

**American Railway Engineering and Maintenance of Way Association
Letter Ballot**

1. Committee and Subcommittee:

Committee 27, Subcommittee 4

2. Letter Ballot Number: 27-22-2

3. Assignment: 2.10

4. Ballot Item: Approval of 2.10 AREMA Guideline for Access Systems for Roadway Machines and on Track Vehicles

5. Rationale: Update

Draft Not Yet Approved

AREMA Guideline for Access Systems for Roadway Machines and on Track Vehicles

AREMA presents this design guideline for railroads, manufacturers and designers to consider for the purpose of designing methods for getting on and off maintenance of way machines, on-track vehicles and plated vehicles. This guidance doesn't apply to interior walking surfaces, stairways, doorways or handholds of Roadway Machines or Track Vehicles. Railroads, AREMA and the roadway machine manufacturers may have other pertinent guidance that could influence designs that may be best utilized to optimize the design for these types of equipment.

This guideline presents one direction for the design of access systems with the knowledge that there are potentially many other acceptable design recommendations for this same purpose. This guideline is a starting point and may be altered to accommodate vehicle functionality or as desired by railroads as necessary.

Several governing bodies have guidance documents that take precedence over the topics covered in these AREMA Guidelines where applicable such as but not limited to DOT 49CFR399.207, OSHA 1910.66, and ANSI/ASSE Z359.

Definitions

Top of Rail (TOR) – A point at the top of the ball of the rail that is used as a reference mark for vertical measurements.

Plated Vehicle - Any vehicle operated by a railroad that requires a license plate. This includes (but is not limited to) heavy duty trucks, light duty trucks, and passenger vehicles. It does not include vehicles such as forklifts, utility vehicles (UTVs), and locomotives.

Exposure Area - Any area on a vehicle that is determined to have an open area through which an operator could fall through and may include a height exposure.

Light Reflectance Value (LRV) - A measure of visible and usable light that is reflected from a surface when illuminated by a light source.

General

Machine designs should use “Preferred” dimensions whenever possible.

AAR Clearance diagrams or individual railroad track clearances should govern protrusions of safety appliances including any swing-in or swing-out caused by the machine traveling through rail curves. Safety appliances and any other structures of maintenance of way machines, on-track vehicles and plated vehicles should not extend past the clearance diagram limits based on AAR “Plate C” unless otherwise specified by the Railroad acquiring the equipment. (Association of American Railroads, Manual of Standards and Recommended Practices, S2056 Clearance Plate Diagrams for Interchange Service). The exception to this requirement is “flexible steps” as noted in this document.

Surface Treatments for Handrails and Walking Surfaces

1. Handrails, handholds, and guardrails may have an applied curable rough coating or adhesive for hand grasp surfaces to achieve a non-slip surface. Examples of these curable surface coatings consist of exothermic Spray-on, and non-slip epoxy.
2. Where positive grip walking surfaces are to be applied, such as walking surfaces, the material should be engineered metal, that is stamped, molded, epoxied or the like. Grip materials comprised of tape should not be used as a walking surface on roadway equipment.

Ladders and Stairs

1. Rung and step material should be perforated, non-slip material and may be used continuing around the top radius. Slip resistant material is preferred wherever possible.
2. Design strategies should be used to allow for 3-point contact when ascending and descending equipment. Vertical hand rails should be constructed with round material and allow for continuous contact while ascending or descending the ladder.
3. Other strategies for coatings may be used that allow the hand to slide on handholds between bouts of gripping.
4. In some cases, evenly spaced steps may not be possible, however, all efforts should be made to design steps to be evenly spaced, horizontal and parallel and should support a centered static load of 450 lbs. (204 Kg).
5. Flexible steps may be used to allow easier access. The flexible step(s) shall deflect when encountering obstructions in the direction of equipment travel to reduce the potential for damage to the steps, equipment and any wayside obstructions.

6. If flexible steps are used, the steps should not move more than 3 inch elastically in the direction of approach when a horizontal force of 225 lb. is applied at the step center. An example of a flexible step can be mounted with a $\frac{3}{4}$ " x 5" piece of conveyor belting, 4-ply and $\frac{3}{8}$ " minimum carcass.
7. Machines that have flexible steps, should include only one flexible step per ladder or stair.
8. Folding ladders and temporary ladders should only be used as a last resort. If a (manually operated) folding or temporary ladder is used, the ladder should be designed with no pinch points when folding or putting into place. The ladder should be designed to meet the load requirements as described in this document.
9. Temporary and folding ladder attachment points should be permanently affixed to the machine to provide stability.

Walkways

1. Walkways should support a centered static load of 450 lbs. (204 Kg) minimum.
2. Walkways are recommended to be a minimum of 16 inches wide (24 inches preferred).
3. If the walkway is four feet above the TOR or higher, there should be a railing on the exposed side (see table 5). If a kick plate is used, a drainage gap should be utilized at the base of the kick plate.
4. There should be no objects protruding into the walkway area such as fasteners, handles or hinges that could cause injury or a tripping hazard to the employees.
5. If a walkway plate is removed for maintenance, there should be protection from sharp edges or the sharp edges should be removed. Banding can be used as a form of protection against sharp edges.
6. See section on "Surface Treatments for Handrails and Walking Surfaces" for additional guidelines.

Doorways

1. Doorways are recommended to be a minimum of 24 inches wide (30 inches preferred) and 73 inches high (79 inches preferred).
2. There should be no objects protruding into the door opening that could injure employees or snag loose clothing.

3. The door latching hardware should positively latch closed and prevent the door from opening if someone leans against it.
4. Door latches should be designed to be operated with one hand from both the outside and inside of the cab.
5. Door latch operation should allow for continuous three-point contact.
6. Doors that are designed to be propped open should have a positive, self-latching mechanism to hold the door open and prevent the door from accidentally releasing from the propped and latched open position.
7. Propped doors should be able to withstand the force of wind or someone pulling on the door.
8. Doors can open in or out. If doors open out they should not be allowed to accidentally protrude past the clearance limits when the door is propped open with a positive latch. Sliding doors are also acceptable.
9. Where feasible, an exterior handhold should be applied adjacent to the door.
10. A door handle clearance of 2.5 inches minimum should be maintained around the handle, through the entire swing of the door to prevent pinch points. Additionally, grab irons near the doorway should have a minimum of 2.5 inch clearance.
11. The door should be lockable. If using a padlock, the hole should be 5/8 inches to accommodate a variety of shackle sizes.
12. Cabs, shrouds, and any other enclosed areas can have an emergency exit route such as removable panes or panes that can be broken to serve as an emergency exit path.
13. Emergency exits should be on a different side of enclosed operator area than the primary exit.
14. Emergency exits should be identified as an emergency exit by using a permanent label that is visible from across the operator enclosure.
15. If any emergency exit is a breakable window, such as tempered glass, then a glass hammer should be provided adjacent to the window and visible when looking at the emergency exit window.
16. If FRA glass or other unbreakable material is provided, an escape window should be installed as a hammer will not break the glass.

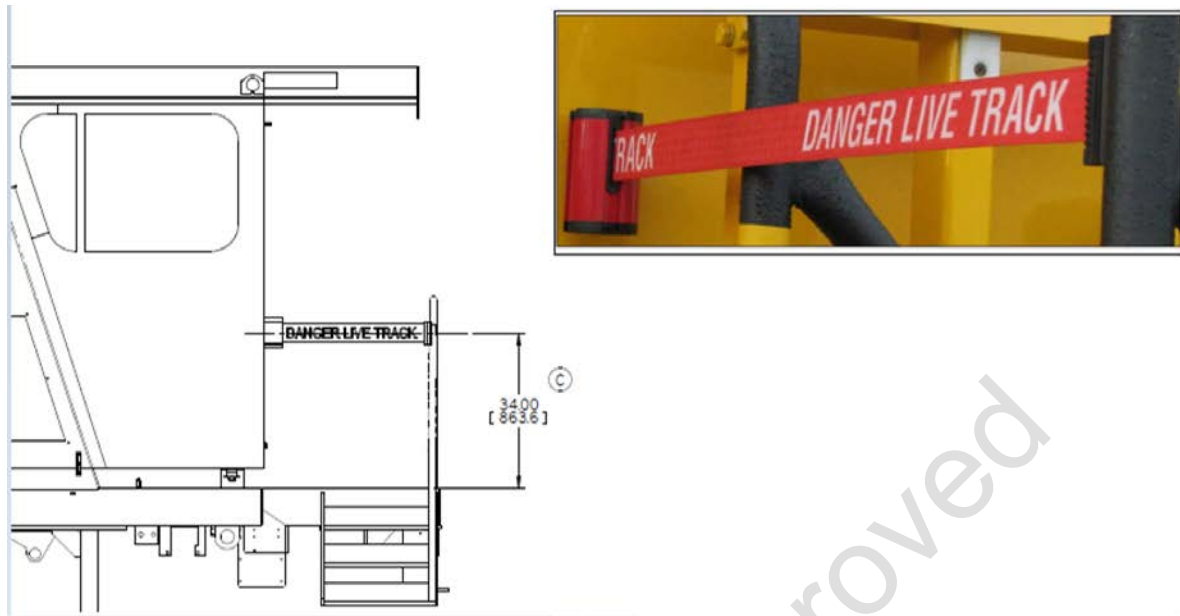


Figure 1. “Danger Live Track” belt example

17. A sign, belt or other type of notification can be used to remind operators to disembark on the opposite side of a live track. Notification can be used in doorways, walkways or other points of egress on the machinery. See Figure 1. “Danger Live Track” belt example.
18. Danger live track belt mounting hardware should minimize encroachment into the walkway.
19. Recommended height for live track notification signage is 34 inches +/-5 inches, as measured from the top of platform or walkway.

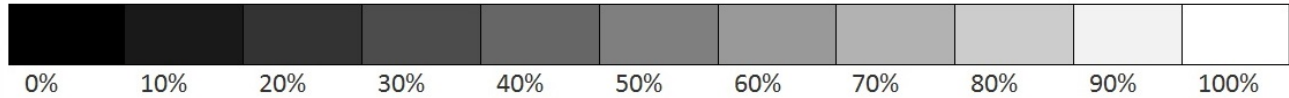
Stairway Visibility

Optimal stairway visibility is a combination of step component design and contrast between step components. The ability to more effectively discriminate between the stair riser (vertical component), nosing (edge of the step), and stair tread (horizontal walking surface) helps to reduce the risk of misjudging the stairway edge and improves judgement of step heights and stride. To help with traversing steps, a 2-inch wide slip resistant nosing is recommended for each step both on the horizontal and vertical surfaces of the stairs.

The main concept in contrasting step nosing from other step components is the Light Reflectance Value (LRV) of all step components and the amount that step nosing visually stands out. At night, dim lighting conditions can cause colors to become black and white to the human eye. So while colors can be helpful for step discrimination in daylight, colors contribute little to visual contrast at night where colors disappear and become the black and white values. When designing step components, it is recommended the LRV of the nosing

versus tread and nosing versus riser is checked using information from the manufacturer or the use of a light meter. Ensure a LRV difference of at least 30% between adjoining surfaces to optimize visual contrast. See the chart below for a visual reference for general percentage differences.

Light Reflectance Value (LRV) Scale



Stairway Lighting

Recommended illumination of stair treads should be at the minimum of 50 lux.

Stairway Color

There are many different paint schemes that have been used on stairs. For example, yellow has been shown to be an effective nosing color as it is highly visible under snowy conditions and is bright when illuminated.

In all cases it is recommended that matte finishes be used on all parts of stairs to avoid glare.

Fall Protection

Maintenance of way machines, on-track vehicles and plated vehicles may need to have fall safety applied depending on the height of platforms and the type of work performed by the equipment. On machines, the decisions for locations of specific fall protection features (railings, safety harness anchoring, etc.) should include the appropriate railroad representatives and equipment manufacturers.

Safety harness anchoring features shall comply with OSHA and ASSE guidance. (OSHA 1910.140, ANSI/ASSE Z359)

Levels of Fall Safety

Here is an example of how to approach fall protection when designing equipment. Each area of ingress, egress and work areas at or above 4 feet from the ground on roadway machines and vehicles should be classified into one of three levels of fall safety. Each higher level is inclusive of each lower level. For example, a unit that requires Level 3 fall safety also requires Level 2 and Level 1. All units require at least Level 1 fall safety.

1. Level 1: 3-Point Contact

Any area on the equipment where the operator will ascend or descend should have features so personnel can use 3-Point Contact at all times when ascending or descending. To achieve this there, should be two handrails or grab handles available so that the operator can always use both hands and a foot or both feet and a hand.

2. Level 2: Conventional Fall Protection

Any exposure area on the unit should be protected by handrails or guard cables.

3. Level 3: Fall Arrest/Fall Restraint

Anchorage, connectors, full body harnesses, and rescue systems must prevent the worker from reaching the ground, water, or object below them. Anchorages should be designed with appropriate safety factors and clearly labeled with load capacities.

Vehicle Work Areas Requiring Fall Protection

1. Self-closing gates should open inwards and never open out. These gates should latch when closed to prevent damage during machine or vehicle movement. Self-closing gates should be used at the top of entry stairways if the vehicle is used on bridges and should have a work area such as a truck bed that has Level 2 or Level 3 fall safety.
2. Guard Cables should be designed for a minimum 350 lb. vertical load capacity and a minimum 200 lb. horizontal load capacity. Recommended cable height is 42 inches and a mid-cable height is 21 inches as measured from the platform or walkway.

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Safety Appliance Guidelines

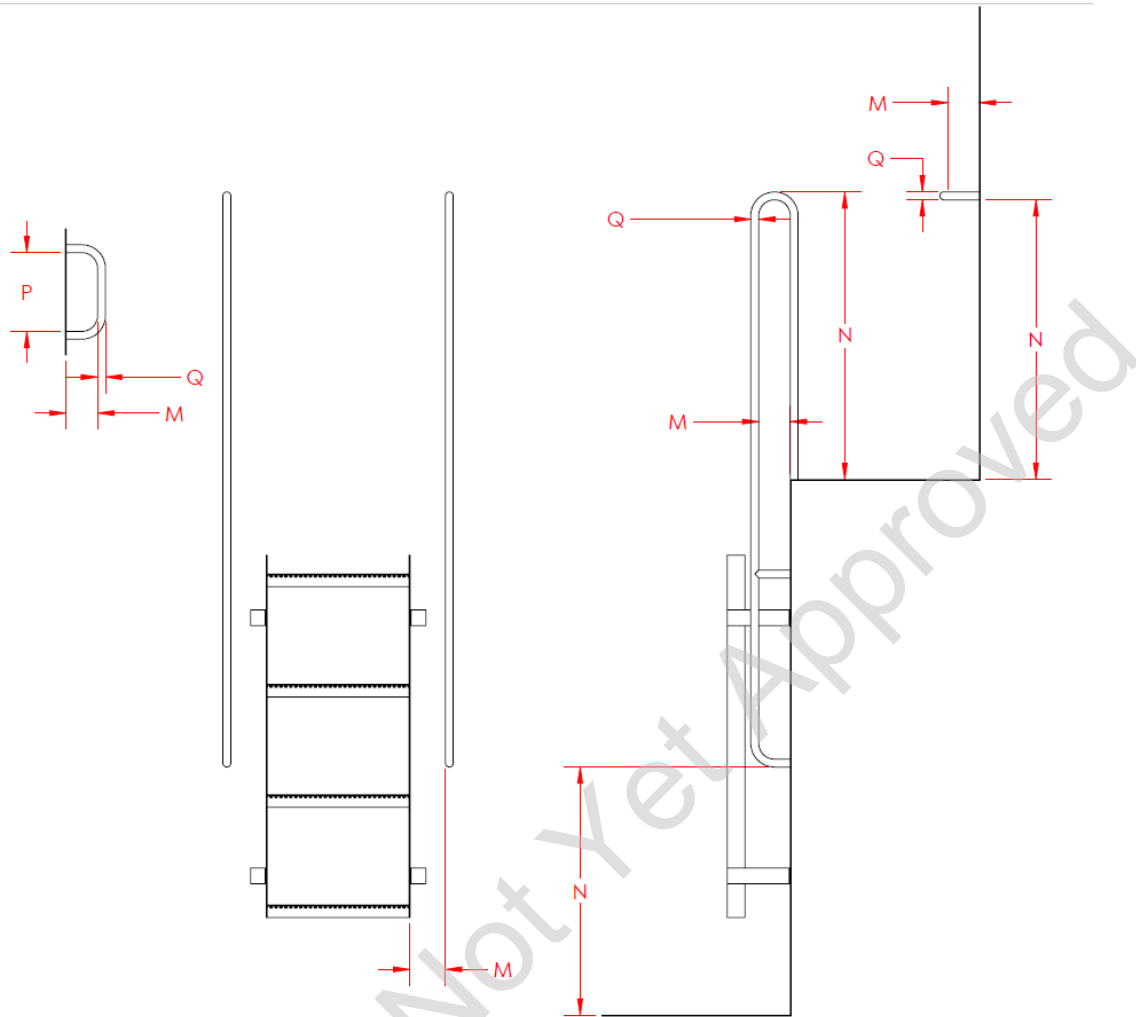


Figure 2. Example Ladder Dimensions

Table 1. Example Ladder Dimensions

Dimension	Description	Preferred	Maximum	Minimum
M	Hand clearance	2-1/2" (63 mm)	3" (76 mm)	1-1/2" (38 mm)
N	Handhold distance above standing surface	35" (889 mm)	55" (1,397 mm)	33" (838 mm)
P	Length of handhold	10" (254 mm)	-----	7" (178 mm)
Q	Ladder, step, and walkway handholds	1-1/4" (32 mm)	1-1/2" (38 mm)	-----

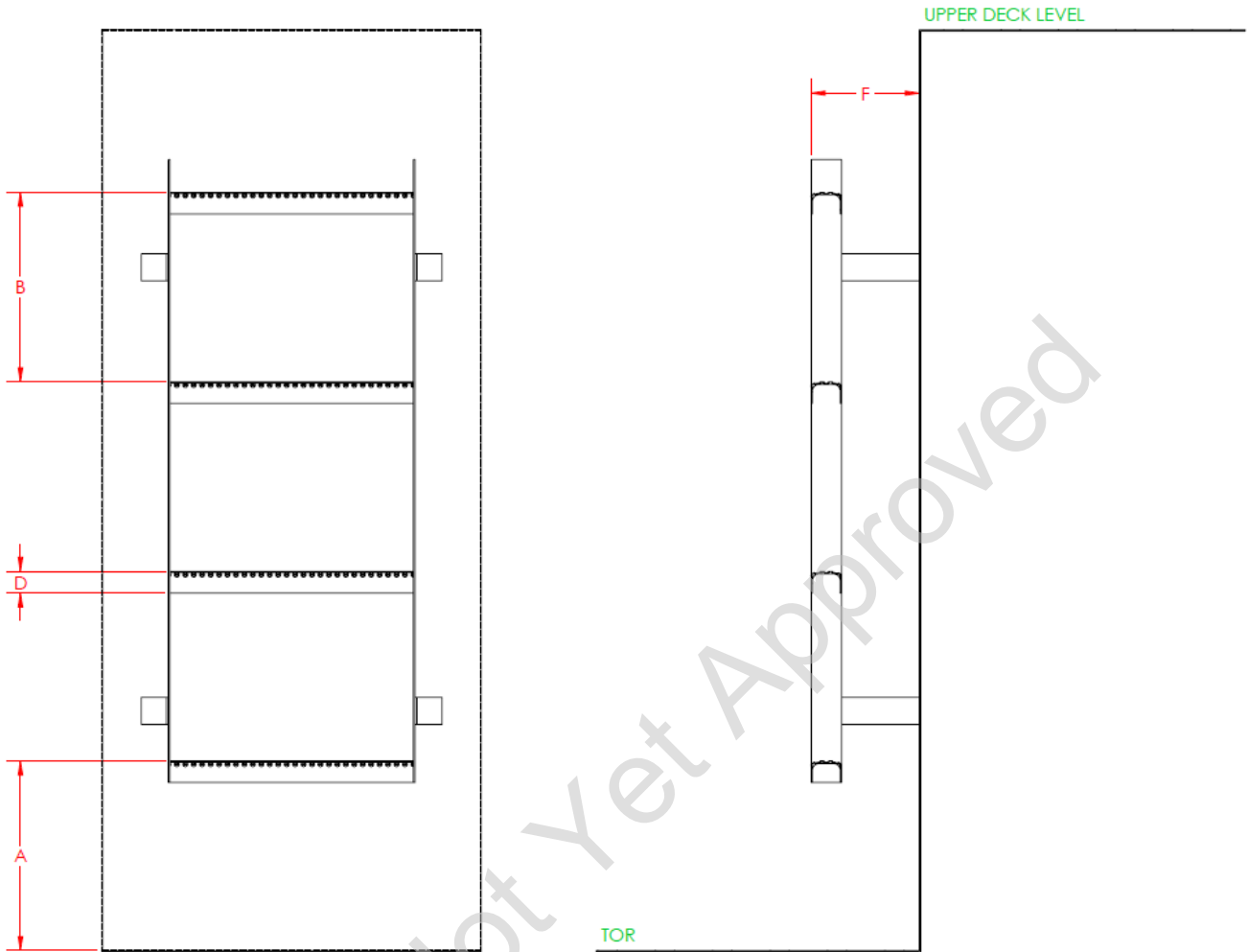


Figure 3. Example Ladder Dimensions

Table 2. Example Ladder Dimensions

Dimension	Description	Preferred	Maximum	Minimum
A	Height of first step above TOR	12" (305 mm)	16" (406 mm)	-----
B	Riser height - Ladders or steps	10" (254 mm)	14" (356 mm)	-----
D	Rung diameter	2-1/2" (6 mm)	-----	1" (25 mm)
F	Toe clearance	8" (203 mm)	-----	7" (178 mm)

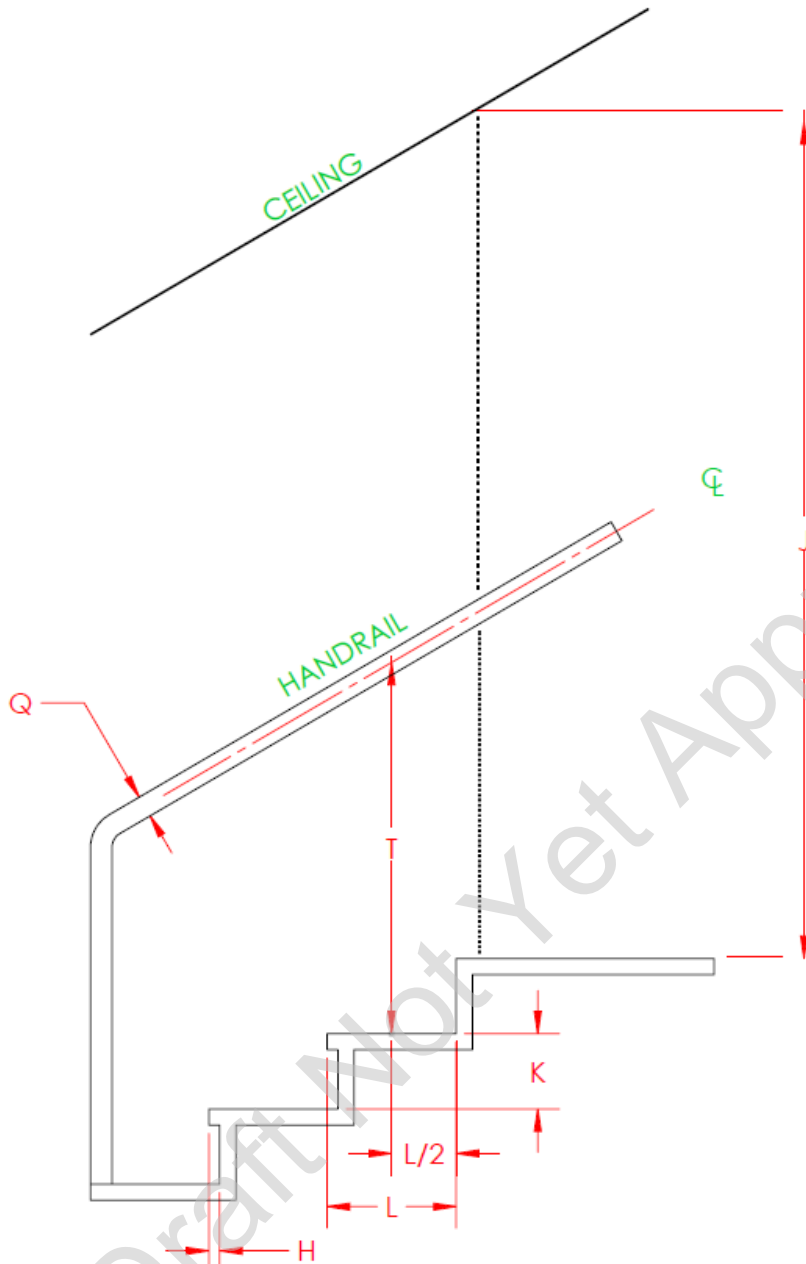


Figure 4. Example Steps and Handrails

Table 3. Example Steps and Handrails

Dimension	Description	Preferred	Maximum	Minimum
H	Tread projection from riser	-----	1" (25 mm)	-----
J	Head clearance	-----	-----	79" (2,007 mm)
K	Riser height - Stairs	7" (178 mm)	9-3/4" (248 mm)	-----
L	Tread Depth - Stairs	12" (305 mm)	16" (406 mm)	9-1/2" (241 mm)
Q	Ladder, step, and walkway handholds	1-1/4" (32 mm)	1-1/2" (38 mm)	-----
T	Handhold height	42" (1,067)	43" (1,092 mm)	41"

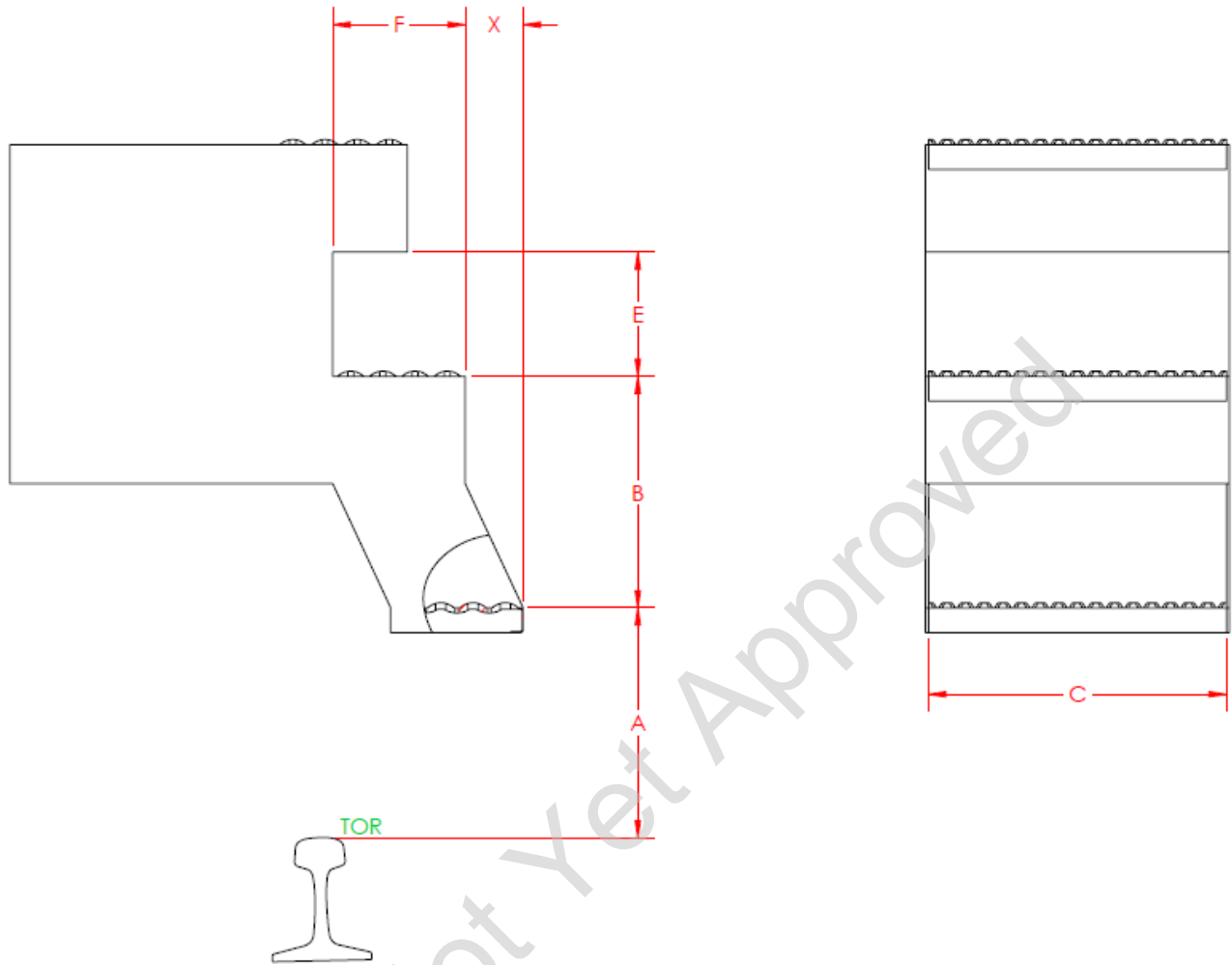


Figure 5. Example Steps

Table 4. Example Steps

Dimension	Description	Preferred	Maximum	Minimum
A	Height of first step above ground or platform	12" (305 mm)	16" (406 mm)	-----
B	Riser height - Ladders or steps	10" (254 mm)	14" (356 mm)	-----
C	1. Step width, one foot	-----	-----	10" (254 mm)
	2. Step width, both feet	18" (457 mm)	24" (610 mm)	15" (381 mm)
E	Instep clearance	7-1/2" (191 mm)	-----	6-1/2" (165 mm)
F	Toe clearance	8" (203 mm)	-----	7" (178 mm)
X	Lateral offset of ladder rungs or steps	3-1/2" (89 mm)	-----	-----

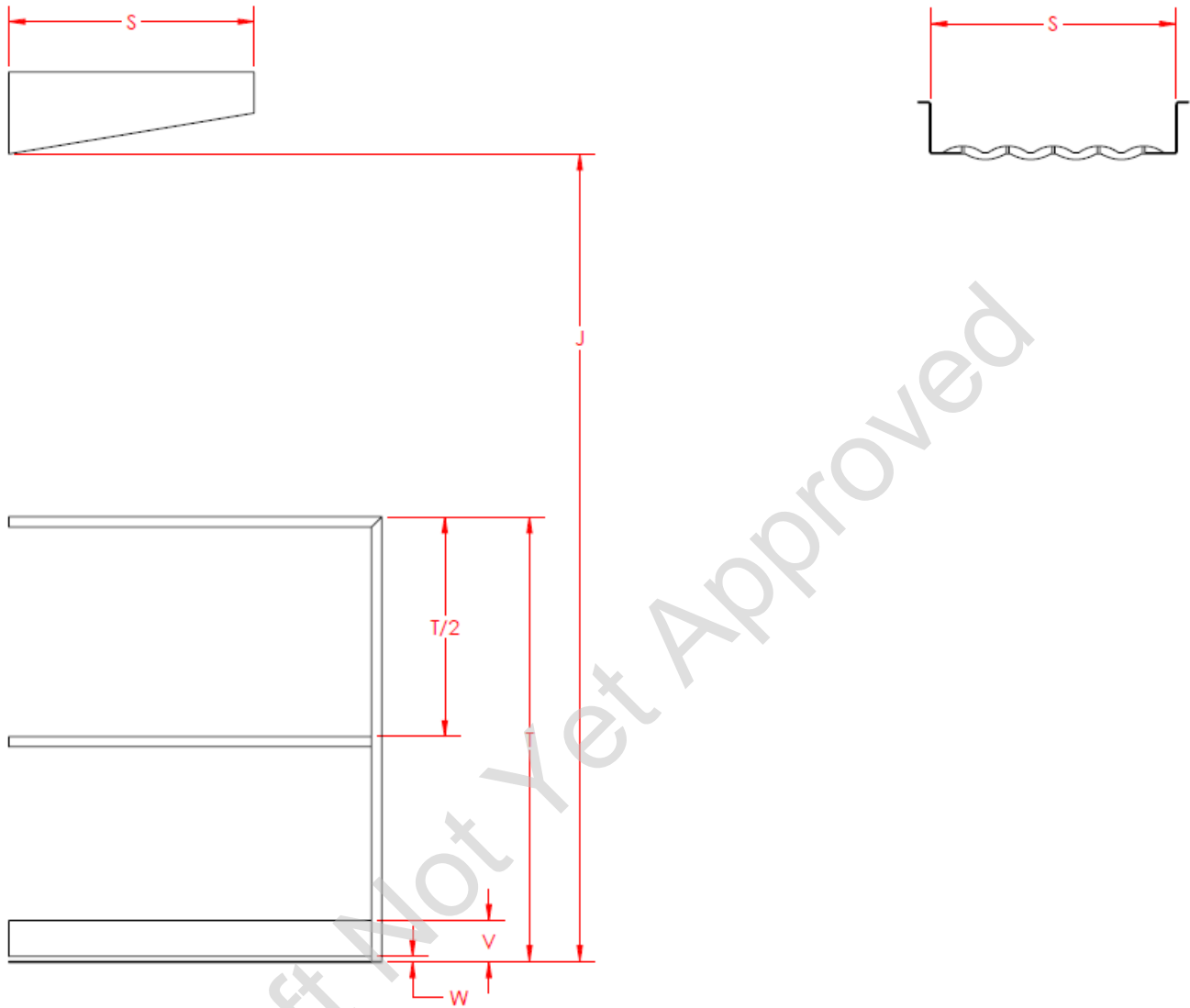


Figure 6. Example Walkways and Handrails

Table 5. Example Walkways and Handrails

Dimension	Description	Preferred	Maximum	Minimum
J	Head clearance	-----	-----	79" (2,007 mm)
S	Walkway and platform width	24" (610 mm)	-----	16" (406 mm)
T	Handhold height	42" (1,067)	43" (1,092 mm)	41"
V	Kick plate height	4" (102 mm)	-----	3"
W	Kick plate to floor clearance	1/2" (13 mm)	3/4" (19 mm)	-----