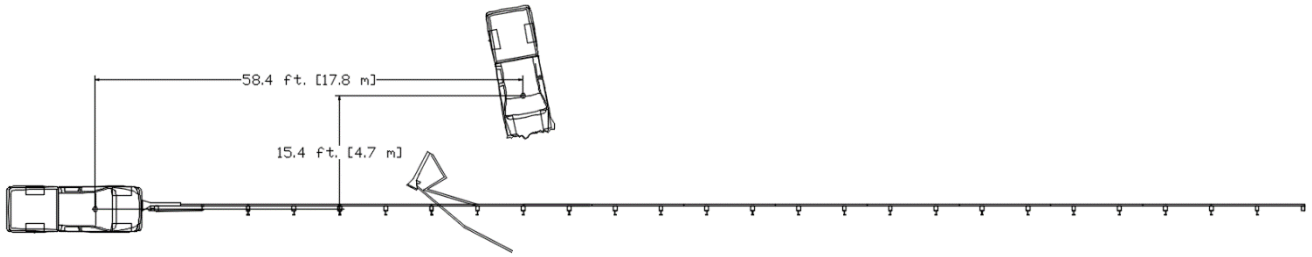


GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO Engineering, LLC.
KARCO Test No	P38108-01
Test Designation	3-31
Test Date	6/8/18

TEST ARTICLE

Name / Model	SGET End Terminal
Type	End Terminal
Installation Length	156.3 ft. (47.6 m)
Terminal Length	50.0 ft. (15.2 m)
Road Surface	Medium to Fine Silty Soil

TEST VEHICLE

Type / Designation	2270P
Year, Make, and Model	2012 RAM 1500
Curb Mass	5,080.5 lbs (2,304.5 kg)
Test Inertial Mass	4,989.0 lbs (2,263.0 kg)
Gross Static Mass	4,989.0 lbs (2,263.0 kg)

Impact Conditions

Impact Velocity	62.53 mph (100.63 km/h)
Impact Angle	0.6°
Location / Orientation	1.2 in. (30 mm) right of terminal CL
Kinetic Energy	652.1 kip-ft (884.1 kJ)

Exit Conditions

Exit Velocity	N/A
Exit Angle	N/A
Final Vehicle Position	58.4 ft. (17.8 m) Downstream 15.4 ft. (4.7 m) Left
Exit Box Criteria Met	N/A
Vehicle Snagging	None
Vehicle Pocketing	None
Vehicle Stability	Satisfactory
Maximum Roll Angle	12.0 °
Maximum Pitch Angle	-6.4 °
Maximum Yaw Angle	-29.6 °

Occupant Risk

Longitudinal OIV	18.4 ft/s (5.6 m/s)
Lateral OIV	1.3 ft/s (0.4 m/s)
Longitudinal RA	-6.0 g
Lateral RA	-4.4 g
THIV	18.7 ft/s (5.7 m/s)
PHD	6.0 g
ASI	0.54

Test Article Deflections

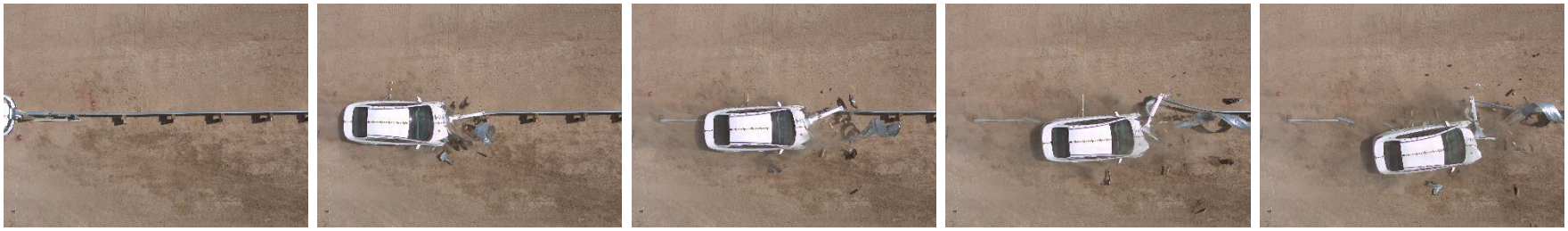
Static	6.3 ft. (1.9 m)
Dynamic	7.6 ft. (2.3 m)
Working Width	7.6 ft. (2.3 m)
Debris Field	49.6 ft. (15.1 m) Downstream 18.2 ft. (5.5 m) Right

Vehicle Damage

Vehicle Damage Scale	12-FR-3
CDC	12FZEW1
Maximum Intrusion	0.3 in. (8 mm)

Figure 2 Summary of Test 3-31

MASH 2016 Test 3-32 Summary



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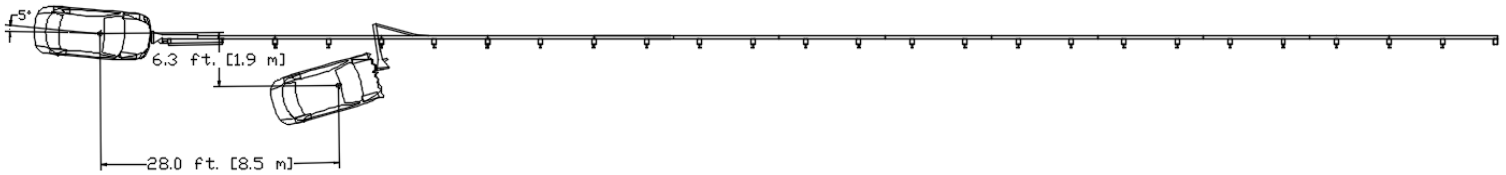


GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO Engineering, LLC.
KARCO Test No	P38107-01
Test Designation	3-32
Test Date	6/7/18

TEST ARTICLE

Name / Model	SGET
Type	End Terminal
Installation Length	156.3 ft. (47.6 m)
Terminal Length	50.0 ft. (15.2 m)
Road Surface	Medium to Fine Silty Soil

TEST VEHICLE

Type / Designation	1100C
Year, Make, and Model	2013 Kia Rio
Curb Mass	2,455.9 lbs (1,114.0 kg)
Test Inertial Mass	2,417.3 lbs (1,096.5 kg)
Gross Static Mass	2,580.5 lbs (1,170.55 kg)

Impact Conditions

Impact Velocity	61.56 mph (99.07 km/h)
Impact Angle	4.8°
Location / Orientation	0.5 in (13 mm) Left of P1
Kinetic Energy	306.2 kip-ft (415.2 kJ)

Exit Conditions

Exit Velocity	N/A
Exit Angle	N/A
Final Vehicle Position	28.0 ft. (8.5 m) Downstream 6.3 ft. (1.9 m) Right
Exit Box Criteria Met	N/A
Vehicle Snagging	None
Vehicle Pocketing	None
Vehicle Stability	Satisfactory
Maximum Roll Angle	9.3 °
Maximum Pitch Angle	1.7 °
Maximum Yaw Angle	-18.5 °

Occupant Risk

Longitudinal OIV	24.9 ft/s (7.6 m/s)
Lateral OIV	0.0 ft/s (0.0 m/s)
Longitudinal RA	-8.5 g
Lateral RA	3.9 g
THIV	24.6 ft/s (7.5 m/s)
PHD	9.2 g
ASI	0.71

Test Article Deflections

Static	4.7 ft. (1.4 m)
Dynamic	4.8 ft. (1.5 m)
Working Width	4.8 ft. (1.5 m)
Debris Field	86.1 ft. (26.2 m) Downstream 12.8 ft. (3.9 m) Right

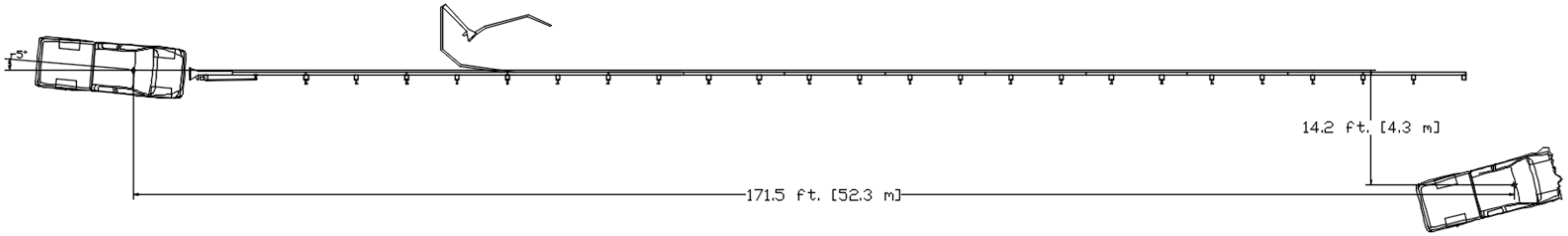
Vehicle Damage

Vehicle Damage Scale	12-FD-5
CDC	12FDEW3
Maximum Intrusion	Negligible

Figure 2 Summary of Test 3-32

MASH 2016 Test 3-33 Summary

0.000 s 0.150 s 0.350 s 0.600 s 0.900 s



GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO Engineering, LLC.
KARCO Test No	P38109-02
Test Designation	3-33
Test Date	06/07/18

TEST ARTICLE

Name / Model	SGET End Terminal
Type	End Terminal
Installation Length	156.3 ft. (47.6 m)
Terminal Length	50.0 ft. (15.2 m)
Road Surface	Medium to Fine Silty Soil

TEST VEHICLE

Type / Designation	2270P
Year, Make, and Model	2013 RAM 1500
Curb Mass	4,980.2 lbs (2,259.0 kg)
Test Inertial Mass	4,998.9 lbs (2,267.5 kg)
Gross Static Mass	4,998.9 lbs (2,267.5 kg)

Impact Conditions

Impact Velocity	61.60 mph (99.14 km/h)
Impact Angle	5.1°
Location / Orientation	0.4 in. (10 mm) from P1 center
Kinetic Energy	634.1 kip-ft (859.7 kJ)

Exit Conditions

Exit Velocity	33.50 mph (53.91 km/h)
Exit Angle	11.9°
Final Vehicle Position	171.5 ft. (52.3 m) Downstream 14.2 ft. (4.3 m) Right
Exit Box Criteria Met	N/A
Vehicle Snagging	None
Vehicle Pocketing	None
Vehicle Stability	Satisfactory
Maximum Roll Angle	47.2°
Maximum Pitch Angle	5.0 °
Maximum Yaw Angle	-16.2 °

Occupant Risk

Longitudinal OIV	18.7 ft/s (5.7 m/s)
Lateral OIV	1.6 ft/s (0.5 m/s)
Longitudinal RA	-5.6 g
Lateral RA	-2.8 g
THIV	19.0 ft/s (5.8 m/s)
PHD	6.0 g
ASI	0.37

Test Article Deflections

Static	8.6 ft. (2.6 m)
Dynamic	9.7 ft. (3.0 m)
Working Width	9.7 ft. (3.0 m)
Debris Field	122.8 ft. (37.4 m) Downstream 46.4 ft. (14.1 m) Left

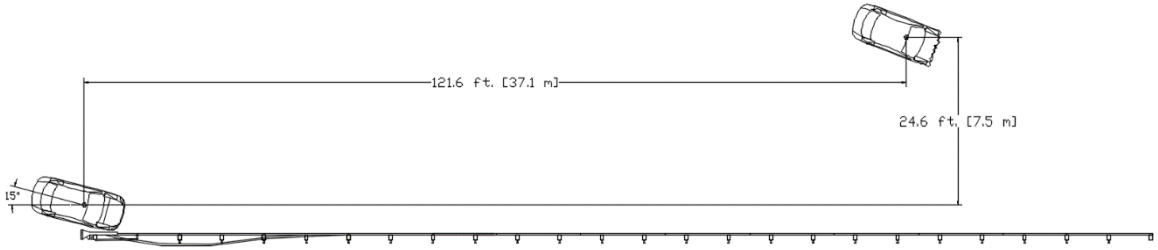
Vehicle Damage

Vehicle Damage Scale	12-FD-4
CDC	12FDEW2
Maximum Intrusion	0.3 in. (8 mm)

Figure 2 Summary of Test 3-33

MASH 2016 Test 3-34 Summary

0.000 s 0.150 s 0.300 s 0.400 s 0.700 s



GENERAL INFORMATION	
Test Agency	Applus IDIADA KARCO Engineering, LLC.
KARCO Test No	P38106-01
Test Designation	3-34
Test Date	04/11/18
TEST ARTICLE	
Name / Model	SGET
Type	End Terminal
Installation Length	156.3 ft. (47.6 m)
Terminal Length	50.0 ft. (15.2 m)
Road Surface	Medium to Fine Silty Soil
TEST VEHICLE	
Type / Designation	1100C
Year, Make, and Model	2013 Hyundai Accent
Curb Mass	2,638.9 lbs (1,197.0 kg)
Test Inertial Mass	2,451.5 lbs (1,112.0 kg)
Gross Static Mass	2,617.9 lbs (1,187.5 kg)

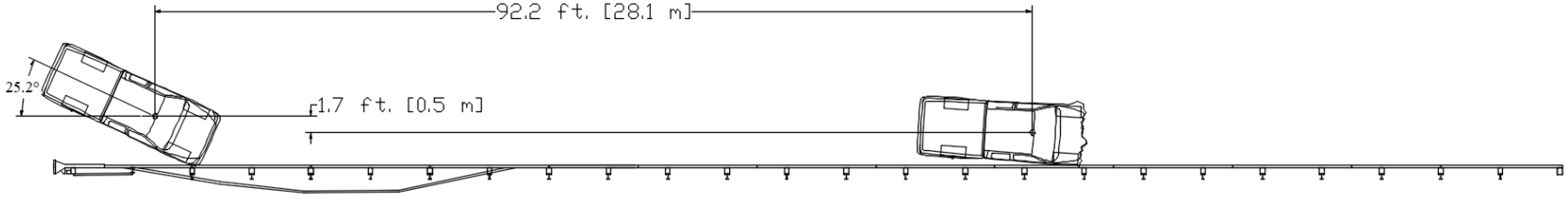
Impact Conditions	
Impact Velocity	61.93 mph (99.67 km/h)
Impact Angle	14.8°
Location / Orientation	33.2 in. (843 mm) DS post 1
Impact Severity	20.5 kip-ft (27.8 kJ)
Exit Conditions	
Exit Velocity	40.0 mph (64.4 km/h)
Exit Angle	10.0°
Final Vehicle Position	121.6 ft. (37.1 m) Downstream 24.6 ft. (7.5 m) Left
Exit Box Criteria Met	Obstructed Camera View
Vehicle Snagging	Minor
Vehicle Pocketing	None
Vehicle Stability	Satisfactory
Maximum Roll Angle	-7.5 °
Maximum Pitch Angle	4.7 °
Maximum Yaw Angle	27.4 °

Occupant Risk	
Longitudinal OIV	17.1 ft/s (5.2 m/s)
Lateral OIV	13.8 ft/s (4.2 m/s)
Longitudinal RA	-9.2 g
Lateral RA	-4.9 g
THIV	23.3 ft/s (7.1 m/s)
PHD	9.4 g
ASI	0.57
Test Article Deflections	
Static	1.8 ft. (0.5 m)
Dynamic	2.3 ft. (0.7 m)
Working Width	3.3 ft. (1.0 m)
Debris Field	106.2 ft. (32.4 m) Downstream 20.1 ft. (6.1 m) Right
Vehicle Damage	
Vehicle Damage Scale	01-RFQ-5
CDC	01RFEW4
Maximum Intrusion	1.5 in. (38 mm)

Figure 2 Summary of Test 3-34

MASH 2016 Test 3-35 Summary

0.000 s 0.100 s 0.400 s 0.600 s 0.700 s



GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO Engineering, LLC.
KARCO Test No	P38032-01
Test Designation	3-35
Test Date	03/12/18

TEST ARTICLE

Name / Model	SGET
Type	End Terminal
Installation Length	156.3 ft. (47.6 m)
Terminal Length	50.0 ft. (15.2 m)
Road Surface	Medium to Fine Silty Soil

TEST VEHICLE

Type / Designation	2270P
Year, Make, and Model	2012 RAM 1500
Curb Mass	4,968.0 lbs (2,253.5 kg)
Test Inertial Mass	5,006.6 lbs (2,271.0 kg)
Gross Static Mass	5,006.6 lbs (2,271.0 kg)

Impact Conditions

Impact Velocity	59.63 mph (95.97 km/h)
Impact Angle	25.2°
Location / Orientation	Post 3
Impact Severity	107.9 kip-ft (146.3 kJ)

Exit Conditions

Exit Velocity	25.10 mph (40.39 km/h)
Exit Angle	6.7°
Final Vehicle Position	92.2 ft. (28.1 m) Downstream 1.7 ft. (0.5 m) Right
Exit Box Criteria Met	Yes
Vehicle Snagging	None
Vehicle Pocketing	None
Vehicle Stability	Satisfactory
Maximum Roll Angle	-3.1 °
Maximum Pitch Angle	-3.5 °
Maximum Yaw Angle	34.4 °

Occupant Risk

Longitudinal OIV	14.1 ft/s (4.3 m/s)
Lateral OIV	13.8 ft/s (4.2 m/s)
Longitudinal RA	-5.8 g
Lateral RA	-7.8 g
THIV	21.3 ft/s (6.5 m/s)
PHD	8.3 g
ASI	0.62

Test Article Deflections

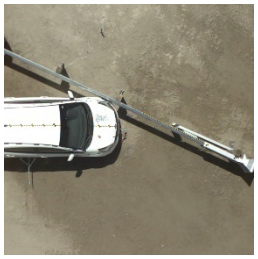
Static	2.7 ft. (0.8 m)
Dynamic	4.0 ft. (1.2 m)
Working Width	4.0 ft. (1.2 m)
Debris Field	149.9 ft. (45.7 m) Downstream 71.1 ft. (21.7 m) Right

Vehicle Damage

Vehicle Damage Scale	01-RFQ-2
CDC	01RFEW1
Maximum Intrusion	0.3 in. (8 mm)

Figure 2 Summary of Test 3

MASH 2016 Test 3-37b Summary



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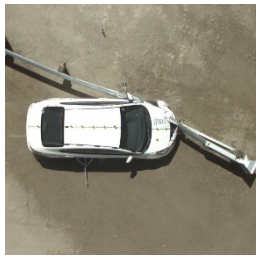

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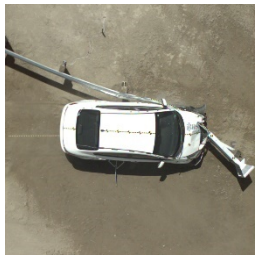

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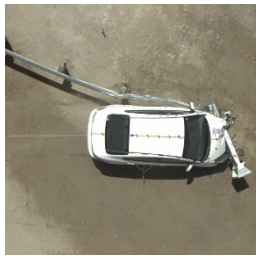

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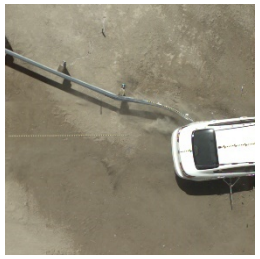

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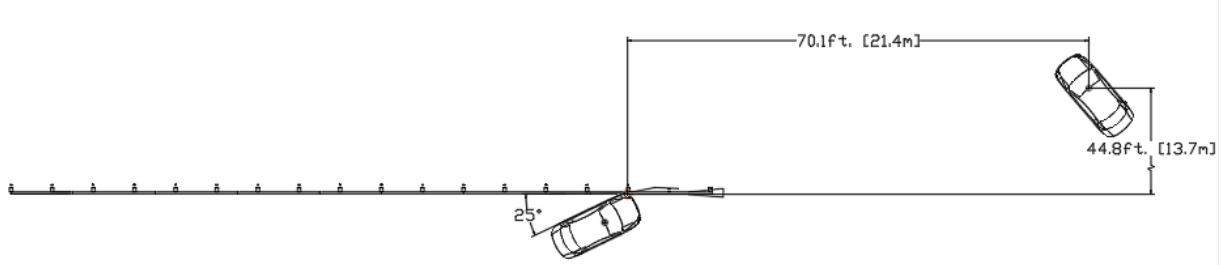


GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO Engineering, LLC.
KARCO Test No	P38033-01
Test Designation	3-37
Test Date	04/10/18

TEST ARTICLE

Name / Model	SGET
Type	End Terminal
Installation Length	106.3 ft. (32.4 m)
Terminal Length	50.0 ft. (15.2 m)
Road Surface	Medium to Fine Silty Soil

TEST VEHICLE

Type / Designation	1100C
Year, Make, and Model	2012 Kia Rio
Curb Mass	2,495.6 lbs (1,132.0 kg)
Test Inertial Mass	2,398.6 lbs (1,088.0 kg)
Gross Static Mass	2,563.9 lbs (1,163.0 kg)

Impact Conditions

Impact Velocity	62.30 mph (100.26 km/h)
Impact Angle	25.2°
Location / Orientation	Post 3
Impact Severity	56.4 kip-ft (76.5 kJ)

Exit Conditions

Exit Velocity	33.20 mph (53.43 km/h)
Exit Angle	18.5°
Final Vehicle Position	70.1 ft. (21.4 m) dw 44.8 ft. (13.7 m) left
Exit Box Criteria Met	N/A
Vehicle Snagging	None
Vehicle Pocketing	None
Vehicle Stability	Satisfactory
Maximum Roll Angle	7.7 °
Maximum Pitch Angle	4.6 °
Maximum Yaw Angle	41.1 °

Occupant Risk

Longitudinal OIV	32.2 ft/s (9.8 m/s)
Lateral OIV	9.2 ft/s (2.8 m/s)
Longitudinal RA	-10.0 g
Lateral RA	-9.8 g
THIV	34.1 ft/s (10.4 m/s)
PHD	13.0 g
ASI	1.03

Test Article Deflections

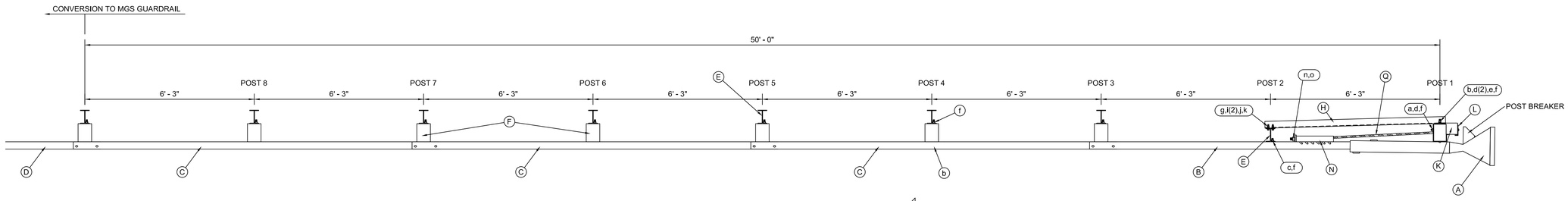
Static	0.9 ft. (0.3 m)
Dynamic	2.3 ft. (0.7 m)
Working Width	2.3 ft. (0.7 m)
Debris Field	148.6 ft. (45.3 m) dw 23.9 ft. (7.3 m) Field Side

Vehicle Damage

Vehicle Damage Scale	01-LFQ-5
CDC	01LFEW4
Maximum Intrusion	0.4 in. (10 mm)

Figure 2 Summary of Test 3-37b

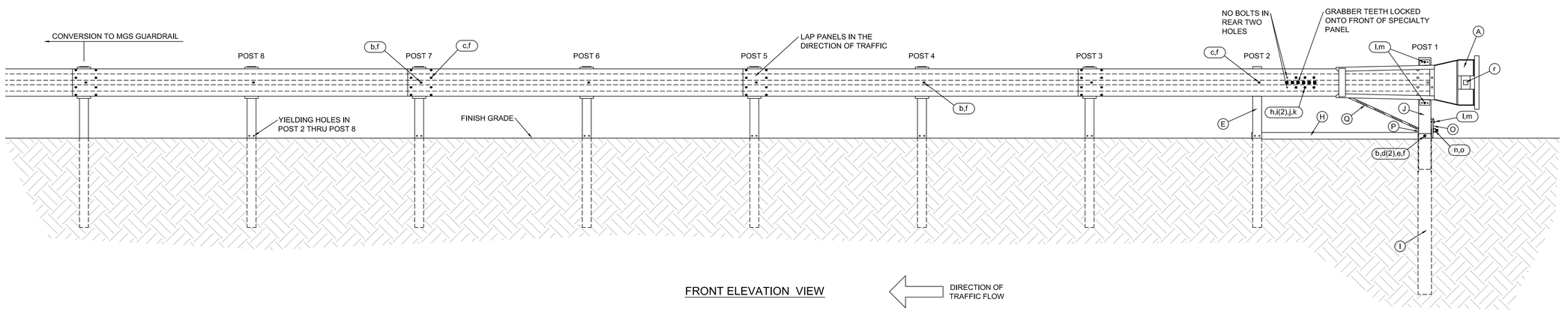
HORIZONTAL ALIGNMENT NOTE:
1. MAXIMUM HORIZONTAL FLARE OVER FIRST 50 FEET IS TWO (2) FEET.



PLAN VIEW

DIRECTION OF TRAFFIC FLOW

* ALTERNATIVES NOTES:
1. COMPOSITE BLOCKOUTS (F) MAY BE REPLACED WITH WOOD BLOCKOUTS (G)



FRONT ELEVATION VIEW

DIRECTION OF TRAFFIC FLOW

MAIN SYSTEM COMPONENTS

	ITEM	QUANTITY	COMPONENT	ITEM NUMBER
	A	1	SGET IMPACT HEAD	SIH1A
	B	1	SPECIALIZED GUARDRAIL PANEL(MODIFIED 12'-6" SECTION W-BEAM M-180)	126SPZGP
	C	3	STANDARD GUARDRAIL PANEL (12'-6" SECTION W-BEAM M-180)	GP126
	D	1	MGS CONVERSION GUARDRAIL PANEL (W-BEAM M-180)	GP25
	E	7	YIELDING POST - MODIFIED W6x8.5 GUARDRAIL POST	YP6MOD
	F	6	COMPOSITE BLOCKOUT 6"x8"x14"	CBO8
*	G	6	WOOD BLOCKOUT 6"x8"14"	WBO8
	H	1	STRUT - 3"x3"x80" ¼" A36 ANGLE	STR80
	I	1	FOUNDATION TUBE - 6"x8"x72" 3/16" RECTANGULAR TUBE	FNDT6
	J	1	WOOD BREAKAWAY POST - 5 ½"x7 ½"x50"	WBRK50
	K	1	WOOD STRIKE BLOCK	WSBLK14
	L	1	STRIKE PLATE - ¼" A36 BENT PLATE	SPLT8
	M	1	REINFORCEMENT PANEL - 12 GA. GR55 17"x9.125" BENT PLATE	REPLT17
	N	1	GUARDRAIL GRABBER - 2 ½"x2 ½"x16 ½" ¼" A36 SQUARE TUBE	GGR17
	O	1	BEARING PLATE - 8"x8 ⅝" ⅝" A36 PLATE	BPLT8
	P	1	PIPE SLEEVE - 4 ¼" LONG x 2 ⅜" O.D. x 2 ⅛" I.D. A36 ROUND TUBE	PSLV4
	Q	1	¾" CABLE - 81" LONG ¾" BCT CABLE	CBL81

SMALL HARDWARE

ITEM	QUANTITY	COMPONENT	ITEM NUMBER
a	1	14" GUARDRAIL BOLT - ⅝ x 12 307A HDG	14GRBLT
b	7	10" GUARDRAIL BOLT - ⅝ x 10 307A HDG	10GRBLT
c	33	1 ¼" GUARDRAIL SPLICE BOLT - ⅝ x 1 ¼ 307A HDG	1GRBLT
d	3	⅝" FLAT WASHER - ⅝ F436 (A325) HDG	58FW436
e	1	⅝" LOCK WASHER - HDG	58LW
f	39	⅝" HEX NUT - ⅝ x 11 A563 HDG	58HN563
g	2	2" STRUT BOLT - ½ x 13 X 2 A325 HDG	2BLT
h	6	1 ¼" REINFORCEMENT PANEL - ½ x 13 X 1 ¼ A325 HDG	125BLT
i	16	½" FLAT WASHER - ½ F436 (A325) HDG	12FWF436
j	8	½" LOCK WASHER - HDG	12LW
k	8	½" HEX NUT - ½ x 13 A563 HDG	12HN563
l	4	⅜" HEX LAG SCREW - ⅜ x 3 GR5 HDG	38LS
m	4	⅜" FLAT WASHER - ⅜" F844 HDG	38FW844
n	2	1" FLAT WASHER - 1 F436 (A325) HDG	1FWF436
o	2	1" HEX NUT - 1 x 8 A563DH HDG	1HN563
p	1	RFID CHIP RATED MIL-STD-810F (e.g. OMNI-ID EX0750)	RFID810F

THIS PLAN IS NOT FINAL. UPON APPROVAL MY SEAL AND DATED SIGNATURE WILL APPEAR WHERE THIS CIRCLE EXISTS.

CERTIFICATION STATEMENT:
I, BARNEY HORRELL, DO HEREBY CERTIFY THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER IN THE STATE OF VIRGINIA, LICENSE NO. 0402044654 AND THAT I PERSONALLY DRAFTED THIS PLAN SHEET BASED ON SKETCHES AND INFORMATION PROVIDED BY THE MANUFACTURER. I DO NOT CERTIFY TO THE DESIGN OR EFFECTIVENESS OF ANY OF THE ITEMS SHOWN. THE MANUFACTURER HAS COMMISSIONED OTHER PROPERLY LICENSED INDEPENDENT FIRMS TO TEST AND CERTIFY TO THE EFFECTIVENESS OF THE ITEMS AND THEIR CONFIGURATION DEPICTED HEREON. THIS STATEMENT AND THE SEAL ABOVE REPRESENT ONLY THAT THIS DRAWING IS AN ACCURATE GRAPHIC DEPICTION OF THE INFORMATION PROVIDED TO ME BY THE MANUFACTURER.

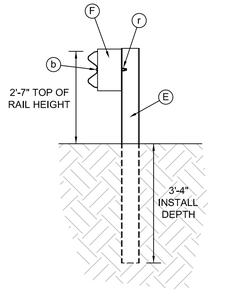
CALIFORNIA DEPT. OF TRANSPORTATION (CALTRANS)

SINGLE GUARDRAIL TERMINAL

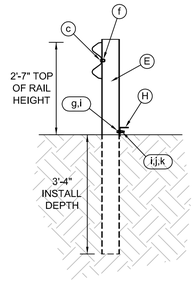
SGET-MASH-TL-3

FILE: SGET_2021_06_17.DWG	DN: ##	CK: ##	DN: ##	CK: ##
	CONT	SECT	JOB	HIGHWAY
	##	##	##	##
	DIST	COUNTY		SHEET NO.
	##	##		1 OF 2

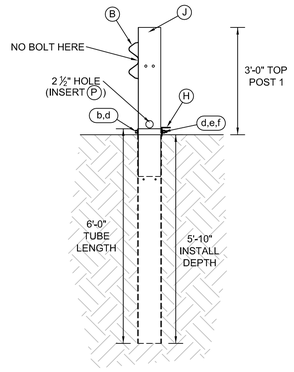
DATE: JUNE 17, 2021
FILE: SGET_2021_06_17.DWG



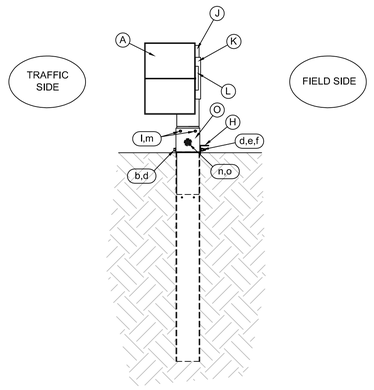
SIDE VIEW - POST 3 THRU POST 8 (TYP.)



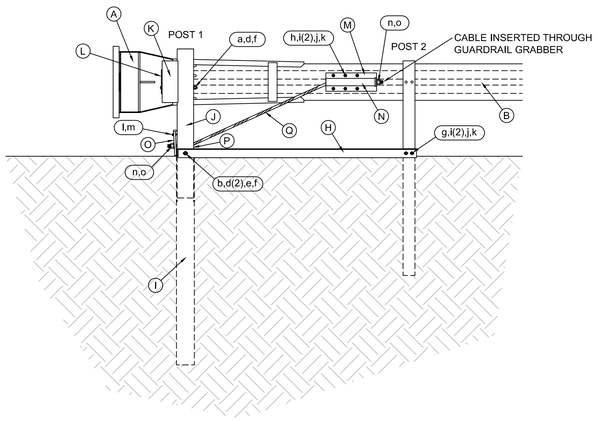
SIDE VIEW - POST 2



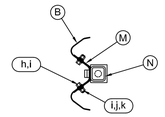
SIDE VIEW - POST 1



FRONT END ELEVATION - POST 1



REAR ELEVATION - POST 1 THRU POST 2



SIDE VIEW - REINFORCEMENT PANEL & GUARDRAIL GRABBER

GENERAL NOTES:

1. STEP-BY-STEP INSTALLATION INSTRUCTIONS AS WELL AS OTHER GUIDANCE ARE AVAILABLE FROM SPIG INDUSTRY, INC., (276) 644-9510, 14675 INDUSTRIAL PARK RD., BRISTOL, VA 24202.

2. THE FIRST SPECIALIZED GUARDRAIL PANEL SHOULD BE CENTERED BETWEEN THE MOUNTING TABS OF THE SGET IMPACT HEAD SUCH THAT THE TOP SPACING BETWEEN THE TOP OF THE FIRST SPECIALIZED GUARDRAIL PANEL AND THE TOP FEED CHANNEL OF THE SGET IMPACT HEAD IS THE SAME AS THE BOTTOM SPACING BETWEEN THE BOTTOM OF THE FIRST SPECIALIZED GUARDRAIL PANEL AND THE BOTTOM FEED CHANNEL OF THE SGET IMPACT HEAD. A PLASTIC SPACER IS PROVIDED WITH THE INSTALLATION KIT TO ACCOMPLISH THE CENTERING OF FIRST SPECIALIZED GUARDRAIL PANEL BETWEEN THE MOUNTING TABS OF THE SGET IMPACT HEAD.

3. THE CABLE SHOULD BE TENSIONED SUCH THAT LESS THAN 1 INCH OF DEFLECTION OCCURS WHEN THE CABLE IS STEPPED ON.

4. THE THREADED END OF THE CABLE SHOULD ONLY PROTRUDE 1 TO 1 ¼ INCH FROM THE CABLE TIGHTENING NUT AT THE END OF THE GUARDRAIL GRABBER (N) ON THE FIRST SPECIALIZED GUARDRAIL PANEL (B).

5. THE NOMINAL HEIGHT OF THE GUARDRAIL BEAM IS 31 INCHES WITH A TOLERANCE OF +/- ONE INCH.

6. THE ENTIRE SYSTEM MUST BE INSTALLED IN A STRAIGHT LINE WITHOUT ANY CURVE. HOWEVER, THE SYSTEM CAN BE FLARED UP TO TWO FEET OVER 50 FEET TO FURTHER OFFSET THE FACEPLATE OF THE SGET IMPACT HEAD FROM THE SHOULDER OF THE ROAD.

7. THE SYSTEM IS SHOWN WITH A FIRST 12'-6" SPECIALIZED GUARDRAIL PANEL, A SECOND 12'-6" STANDARD GUARDRAIL PANEL, A THIRD 12'-6" STANDARD GUARDRAIL PANEL, AND A FOURTH 12'-6" STANDARD GUARDRAIL PANEL. THE FIRST 12'-6" SPECIALIZED PANEL MUST ALWAYS BE USED.

8. POSTS 2 THROUGH 8 MUST ALL BE YIELDING POSTS WITH THE YIELDING HOLES AT GROUND LEVEL.

9. THE REDIRECTIVE CAPABILITY OF THE SYSTEM BEGINS AT POST 3.

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CALIFORNIA DEPT. OF TRANSPORTATION (CALTRANS)

SINGLE GUARDRAIL TERMINAL

SGET-MASH-TL-3

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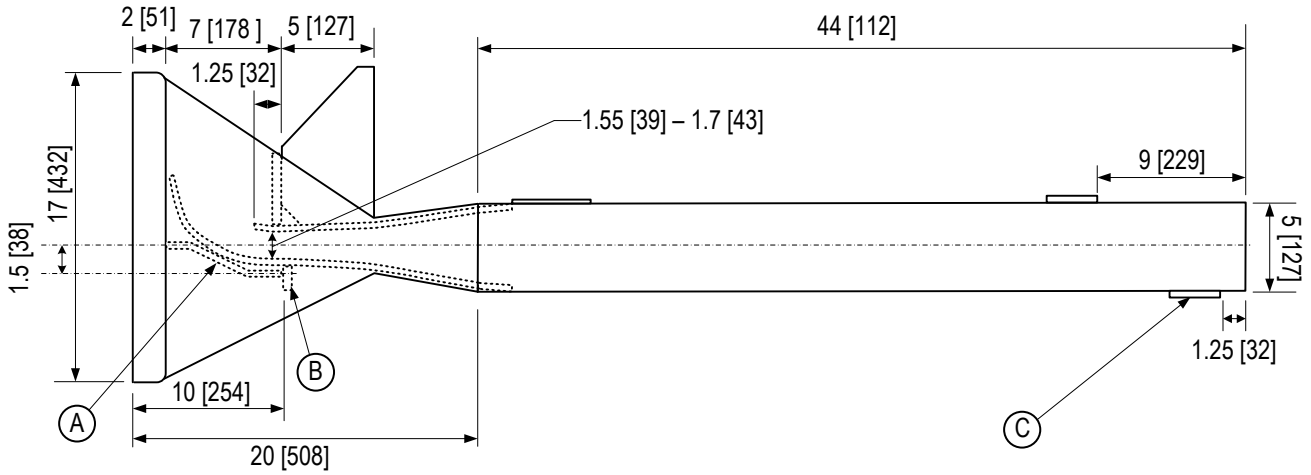
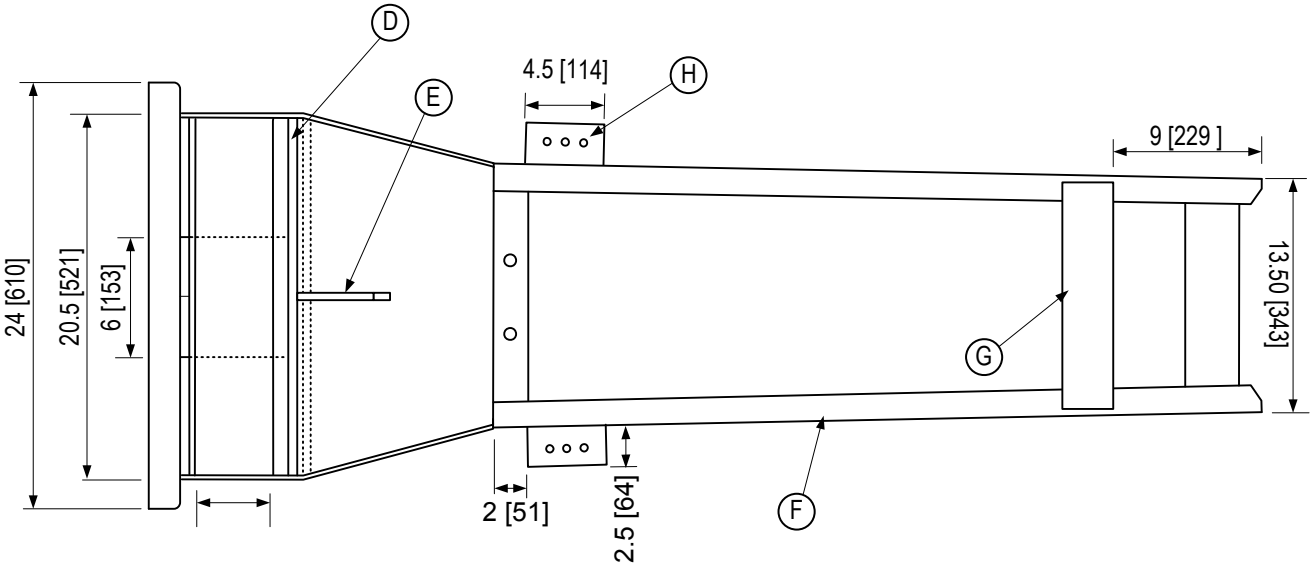
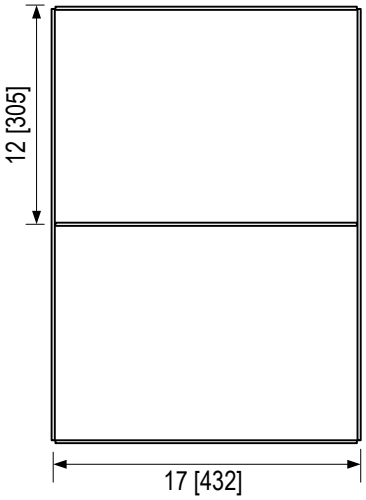
FILE: SGET_2021_06_17.DWG	DN: ##	CK: ##	DN: ##	CK: ##
	CONT	SECT	JOB	HIGHWAY
	##	##	##	##
	DIST	COUNTY		SHEET NO.
	##	##		2 OF 2

DATE: JUNE 17, 2021
FILE: SGET_2021_06_17.DWG







PART	DESCRIPTION
A	0.25 [6] PLATE STEEL BENT +30° at 3 [76] AND -30° at 6.5 [165]
B	0.5 [13] PLATE STEEL MEASURING 1.75 [44] X 19.5 [495]
C	0.5 [13] PLATE STEEL MEASURING 3 [76] X 12.75 [324]
D	0.5 [13] PLATE STEEL MEASURING 4 [102] X 19.8125 [503]
E	0.625 [16] PLATE STEEL
F	0.25 [6] C-CHANNEL STEEL WITH 1.75 [44] SIDES
G	0.5 [13] PLATE STEEL MEASURING 3 [76] X 13 [330]
H	0.1825 [5] PLATE STEEL WITH THREE .5 [13] HOLES

SPIG GUARDRAIL END TERMINAL (SGET) 44" w/offset brake

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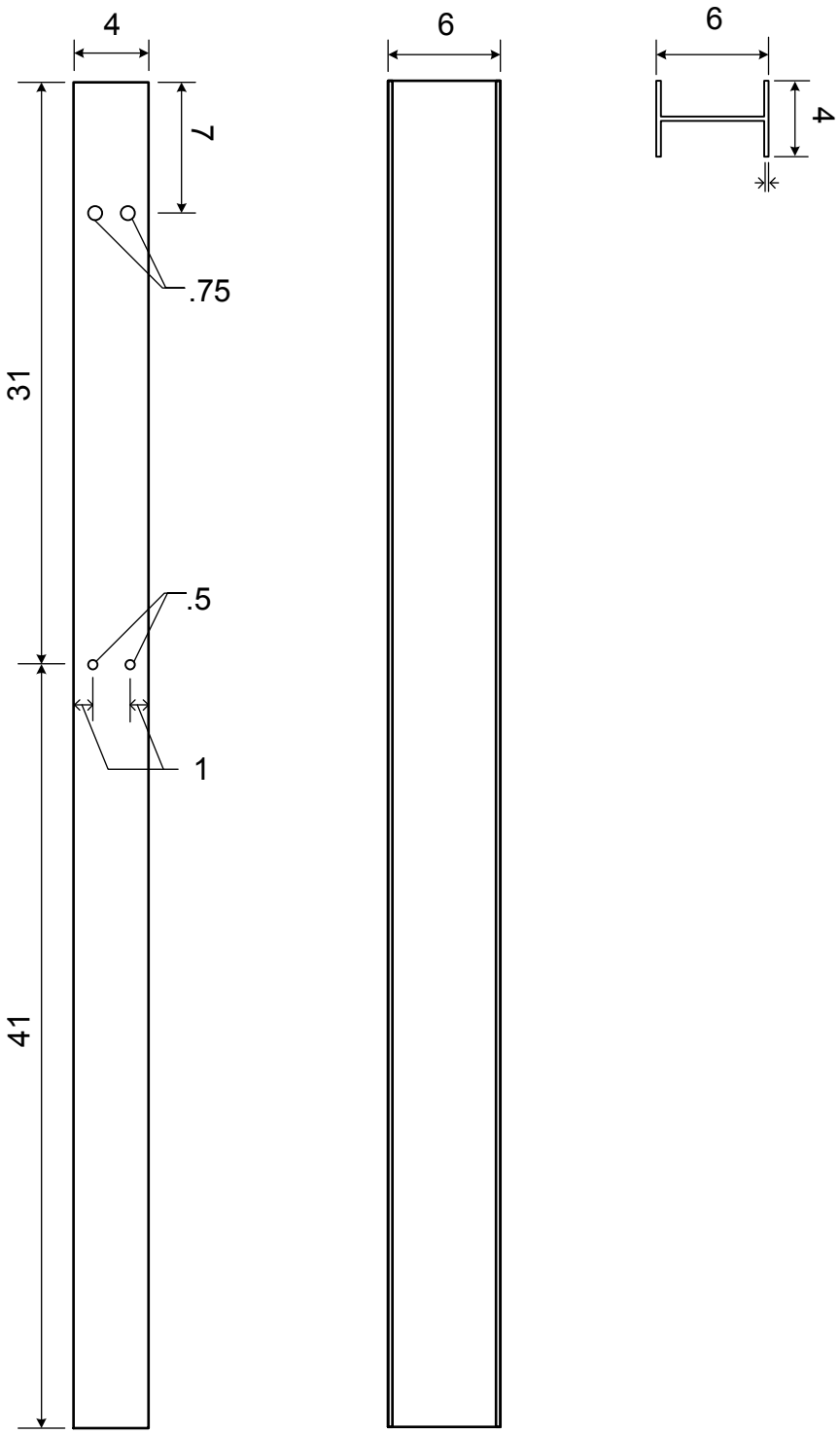

YIELDING POST

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SHEET NO.	DATE:
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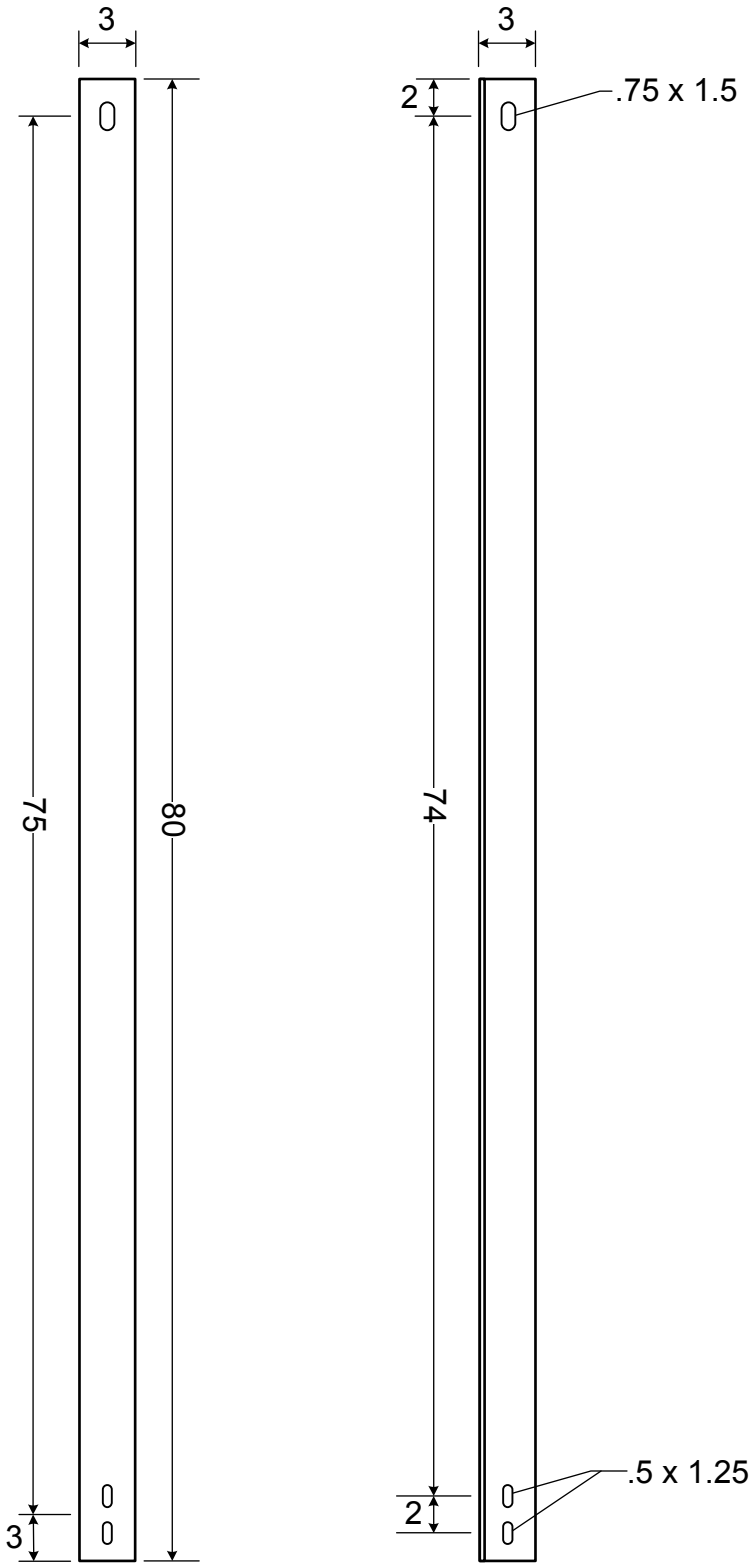

STRUT CHANNEL

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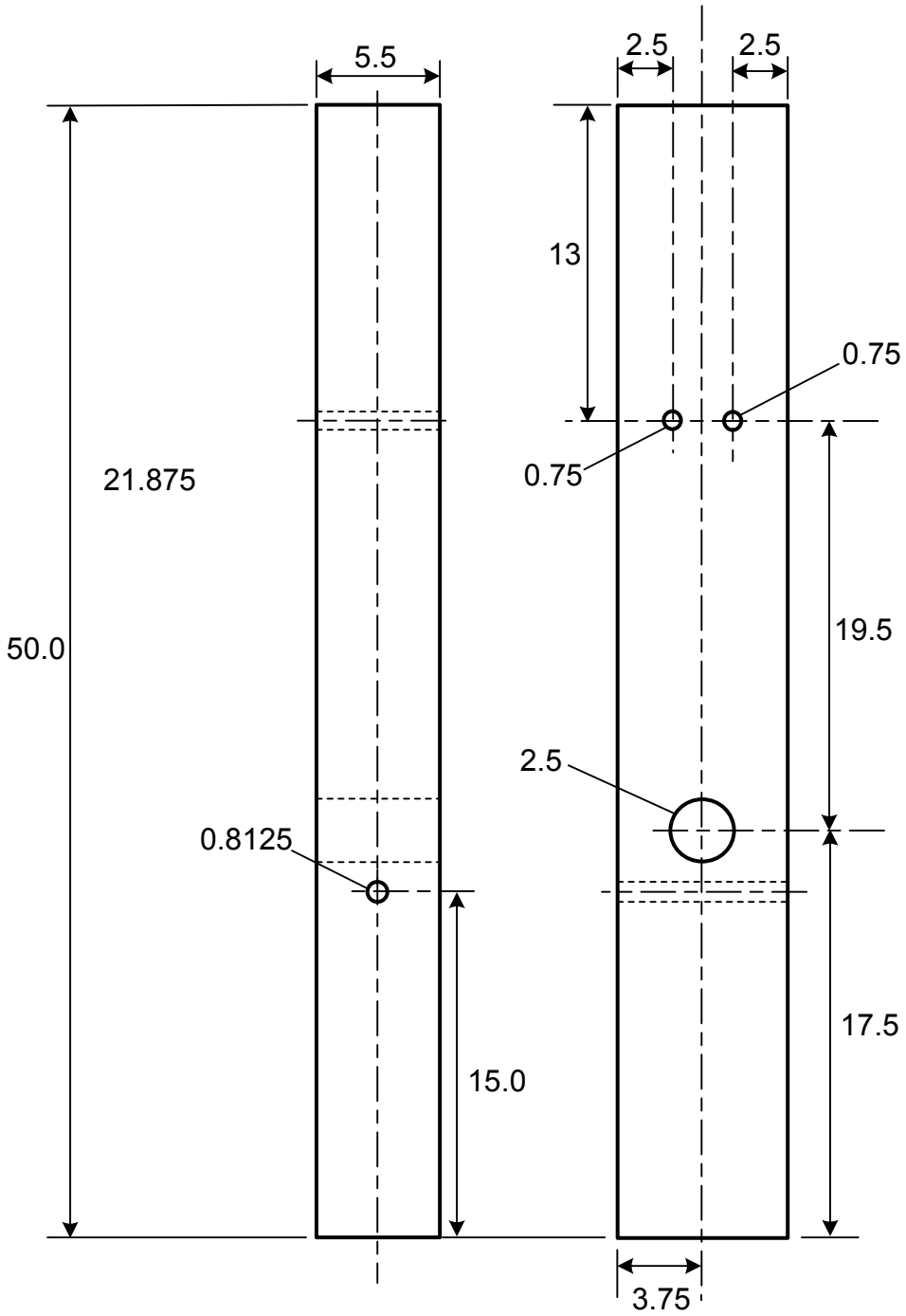

WOOD POST 1

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SHEET NO.	DATE:
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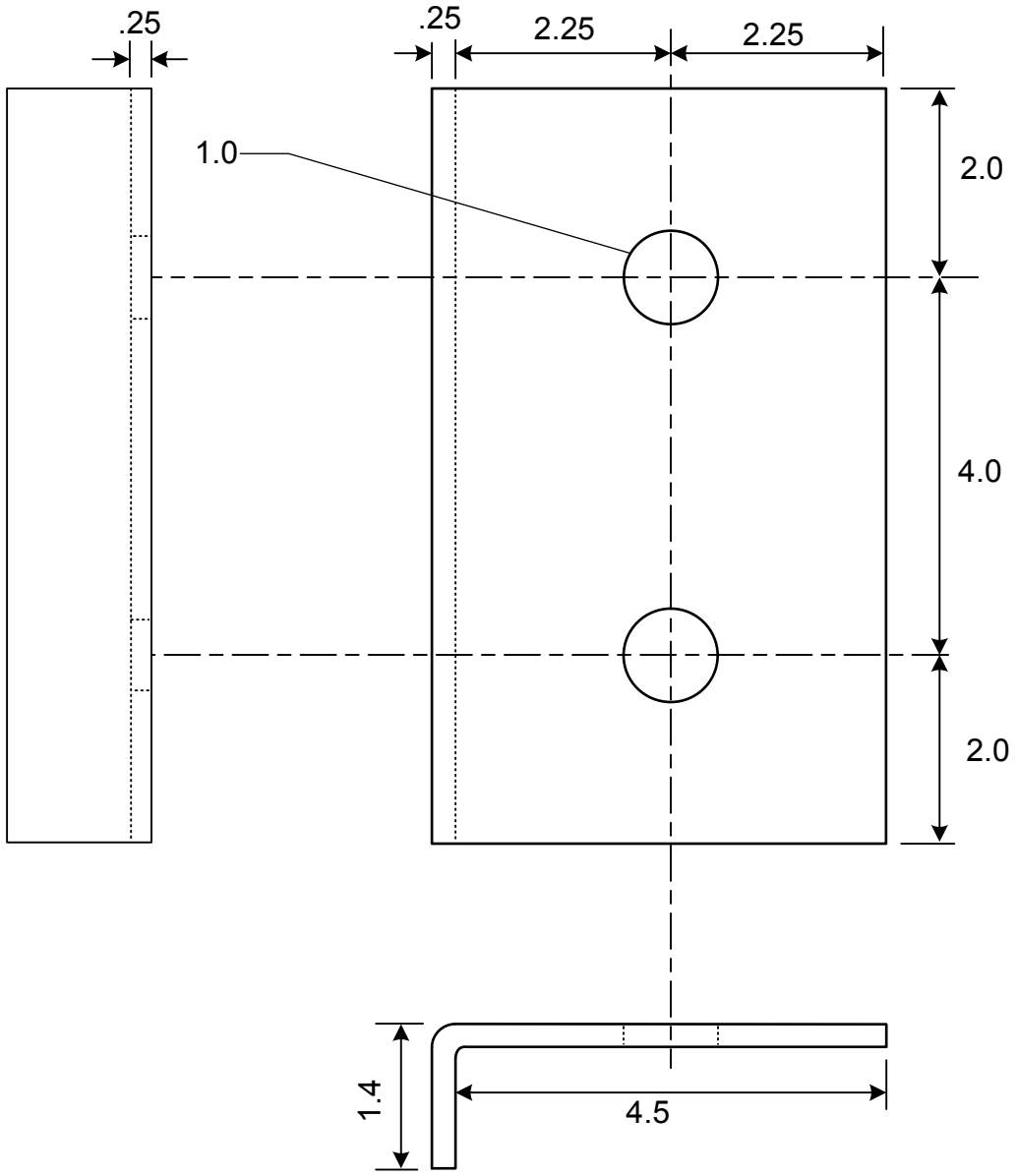

STRIKE PLATE

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SHEET NO.	DATE:
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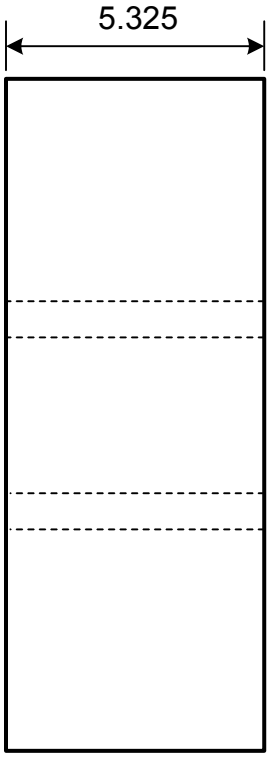

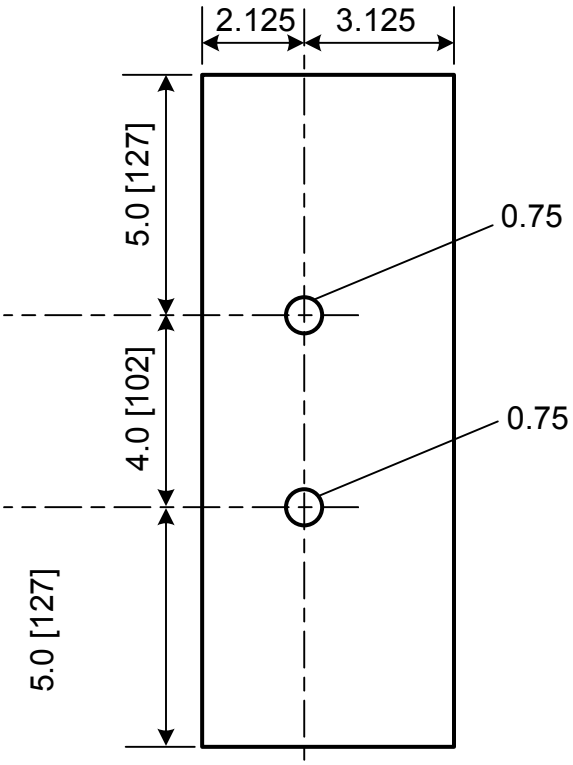

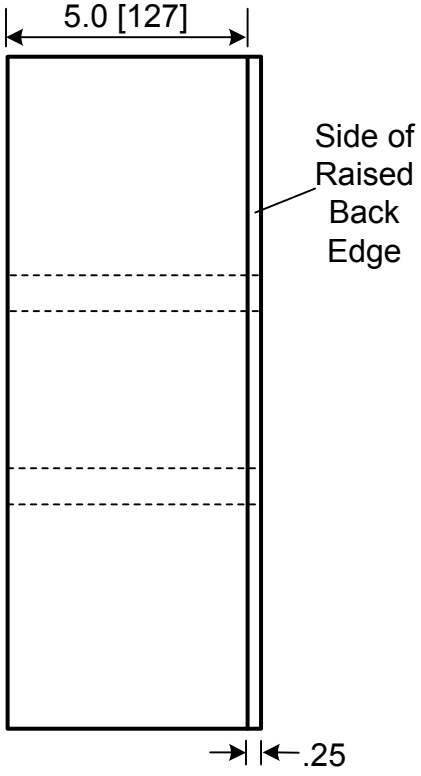

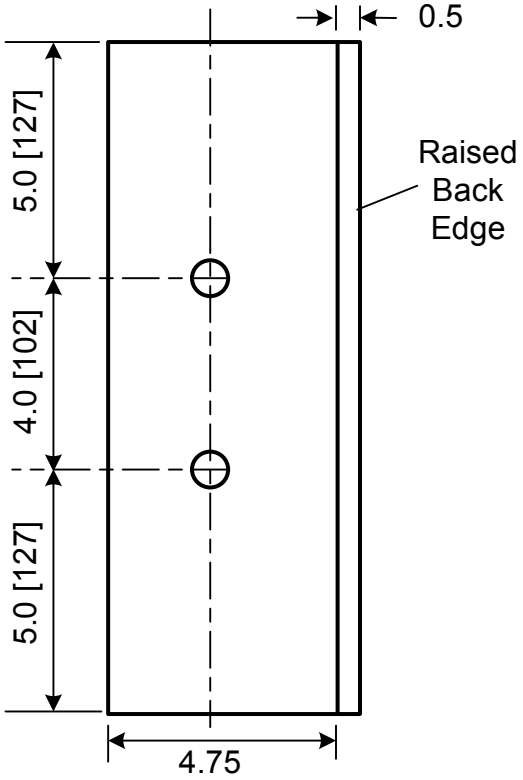

BLOCK ON WOOD POST 1

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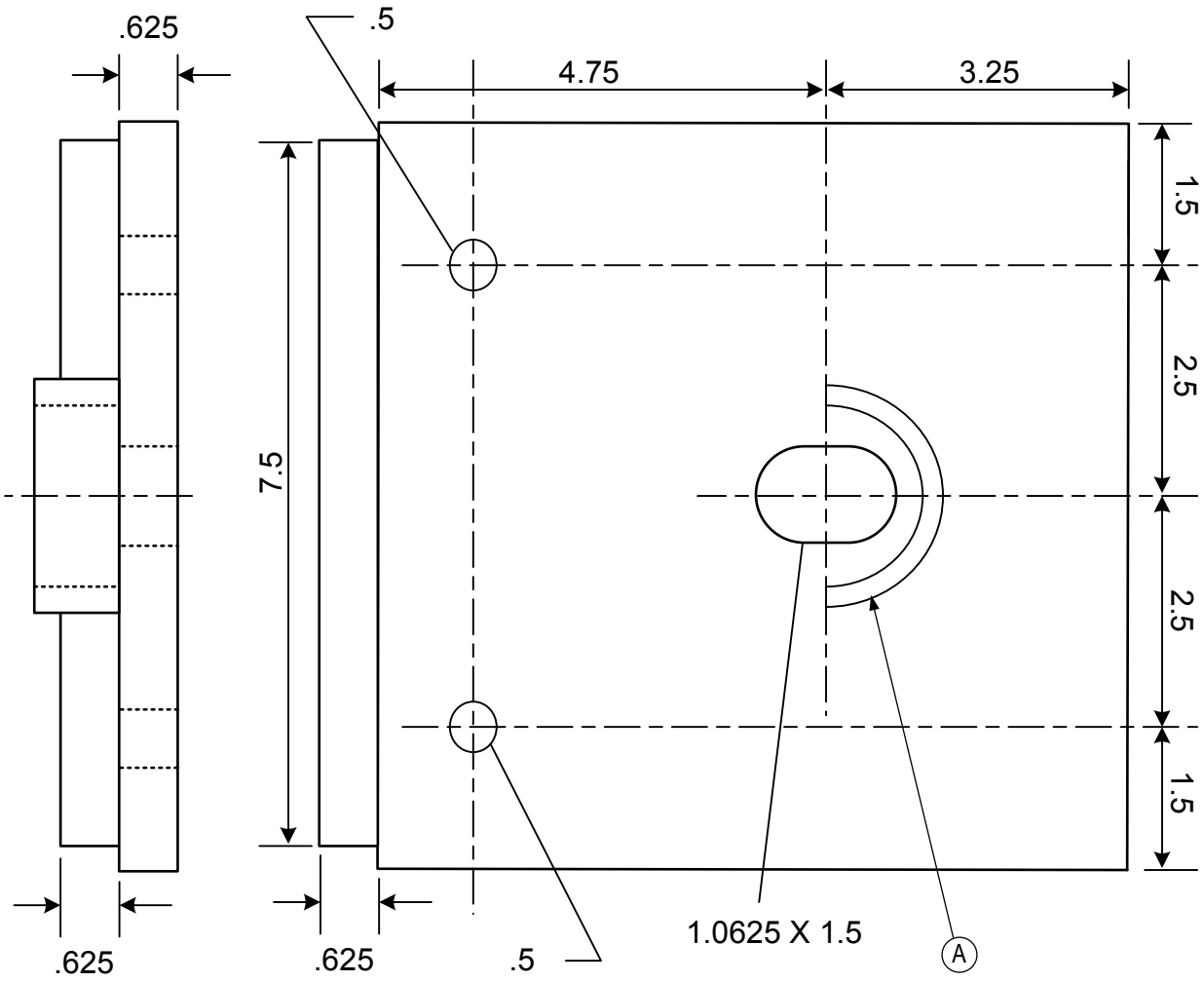

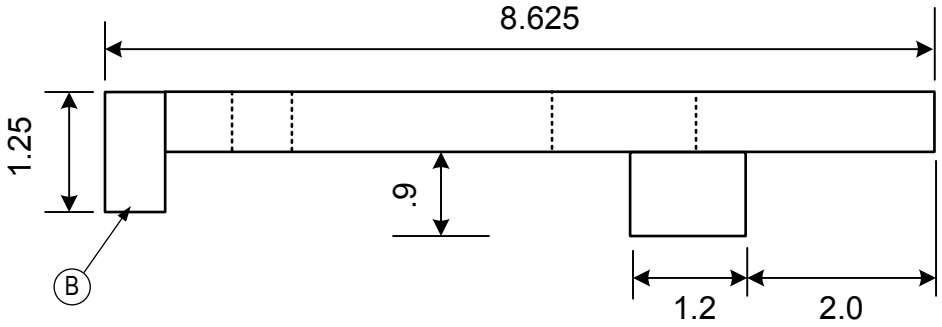

PART	DESCRIPTION
A	HALF DIAMETER OF 2.125 OD X 1.75 ID X 0.1875 WALL PIPE
B	0.625 [16] PLATE STEEL MEASURING 1.25 [32] X 7.5 [191]

BEARING PLATE

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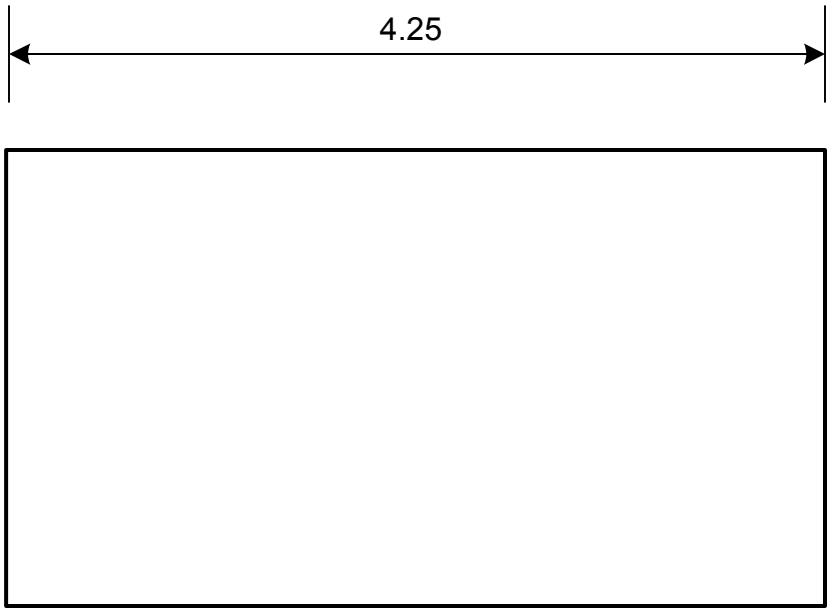

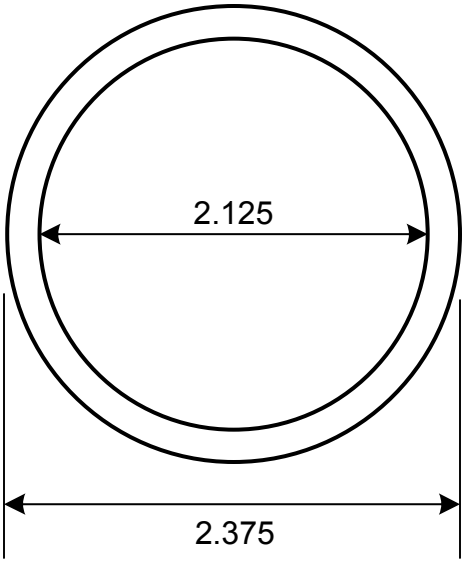

SLEEVE PIPE

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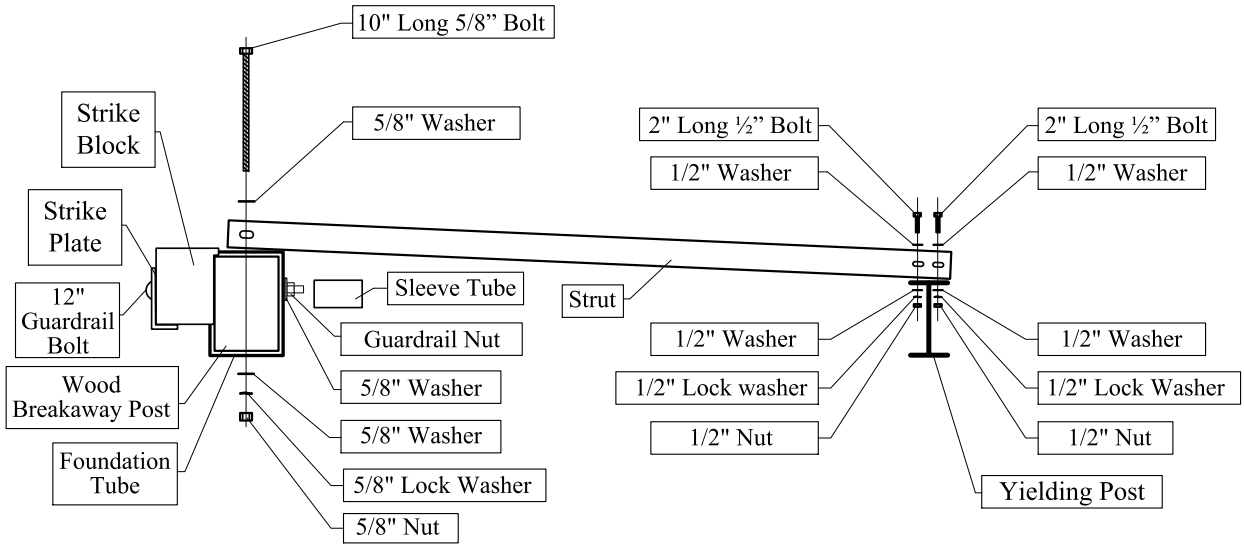
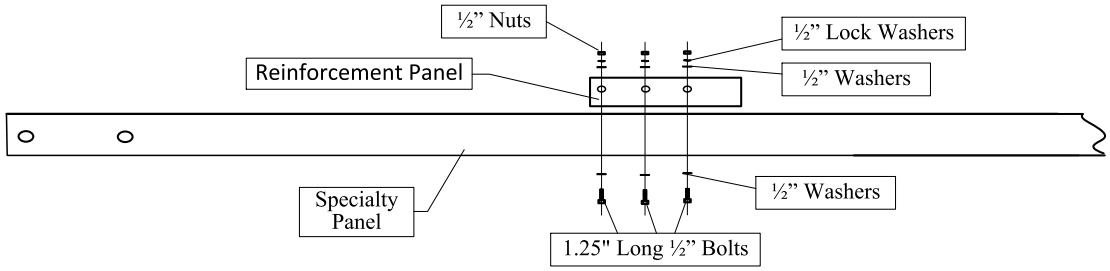
SGET SYSTEM PARTS

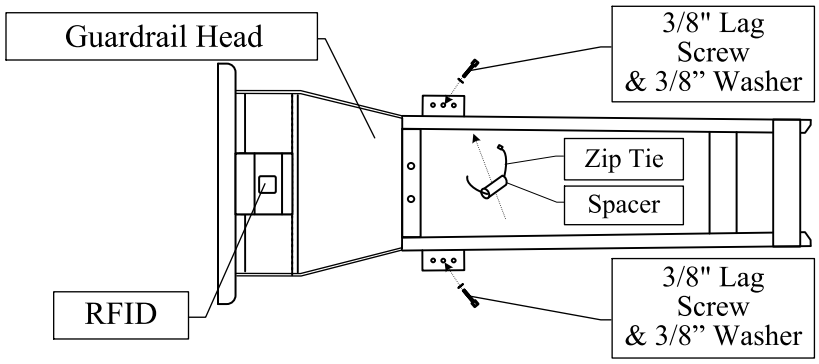


POST PARTS	QTY
12" Guardrail Bolt – 5/8 X 12 307A HDG	1
Strike Plate	1
Strike Block	1
Guardrail Nut – 5/8-11 Nut A563 HDG	1
Wood Breakaway Post – 5-1/2 X 7-1/2 X 50 BCT	1
Foundation Tube – 6" X 8" X 6' Rectangular Tube	1
10" long 5/8" Bolt – 5/8-11 X 10 A325 HDG	1
5/8" Nut – 5/9-11 A563 Hex Nut Galvanized	1
5/8" Washer – 5/8 F436(A325) HDG Flatwasher	3
5/8" Lock Washer Galvanized	1
2" long 1/2" Bolt – 1/2-13 X 2 A325 HDG	2
1/2" Washer – 1/2 F436(A325) HDG Flatwasher	4
1/2" Nut – 1/2-13 A563 Hex Nut Galvanized	2
1/2" Lock Washer Galvanized	2
Yielding Post – Modified W6 X 8.5 Guardrail Post	7
Strut – 3" X 3" X 80" Angle	1
Sleeve Tube – 2-3/8 OD X 4-1/4	1

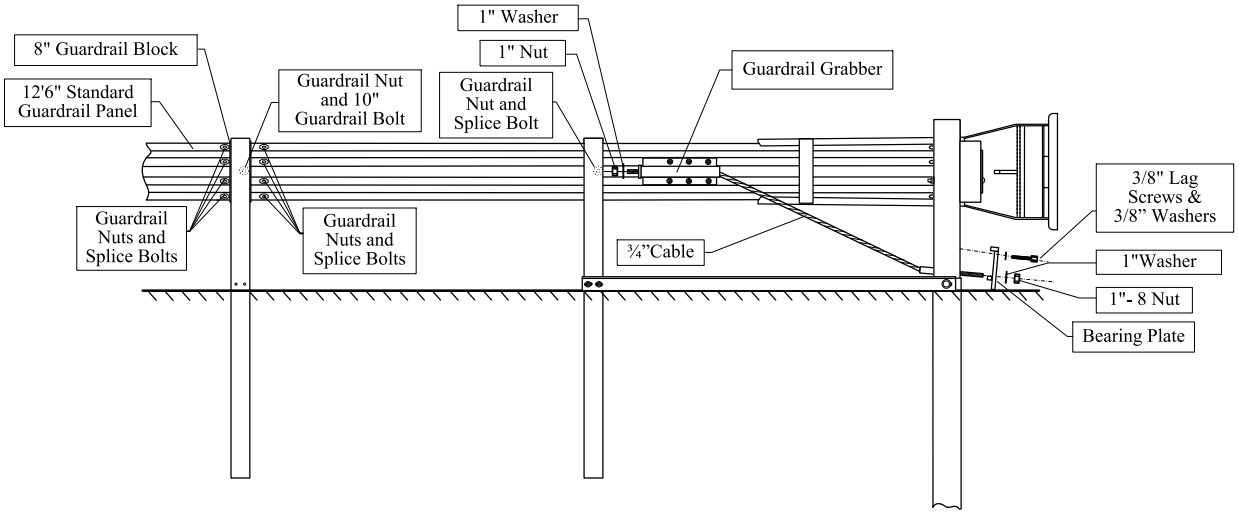


SPECIALTY PANEL PARTS	QTY
Specialty Panel	1
1.25" Long 1/2" Bolt – 1/2-13 X 1-1/4 A325 HDG	6
1/2" Washer – 1/2 F436(A325) HDG Flatwasher	12
1/2" Nut – 1/2-13 A563 Hex Nut Galvanized	6
1/2" Lock Washer Galvanized	6
Reinforcement Plate	1

SGET SYSTEM PARTS



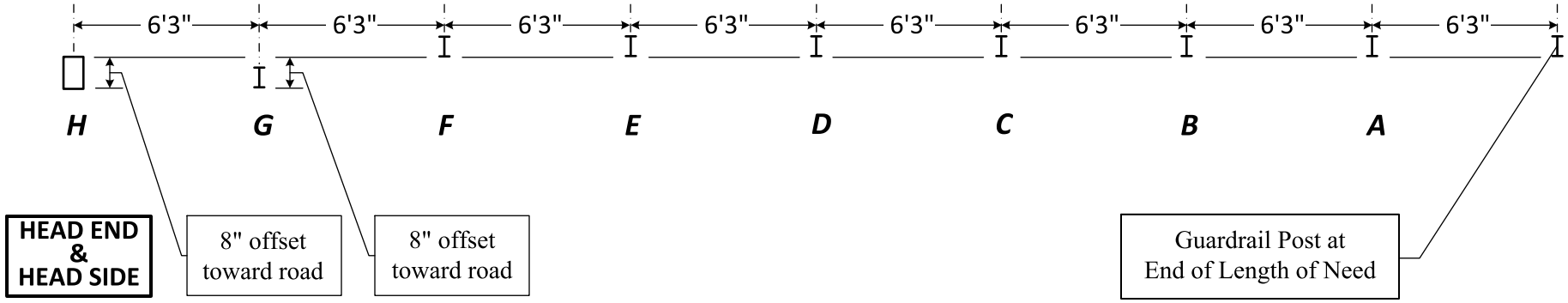
GUARDRAIL HEAD PARTS	QTY
Guardrail Head	1
3/8” Lag Screw – 3/8 X 3 GR5 HDG Hex Lag Screw	2
3/8” Washer Galvanized F844	2
Spacer – 4” Long X 1-1/2 SCH-40 PVC PIPE	1
Zip Tie – 18”-24” Long Rated at 175-200 lbs.	1
RFID chip rated MIL-STD-810F (e.g. Omni-ID EX0750)	1



RAIL AND CABLE PARTS	QTY
¾” Cable – 81” Long BCT Cable	1
1” Nut – 1- 8 Hex Nut UNC Galvanized A563DH	2
1” Washer Galvanized F436	2
Guardrail Splice Bolt – 5/8 X 1-1/4 307A HDG	25
10” Guardrail Bolt – 5/8 X 10 307A HDG	6
Guardrail Nut– 5/8-11 Nut A563 HDG	31
8” Guardrail Block	6
12’ 6” Standard Guardrail Panel – W-Beam M-180	3
Bearing Plate	1
3/8” Lag Screw – 3/8 X 3 GR5 HDG Hex Lag Screw	2
3/8” Washer Galvanized F844	2
Guardrail Grabber	1

1. Install Guardrail Post A extending ~32 inches above the ground at a spacing of 6'3" from the end of the length of need and inline with the length of need.
2. Install Guardrail Post B extending ~32 inches above the ground at a spacing of 6'3" from Guardrail Post A and inline with Guardrail Post A and the length of need.
3. Install Guardrail Post C extending ~32 inches above the ground at a spacing of 6'3" from Guardrail Post B and inline with Guardrail Post B and Guardrail Post A.
4. Install Guardrail Post D extending ~32 inches above the ground at a spacing of 6'3" from Guardrail Post C and inline with Guardrail Post C and Guardrail Post B.
5. Install Guardrail Post E extending ~32 inches above the ground at a spacing of 6'3" from Guardrail Post D and inline with Guardrail Post D and Guardrail Post C.
6. Install Guardrail Post F extending ~32 inches above the ground at a spacing of 6'3" from Guardrail Post E and inline with Guardrail Post E and Guardrail Post D.
7. Install Strut Post G extending ~32 inches above the ground at a spacing of 6'3" from Guardrail Post F and offset 8" toward road from the line of Guardrail Posts F and E.
8. Install Soil Tube H extending ~2.5 inches above the ground at a spacing of 6'3" from Strut Post G and offset 8" toward road from the line of Guardrail Posts F and E.

A - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
B - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
C - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
D - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
E - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
F - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges near ground}
H - 6"X8"X6' Soil Tube



I. INSTALLATION OF POSTS AND TUBE

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PO Box 2617
Abingdon, VA 24212

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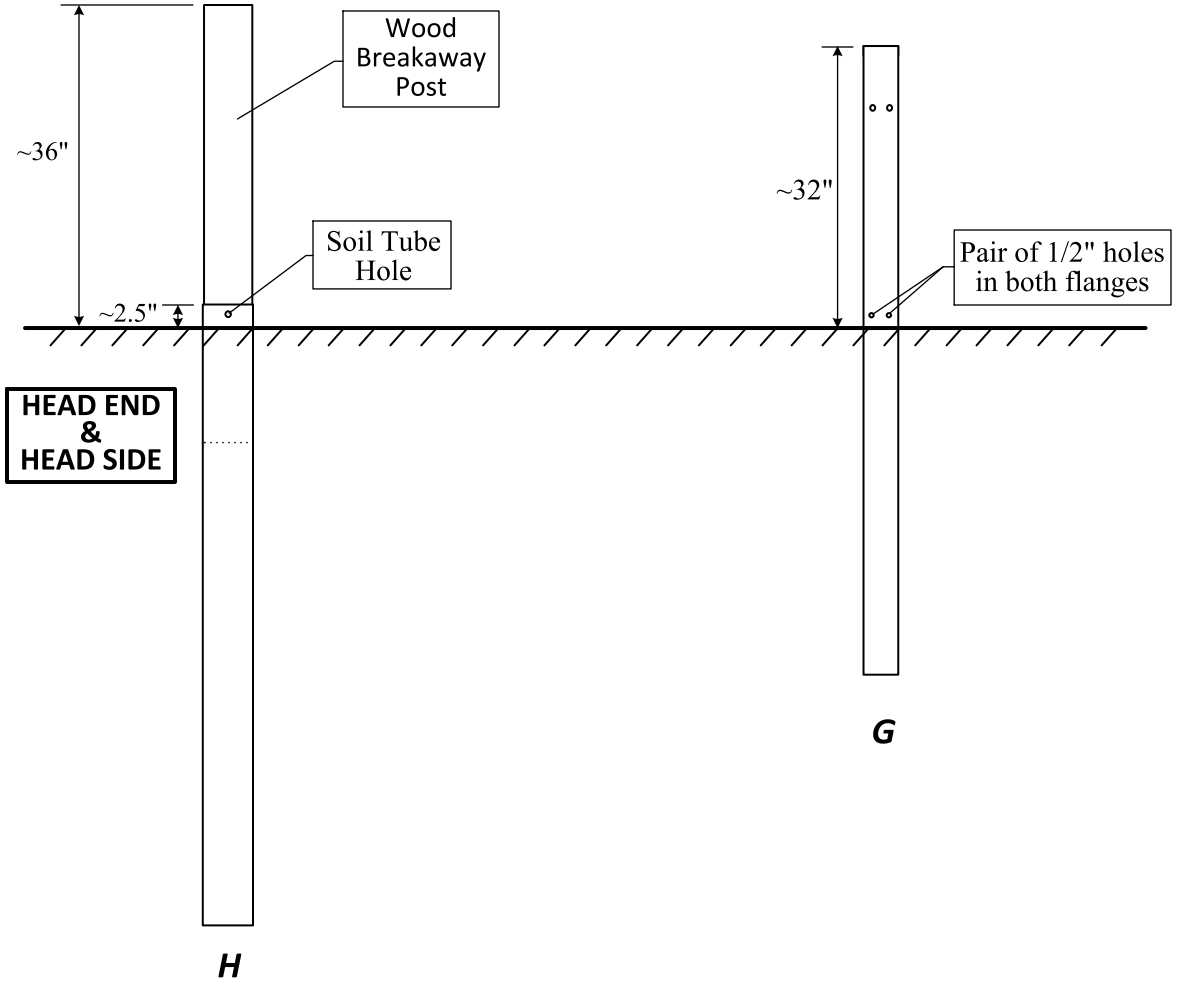
1. Insert 50" Wood Breakaway Post into Soil Tube ***G*** until hole in Soil Tube matches hole in Wood Breakaway post.

G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges near ground}
H - 6"X8"X6' Soil Tube



II. INSTALLATION OF 50" WOOD BREAKAWAY POST

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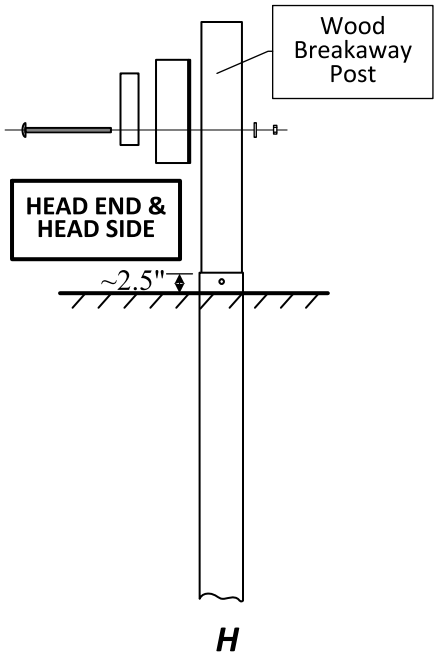
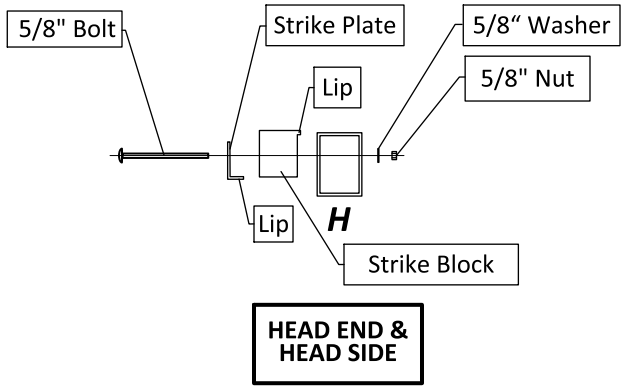
Abingdon, VA 24212

1. (Left Road Side) Position Strike Block on Wood Breakaway Post such that lip of Strike Block is on side of Wood Breakaway Post opposite the Head Side of Wood Breakaway Post and then position Strike Plate on Strike Block such that lip of Strike Plate is on head side of Strike Block.
2. (Left Road Side) Insert 14" long 5/8” guardrail bolt through the lower hole of the Strike Plate, through the Strike Block, and then the Wood Breakaway Post. Then, put 5/8" washer and 5/8" nut on the 14" long 5/8” guardrail bolt.

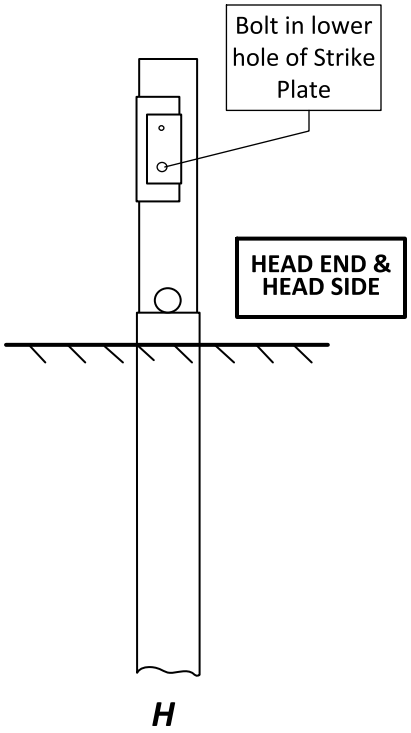
H - 6"X8"X6' Soil Tube



SIDE VIEW



TOP VIEW



FRONT VIEW

IIIa. INSTALLATION OF STRIKE PLATE AND STRIKE BLOCK ON RIGHT SIDE

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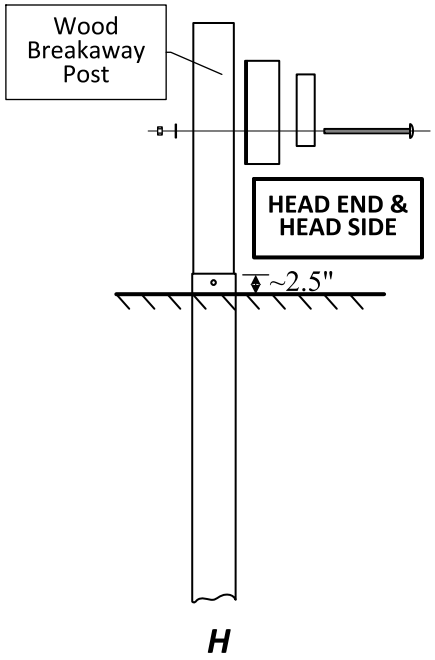
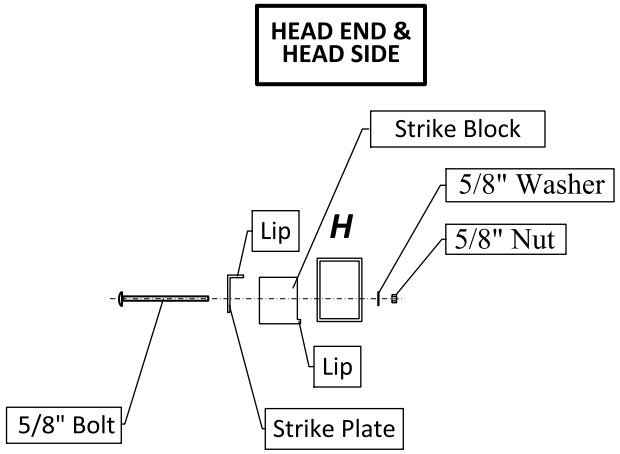
1. (Right Road Side) Position Strike Block on Wood Breakaway Post such that lip of Strike Block is on side of Wood Breakaway Post opposite the Head Side of Wood Breakaway Post and then position Strike Plate on Strike Block such that lip of Strike Plate is on head side of Strike Block.

2. (Right Road Side) Insert 14" long 5/8” guardrail bolt through the lower hole of the Strike Plate, through the Strike Block, and then the Wood Breakaway Post. Then, put 5/8" washer and 5/8" nut on the 14" long 5/8” guardrail bolt.

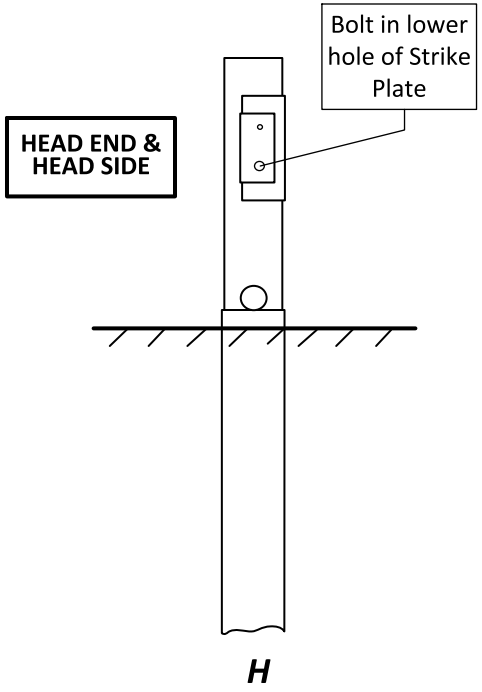
H - 6"X8"X6' Soil Tube



SIDE VIEW



TOP VIEW



FRONT VIEW

IIIb. INSTALLATION OF STRIKE PLATE AND STRIKE BLOCK ON LEFT SIDE

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SHEET NO.	DATE:
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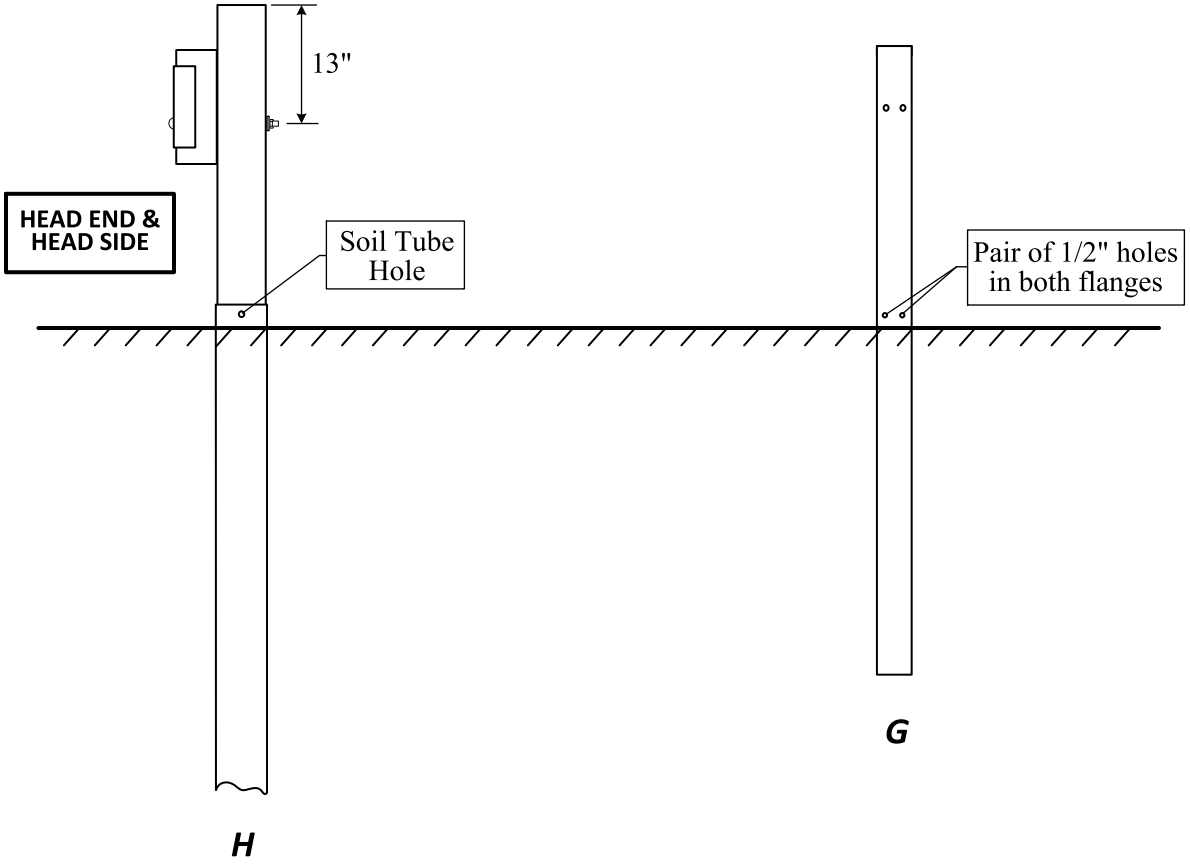
3. Tighten 5/8" nut on 14" long 5/8” guardrail bolt inserted through the lower hole of the Strike Plate, through the Strike Block, and then the Wood Breakaway Post.

G - 4"X6"X6' Strut Post
{w/four ½”holes in flanges near ground}
H - 6"X8"X6' Soil Tube



IIIc. INSTALLATION OF STRIKE PLATE AND STRIKE BLOCK ON LEFT SIDE

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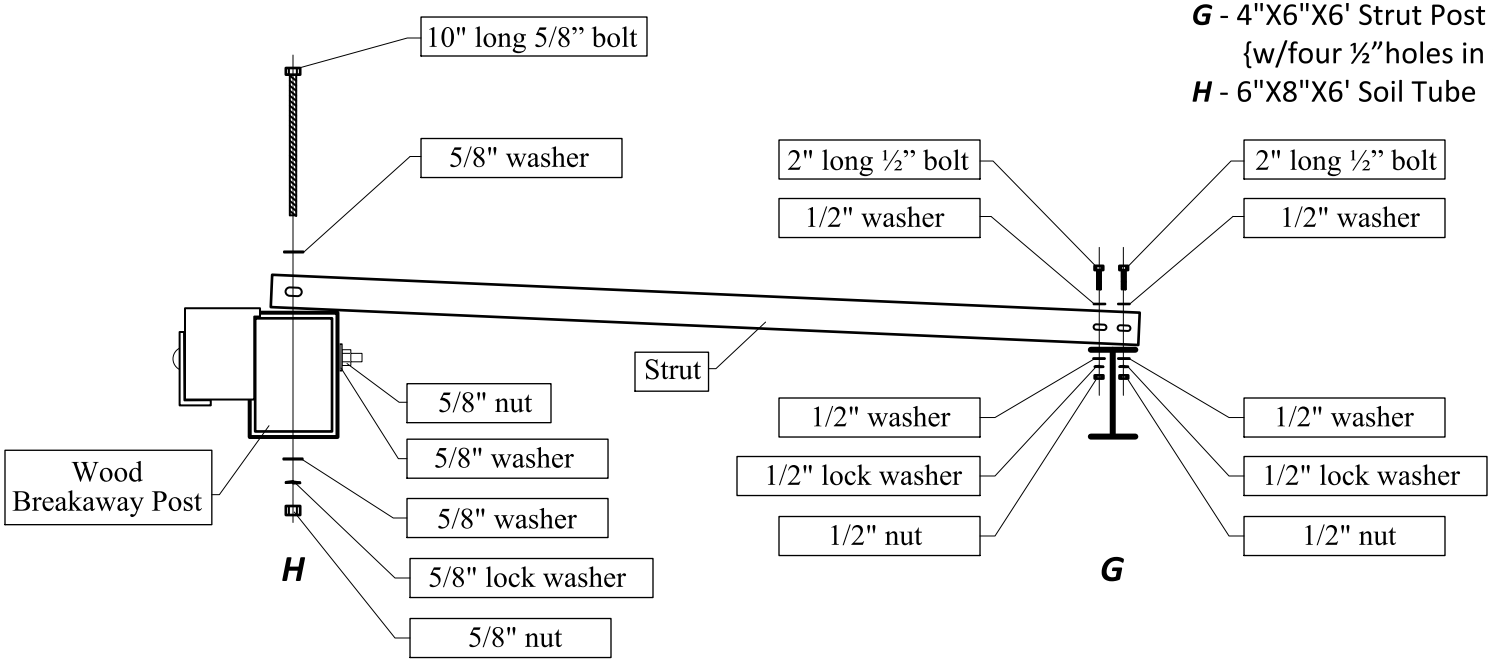
1. Position Strut between Strut Post G and Soil Tube H such that one flange of the Strut is on top and the other flange of the Strut is against Strut Post G and Soil Tube H.
2. Insert washered 2" long ½" bolts under the one flange and through both the Strut and Strut Post G. Then, put washers, lock washers and nuts on the 2" long ½" bolts to attach the Strut to the Strut Post G.
3. Insert washered 10" long 5/8" bolt under the one flange and through the Strut, Soil Tube H and Wood Breakaway Post. Then, put washers, lock washers and nuts on the 10" long 5/8" bolt to attach the Strut to the Soil Tube H and the Wood Breakaway Post.

A - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
B - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
C - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
D - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
E - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
F - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges near ground}
H - 6"X8"X6' Soil Tube



IV. INSTALLATION OF STRUT

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Abingdon, VA 24212

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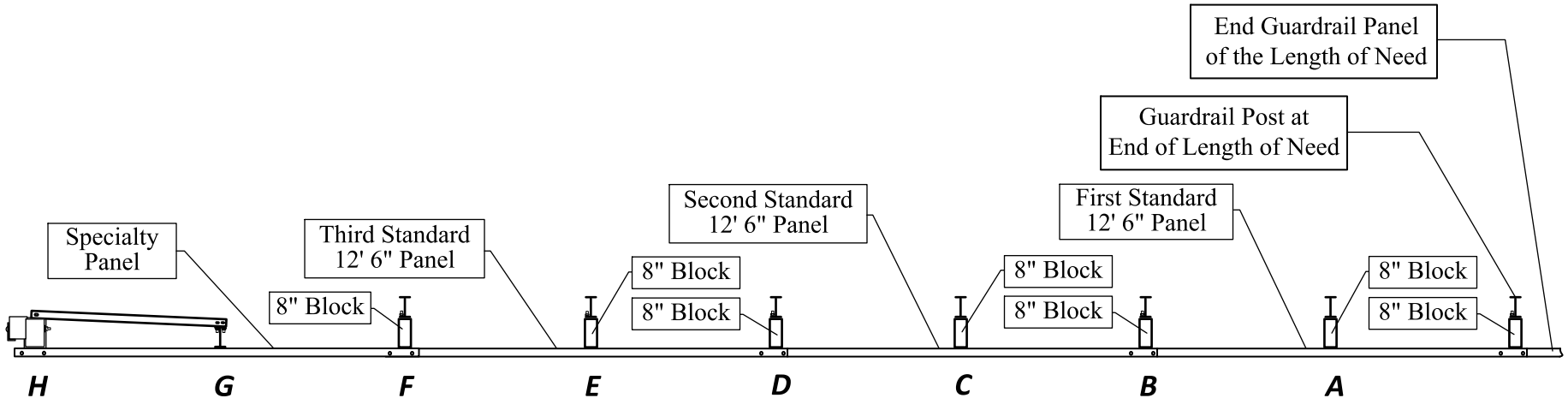
1. Attach First 12" 6" Standard Panel to the guardrail post at the end of the length of need and to Guardrail Post A through 8" Block Outs using 10" guardrail bolts.
2. Attach First 12" 6" Standard Panel to the End Guardrail Panel of the Length of Need using 1" splice bolts.
3. Attach Second 12" 6" Standard Panel to Guardrail Posts B and C through 8" Block Outs using 10" guardrail bolts.
4. Attach Second 12" 6" Standard Panel to the First 12" 6" Standard Panel using 1" splice bolts.
5. Attach Third 12" 6" Standard Panel to Guardrail Posts D and E through 8" Block Outs using 10" guardrail bolts.
6. Attach Third 12" 6" Standard Panel to the Second 12" 6" Standard Panel using 1" splice bolts.

A - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
B - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
C - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
D - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
E - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
F - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges near ground}
H - 6"X8"X6' Soil Tube



Va. INSTALLATION OF PANELS

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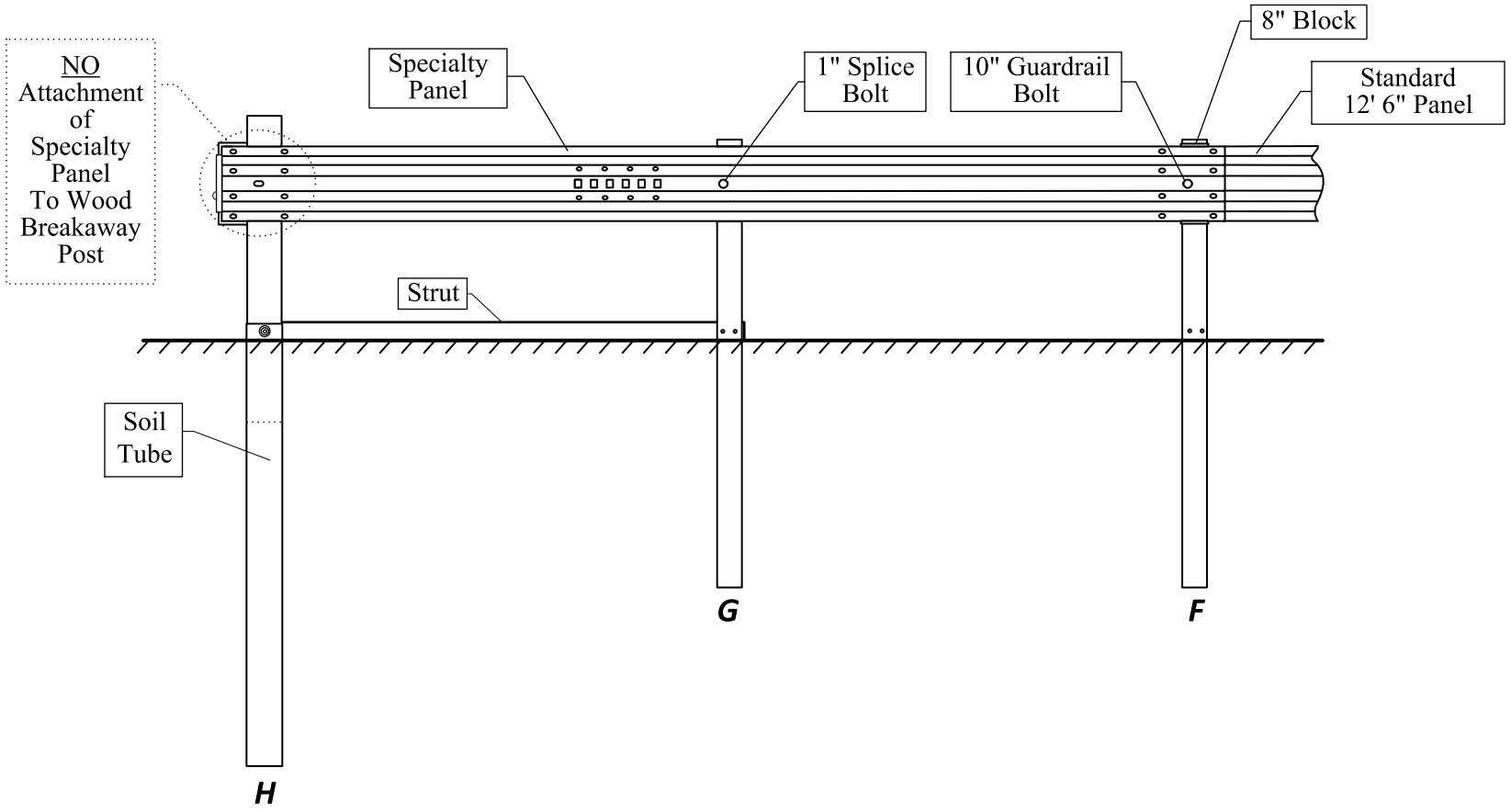
7. Attach Specialty Panel to Guardrail Post F through an 8" Block Out using 10" guardrail bolt and to Guardrail Post G .
8. Attach Specialty Panel to the Third 12" 6" Standard Panel using 1" splice bolts.
9. DO NOT ATTACH Specialty Panel to the Wood Breakaway Post in Soil Tube H. The end of the Specialty Panel just lays across the Wood Breakaway Post in Soil Tube H.

F - 4"X6"X6' Guardrail Post
{w/four ½"holes in flanges near ground}
G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges near ground}
H - 6"X8"X6' Soil Tube



Vb. INSTALLATION OF PANELS

SPIG Industry, LLC
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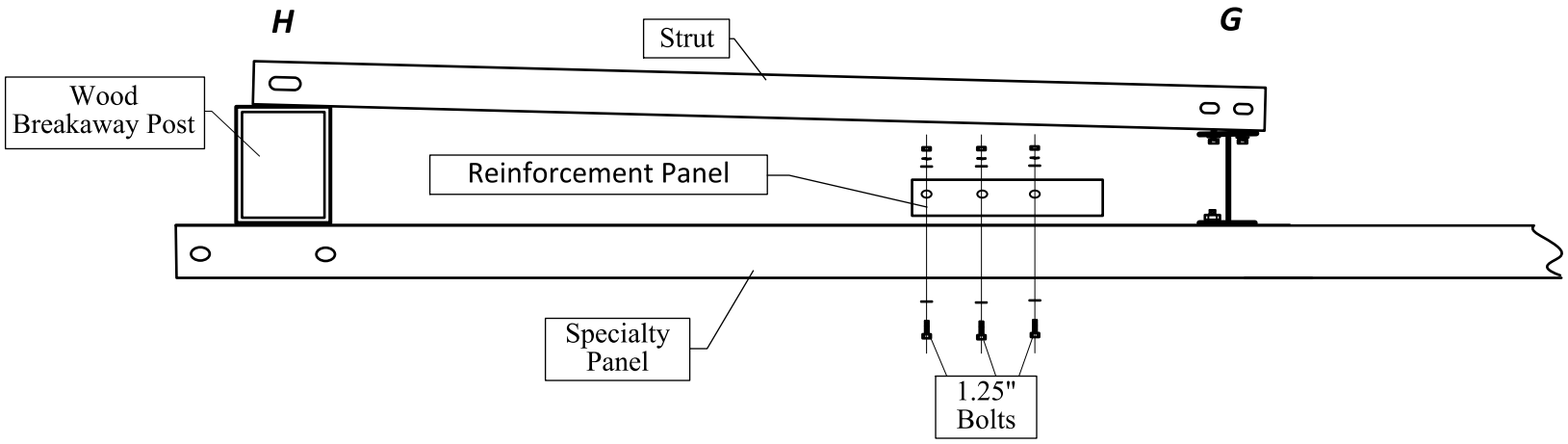
1. Place Reinforcement Panel behind Specialty Panel and align all of the square holes of the Reinforcement Panel correspondingly to all of the square holes in the Specialty Panel such that the Reinforcement Panel is positioned on the back side of the Specialty Panel with the round bolt holes of the Specialty Panel corresponding to the oblong bolt holes of the Reinforcement Panel.
2. Insert washered 1.25" long ½" bolts from the front side of the Specialty Panel through the round holes of the Specialty Panel and the oblong holes of the Reinforcement Panel. Then, put washers, lock washers and nuts on ends of the 1" long ½" bolts outside of the Reinforcement Panel, which is on the back side of the Specialty Panel.

G - 4"X6"X6' Strut Post {w/four ½"holes in flanges}
H - 6"X8"X6' Soil Tube



V. INSTALLATION OF REINFORCEMENT PANEL

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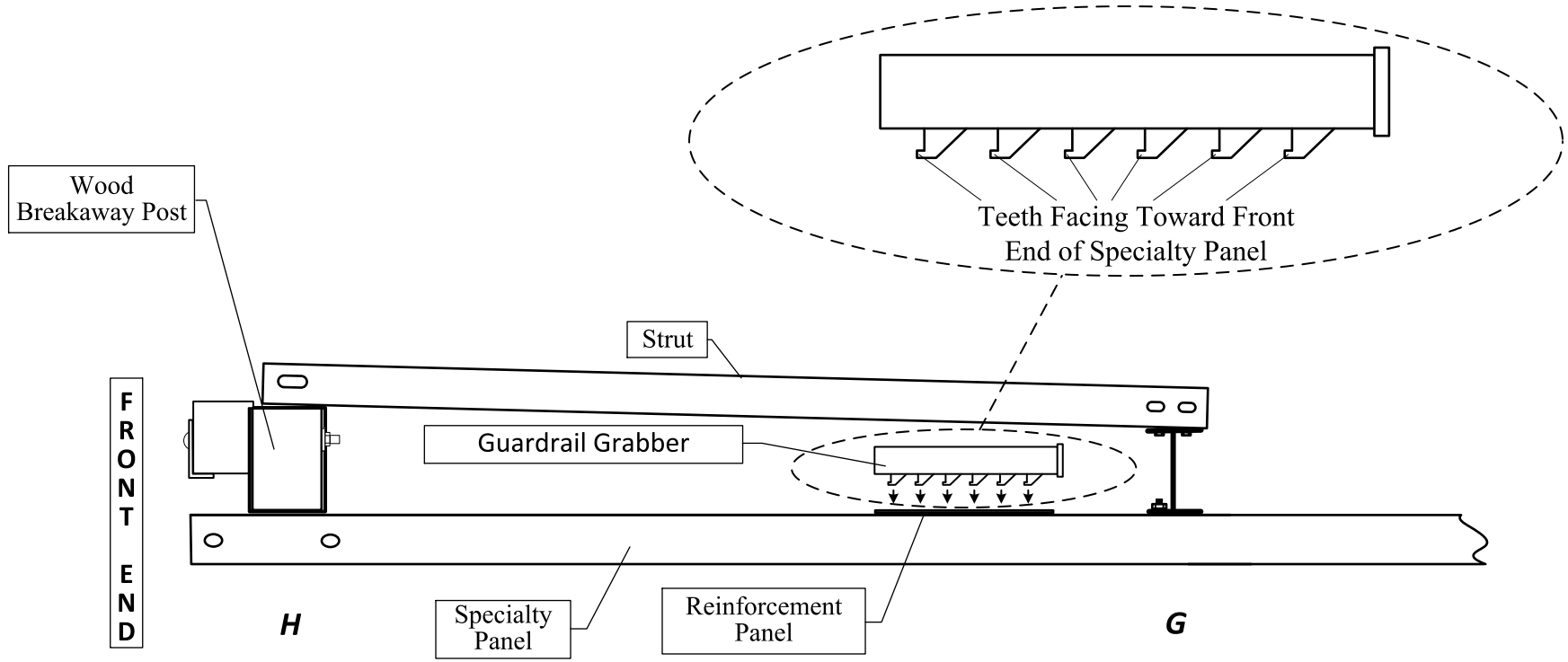
Abingdon, VA 24212

1. Insert rectangular-shaped pegs of Guardrail grabber into corresponding rectangular holes in both the Reinforcement Panel and the Specialty Panel with the teeth of the Guardrail Grabber pointing toward the front end of the specialty panel.

G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges}
H - 6"X8"X6' Soil Tube



VIa. INSTALLATION OF GUARDRAIL GRABBER

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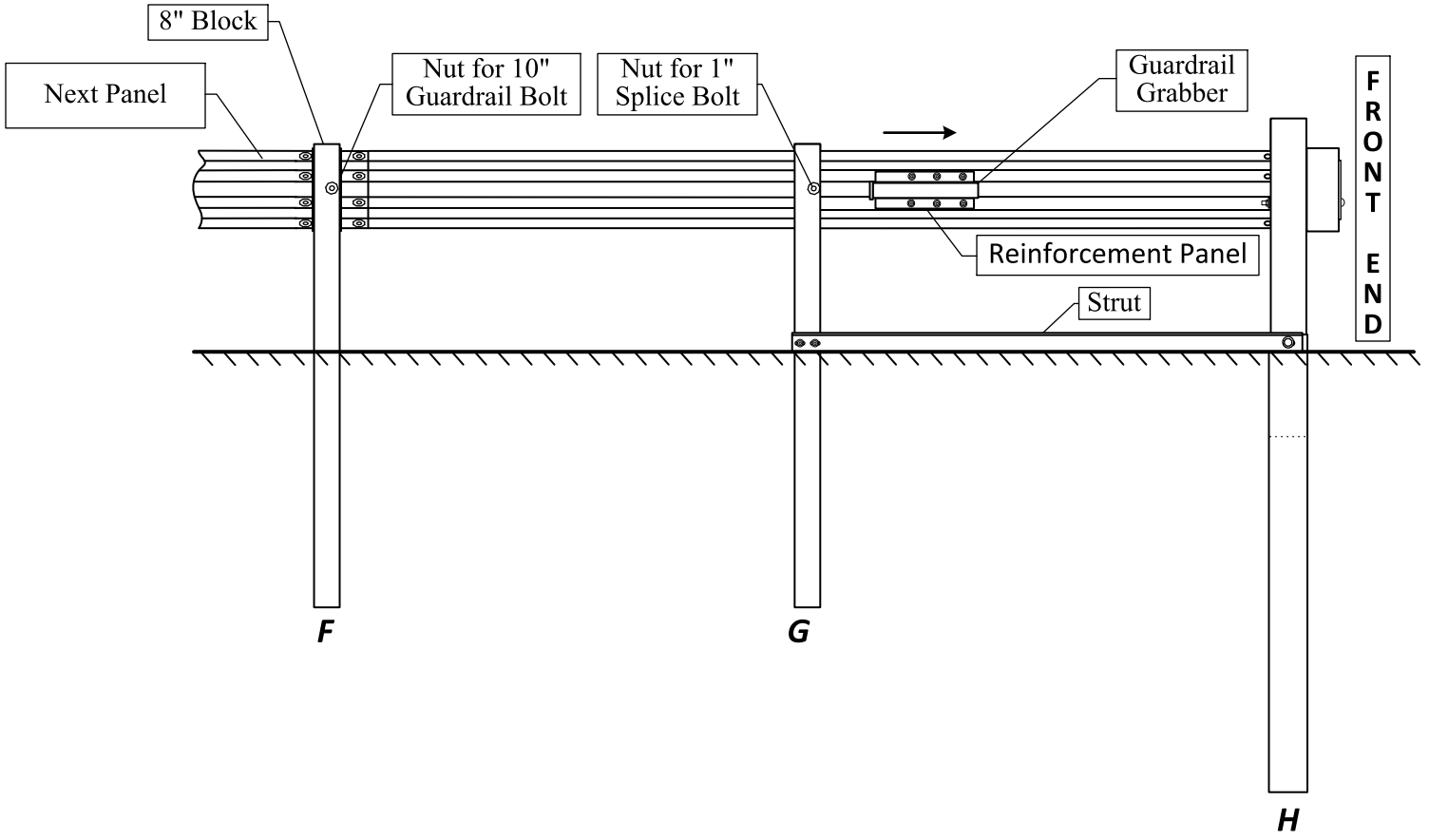
2. After insertion of the Guardrail Grabber into the Reinforcement Plate, slide Guardrail Grabber forward toward the front end of the Specialty Panel such that the teeth of the Guardrail Grabber lock onto the front side (or road side) of the specialty panel. A hammer may be used to assist in sliding the Guardrail Grabber forward toward the front end of the Specialty Panel.

F - 4"X6"X6' Guardrail Post
G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges}
H - 6"X8"X6' Soil Tube



VIb. INSTALLATION OF GUARDRAIL GRABBER

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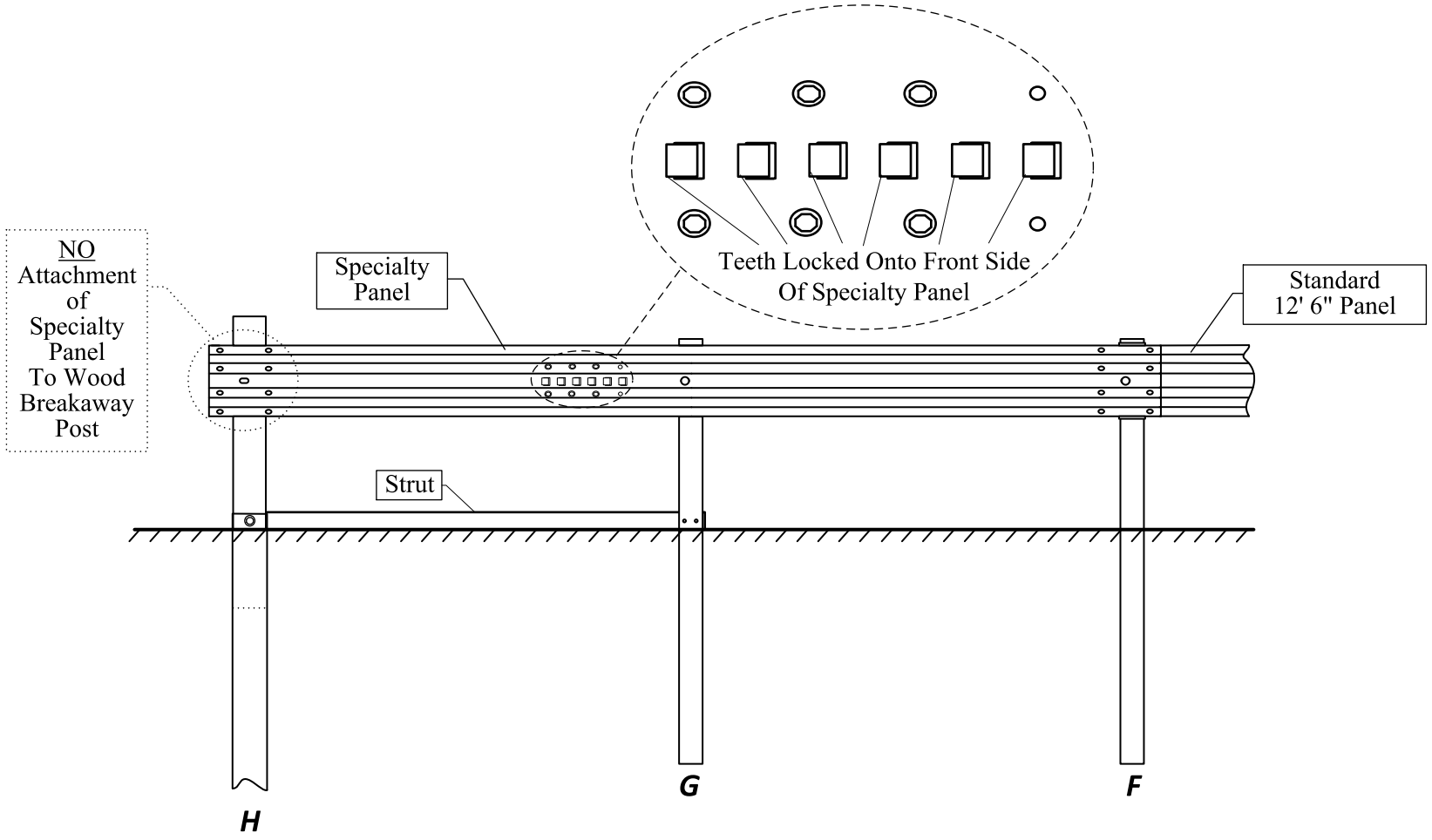
4. After sliding the Guardrail Grabber forward toward the front end of the Specialty Panel Specialty Panel, tighten the 1" bolts attaching the Reinforcement Panel to the Specialty such that the locknuts are completely crushed and then at least another half turn.

F - 4"X6"X6' Guardrail Post
G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges}
H - 6"X8"X6' Soil Tube



VId. INSTALLATION OF GUARDRAIL GRABBER

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Abingdon, VA 24212

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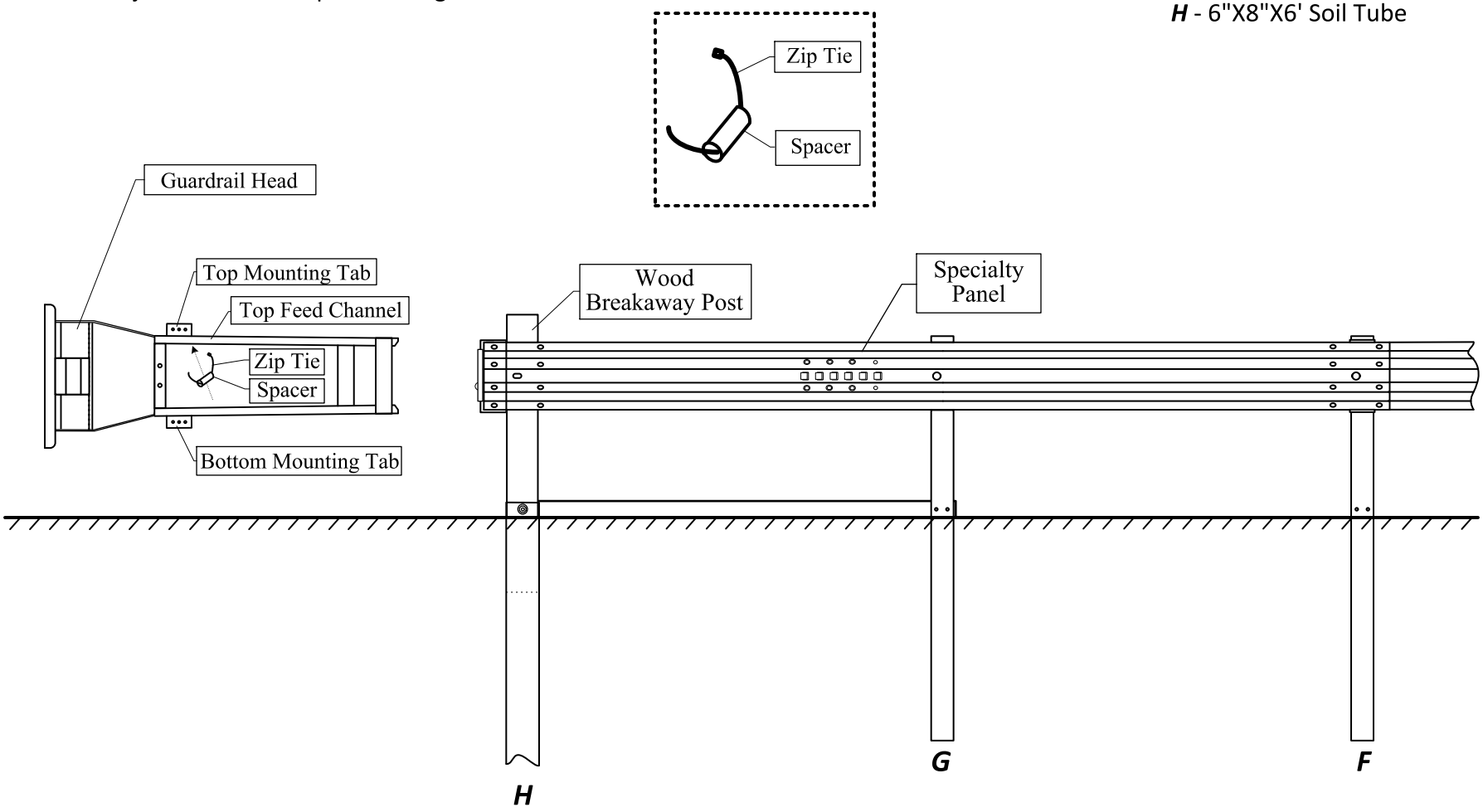
1. Insert Zip Tie through Plastic Spacer and zip tie plastic spacer into the top feed channel just in front of top mountinig tab.

F - 4"X6"X6' Guardrail Post
G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges}
H - 6"X8"X6' Soil Tube



VIIa. INSTALLATION OF GUARDRAIL HEAD

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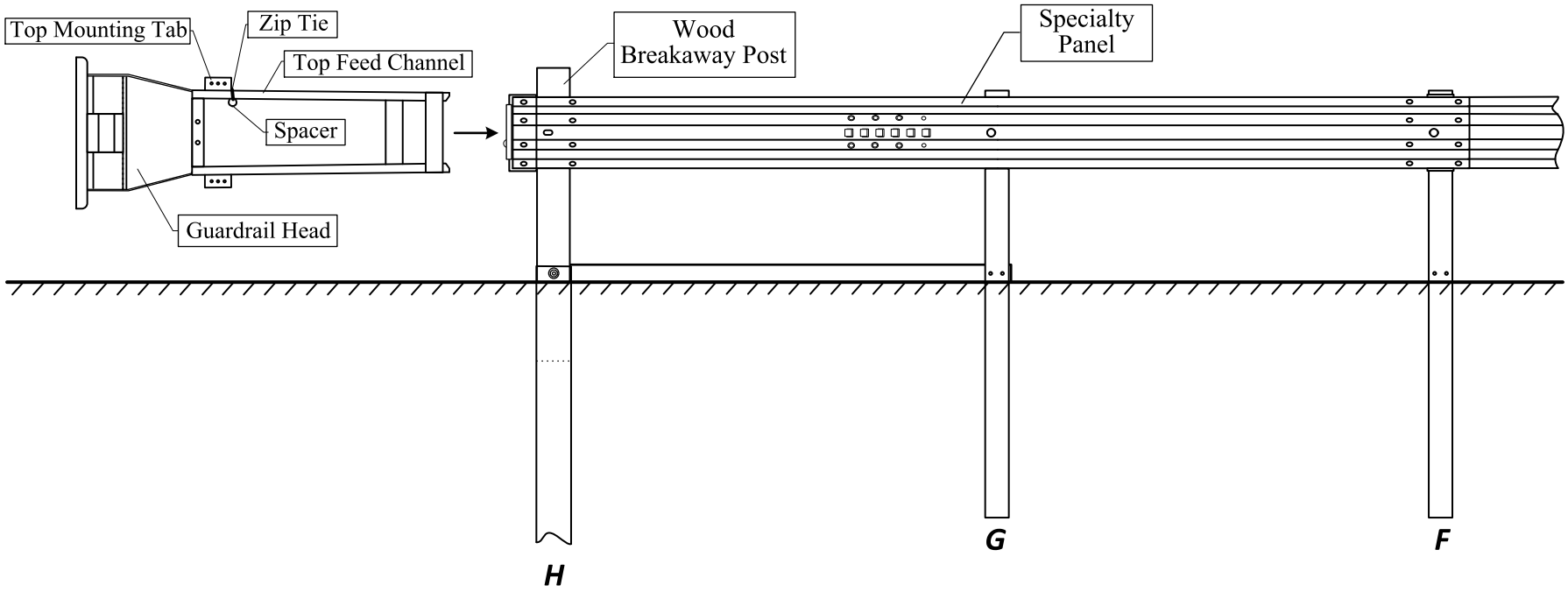
2. Tighten Zip Tie such that plastic spacer is within the top feed channel just in front of top mounting tab.
3. Slide Guardrail Head onto Specialty Panel.

F - 4"X6"X6' Guardrail Post
G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges}
H - 6"X8"X6' Soil Tube



VIIb. INSTALLATION OF GUARDRAIL HEAD

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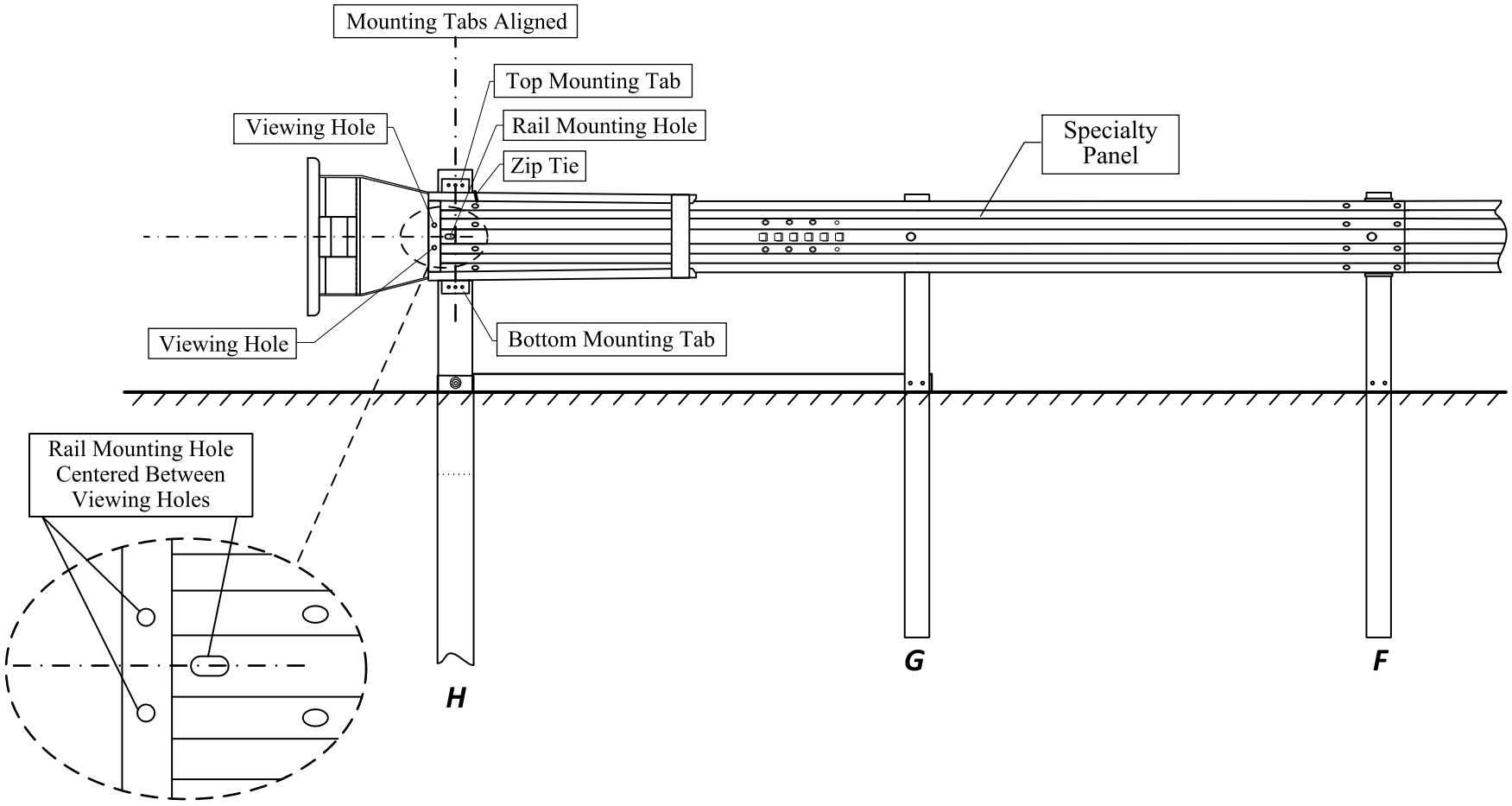
4. Slide the Guardrail Head onto the Specialty Rail until the Guardrail Head is stopped by the Specialty Panel. Note that the Rail Mounting Hole of the Specialty Panel should be centrally positioned between the Viewing Holes of the Guardrail Head and that the Top and Bottom Mounting Tabs are directly over each other.

F - 4"X6"X6' Guardrail Post
G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges}
H - 6"X8"X6' Soil Tube



VIIc. INSTALLATION OF GUARDRAIL HEAD

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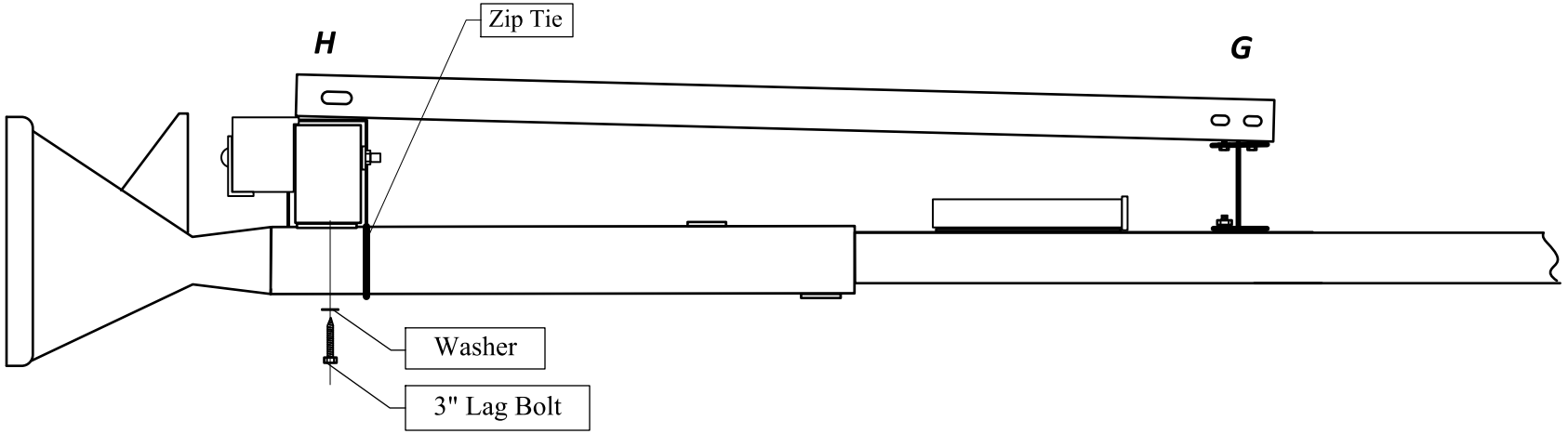
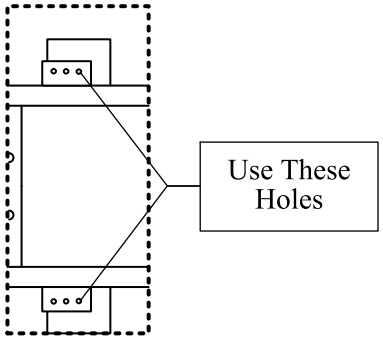
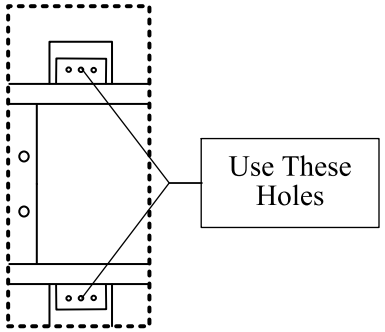
5. Attach upper and lower Mounting Tabs of Guardrail Head to the Wood Breakaway Post by inserting 3" washered lag bolts through Mounting Tabs of Guardrail Head and screw washered lag bolts into Wood Breakaway Post. Note: Use tab hole nearest to center of Wood Breakaway Post.

G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges}
H - 6"X8"X6' Soil Tube





FORWARD



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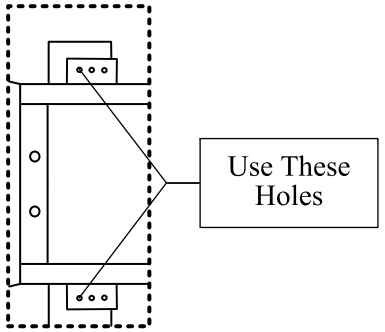

BACK

VIId. INSTALLATION OF GUARDRAIL HEAD

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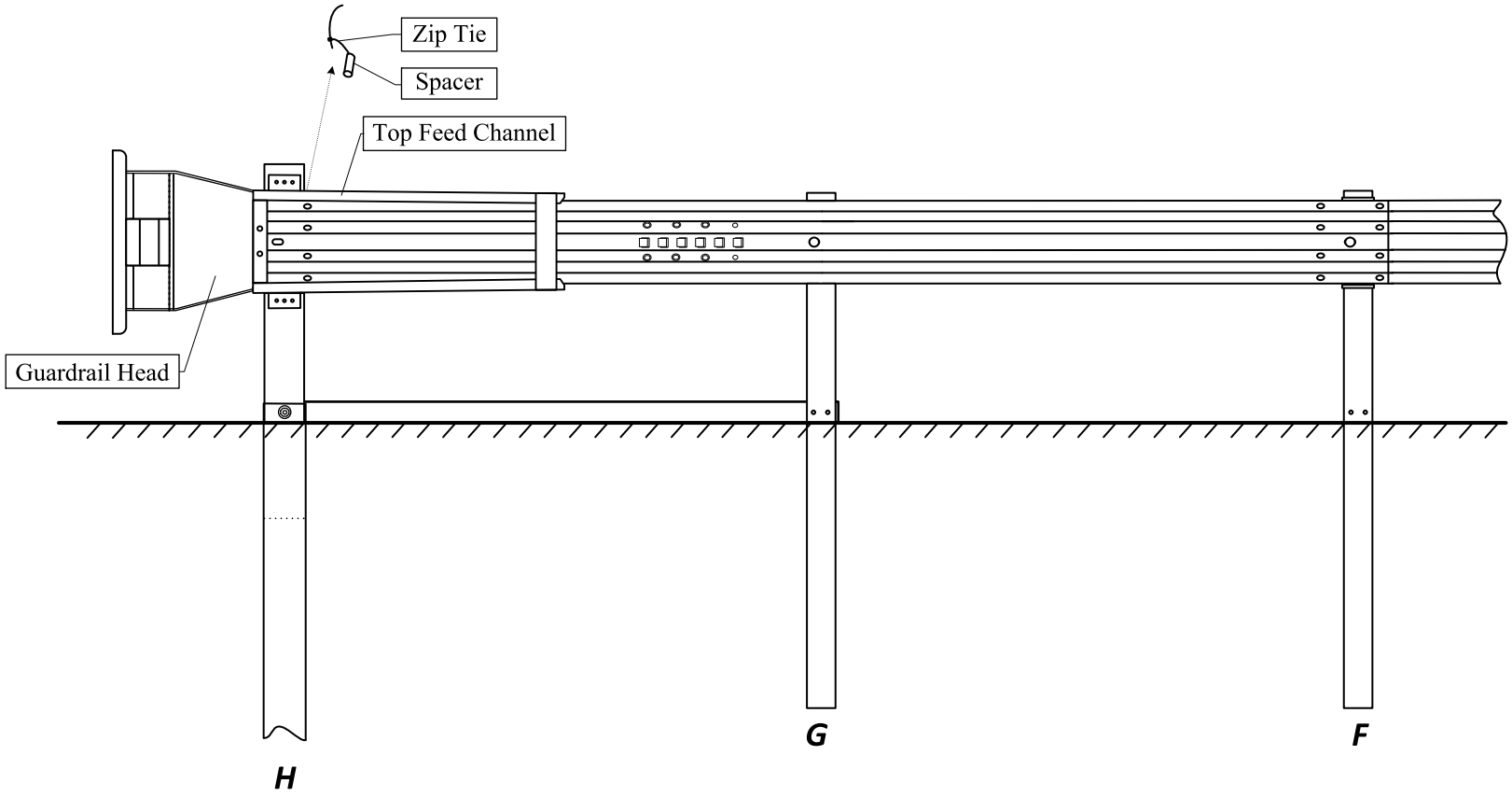
6. Cut Zip Tie and remove both Zip Tie and Plastic Spacer from within Top Feed Channel of Guardrail Head.

F - 4"X6"X6' Guardrail Post
G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges}
H - 6"X8"X6' Soil Tube



VIIe. INSTALLATION OF GUARDRAIL HEAD

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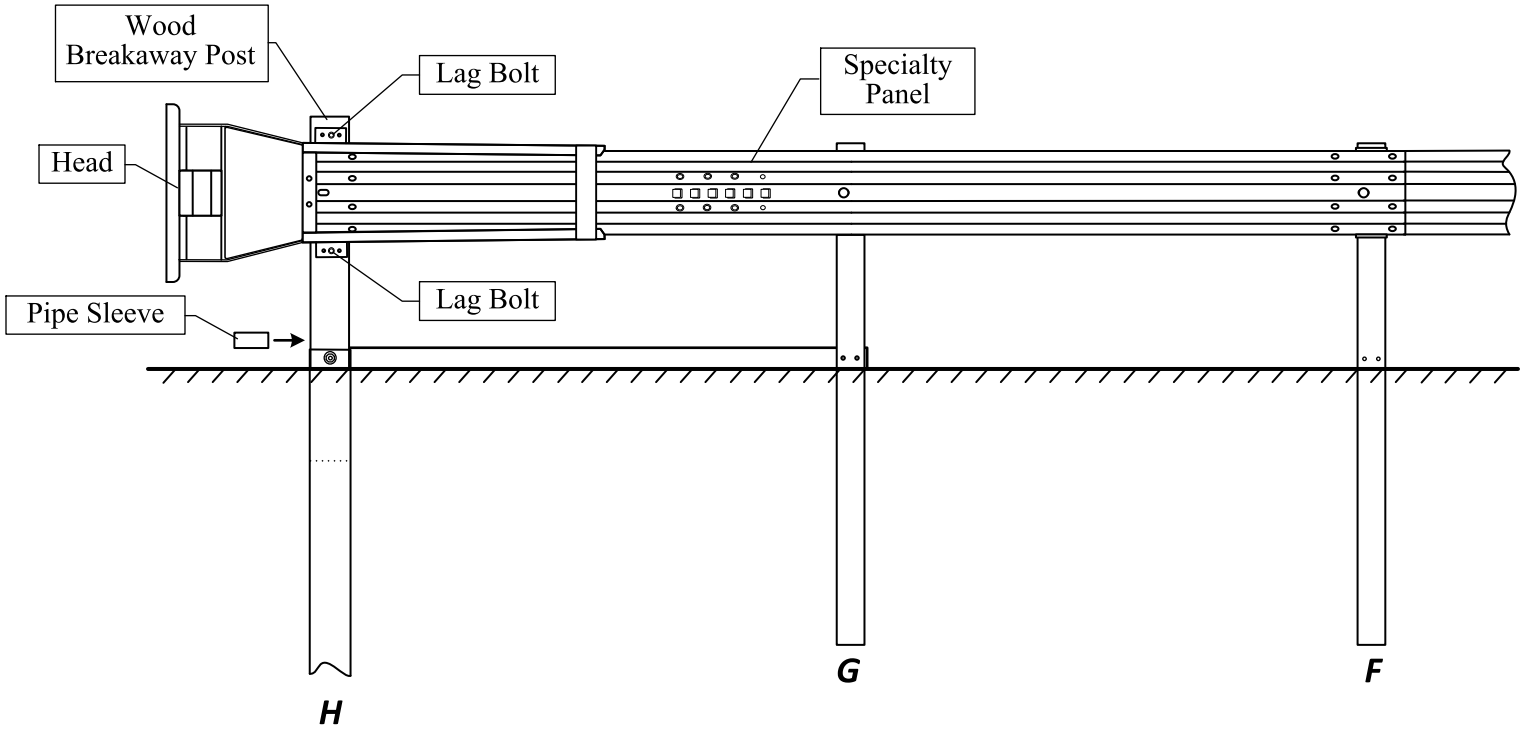
1. Insert Pipe Sleeve into hole of Wood Breakaway Post.

F - 4"X6"X6' Guardrail Post
G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges}
H - 6"X8"X6' Soil Tube



VIIIa. INSTALLATION OF CABLE ANCHOR

SPIG Industry, LLC
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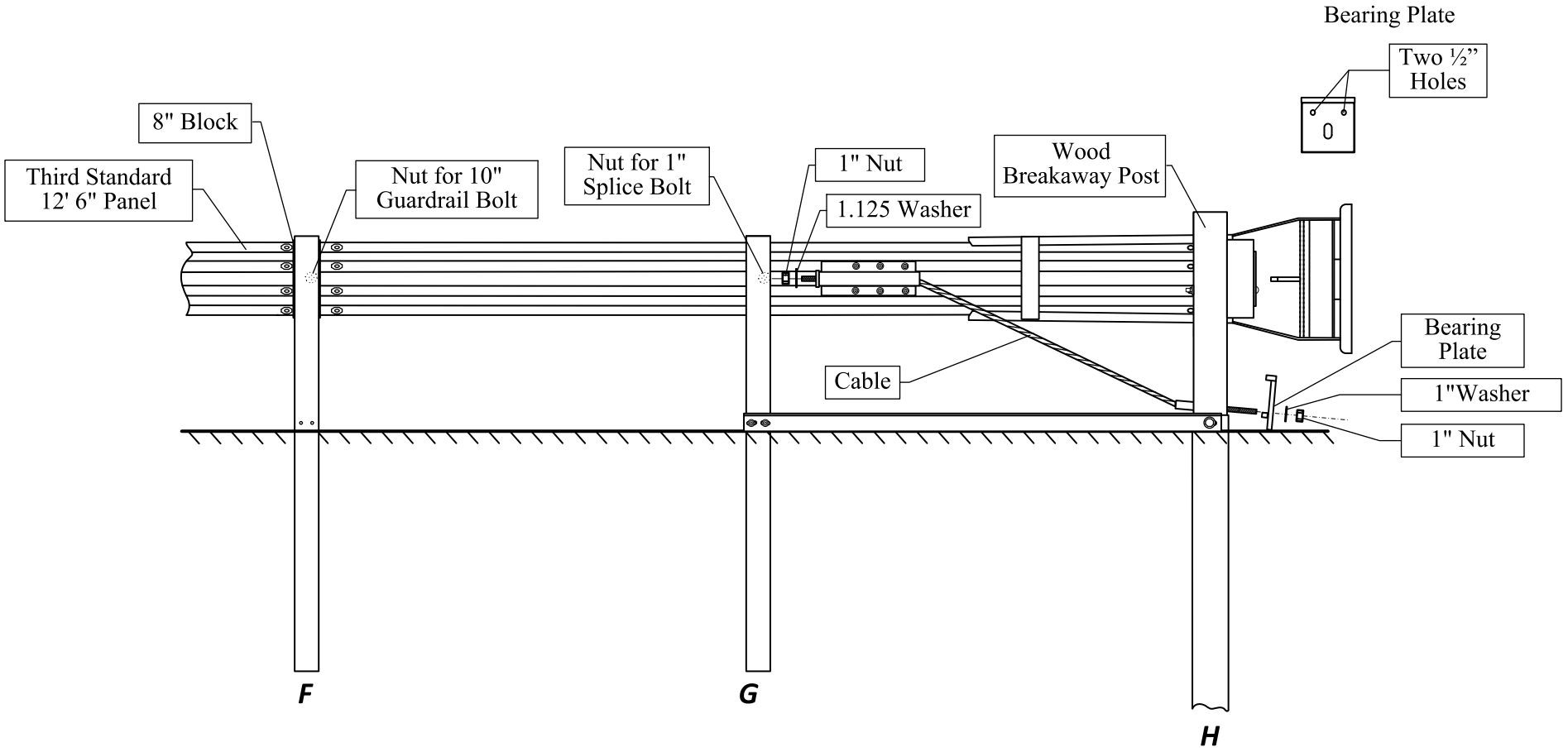
2. Thread Cable through Guardrail Grabber and through Pipe Sleeve within Wood Breakaway Post.
3. Attach Cable to Guardrail Grabber using a washer and a nut.
4. Attach Cable to Wood Breakaway Post through Pipe Sleeve and Bearing Plate using a washer and a nut. Position the Bearing Plate such that the two ½" holes of the of the Bearing Plate are on the top.

F - 4"X6"X6' Guardrail Post
G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges}
H - 6"X8"X6' Soil Tube



VIIIb. INSTALLATION OF CABLE ANCHOR

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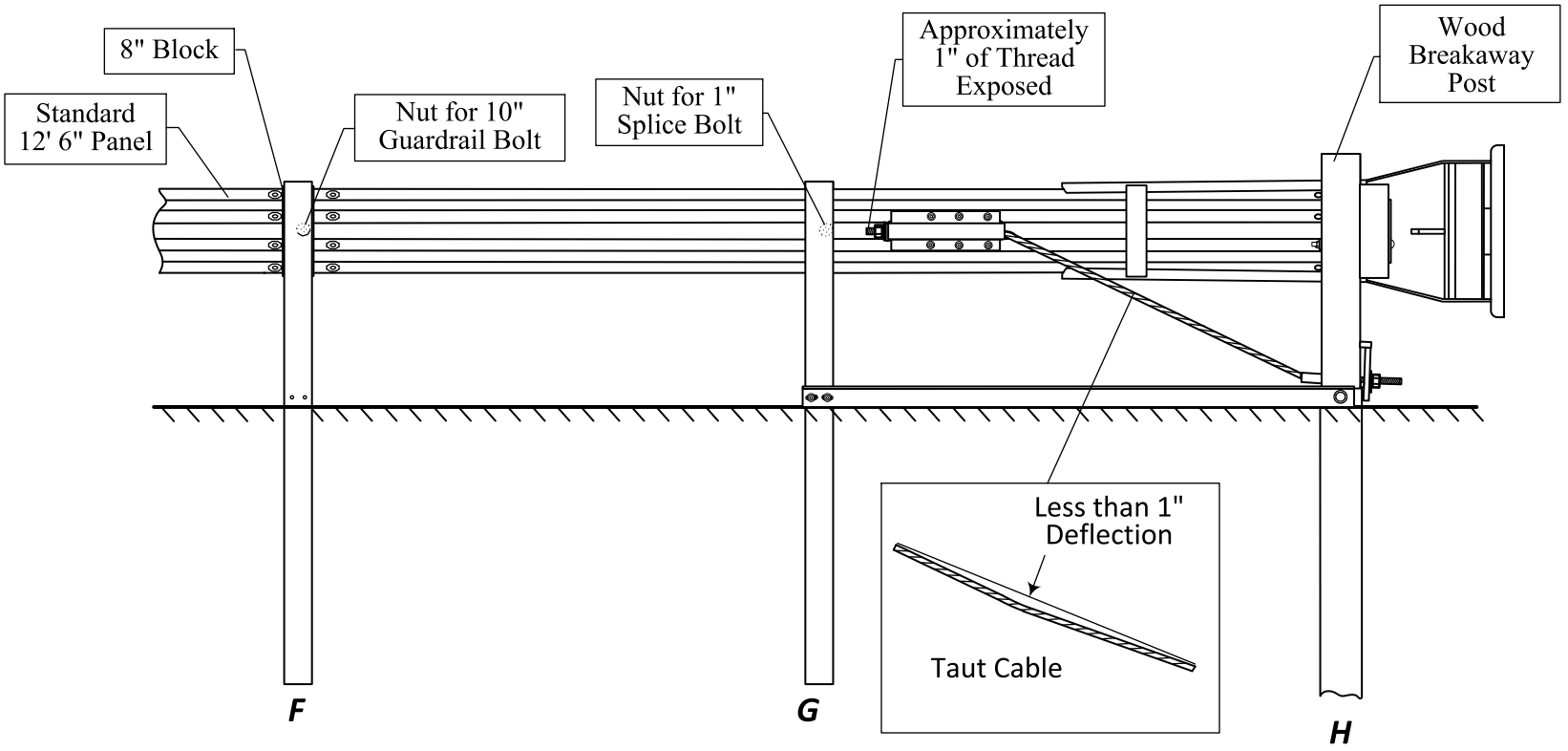
5. Tighten the nuts on the threaded ends of the Cable such that approximately one inch of threading is exposed at the back end of the Guardrail Grabber and the cable becomes taut. Cable should be so taut or tight so as not to deflect more than an inch when kicked.

F - 4"X6"X6' Guardrail Post
G - 4"X6"X6' Strut Post
{w/four ½"holes in flanges}
H - 6"X8"X6' Soil Tube

No more than 1.25 inches of the threaded end of the cable should extend or protrude beyond the nut at the back end of the Guardrail Grabber.



VIIIc. INSTALLATION OF CABLE ANCHOR

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Abingdon, VA 24212

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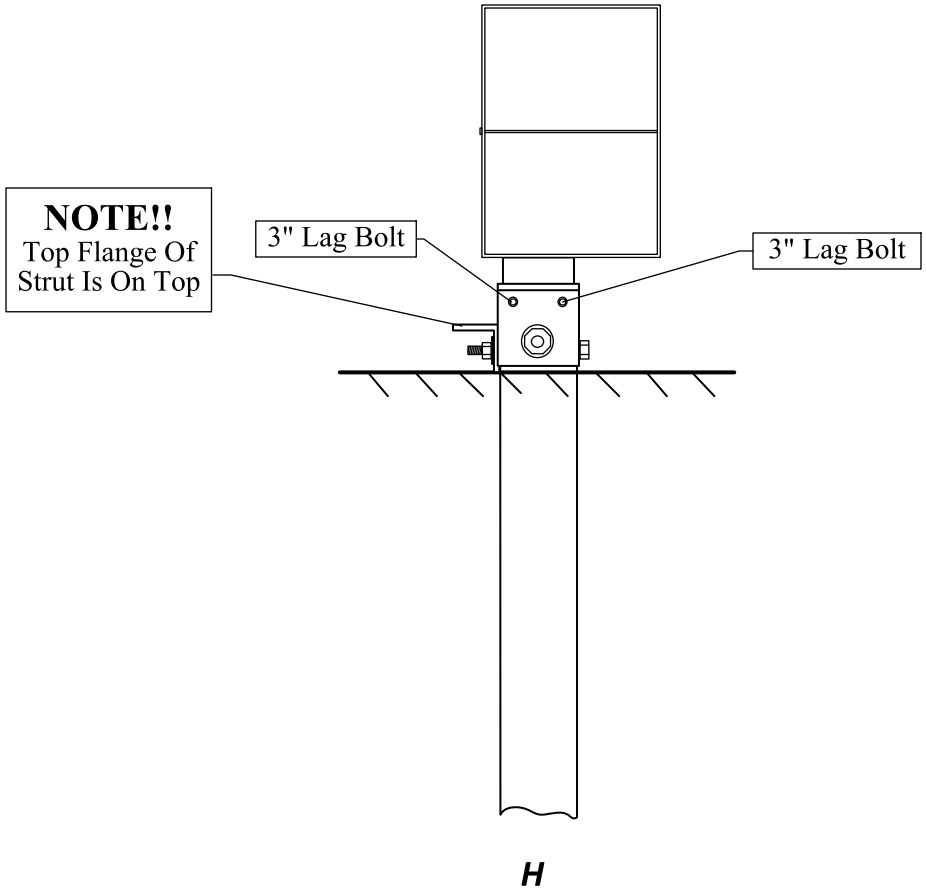
6. Insert 3" washered lag screws into the two holes of the Bearing Plate and screw 3" washered lag screws into Wood Breakaway Post.

H - 6"X8"X6' Soil Tube



VIIId. INSTALLATION OF CABLE ANCHOR

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