



South Carolina
Department of Transportation

BRIDGE DESIGN MEMORANDUM – DM0307

TO: RPG Structural Engineers
Structural Design Consultants

DATE: September 28, 2007

RE: CSX Transportation Criteria for Overhead Bridges

As indicated in Sections 22.2.1 and 22.2.4 of the *SCDOT Bridge Design Manual*, the Department considers the criteria established by the individual railroad companies when designing highway bridges over railroads. The attached CSX Transportation (CSXT) "Criteria for Overhead Bridges," dated September 14, 2007, shall be used when preparing designs for projects that involve bridge work over CSXT's railroad tracks.

Where there are conflicts with the CSXT criteria and the requirements of the *Manual*, the more conservative requirement shall be used for design. For projects where designs are complete or are substantially complete and where the designs do not fully comply with all of the revised CSXT requirements, the designer will coordinate with the Department's Railroad Projects Manager to determine if revisions are needed.

Barry W. Bowers
Structural Design Support Engineer

Attachment

cc: Bridge Construction Engineer
Bridge Maintenance Engineer
FHWA Structural Engineer
Preconstruction Support Engineer
Railroad Projects Manager
Regional Production Engineers
RPG Design Managers
Rights of Way Administrator

File: PC/BWB



CSX TRANSPORTATION

CRITERIA FOR OVERHEAD BRIDGES

Office of Director Fixed Plant Engineering
Jacksonville, Florida
Date Issued: September 14, 2007

CRITERIA FOR OVERHEAD BRIDGES

CSX Transportation (CSXT) has minimum requirements for outside parties constructing, rehabilitating, or replacing bridges over CSXT's railroad tracks. These requirements are intended to provide safe and continuous passage of all train traffic during and after construction of bridges over its tracks. Part of these requirements is for the outside party to submit a detailed plan of the project as well as provide details of the construction methodology. This document provides information on the requirements by CSXT for overhead bridges.

Plans and specifications for new or reconstructed bridges over CSXT's railroad tracks or right-of-way shall meet the following requirements:

I. GENERAL REQUIREMENTS:

- A. CSXT's valuation station and the distance from the nearest milepost at the intersection of the centerline of the track and the centerline of the bridge shall be shown on the General Plan.
- B. The existing and proposed minimum horizontal and vertical clearances shall be marked clearly on the General Plan and Elevation.
- C. At least one subsurface exploration boring for each substructure unit adjacent to the track shall be furnished to CSXT's during the design submittal. Borings shall provide enough information to design shoring and foundations.
- D. Prior to construction activities, all overhead bridge projects will require the procurement of the appropriate property rights from CSX Real Property and other construction agreement(s) with CSX Transportation.
- E. All lifting equipment and connection devices shall have capacity for 150% of the actual lifting load. The factor of safety provided by the manufacturer in the lifting capacity data shall not be considered in the 150% requirement. A licensed professional engineer, familiar with lifting and rigging, in the State where the construction work is proposed must sign and seal all plans and calculations related to critical lifting on the project.

II. CLEARANCES:

- A. **Horizontal Clearance:** Standard horizontal clearance from centerline of the track to the face of the pier or abutment shall typically be 25'-0" or greater, but never less than 18'-0", measured perpendicular to the track. Provisions for future tracks, access roads, other CSXT facilities, and drainage may require the minimum clearance be increased or use of multi-span structures. The toe of footings shall not be closer than 11'-0" from centerline of the track to provide adequate room for sheeting.

- B. Vertical Clearance: A standard vertical clearance of 23'-0" shall be provided, measured from top of high rail to lowest point of structure in the horizontal clearance area which extends 6'-0" either side of the centerline of track.
- C. Temporary Construction clearances to be used shall be subject to approval by CSXT. Typically reductions in clearance for construction are not permitted.
- D. CSXT shall be furnished as-built drawings showing actual clearances as constructed.

III. CRASHWALLS:

AREMA Specifications, Chapter 8, Article 2.1.5 covers the requirements for crashwalls. Crashwalls are required when face of the pier is closer than 25'-0" from centerline of the track, measured perpendicular to the track, except as noted below.

Crashwalls shall meet the following requirements:

- A. Crashwalls for single column piers shall be minimum 2'-6" thick and shall extend a minimum of 6'-0" above the top of high rail for piers located between 18'-0" and 25'-0" from the centerline of the nearest track. The wall shall extend minimum 6'-0" beyond the column on each side in the direction parallel to the track.
- B. For multi-column piers, the columns shall be connected with a wall of the same thickness as the columns or 2'-6" whichever is greater. The wall shall extend a minimum of 2'-6" beyond the end of outside columns in a direction parallel to the track.
- C. Reinforcing steel to adequately anchor the crashwalls to the column and footing shall be provided.

For piers of heavy construction, crashwalls may be omitted. Solid piers with a minimum thickness of 2'-6" and length of 20'-0", single column piers of minimum 4'-0" X 12'-6" dimensions or any other solid pier sections with equivalent cross sections and minimum 2'-6" thickness are considered as heavy construction.

IV. DRAINAGE:

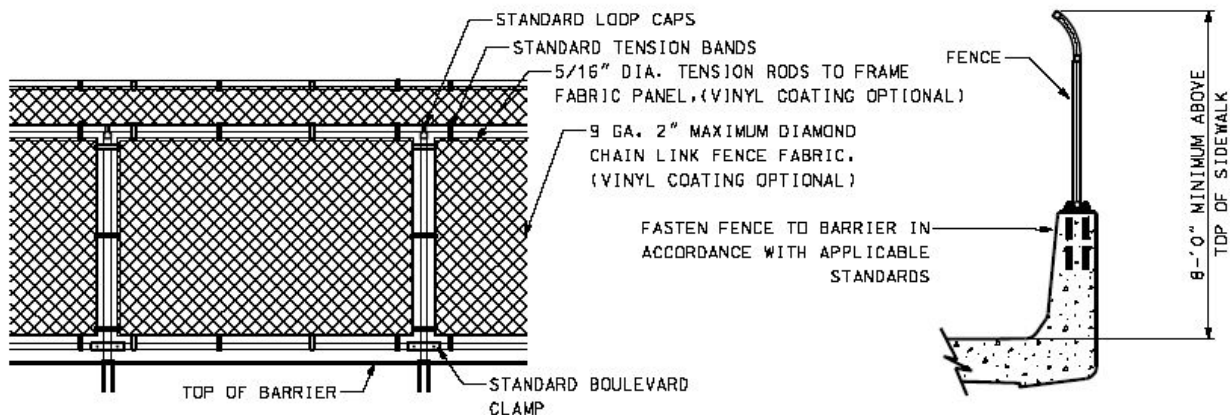
Drainage from the bridge shall be preferably collected with drain pipes and drained away from CSXT's right-of-way. When open scuppers are provided on the bridge, none shall be closer than 25'-0" of the centerline of nearest track. Flow from the scuppers shall be directed away from CSXT's drainage ditches.

Projects including stormwater systems shall be designed for a 100-year storm event as a minimum. If stormwater is drained on or to CSXT's right-of-way, calculations must be submitted to CSXT to verify the 100-year storm event is properly handled. Improvements to the adjacent drainage systems may be required at project expense, to ensure the impacted system will meet the 100-year storm event minimum condition.

During and after completion of construction, the outside party or its contractor must clear CSXT's drainage ditches of all debris to the satisfaction of CSXT's construction engineering and inspection representative

V. PROTECTIVE FENCING

All highway structures shall have a protective barrier fence to extend at least 8'-0" from the top of the sidewalk or driving surface adjacent to the barrier wall. The fence may be placed on top of the barrier wall. The fence shall be capable of preventing pedestrians from dropping debris onto CSXT's right-of-way, and in particular, passing trains. Openings in the fence shall not exceed 2"x2". Fencing should also include anti-climb shields or be of a configuration to minimize the likelihood of climbing on the outside of the protective fencing. A chain link fence option is shown below:



VI. STRUCTURE EXCAVATION AND SHORING:

Shoring protection shall be provided when excavating adjacent to an active track. Shoring will be provided in accordance with AREMA *Manual for Railway Engineering* Chapter 8 part 28, except as noted below.

Shoring will not be required if both the following conditions are satisfied:

1. Excavation does not encroach upon a 1 ½ horizontal: 1 vertical theoretical slope line starting 1'-6" below top of rail and at 12'-0" minimum from centerline of the track (live load influence zone).
2. Track is on level ground or in a cut section and on stable soil.

When the track is on an embankment, excavating the toe of the embankment without shoring may affect the stability of the embankment. Therefore, excavation of the embankment toe without shoring will not be permitted.

Preferred protection is the cofferdam type that completely encloses the excavation. Where dictated by conditions, partial cofferdams with open sides away from the track may be used. Cofferdams shall be constructed using steel sheet piling or steel soldier piles with timber lagging. Wales and struts shall be provided as needed. The following shall be considered when designing cofferdams:

- a. Shoring shall be designed to resist a vertical live load surcharge of 1,882 lbs. per square foot, in addition to active earth pressure. The surcharge shall be assumed to act on a continuous strip, 8'-6" wide. Lateral pressures due to surcharge shall be computed using the strip load formula shown in *AREMA Manual for Railway Engineering*, Chapter 8, Part 20.
- b. Allowable stresses in materials shall be in accordance with *AREMA Manual for Railway Engineering*, Chapter 7, 8, and 15.
- c. A construction procedure for temporary shoring shall be shown on the drawing.
- d. Safety railing shall be installed when temporary shoring is within 15'-0" of the centerline of the track.
- e. A minimum distance of 10 feet from centerline of the track to face of nearest point of shoring shall be maintained.

The contractor shall submit the following drawings and calculations for CSXT's review and approval.

1. Three (3) sets of detailed drawings of the shoring systems showing sizes of all structural members, details of connections, and distances from centerline of track to face of shoring. Drawing shall show a section showing height of shoring and track elevation in relation to bottom of excavation.
2. One set of calculations of the shoring design.

The drawings and calculations shall be prepared by a Licensed Professional Engineer in the State where shoring is to be constructed and shall bear his seal and signature. Shoring plans shall be approved by CSXT's construction engineering and inspection representative.

3. For sheeting and shoring within 18'-0" of the centerline of the track, the live load influence zone, and in slopes, the contractor shall use sheet pile. No sheet pile in slopes or within 18'-0" of the centerline of track shall be removed. Sheet piles shall be cut off 3'-0" below the finished ground line. The remaining 3'-0" shall be backfilled and compacted immediately after cut off.

VII. DEMOLITION OF EXISTING STRUCTURE:

The Contractor shall submit a detailed procedure for demolition of existing structures over or adjacent to CSXT's tracks or right-of-way. The procedure shall clearly indicate the capacity of cranes, location of cranes with respect to the tracks and calculated lifting loads (refer to Section I.E of this document). The demolition procedure must be approved by CSXT's construction engineering and inspection representative.

CSXT's tracks, signals, structures, and other facilities shall be protected from damage during demolition of existing structure or replacement of deck slab. As a minimum, both of the following methods shall be used:

- A. During demolition of the deck, a protection shield shall be erected from the underside of the bridge over the track area to catch falling debris. The protection shield shall be supported from girders or beams. The deck shall be removed by cutting it in sections and lifting each section out. The protection shield shall be designed, with supporting calculations, for a minimum of 50 pounds per square foot plus the weight of the equipment, debris, personnel, and other loads to be carried.

Large pieces of deck shall not be allowed to fall on the protection shield

- B. A ballast protection system consisting of geofabric or canvas shall be placed over the track structure to keep the ballast clean. The system shall extend along the track structure for a minimum of 25'-0" beyond the limits of the demolition work, or farther if required by CSXT's construction engineering and inspection representative.
- C. The Contractor shall submit detailed plans, with supporting calculations, of the protection shield and ballast protection systems for approval prior to the start of demolition.
- D. Blasting will not be permitted to demolish a structure over or within CSXT's right-of-way.

VIII. ERECTION PROCEDURE:

The Contractor shall submit a detailed procedure for erecting over or adjacent to CSXT's tracks or right-of-way. The procedure shall clearly indicate the capacity of cranes, location of cranes with respect to the tracks and calculated lifting loads (refer to Section I.E of this document). The erection procedure must be approved by CSXT's construction engineering and inspection representative.

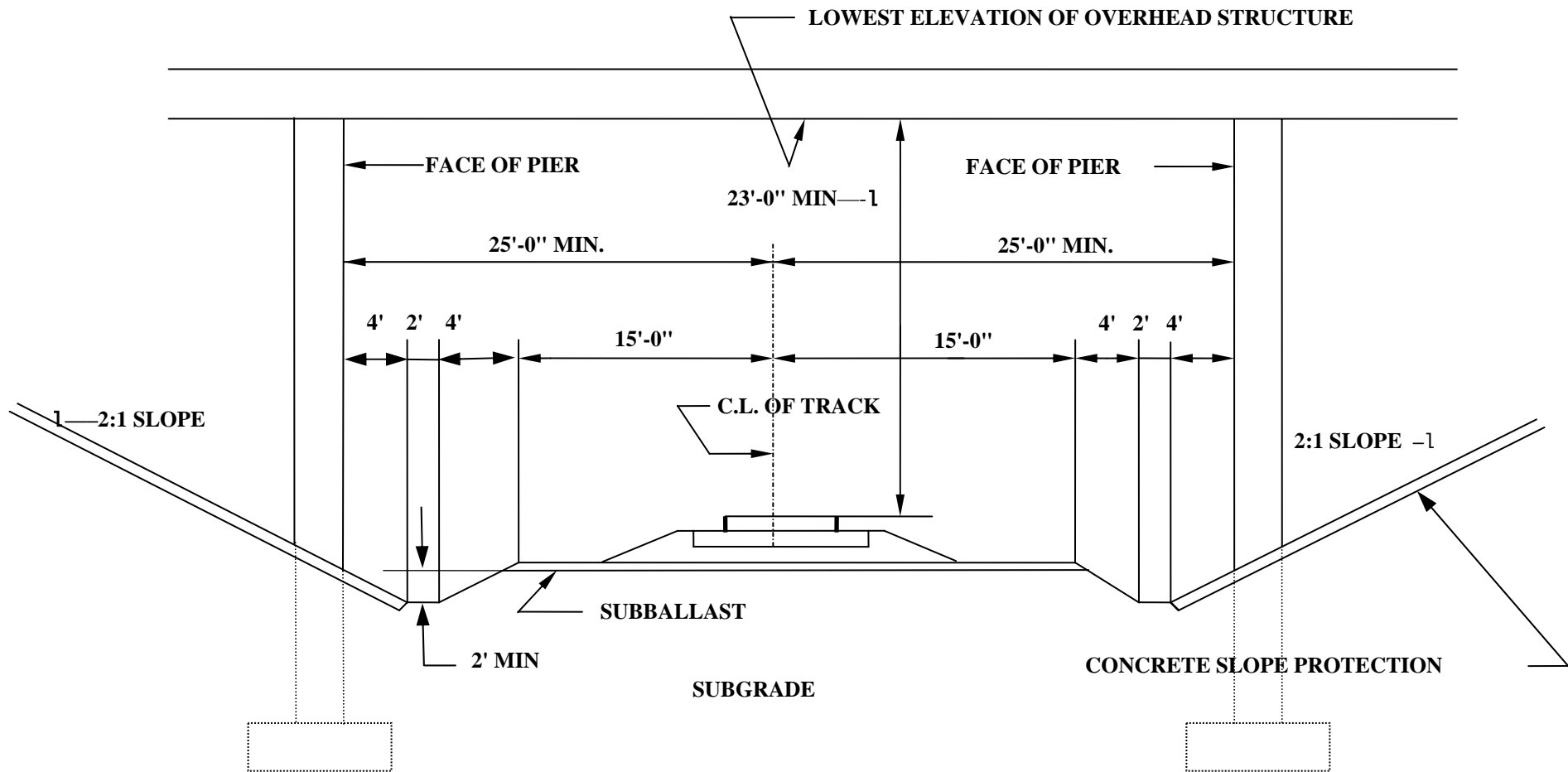
IX. PILE INSTALLATION

- A. For the installation of piles and sheeting for abutment foundations, pier foundations, retaining wall foundations, temporary and permanent shoring and other structures on or adjacent to CSXT's right-of-way, the contractor may be required to submit a detailed track monitoring program for CSXT's approval prior to performing any work near CSXT's right-of-way.
- B. The program shall specify the survey locations, the distance between the location points, and frequency of monitoring before, during, and after construction. CSXT shall have the capability of modifying the survey locations and monitoring frequency as needed during the project.
- C. If any settlement is observed, CSXT's construction engineering and inspection representative shall be immediately notified. CSXT, at its sole discretion, shall have the right to immediately require all contractor operations to be ceased, have the excavated area immediately backfilled and/or determine what corrective action is required. Any corrective action required by CSXT or performed by CSXT including the monitoring of corrective action of the contractor will be at project expense.

X. PEDESTRIAN OVERHEAD

Pedestrian overhead bridges shall be governed by this document in its entirety with the following exceptions:

- A. Pedestrian overhead bridges shall span the entire width of CSXT's right-of-way. Intermediate piers or other supports will not be permitted.
- B. Pedestrian overhead bridges shall be completely enclosed with protective canopy or by other means to prevent users from dropping debris onto CSXT's right-of-way.

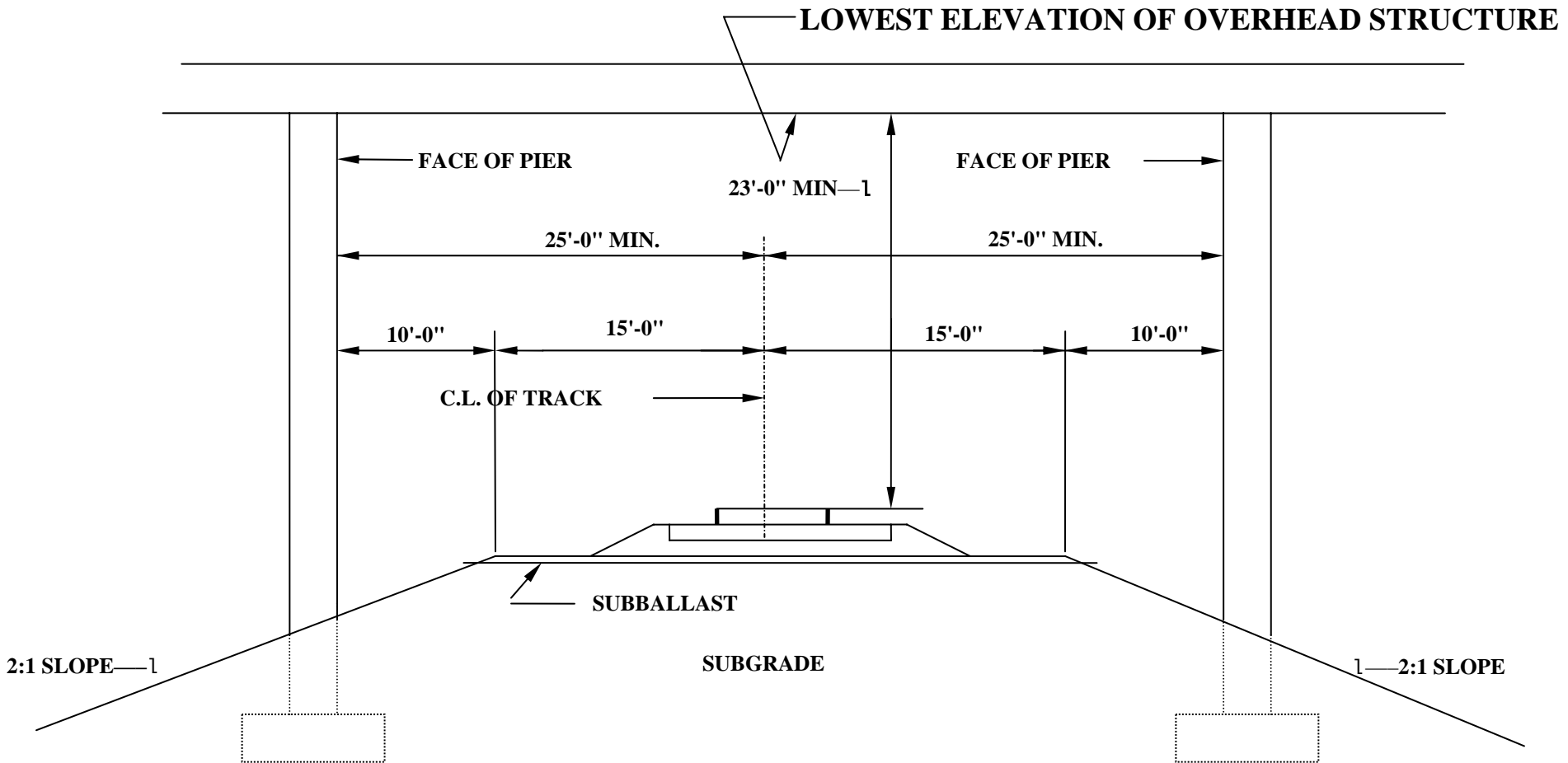


CLEARANCES REQUIRED FOR OVERHEAD STRUCTURES
TYPICAL ROADBED SECTION WITH STANDARD DITCHES

NOTE: FOR MULTIPLE TRACKS, STANDARD TRACK CENTERS IS 15'-0". AN ADDITIONAL 8'-0" WIDE ACCESS ROAD MAY BE REQUIRED TO PROVIDE 33'-0" MINIMUM DISTANCE FROM CENTERLINE OF TRACK TO FACE OF PIER.

CSX ENGINEERING DEPARTMENT

STANDARD CLEARANCES FOR OVERHEAD STRUCTURES



CLEARANCES REQUIRED FOR OVERHEAD STRUCTURES
TYPICAL SECTION FOR ROADBED IN FILL
(WHERE NO DEFINED DITCHES ARE NEEDED)

CSX ENGINEERING DEPARTMENT

STANDARD CLEARANCES FOR
OVERHEAD STRUCTURES