



American Railway Engineering and
Maintenance-of-Way Association

CHAPTER 28

CLEARANCES¹



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¹ The material in this and other chapters in the AREMA *Manual for Railway Engineering* is published as recommended practice to railroads and others concerned with the engineering, design and construction of railroad fixed properties (except signals and communications), and allied services and facilities. For the purpose of this Manual, RECOMMENDED PRACTICE is defined as a material, device, design, plan, specification, principle or practice recommended to the railways for use as required, either exactly as presented or with such modifications as may be necessary or desirable to meet the needs of individual railways, but in either event, with a view to promoting efficiency and economy in the location, construction, operation or maintenance of railways. It is not intended to imply that other practices may not be equally acceptable.

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INTRODUCTION

The Chapters of the AREMA Manual are divided into numbered Parts, each comprised of related documents (specifications, recommended practices, plans, etc.). Individual Parts are divided into Sections by centered headings set in capital letters and identified by a Section number. These Sections are subdivided into Articles designated by numbered side headings.

Page Numbers – In the page numbering of the Manual (28-2-1, for example) the first numeral designates the Chapter number, the second denotes the Part number in the Chapter, and the third numeral designates the page number in the Part. Thus, 28-2-1 means Chapter 28, Part 2, page 1.

In the Glossary and References, the Part number is replaced by either a “G” for Glossary or “R” for References.

Document Dates – The bold type date (Document Date) at the beginning of each document (Part) applies to the document as a whole and designates the year in which revisions were last made somewhere in the document, unless an attached footnote indicates that the document was adopted, reapproved, or rewritten in that year.

Article Dates – Each Article shows the date (in parentheses) of the last time that Article was modified.

Revision Marks – All current year revisions (changes and additions) which have been incorporated into the document are identified by a vertical line along the outside margin of the page, directly beside the modified information.

Proceedings Footnote – The Proceedings footnote on the first page of each document gives references to all Association action with respect to the document.

Annual Updates – New manuals, as well as revision sets, will be printed and issued yearly.



Part 1

Clearance Diagrams – Fixed Obstructions¹

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¹ References, Vol. 32, 1931, pp. 95, 715; Vol. 33, 1932, pp. 109, 677; Vol. 35, 1934, pp. 675, 1109; Vol. 37, 1936, pp. 292, 1065; Vol. 39, 1938, pp. 427, 877; Vol. 49, 1948, pp. 273, 671; Vol. 51, 1950, pp. 341, 874; Vol. 52, 1951, pp. 404, 356; Vol. 53, 1952, pp. 612, 1032; Vol. 54, 1953, pp. 834, 1332; Vol. 61, 1960, pp. 545, 1025; Vol. 63, 1962, pp. 338, 621; Vol. 70, 1969, p. 436; Vol. 76, 1975, p. 233; Vol. 84, 1983, p. 106; Vol. 85, 1984, p. 61. Reapproved with revisions 1984.

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SECTION 1.1 SPECIAL NOTES (1984)

- The clearances shown are for tangent track and new construction. Clearances for reconstruction work or for alteration are dependent on existing physical conditions and, where reasonably possible, should be improved to meet the requirements for new construction. Equivalent metric dimensions are shown in parentheses (millimeters) based on 1'-0" = (304.8 mm).
- On curved track, the lateral clearances each side of track centerline shall be increased 1-1/2 inches (38.1 mm) per degree of curvature. When the fixed obstruction is on tangent track but the track is curved within 80 feet (24,384 mm) of the obstruction, the lateral clearances each side of track centerline shall be increased as shown in [Table 28-1-1](#).

Table 28-1-1. Lateral Clearance Increase for Fixed Obstruction

Distance from Obstruction to Curved Track		Increase Per Degree of Curvature	
Feet	(Millimeters)	Inches	(Millimeters)
20	(6,096)	1-1/2	(38.100)
40	(12,192)	1-1/8	(28.575)
60	(18,288)	3/4	(19.050)
80	(24,384)	3/8	(9.525)

- On superelevated track, the track centerline remains perpendicular to a plane across top of rails. The superelevation of the outer rail shall be in accordance with the recommended practice of the AREMA.
- In some instances state or Canadian laws and individual railroads require greater clearances than these recommended minimums. Any facility adjacent to or crossing over railroad tracks must not violate applicable state laws, Canadian law, or requirements of railroads using the tracks. As information, a summary of the various state laws is shown in chart form in [Table 28-3-3](#).



SECTION 1.2 GENERAL OUTLINE (1983)

For a general outline for tangent track, refer to Figure 28-1-1. The information found in Section 1.1 will apply to this illustration.

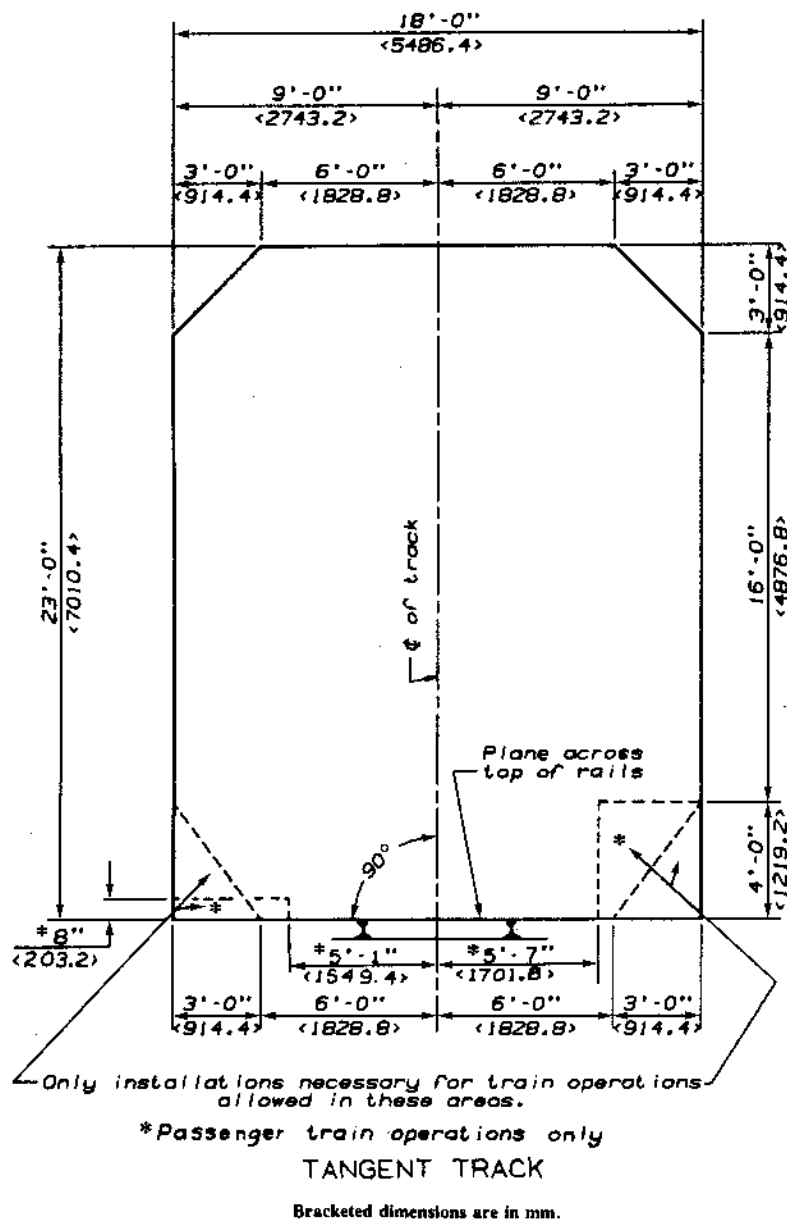


Figure 28-1-1. General Outline

SECTION 1.3 RAILWAY BRIDGES (1983)

For railway bridges, refer to Figure 28-1-2. The information found in Section 1.1 will apply to this illustration.

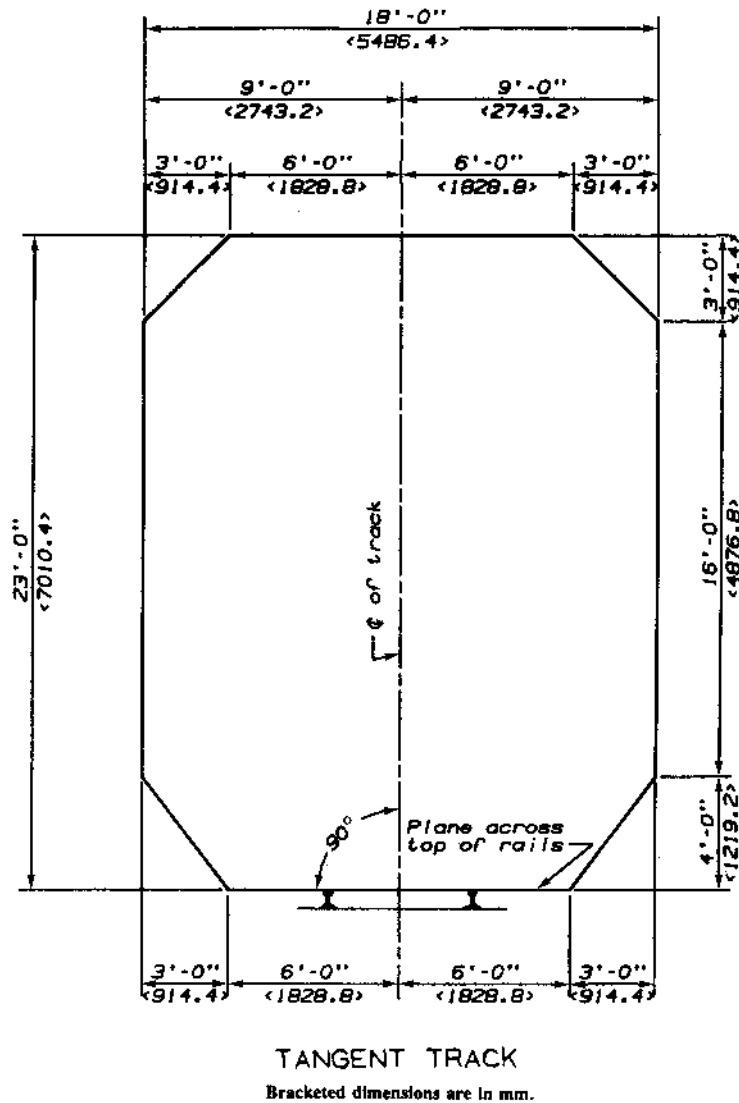


Figure 28-1-2. Railway Bridges

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SECTION 1.4 SINGLE-TRACK RAILWAY TUNNELS (1983)

For single-track railway tunnels, refer to Figure 28-1-3. The information found in Section 1.1 will apply to this illustration.

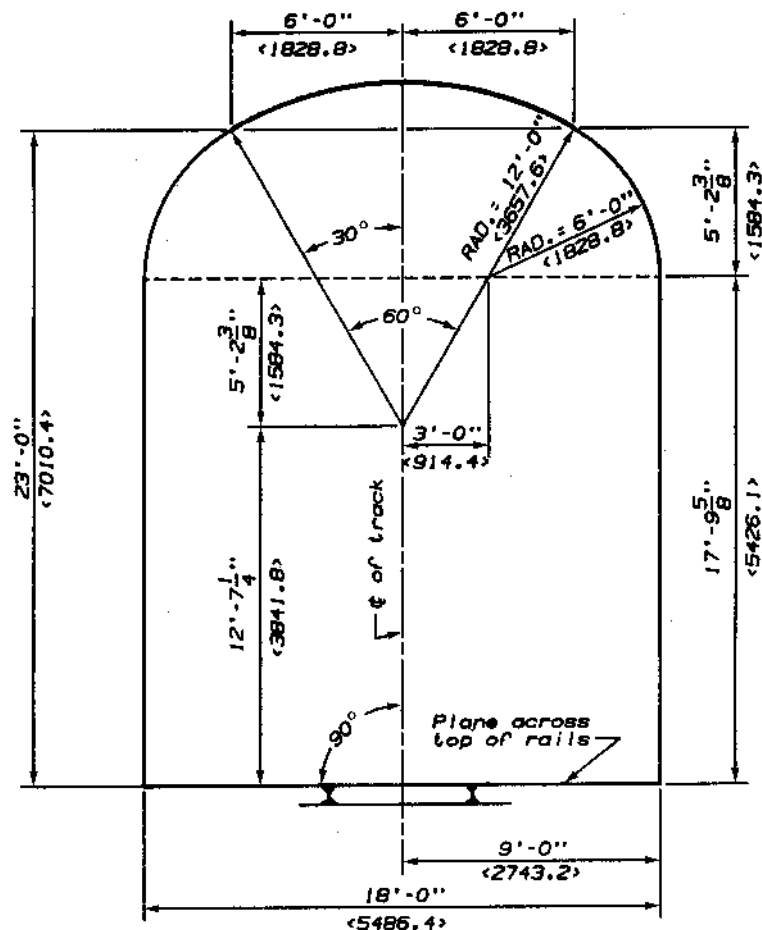
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TANGENT TRACK

Bracketed dimensions are in mm.

Figure 28-1-3. Single-Track Railway Tunnels

SECTION 1.5 DOUBLE-TRACK RAILWAY TUNNELS (1983)

For double-track railway tunnels, refer to Figure 28-1-4. The information found in Section 1.1 will apply to this illustration.

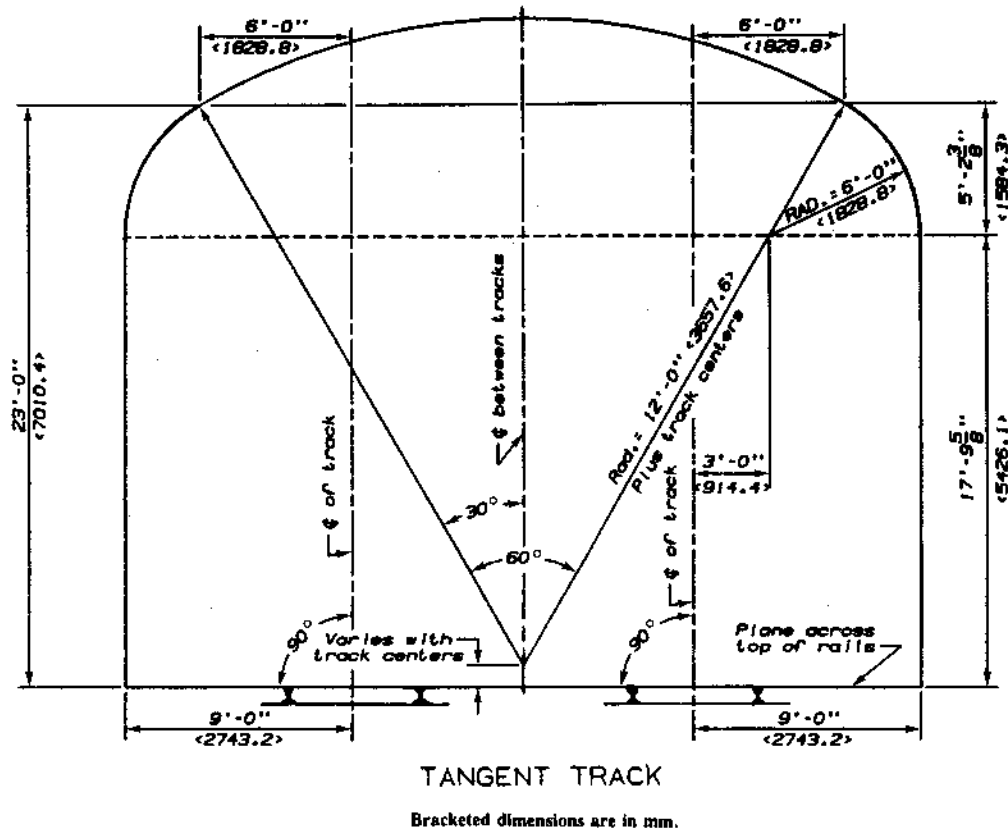


Figure 28-1-4. Double-Track Railway Tunnels

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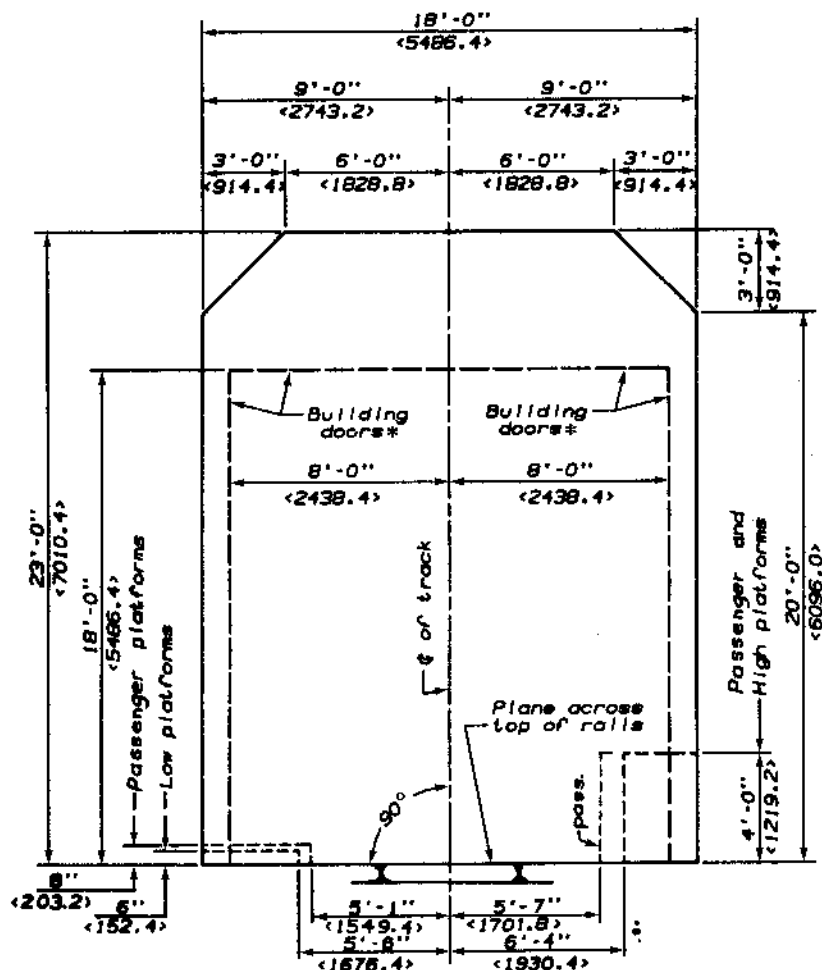
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SECTION 1.6 RAILWAY SIDE TRACKS AND INDUSTRIAL TRACKS (1983)

For railway side tracks and industrial tracks, refer to Figure 28-1-5. The information found in Section 1.1 will apply to this illustration.



TANGENT TRACK

THE 6'-4" <1930.4> DIMENSION WILL ACCOMMODATE CARS WITH EITHER FLUSH SLIDING DOORS OR PLUG DOORS. CARS WITH HINGED DOUBLE DOORS REQUIRE 8'-0" <2438.4> CLEARANCE. WHERE 6'-4" <1930.4> PLATFORM IS USED, FULL CLEARANCE SHOULD BE PROVIDED ON THE OPPOSITE SIDE.

*ENCLOSED TRI-LEVELS AND OTHER SPECIALIZED HIGH EQUIPMENT WILL REQUIRE ADDITIONAL DOOR HEIGHT. WHEN NECESSARY AND JUSTIFIED, <ENVIRONMENTAL CONTROLS, ETC.>, RAILROAD APPROVAL FOR REDUCED BUILDING CLEARANCE CAN BE GIVEN PROVIDED APPROVAL OF EXCEPTIONS TO ANY GOVERNMENTAL CLEARANCE LAWS IS OBTAINED.

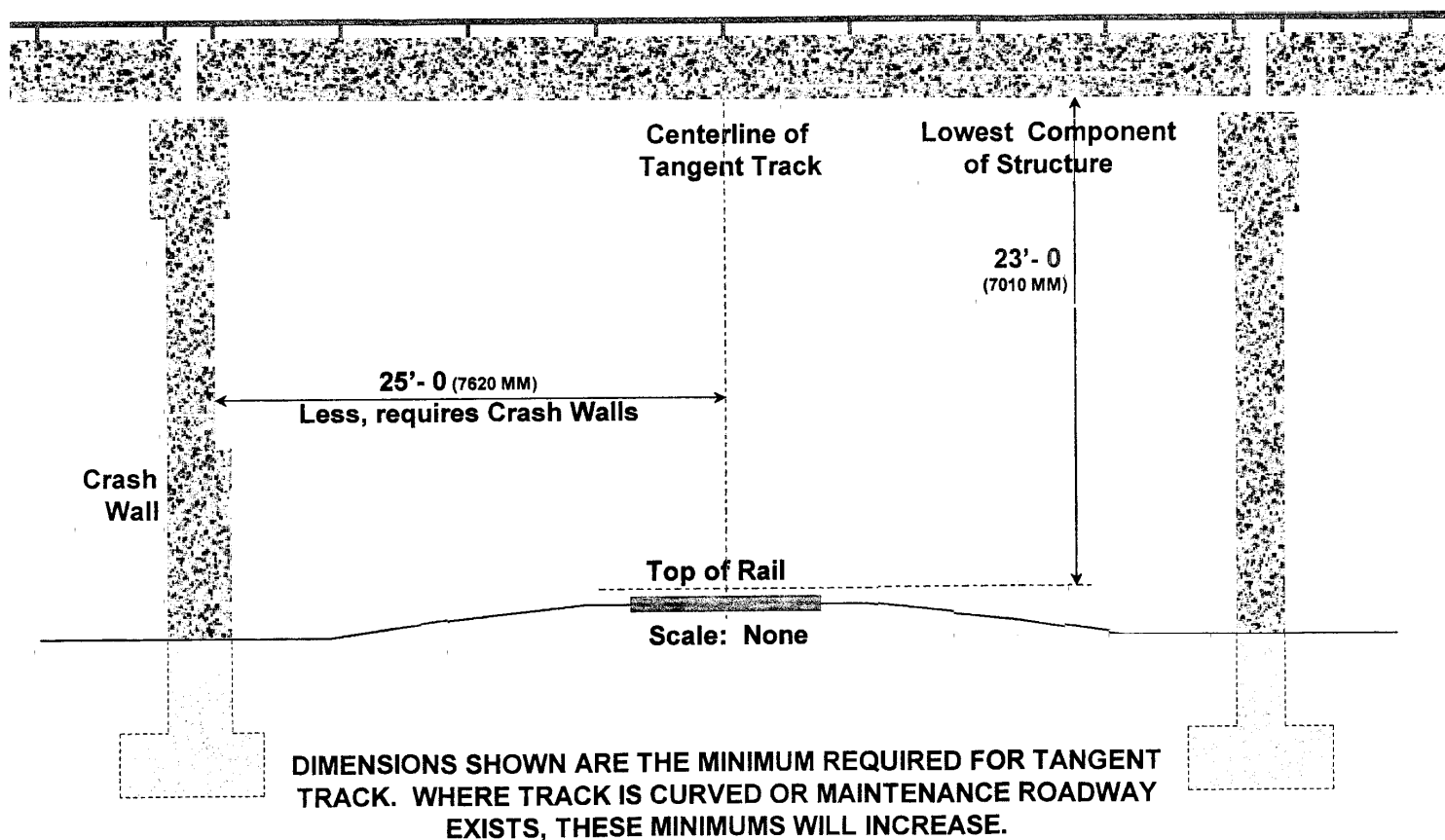
BRACKETED DIMENSIONS ARE IN MM.

Figure 28-1-5. Railway Side Tracks and Industrial Tracks

SECTION 1.7 HIGHWAY STRUCTURES OVER RAILROADS (2001)

For overhead highway structures over railroads, refer to [Figure 28-1-6](#). The information found in [Section 1.1](#) will apply to this illustration.





(NOTE: For bridge pier design specifications, see AREMA [Chapter 8](#).)

Figure 28-1-6. Highway Structures Over Railroads

SECTION 1.8 OVERHEAD ELECTRIFICATION (1983)

For single-track railway tunnels for tangent track, refer to Figure 28-1-7. The information found in Section 1.1 will apply to this illustration along with dimensions found on Figure 28-1-1 through Figure 28-1-6. See Chapter 33, Electrical Energy Utilization for complete electrification specifications.

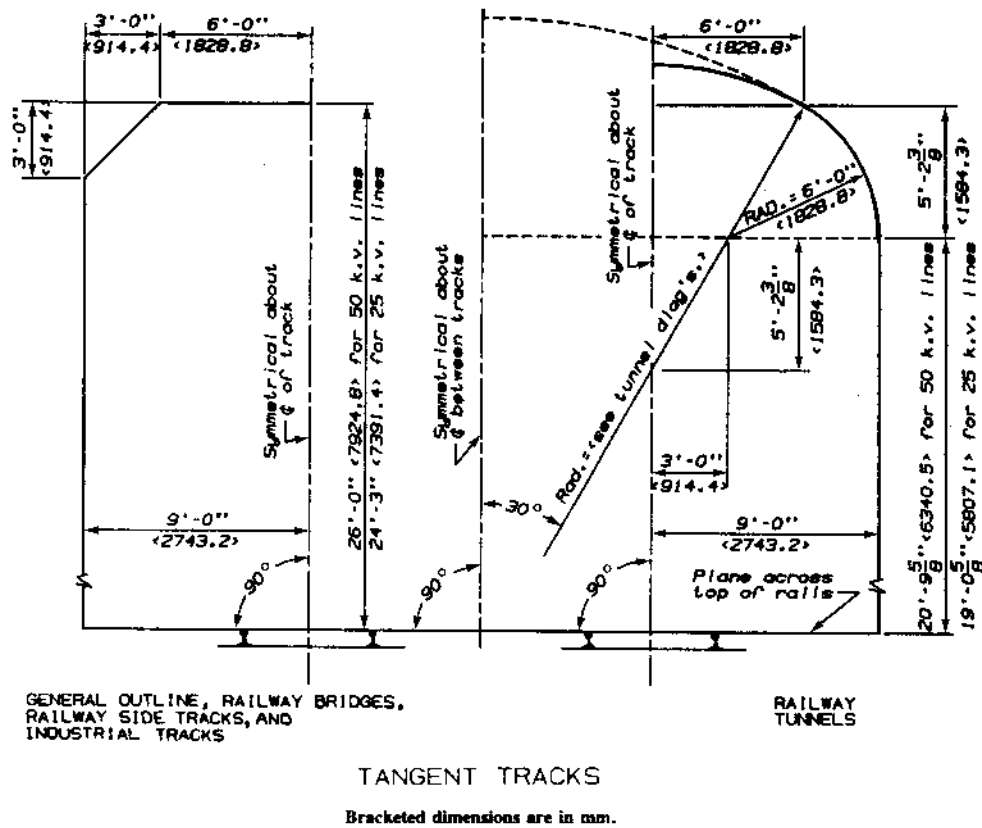


Figure 28-1-7. Overhead Electrification

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Part 2

Equipment Diagrams¹

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¹ References, Vol. 39, 1938, pp. 427, 877; Vol. 54, 1953, pp. 834, 1332; Vol. 58, 1957, pp. 654, 1207; Vol. 61, 1960, pp. 542, 1024; Vol. 66, 1965, pp. 246, 611; Vol. 76, 1975, p. 233.

SECTION 2.1 DIAGRAMS

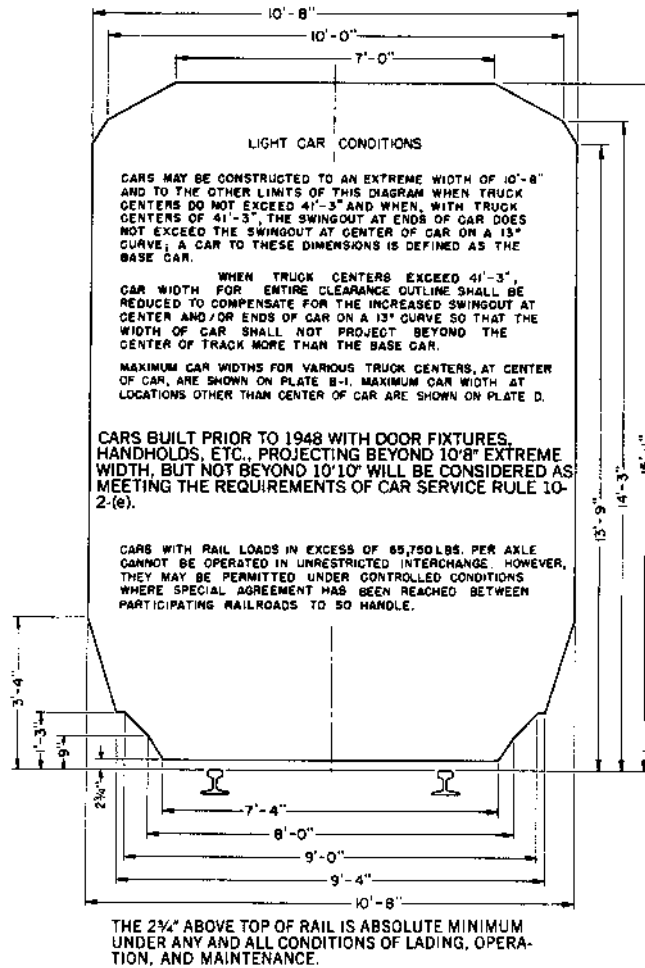
2.1.1 GENERAL (1986)

Refer to [Table 28-2-1](#) for a list of diagrams contained in this Part.

Table 28-2-1. Diagram List

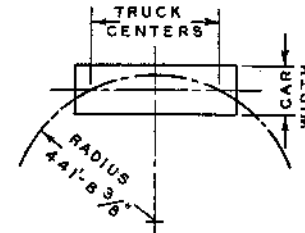
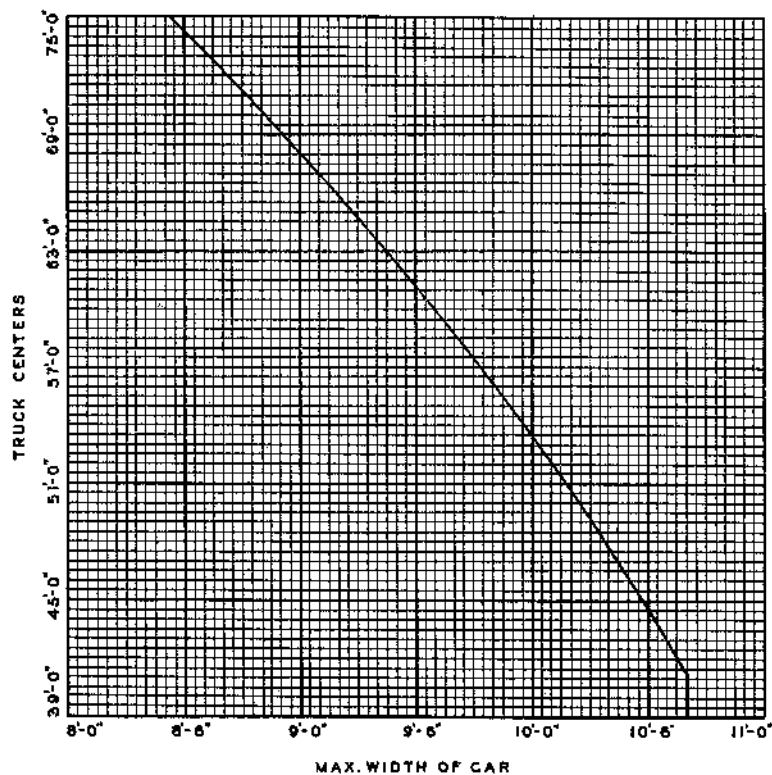
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*THIS DIAGRAM IS THE SAME AS PLATE B OF THE MECHANICAL DIVISION, AAR, AND IS INCLUDED IN THE AREMA MANUAL FOR CONVENIENT REFERENCE.

Figure 28-2-1. Equipment Diagram Unrestricted for Interchange Service – Plate B



THE REDUCTION IN WIDTH IS PREDICATED ON THE BASE CAR DEFINED ON PLATE B, AND ON A 13° CURVE.

BASE CAR - (EXTREME WIDTH 10'-8"
TRUCK CENTERS 41'-3"
13° CURVE = 441'-8 ³/₈ RADIUS.

MAXIMUM SWINGOUT AT CENTER OF CAR WITH 41'-3" TRUCK CENTERS = 5 ³/₄'.

NOTE: THE MAXIMUM WIDTHS SHOWN ARE BASED ON THE SWINGOUT AT CENTER OF CAR WHICH USUALLY GOVERNS, BUT ON CARS WITH LONG OVERHANGS THE SWINGOUT AT ENDS OF CAR MUST ALSO BE CHECKED.

*THIS DIAGRAM IS THE SAME AS PLATE B-1 OF THE MECHANICAL DIVISION, AAR, AND IS INCLUDED IN THE AREMA MANUAL FOR CONVENIENT REFERENCE.

NOTE: FOR USE WITH PLATE "B"

Figure 28-2-2. Maximum Width of Cars with Various Truck Centers – Plate B-1

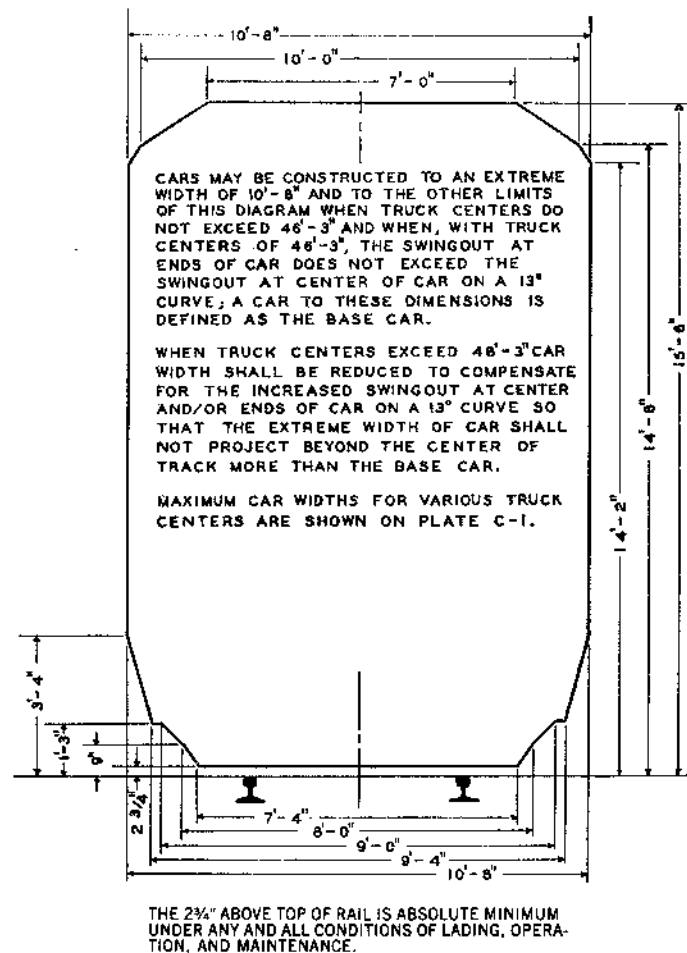
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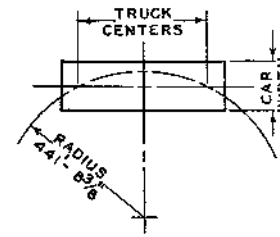
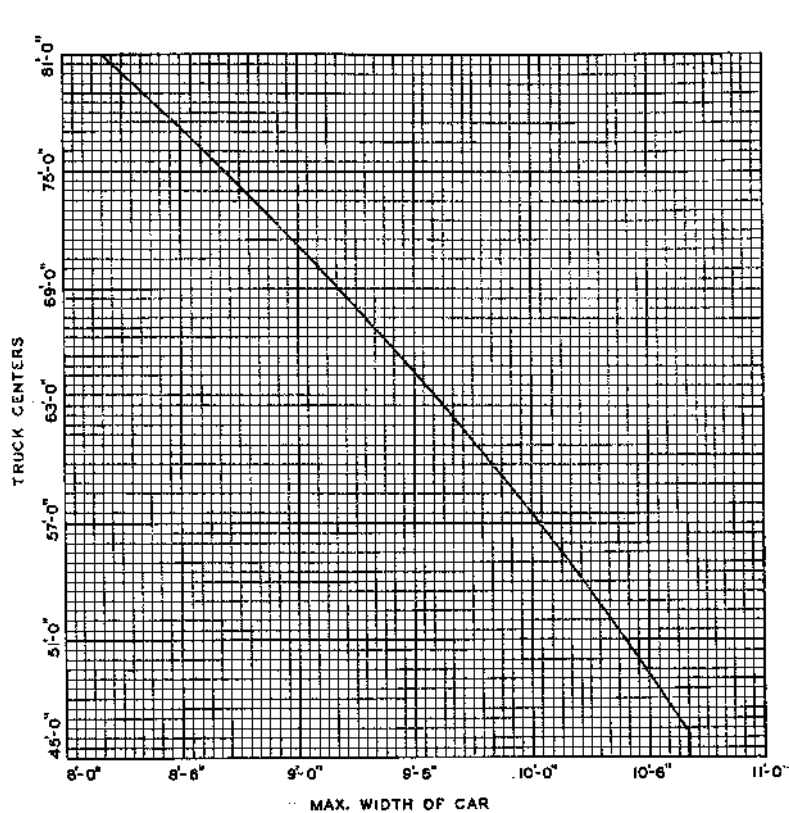
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*THIS DIAGRAM IS THE SAME AS PLATE C OF THE MECHANICAL DIVISION, AAR, AND IS INCLUDED IN THE AREMA MANUAL FOR CONVENIENT REFERENCE. FOR RESTRICTIONS APPLICABLE TO THIS DIAGRAM SEE "RAILWAY LINE CLEARANCES".

Figure 28-2-3. Equipment Diagram for Limited Interchange Service – Plate C



THE REDUCTION IN WIDTH IS PREDICATED ON THE BASE CAR, DEFINED ON PLATE C, AND ON A 13° CURVE.

BASE CAR - (EXTREME WIDTH 10'-8"
(TRUCK CENTERS 46'-3")

13° CURVE = 441'-8 3/8" RADIUS.

MAXIMUM SWINGOUT AT CENTER OF CAR WITH 46'-3" TRUCK CENTERS = 7 1/4".

NOTE: THE MAXIMUM WIDTHS SHOWN ARE BASED ON THE SWINGOUT AT CENTER OF CAR WHICH USUALLY GOVERNS, BUT ON CARS WITH LONG OVERHANGS THE SWINGOUT AT ENDS OF CAR MUST ALSO BE CHECKED.

*THIS DIAGRAM IS THE SAME AS PLATE C-1 OF THE MECHANICAL DIVISION, AAR, AND IS INCLUDED IN THE AREMA MANUAL FOR CONVENIENT REFERENCE.

NOTE: FOR USE WITH PLATE "C"

Figure 28-2-4. Maximum Width of Cars with Various Truck Centers – Plate C-1

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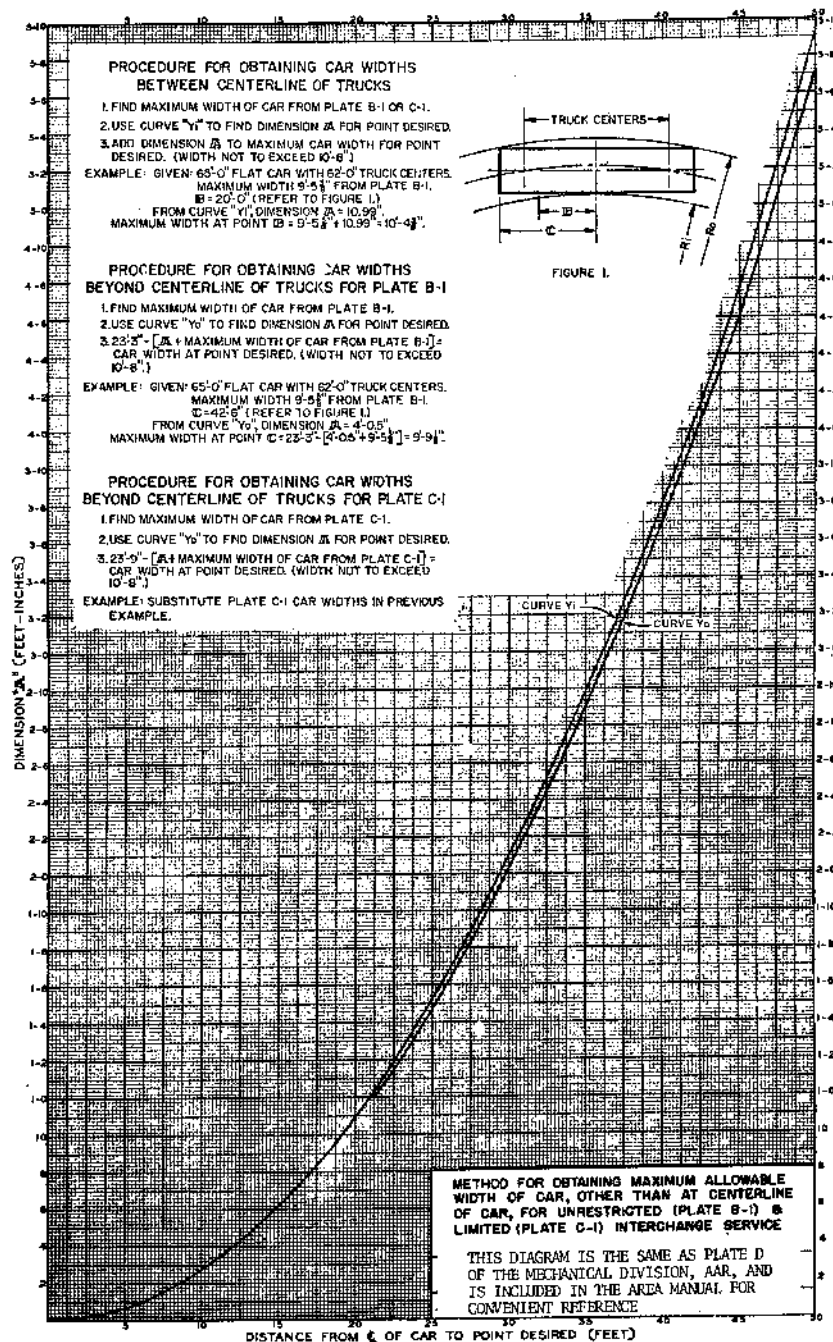
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Figure 28-2-5. Method for Obtaining Maximum Allowable Width of Car, Other Than at Center Line of Car, for Unrestricted (Plate B-1) and Limited (Plate C-1) Interchange Service – Plate D

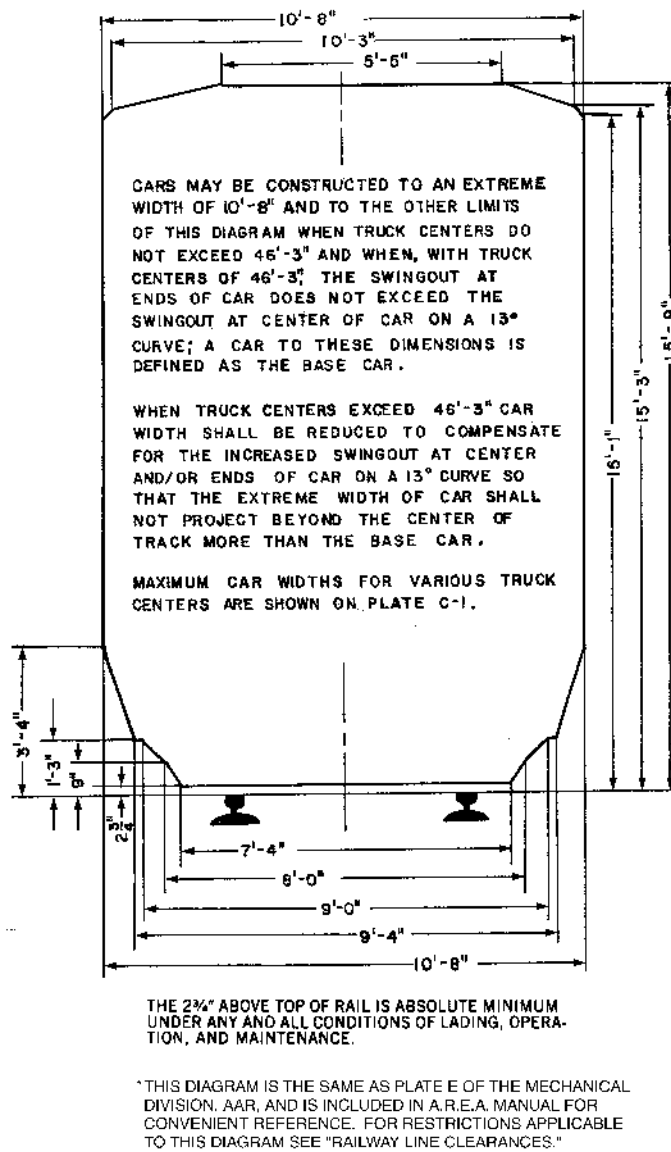


Figure 28-2-6. Equipment Diagram for Limited Interchange Service – Plate E

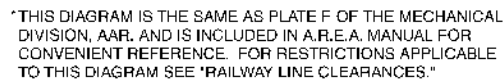
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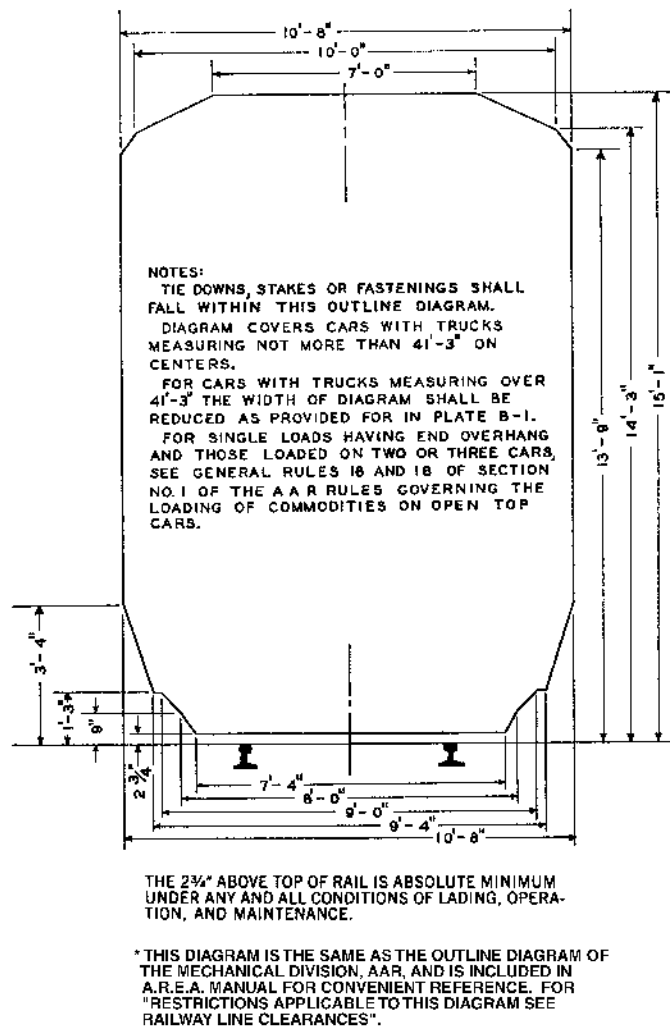


Figure 28-2-8. Outline Diagram for Single Loads, Without End Overhang, on Open Top Cars

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Part 3

Methods and Procedures¹

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¹ References, Vol. 61, 1960, pp. 549, 1025; Vol. 63, 1962, pp. 339, 622; Vol. 66, 1965, pp. 252, 255; Vol. 71, 1970, p. 485; Vol. 76, 1975, p. 233; Vol. 79, 1978, p. 291; Vol. 83, 1982, p. 386; Vol. 86, 1985, p. 110; Vol. 88, 1987, p. 97; Vol. 89, 1988, p. 189; Vol. 90, 1989, p. 113; Vol. 91, 1990, p. 124; Vol. 92, 1991, p. 122; Vol. 96, p. 97. Reapproved with revisions 1995.

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SECTION 3.1 CLEARANCE ALLOWANCES FOR HORIZONTAL MOVEMENTS OF PASSENGER CARS DUE TO LATERAL PLAY, WEAR AND SPRING DEFLECTION

3.1.1 GENERAL (1995)

- a. The calculation of lateral clearance requirements for passenger cars on curved track involve the following factors:
 - (1) Width of cars.
 - (2) Overhang at ends and middle of cars due to curvature.
 - (3) Elevation of outer rail.
 - (4) Lateral play between wheels and rails and displacement due to wear in truck parts.
 - (5) Roll of car body, due to unequal spring deflections and play in side bearings.
 - (6) Allowances for the effect of track irregularities and dynamic behavior of equipment.
- b. The first four factors can easily be calculated and present no problem. A method of determining allowances for factors (5) and (6) is presented below.
- c. The roll of the car body, with respect to the truck, on curved track occurs when the effect of the centrifugal force is not exactly balanced by the elevation in the track. When this condition exists, there is an “unbalanced elevation” equal to the deficiency or excess of elevation required for equilibrium. Such unbalanced elevation has a similar effect on a moving car as elevated track has on a standing car for equal values of unbalanced elevation and track elevation.
- d. The determination of the lateral displacement of the car body due to lateral play and wear in the truck parts, may, for all practical purposes, be combined with the lateral displacement due to tilting, and the two factors may be determined as follows:
 - (1) Make static tests on elevated track, preferably at 2 inches, 4 inches, and 6 inches, elevation.
 - (2) Make measurements as shown in Figure 28-3-1 to determine value of L.
 - (3) Plot L values, as in Figure 28-3-2, and draw line through the zero of coordinates and of average of L values and extend line into area of positive values of unbalanced elevation and displacement.

The lateral displacement of a moving car with reference to the center line of car trucks may now be determined, as follows:

- (4) Calculate unbalanced elevation from formula:

$$E_u = E_r - E_a$$

where:

E_u = Unbalanced elevation

E_r = Elevation required for equilibrium

E_a = Actual elevation in the track

- (5) Determine average lateral displacement R ([Figure 28-3-3](#)) corresponding to the unbalanced elevation, determined in [paragraph \(4\)](#) from chart drawn under [paragraph \(3\)](#).

- e. The value of R may be either plus or minus, depending upon whether the speed of the car is more or less than the speed required for equilibrium.
- f. The results obtained are only as good as the basic information, such as degree of curvature and elevation. For best results, it is recommended that actual field conditions be determined by actual field measurement, determining curvature by string lining and elevation by cross levels. Variation of a few minutes in curvature should not be ignored.
- g. Since track and equipment conditions are variable, to some extent, allowance must be added to the calculated average displacement to provide for track irregularities and the dynamic behavior of equipment. This allowance cannot be determined exactly. Recommended allowances, expressed as a percentage of the average displacement, for various speeds, are shown in [Figure 28-3-4](#) and are based upon field tests on high-speed track of eight passenger cars having various types of trucks. This allowance is to be added to the displacement as calculated above.



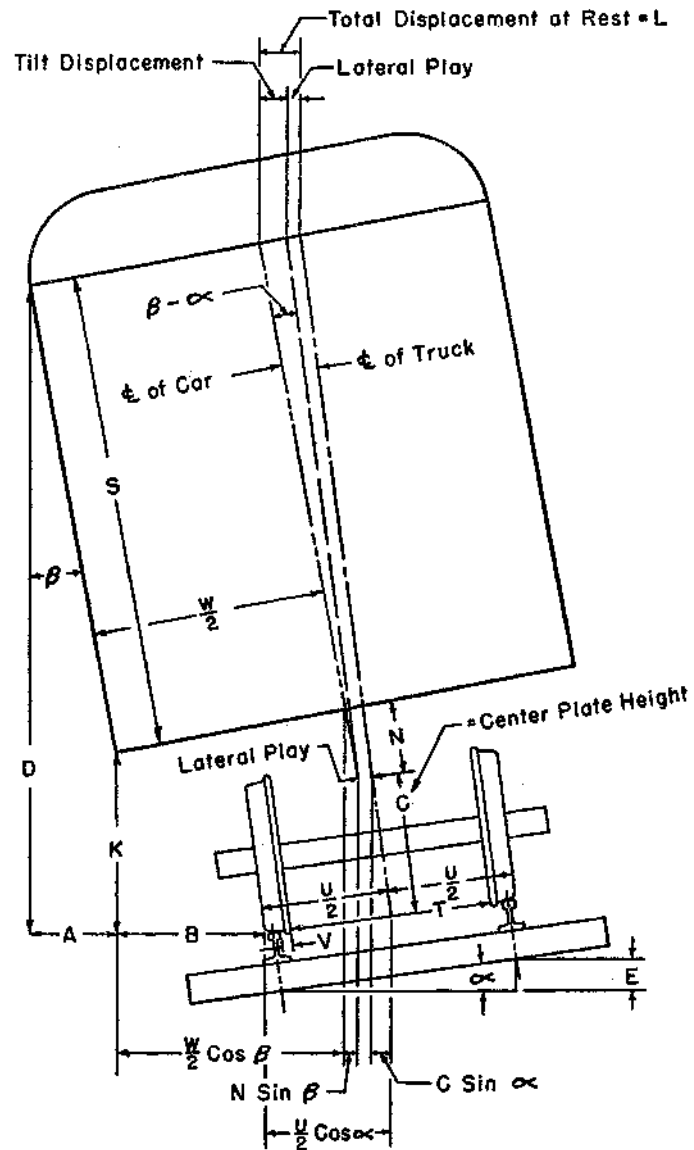
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$$L = (S + N) \sin (\beta - \alpha) + (B + \frac{U}{2} \cos \alpha) - (\frac{W}{2} \cos \beta + N \sin \beta + C \sin \alpha)$$

Figure 28-3-1. Diagram Showing Static Test Measurements Required for Calculation of "L"

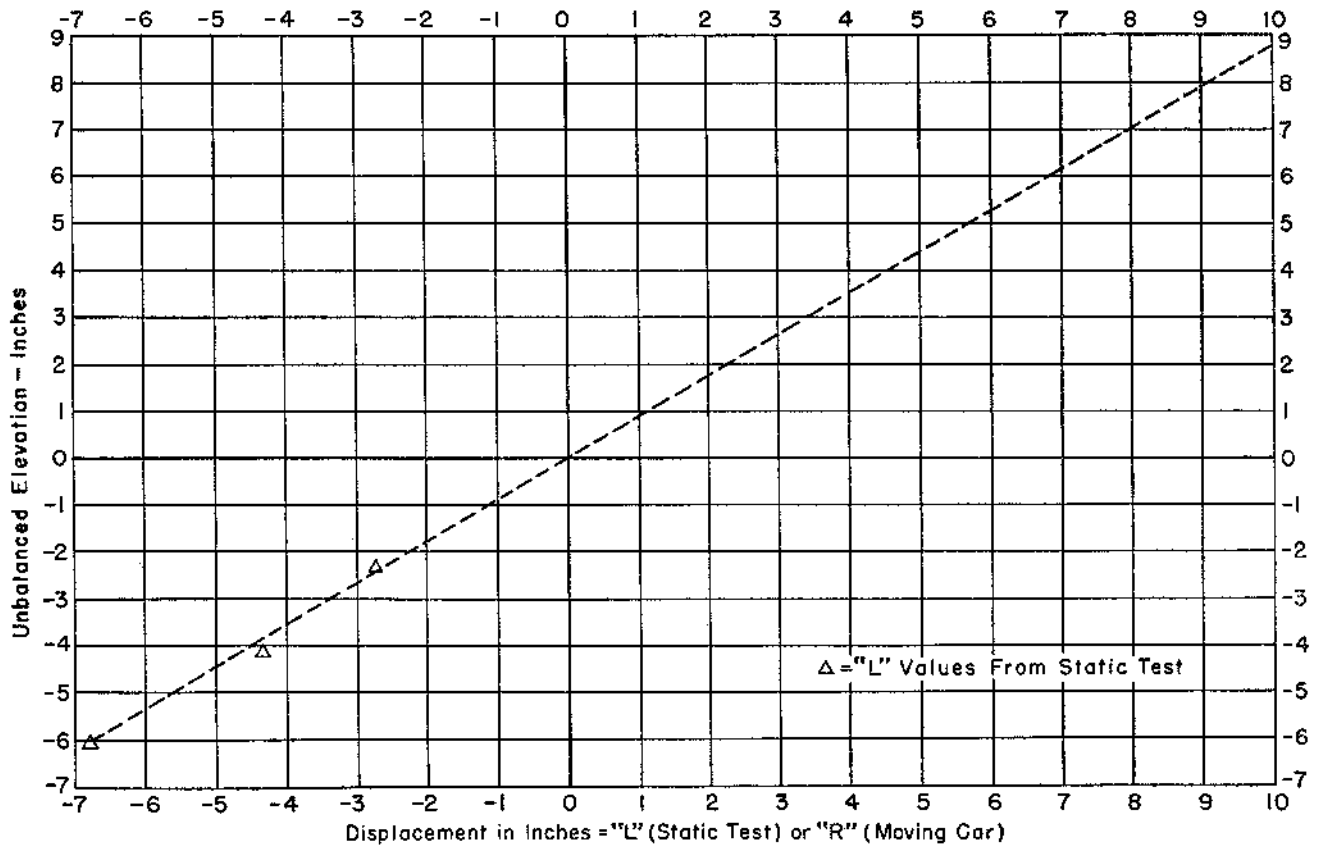


Figure 28-3-2. Diagram Showing Relation Between Displacement and Unbalanced Elevation

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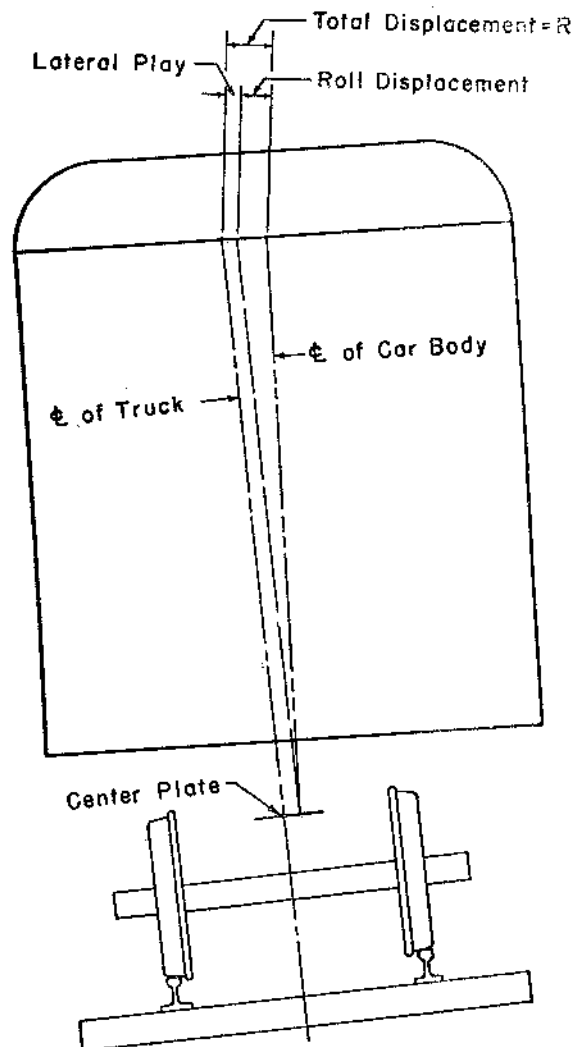
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Figure 28-3-3. Diagram Showing Displacement "R" of a Car Moving on a Curve in Excess of Equilibrium Speed

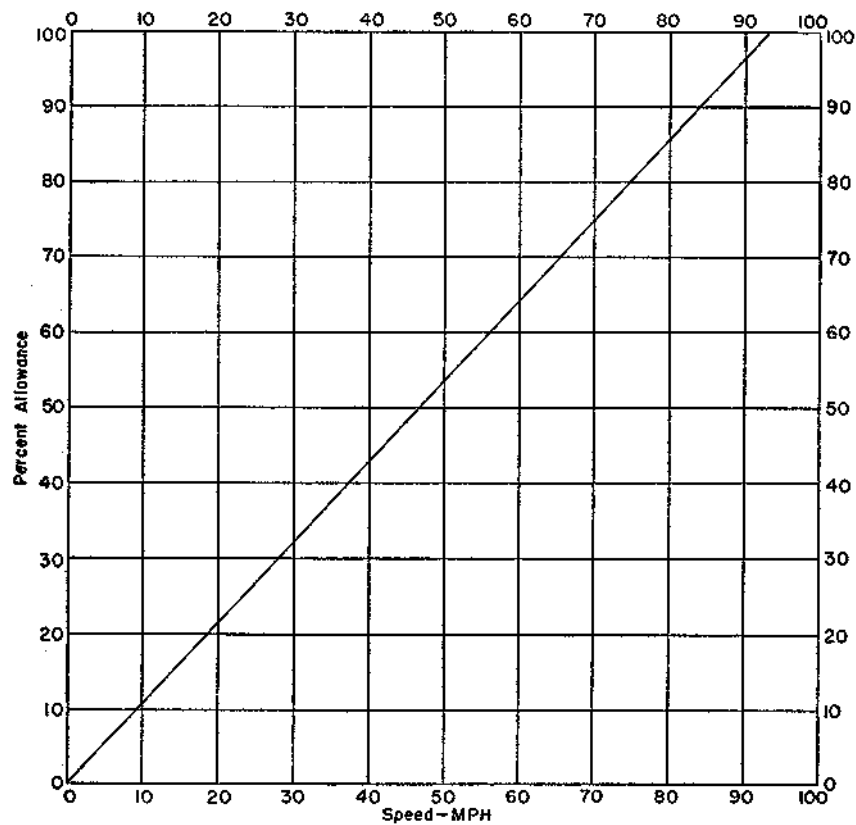


Figure 28-3-4. Diagram Showing Percent of Average Lateral Displacement to be Added, as an Allowance for the Effect of Track Irregularities and Dynamic Behavior of Passenger Cars

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SECTION 3.2 SUGGESTED METHOD OF PRESENTING PUBLISHED CLEARANCES

3.2.1 GENERAL (1991)

The following data is desirable in presenting published clearances in the publication “*Railway Line Clearances.*”

- a. Date of last change.
- b. A map showing the lines and the interchange points, junctions or other major points involved in the routes and weight limits and the column numbers.
- c. Identification of the Individual or department to notify for advance authority, dimensions exceeding published clearances and other specific questions.
- d. A statement providing description of car on which carrier’s clearances and weight limitations are based. The recommended standard car is having maximum truck centers of 50’-0”, with 10’-2” overhang from truck center to end sill. (Maximum 70’-4” load length, loaded within end sills.) Coupled length of car not exceeding 73’-0”.
- e. A notice section to provide both specific and general information concerning clearance and other important information not shown elsewhere.
- f. A list of routes to show maximum gross weight between specific cities and areas and including cross reference to clearance columns.
- g. Notes. To include additional data, exceptions, further information related to weight or clearances, allowable combined center of gravity, etc.



SECTION 3.3 SUGGESTED METHODS FOR CHARTING ALL OBSTRUCTIONS

3.3.1 GENERAL (2007)

- [Figure 28-3-5](#) shows clearance obstructions and critical areas relative to the movement of high and wide loads over a given territory on a hypothetical railroad. Also shown is pertinent information to be used in clearing a load through each restrictive area.
- It is recognized that there are various requirements and standards established by individual carriers, and the form of the chart may be modified to best fit the particular need.
- The plane of top-of-rail and centerline of track should always be shown parallel and perpendicular to the sheet. Where track superelevation exists at an obstruction, that obstruction should be diagrammed so as to reflect the superelevation with respect to top-of-rail and centerline of track.

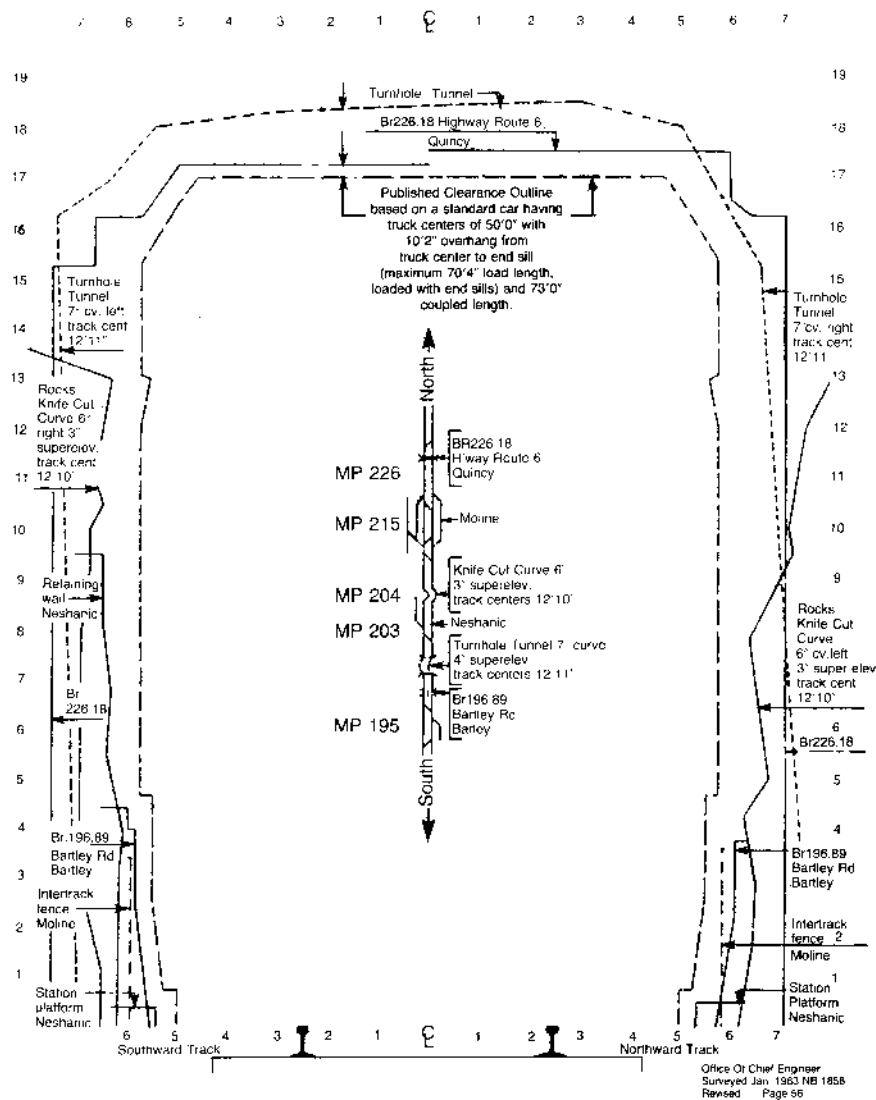


Figure 28-3-5. Clearance Obstruction Chart