

**ENTRANCEWAY AND CAR BODY DESIGN: EBD 2.1 -
AN INTEGRATED RAILCAR DESIGN FOR MIXED HIGH LEVEL
(INCLUDING MINI-HL) AND LOW LEVEL PLATFORM LINES
THAT MEETS BOTH ADA ACCESSIBILITY REQUIREMENTS
AND FREIGHT SERVICE CLEARANCE REQUIREMENTS**

by

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1. Abstract

A new design for railroad passenger cars and platforms is presented. This design provides the technology needed to solve many pressing problems associated with rail passenger and freight service in the Northeastern U.S. Important features of this innovative design are:

- It provides an entranceway that operates with standard high level (HL), mini-HL, and low level (LL) station platforms and that has remotely controlled doors (and other elements). Thus it permits all doors to be opened and closed at all stations on current mixed HL and LL platform systems.
- It provides an entranceway and car body design that, in conjunction with any of the standard platform designs (HL, mini-HL, set-back mini-HL, retractable HL, and LL), meets ADA accessibility requirements (for mobility-impaired persons).
- By eliminating the need for any type of HL platform to meet ADA requirements, LL platforms can be retained. HL platforms restrict clearances for freight cars and cargo, and interfere with freight switching operations. Furthermore, this entranceway design provides, with standard LL platforms, most of the advantages for passenger service previously found only with HL platforms.
- A new LL platform design is presented that eliminates special efforts required of the crew to accommodate wheelchair or other mobility-impaired passengers and does not infringe on line clearances.

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2. Basic Car Body and Entranceway Design

The basic design is presented in Figure 1 (at the end of this document). As shown in Figure 1(a), the car body consists of a lowered or drop center section (level 1) and two end sections (level 2) with floors at the usual car floor height of a single level car (about 51 in. (1295.4 mm) above the rail). The level 1 floor is about 17 in. (431.8 mm) above the rail, and thus one step above the standard location for a LL platform. (See Appendix A for details.) One or more HL doors are provided on level 2, for HL platforms. Similarly level 1 has one or more LL doors for LL platforms. To enable passengers to move freely between levels 1 and 2, stairways are provided at each end of the car. For wheelchair and other mobility-impaired passengers, one or more lifts are provided. Figure 1(b) shows the lift located between the two sets of doors, so that mobility-impaired passengers have access to both HL and LL platform doors and both levels. Where the doors are not adjacent to the lift, aisles must be sufficiently wide for wheelchairs. Figure 1(c) presents cross sectional views further illustrating the two floor levels.

2.1. Entranceway Design and Operation at HL Platforms

At standard HL platforms, ADA accessibility requires that a bridge plate be used between the car and platform. A powered rotating bridge plate with railings is provided, as shown in Figure 2(a). This bridge plate is remotely controlled and interlocked with the doors. It replaces the manually operated bridge plate now commonly used at HL platforms. This bridge plate would rotate downward after the train stops but before the doors are opened, and simultaneously the railings would rotate downward into position, preventing passengers from stepping (or wheelchairs rolling) off the bridge plate into the gap between the car and the platform. After the doors are closed, the bridge plate and railings would be retracted, and the train would depart.

The powered bridge plate design achieves three important objectives. One, it results in an entranceway that meets ADA vertical and horizontal gap requirements. These can not realistically be met with cars that conform to current (and longstanding) railroad industry maximum car envelope limitations of AAR Plates B or C (which apply on Northeast passenger lines) and HL platform locations that conform to the AREMA standards for structures along a rail line. These, along with current track and structure maintenance practices, result in non-compliant vertical and horizontal gaps, requiring some type of gap filler. Second, the powered bridge plate is compatible with the mini-HL platforms that have been constructed at many stations to accommodate wheelchair passengers. These are often set back from the normal HL platform location so as to clear freight trains—typically from about 1 ft. (304.8 mm) back up to about 1 ft 6 in (457.2 mm) from the normal location. The latter location is 7 ft. 1 in. (2159.0 mm) from the track centerline, so as to clear both wide freight cars and many (but not all) excess dimension loads safely. Figure 2(b) illustrates the longer bridge plate and railing assembly needed for such platforms. Since an even greater set-back is possible with this design, it is probably compatible with all existing HL and mini-HL platforms.

Based on information from one freight railroad, a set-back of 8 ft 6 in is required on some lines where the issue of installing new mini-HL or HL platforms has arisen. This design is compatible with such a set-back. However, another approach described below appears more practical. That approach also would meet the needs of larger clearances, which surely could be required on some lines since other rail structures are normally at least 9 ft (2743.2 mm) from the track centerline.

2.2. Entranceway Design and Operation at Standard LL Platforms

At LL platforms the level 1 LL doors are used, as shown in Figure 3. For situations where the platform is unusually low, a sliding step can be installed about 9 in (228.6 mm) above the rail. This would be extended in such situations, but be retracted before train departure so that the car conforms to the AAR Plate B and C envelope requirements.

To enable wheelchair passengers to board and alight at standard LL platforms, either of the two usual approaches can be employed. Where the station platform is sufficiently wide, a long moveable ramp can be attached to the car floor at the door, the other end resting on the platform, as shown in Figure 3(a). The modest slope then enables wheelchair passage between the floor and platform. The ramp might be carried on the car, or be located at the station. Where the platform width is insufficient, then a lift of the type used by Amtrak and others on bi-level (double deck and gallery) cars could be used. This is carried on the train. However, superior to both the ramp and lift is the new type of LL platform described below.

2.3. An Improved LL Platform and Entranceway Design

Clearly it is desirable to eliminate the aforementioned manual tasks when accommodating wheelchair passengers at LL platforms. This can be achieved by a modification to the platform design and a corresponding addition to the entranceway. These two new designs are shown in Figure 3(b). The LL platform is raised one step (about 8 in., or 303.2 mm) at a point about 8 ft (2438.4 mm)--from the centerline of the track. The edge of the raised part is marked by closely spaced stanchions, so that pedestrians know there is a step at that location. The level 1 entranceway is then equipped with a powered rotating bridge plate that spans this gap. (The gap would be about 3 ft. 4 in (101.6 mm)). The similarity to the design for HL platforms is clear, and the operational sequence with the doors is identical. Naturally this bridge plate would also be equipped with railings. If it is desired that the normal height portion of the LL platform be wider than the 2 ft. 11 in. (889.0 mm) of this step-up location, then the step-up platform could easily be set back further. (Clearly a uniform standard for step-up platform location would be desirable. Its location is quite flexible, as described in Appendix A.)

The bridge plate can be installed only on those cars that are to be used by mobility-impaired passengers. However, with this platform design, those cars are not restricted to any particular location on the train. Furthermore, the platform remains entirely compatible with all entranceways designed for use with LL platforms, since the track side portion is in

the standard position. The step-up is located so as to satisfy all railroad clearance requirements for freight cars and loads, so that it in no way restricts freight traffic.

An option is to eliminate the LL platform next to the track, and use only the step-up platform for all passengers. This has obvious safety benefits, by virtue of keeping pedestrians away from the track. In this case, the step-up platform could be located closer to the track, if desired, the minimum distance to the track centerline permitted by AREMA standards being 7 ft (2133.6 mm). All passenger cars would then be equipped with the bridge plate.

3. Eliminating the Conflict between ADA and Freight Service Requirements

This car's entranceway design, with or without the step-up LL platform feature, eliminates most if not all of the advantages of installing new HL platforms, and thus eliminates the source of the conflict between freight service and passenger service needs on the same rail line. It is new, or recently constructed, HL and mini-HL platforms that have created the problem of compatibility, because until recently railroads simply did not install such platforms where they would infringe on freight operations. The three primary reasons for using HL platforms are: (1) speeding passenger boarding and alighting, (2) enabling use of remotely controlled doors (so that even a small train crew can open and close all doors at every station), and (3) making rail travel accessible to wheelchair and other mobility-impaired riders (so as to meet ADA requirements). The LL doors are only one step above a (standard location) LL platform, and thus entry and exit at such a door should be almost as rapid—if not equally rapid—as that with level entry and exit. All LL doors are remotely controlled. And LL platform access meeting ADA requirements is provided. Thus all reasons for using HL platforms from a passenger service perspective are addressed.

Furthermore, this design eliminates the extra tasks required of train crews to accommodate mobility-impaired passengers at HL and mini-HL platforms—namely the placement of the manual bridge plate. Also, the second stop often required at mini-HL platform is eliminated. This is beneficial to mobility-impaired passengers, other passengers (whose ride is shortened), and for the passenger train crewmembers.

The issues of clearance for freight trains and excess dimension loads, and for safety in switching operations (which require crewmembers to ride on the side of freight cars, resulting in an obvious safety hazard with HL platforms) are simply eliminated. Even a mini-HL platform within the usual range of set back can encroach on the pre-existing clearances of many rail lines. While current freight service may not require larger clearances, the presence of such a platform reduces future options for larger cars or handling excess dimension loads.

4. Related New Car Body Design

The only disadvantage of this car and entranceway design is that it requires distinct doors for HL and LL platforms. The additional set of doors obviously reduces the space available in the car for seating (or standing passengers). Each single lane for passengers at

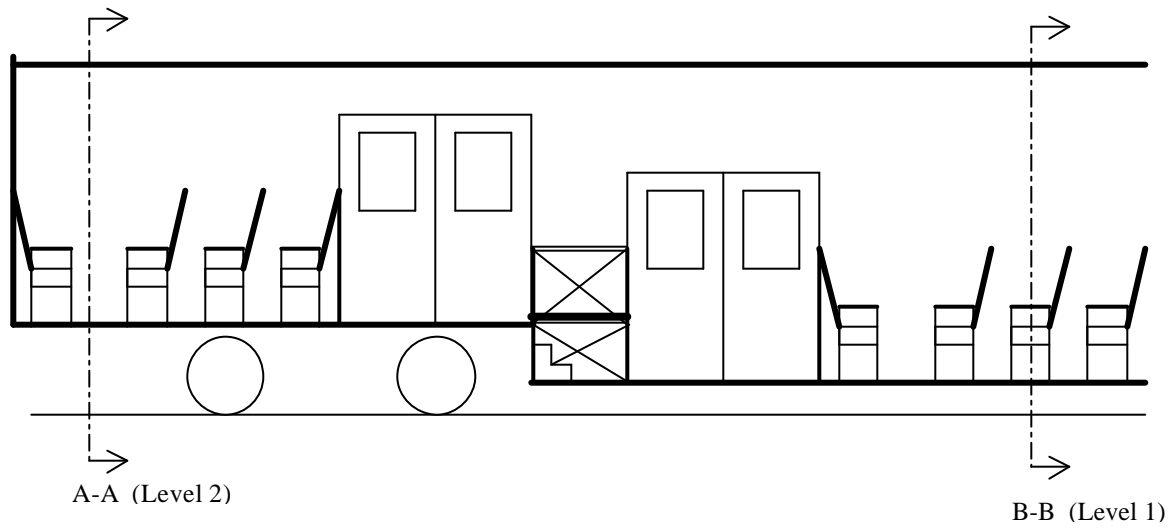
a door takes approximately the same length along the car as a row of seats (seat pitch). Most recently purchased single level commuter cars with the traditional end vestibule (the design used on all mixed HL and LL platform lines in the U. S.) have 2 single lane end doors used for both LL and HL boarding (with conventional traps and doors) and a single 2-lane center HL door. These have an interior space sufficient for about 25 rows of seats (assuming no space is devoted to wheelchairs, a toilet, or other floor-space occupying features). This new design—with a pair of entranceways at each end of the car, would reduce seating by about three rows, or 12%.

To overcome this disadvantage, this car body and entranceway design can be combined with another novel design so that a car with considerably more seating capacity results. This design is covered in a separate document (and is designated EBD 3.1). Thus the disadvantage of a modest loss of usable car space is eliminated.

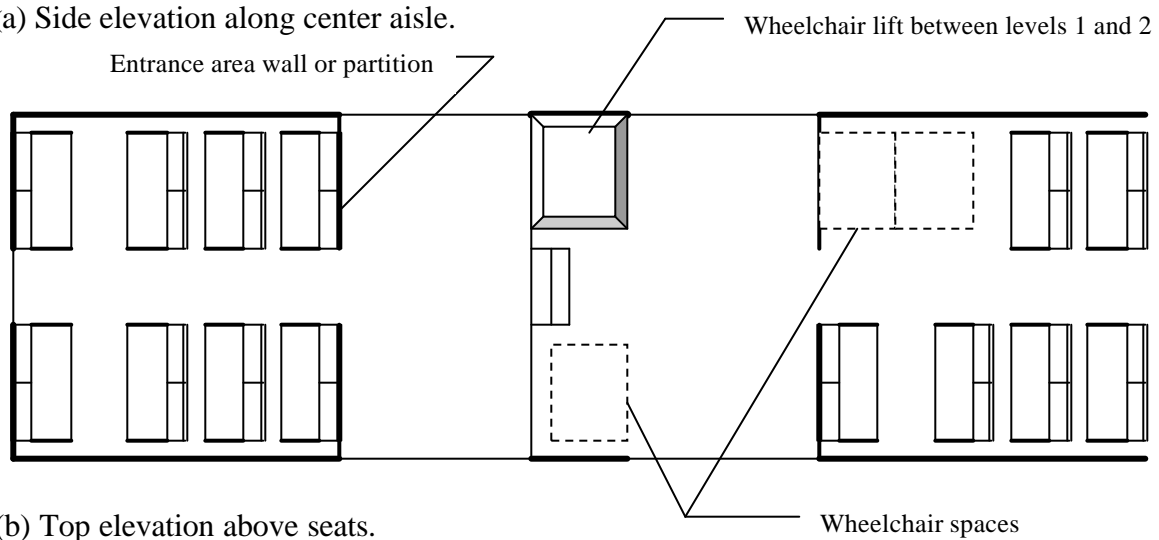
5. Conclusions

This car and entranceway and car body design has numerous advantages compared to existing designs. In particular, the ability to accommodate mobility-impaired passengers (and hence meet ADA requirements) at any LL platform station represents a major accomplishment. This avoids the cost of installing and maintaining mini-HL or HL platforms, and eliminates the growing conflict between freight and passenger service with respect to adequate clearances past passenger station platforms. Particularly with the improved LL platform design, it enhances the accommodation of mobility-impaired travelers, and reduces –probably eliminates--the special demands on train crewmembers associated with their transportation.

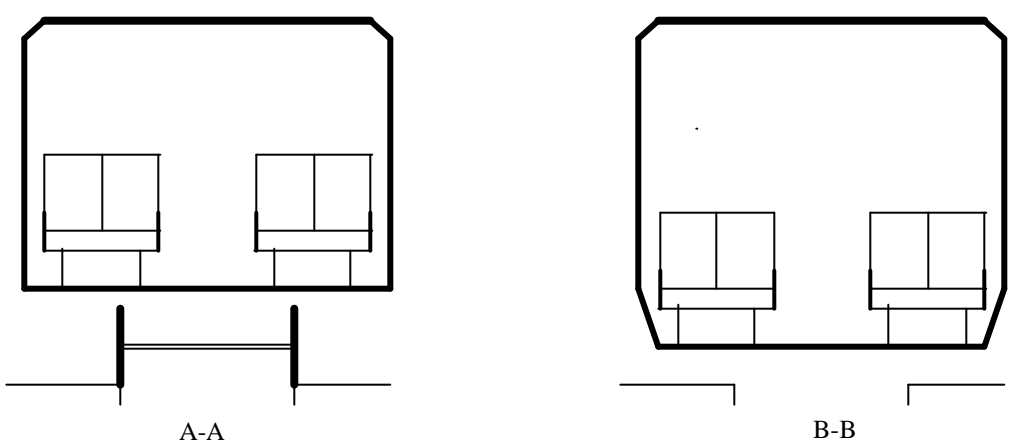
Attachments:
Figures 1 – 3
Appendix A (1 page)



(a) Side elevation along center aisle.

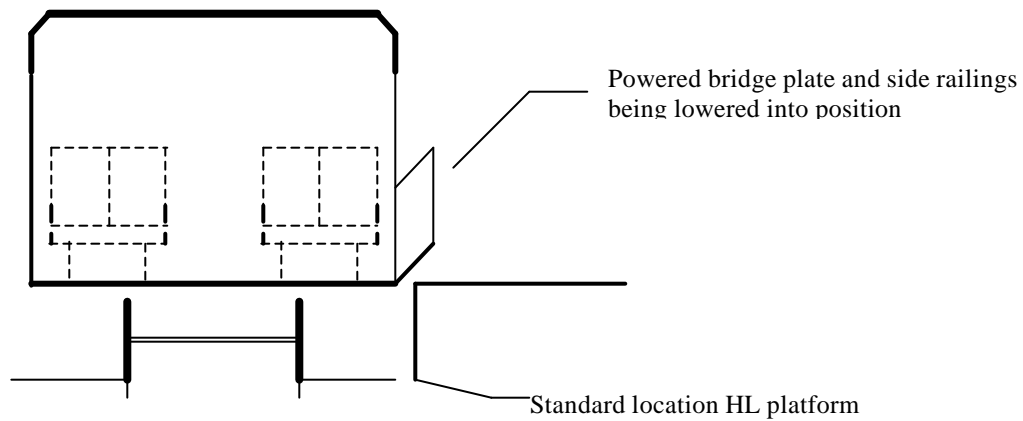


(b) Top elevation above seats.

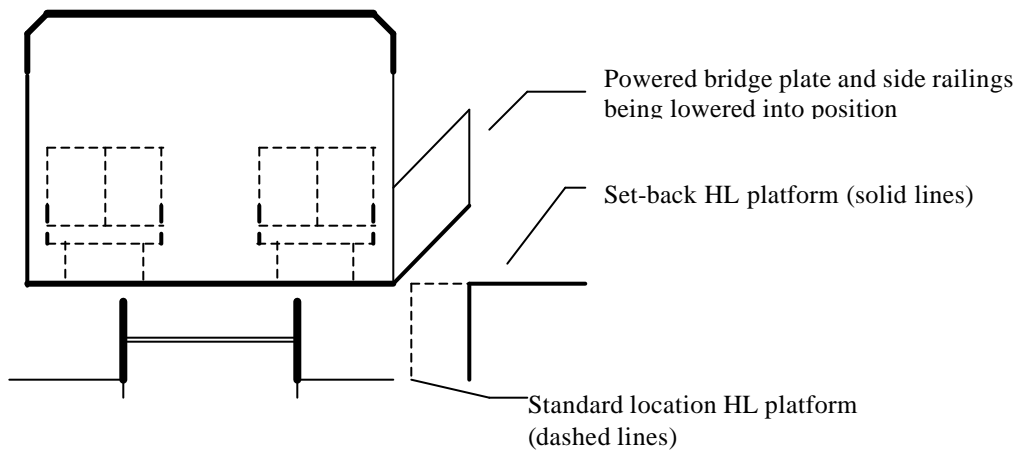


(c) Cross-section views.

Figure 1. Basic car body and entranceway design EBD 2.1. (Only half of car is shown in (a) and (b).)



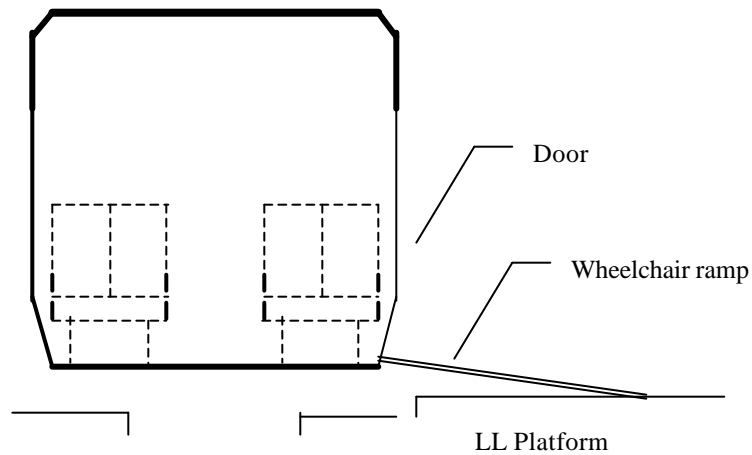
(a) Short bridge plate (to meet ADA requirements) used if all HL platforms are at the standard location.



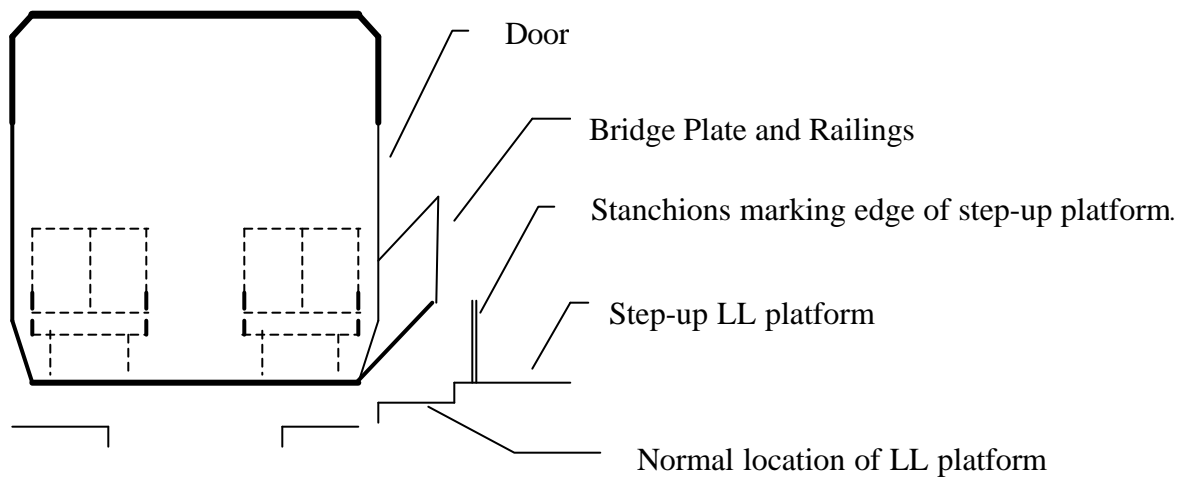
(b) Long bridge plate necessary if set-back mini-HL or HL platforms are used.

Note: Seats are shown by dashed lines, and the usual partitions--or wall and door--separating the entranceway from the seating area are omitted.

Figure 2. Level 2 entranceway and HL platform, showing powered rotating bridge plate and side railings.



(a) Manual ramp from car floor to standard LL platform. Alternatively, usual on-board wheelchair lift could be used.

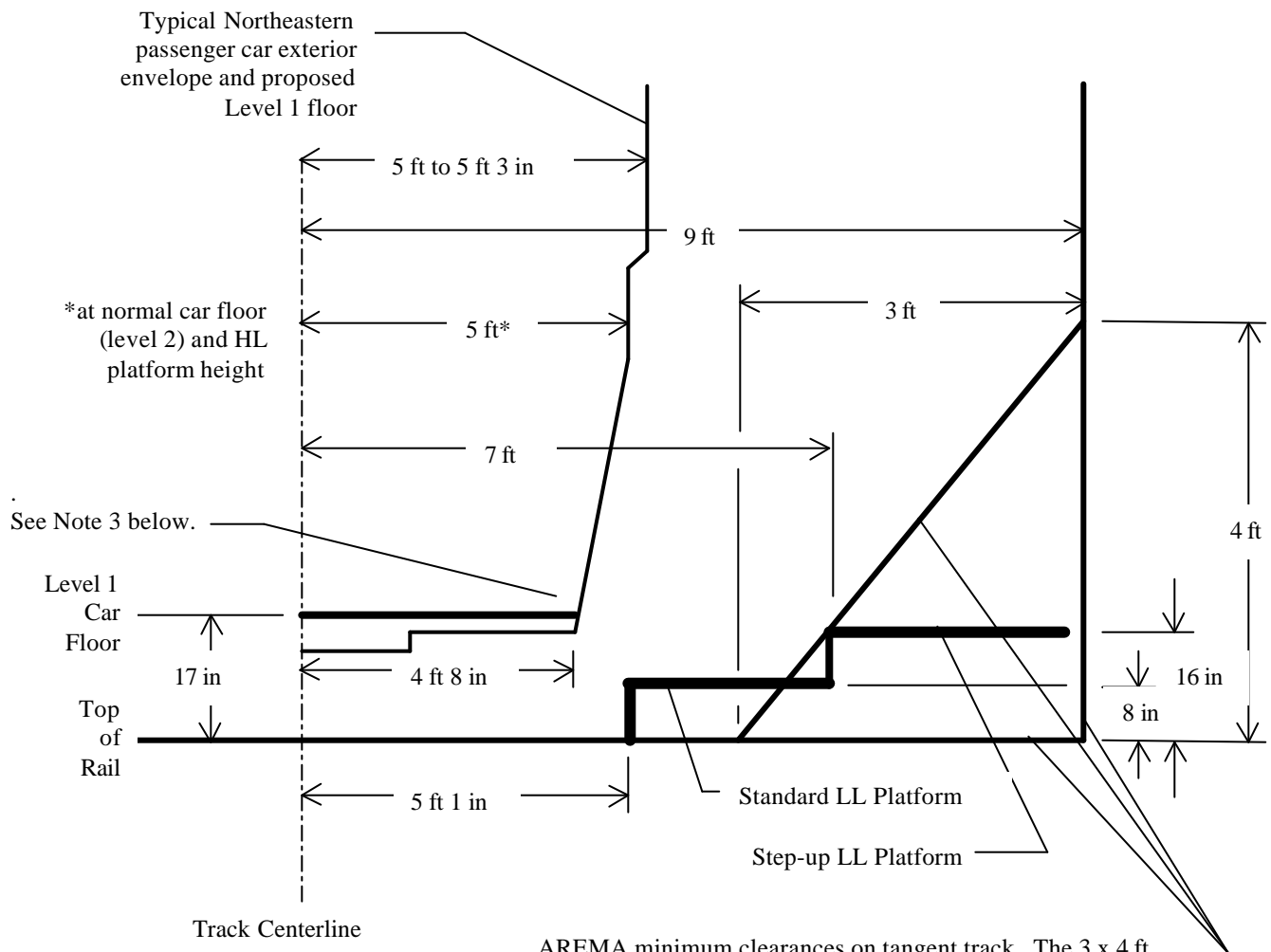


(b) Powered bridge plate and railings being rotated into position at a step-up LL platform.

Note: Seats are shown by dashed lines, and the usual partitions--or wall and door--separating the entranceway from the seating area are omitted.

Figure 3. Level 1 entranceway with standard LL platform and new step-up LL platform design.

Appendix A: Step-up Low Level Platform and Car Body Level 1 Dimensions



AREMA minimum clearances on tangent track. The 3 x 4 ft triangular area can be used only for "installations necessary for train operations". In addition, the clearances permit standard high level platforms for "passenger train operations only". Source: AREA, 1994 Manual, p. 28-1-2.

Thus the Step-up Low Level Platform can be as close as 7 ft from the track centerline.

Notes:

1. The gap between the car floor at the level 1 doorway and a step-up platform located as shown above will be approximately 2 ft 4 in.
2. If the standard location LL platform next to the track is retained (see text for discussion), then it would be 1ft 11 in wide. A wider platform, and hence a larger set-back of the step-up platform, may be desired.
3. Outer edge of Level 1 floor is at same location as lowest step of a standard end vestibule stairway