

Edgerail™ Aluminum Bridge Railing System Specification & Installation Instructions



Hill & Smith, Inc

1000 Buckeye Park Road
Columbus, Ohio 43207

Tel: 614-340-6294

Fax: 614-340-6296

www.hillandsmith.com



HILL & SMITH INC.

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Section A

System Specification

1. List of Drawings

1.1. System Drawings

E-2000-1	Edgerail Aluminum Bridge Rail System – General Arrangement
E-2000-2	Edgerail Aluminum Bridge Rail System – Installation Details
E-2000-3	Edgerail Aluminum Bridge Rail System – Installation Details

2. Product Description

The Edgerail aluminum bridge rail is a modular system providing supporting posts spaced at 8'-0 centers. Exceptions are at Type 3 expansion joint locations where posts spanning the joint should not exceed 5'-0 centers and the adjacent bays either side of the joint should not exceed 3'-3 centers.

The system consists of three horizontal extruded aluminum rail sections. The lower two main traffic rails are nominally 6" x 3 7/8" connected to supporting posts at heights specified on the system drawings. Standard traffic rails are nominally 32'-0 long with square cut ends to receive sliding rail to rail splices. Shorter rail lengths are utilized at expansion joints and ends of runs. Traffic rails are joined together with extruded aluminum internal splice sleeves nominally 5.5" x 3 3/8" which are fitted with a 5/16" diameter coiled spring pin. The top pedestrian rail is nominally 4.5" x 2 13/16" connected to supporting posts at heights specified on system drawings. Standard pedestrian rails are nominally 32'-0 long with square cut ends to receive sliding rail to rail splice joints. Shorter rail lengths are utilized at expansion joints and ends of runs. Pedestrian rails are joined together with extruded aluminum internal splice sleeves nominally 4 1/8" x 2.5" which are fitted with a 5/16" diameter coiled spring pin.

There are three types of rail splice joints to accommodate varying degrees of expansion or contraction. Type 1 joint (Standard) accommodates movement range up to +/- 3/8". Type 2 joint (Expansion) accommodates movement range up to +/- 1". Type 3 joint (No-Tension Expansion) accommodates movement range up to +/- 6" mm.

The rails are attached to the supporting posts with two 5/8" stainless steel setpins located and secured into the rear of the rail with a sliding rail nut.

The supporting posts are a single cast aluminum alloy. Posts are usually attached to the bridge structure or retaining wall with four 7/8" stainless steel bolts into approved cast-in anchorage units or resin fixed drilled anchorages. The bolts and washers are isolated from the aluminum baseplate with a nylon top hat washer

3. Durability

The durability of a product is dependent upon numerous factors such as weather conditions, air pollution, location, handling, repair and routine maintenance.

Aluminum weathers to a dull grey finish due to the formation of an impervious oxide layer which is integral with the base metal on exposed surfaces and which is highly resistant to atmospheric corrosion. The rapid forming of the oxide layer and reforming of the layer when scratched is a main reason for the good corrosion characteristics of aluminum and an almost unlimited life expectancy.

The use of stainless steel fasteners with aluminum can raise concern of bi-metallic (Galvanic) corrosion. Galvanic corrosion takes place when two different metals have contact with each other in the presence of an electrolyte and is also dependent upon the relative masses of the two materials and the level of current density in the sacrificial anode which would be the aluminum extrusions. The high relative mass of the aluminum compared with the stainless steel fasteners would result in a low current density. The extent of isolation between stainless steel fasteners in aluminum components, in our opinion, is over specified and the use of stainless steel in contact with aluminum in several existing parapet systems used for over 30 years in Europe confirms this. The main area of concern would be the anchor bolts and the baseplate which would be prone to standing water and road salts and for this reason a nylon isolation washer is utilized.

Splashes of alkaline building materials like grout and concrete will cause visible spots on the surface of the aluminum. These are difficult to remove and for this reason aluminum should be protected on site. The underside of the aluminum baseplate is painted with two coats of bitumastic paint to prevent alkaline contact during the grouting process. After cementation of the grout corrosion cannot happen.

Pitting corrosion can occur on aluminum surfaces frequently in contact with a humid environment. In general, the consequence is only aesthetic. Accumulation of dirt and debris on surfaces can cause a reduced durability due to the consequence of long-term moisture. Dirt and debris should be removed during routine inspections.

4. Design Compliance

The Edgerail Aluminum Bridge Rail vehicle restraint system as shown on drawings listed in section 1 has been designed in compliance with the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges 17th Edition and the Aluminum Association Design Manual 8th Edition for Allowable Stress Design to Aluminum structures.

5. Recommendations for use

This vehicle restraint system is suitable for use on highways with a speed limit of less than 70mph where the following provisions can be met

5.1. Minimum plinth dimensions.

The minimum width of the bridge or retaining wall stringcourse (plinth) shall be 17.75" wide.

The upstand at the traffic face adjacent to the paved surface shall be a minimum of 2" and the

maximum cross sectional profile of the plinth shall not exceed 4".

5.2. Minimum Length of parapet.

The minimum recommended length for the product installation is 100'-0.

5.3. Horizontal and Vertical Alignment.

The minimum horizontal curvature without pre-curving of main rails is 500'-0. Smaller radii can be accommodated by special arrangement with pre-curving. Posts can accommodate vertical alignments of up to +/-2.5°. However, when the vertical alignment results in a longitudinal fall in excess of 2.5° the posts should be fixed square to the concrete plinth transversely and perpendicular to the concrete longitudinally

6. Technical Information

6.1. Post Capacity

6.1.1. Unfactored Design Moment of Resistance of Post.

The unfactored design moment of resistance of the posts at the underside of the post baseplate = 76,338 ft-lbs.

6.1.2. Ultimate Shear Force Resistance of post.

The ultimate shear for resistance of the post = 39.8 kips.

6.2. Anchorage Capacity

6.2.1. Characteristic Load Value.

The characteristic value of actions due to loads = 14.41 kips.

6.2.2. Serviceability Limit State Value.

The serviceability limit state value = 15.85 kips.

6.2.3. Ultimate Limit State Value. The ultimate limit state value = 25.93 kips.

6.3. System Weights:

Weight = 18.9 lbs per foot, based upon 8'-0 post centers and use of anchorage units type VGAS/1. The stated values could vary due to material, fabrication and installation tolerances, however, these values should be utilized for any design purposes.

Section B

Installation Instructions

1. Safety

All work on site shall comply with all governing jobsite requirements.

2. Installation of posts and rails

- 2.1. Identify post locations from the General Arrangement (GA) drawings and place all posts and rails in the required locations.
- 2.2. Layout in front of each post location the M20 stainless steel holding down bolts complete with stainless steel washers and plastic top hats as required. Place washers onto holding down bolts to ensure that the plastic top hat washer is in contact with the baseplate upon installation.
- 2.3. Ensure that the threads of all bolts have a thin coat of grease applied (copper slip or similar) prior to fitting.
- 2.4. Check that anchorage sockets are undamaged and clean and free of debris.
- 2.5. Locate post over anchor cluster and insert the M20 bolts with washers through the baseplate into the anchorage sockets. Ensure minimum bolt engagement into the anchorage socket, but do not tighten down as the post has to be lifted approximately 25mm. (see 2.6).
- 2.6. Lift post and place solid inert shims in the center of the anchorage cluster.
- 2.7. Plumb posts in both elevations using the shims, and by rocking front to side. Do not apply final torque to the M20 bolts at this stage. Bolts need to be tightened sufficiently to allow for correct alignment.
- 2.8. Repeat items 2.2 through 2.7 along length of work area.
- 2.9. Starting at one end of the run, begin erecting the rails by laying them on wood or plastic blocking, to avoid damage. Insert the rail connection nuts and slide along the back of the rails. The quantity of rail connection nuts required is dependent upon the number of posts the rail is connected to. Two rail connection nuts per post to rail location are required. For example; if the rail is connected to three posts then six rail connection nuts are required.
- 2.10. Lift the rails up into position (starting with the bottom rail) and fit the post/rail connections. M16x45mm long for the bottom two rails and M16x35mm long for the top rail.
- 2.11. Once the first set of rails are installed, plumb the end of the rails and tighten post/rail bolts. **Do not** apply the required torque to the post/rail bolts at this stage.
- 2.12. Determine from the GA layout drawing if safety fence connectors are to be installed at the ends of the rails and proceed to fit (if required).
- 2.13. Insert the rail to rail splices Type 1, 2 or 3 as determined from the GA layout and set the appropriate joint gap.
- 2.14. Repeat steps 2.10 and 2.13 along entire length of the run, ensuring the correct rail joint gaps are set (see GA drawing).
- 2.15. Repeat step 2.12 at the other end (if required).
- 2.16. Apply the correct torque of 30 ft-lb to the lower two traffic rail post / rail bolts only. The top rail bolts are to be tightened until the spring washer is flat.
- 2.17. Align and level the system by means of eying the top rail, lifting and lowering posts using thin shims for level and using rocking action for alignment.
- 2.18. Check and tighten down all holding down bolts so that the underside of the bolt head and washer are tight against the baseplate.

- 2.19. When posts are attached to anchorage units supplied by Hill & Smith, the length of bolt engagement needs to be a minimum of 25mm. When parapets are attached to anchorage provided by others the following equation should be followed:

Where: LE = Length of Engagement
D = Bolt Diameter

- 2.20. Alignment should be inspected and approved by the appropriate representative of the General Contractor or inspector.

3. Grouting under Baseplates

- 3.1. If the temperature is likely to fall below 40°F for 24 hours either side of pouring the grout either:
- 3.1.1. cover area with hessian cloth, providing temperature is not likely to fall to freezing point.
 - 3.1.2. **DO NOT** grout.
- 3.2. Using 2" x 1" wood, construct a grouting frame slightly bigger than the baseplate. (See Figure 1.)

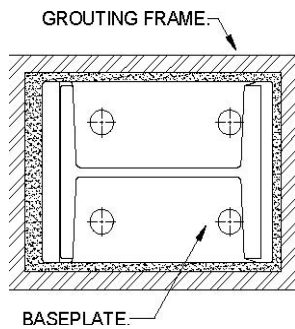


Figure 1

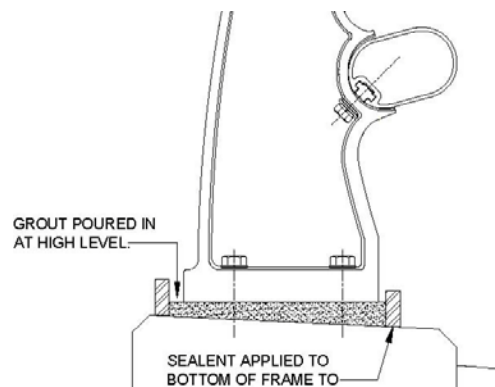


Figure 2

- 3.3. Nail the frame together and apply silicone sealant (where appropriate) to the outside of the frame when positioning, to stop any grout from seeping out.
- 3.4. Place the frame around the baseplate and pour in an approved non-shrink grout at the high end (See Figure 2.) Ensure that the grout runs through to all sides.
- 3.5. Leave the grout to set. (per manufacturers' recommendations).
- 3.6. Once set remove the frame.

3.7. When grout boxes are removed the holding down bolts are to be torqued to between 37 and 52 ft-lbs.

4. **Routine Inspections:**

4.1. It is recommended that a general inspection of the aluminum bridge rail is carried out during routine and principle inspections of the main structure.

4.2. **Guidance for Inspection:**

The following items should be reviewed as part of the inspection:

4.2.1. Absence or looseness of bolts or nuts.

4.2.2. Absence of or damage to grout pad.

4.2.3. Build up of debris and dirt.

4.3. **Accident Damage Inspection:**

The following items should be reviewed as part of the inspection:

4.3.1. Any damage to posts and rail sections.

4.3.2. Absence or looseness of bolts or nuts.

4.3.3. Absence of or damage to grout pad.

4.3.4. Build up of debris and dirt.