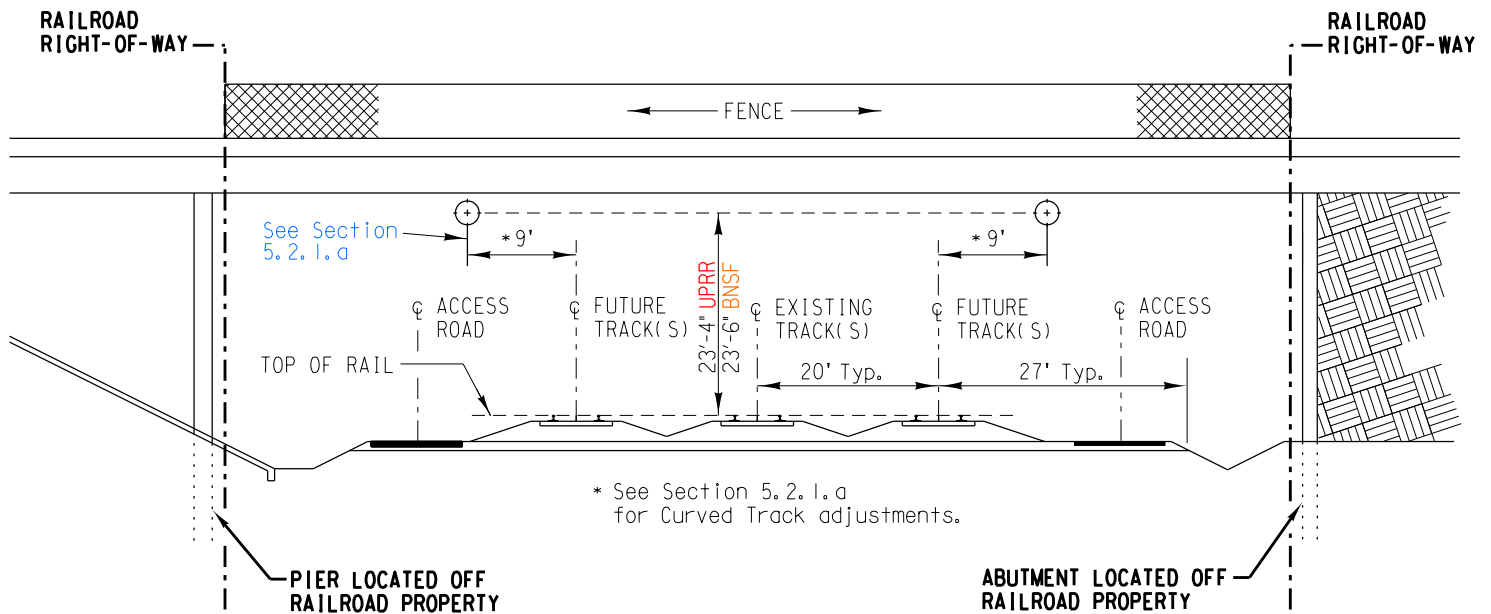


UNION PACIFIC RAILROAD - BNSF RAILWAY

GUIDELINES FOR RAILROAD GRADE SEPARATION PROJECTS



The above depiction is for example purposes only. The individual dimensions are the minimum required. Project specific design plans require the review and prior approval by the Railroad.

It is the intent of the Railroad to maintain the right-of-way free of permanent obstructions such as overhead bridge piers, earth fills and drainage facilities which do not support Railroad infrastructure. Permanent obstructions restrict the Railroad's ability to perform maintenance and expand service to existing and future customers. Keeping the right-of-way unobstructed is not a betterment for the Railroad, it is a necessity.



BRIDGE STANDARDS

GRADE SEPARATION GUIDELINES

COVER PAGE

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AUTHORED BY: R. FRIESEN	CHECKED BY: A. HURST

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1. INTRODUCTION

1.1 Purpose

The purpose of these Guidelines is to inform Applicants, Contractors and other parties concerned with Railroad policies of the requirements and standards for the design and construction of Grade Separation Projects. Compliance with these Guidelines is required to expedite the review and approval of design and construction submittals by the Railroad.

Railroad review is limited exclusively to potential impacts on existing and future Railroad operations. The Railroad accepts no responsibility for errors or omissions in the design of grade separation projects by others.

1.2 Definitions

Access Road:

A road used and controlled by the Railroad for maintenance, inspection and repair.

Applicant:

Any party proposing a grade separation project on Railroad right-of-way or other Railroad operating location, regardless of track being active or out of service.

AREMA:

The current edition of the American Railway Engineering and Maintenance-of-Way Association Manual for Railway Engineering.

AASHTO:

The current edition of the American Association of State Highway and Transportation Officials Standard Specifications for Highway Bridges.

BNSF:

Burlington Northern Sante Fe Railway

C & M Agreement:

A Construction and Maintenance Agreement that has been negotiated between the Railroad and the Applicant that addresses all the duties and responsibilities of each party regarding the construction of the proposed grade separation and the maintenance requirements after construction of the said structure.

Construction Documents:

Design plans and calculations, project and/or standard specifications, geotechnical report and drainage report.

Construction Window:

A timeframe in which construction or maintenance can be performed by the Contractor with the required presence of a Flagman.

Contractor:

The individual, partnership, corporation or joint venture and all principals and representatives (including Applicant's subcontractors) with whom the contract is made by the Applicant for the construction of the Grade Separation Project.

Crossover:

A track connection which allows trains and on-track equipment to cross from one track to another.

Engineer-of-Record:

The Professional Engineer that develops the criteria and concept for the project and is responsible for the preparation of the Plans and Specifications.

Final Plans:

100% plans signed & stamped by the Engineer-of-Record.

Flagman:

A qualified employee of the Railroad providing protection to and from Railroad operations per Railroad requirements.

Guidelines:

Information contained in this document or referenced in AREMA or AASHTO.

Grade Separation Project:

A project that includes an Overhead or Underpass Structure that crosses the Railroad right-of-way or other Railroad operating location regardless of track status being active or out of service.

Main Track:

A principle track, designated by Timetable or special instructions, upon which train movements are generally authorized and controlled by the train dispatcher. Main Track must not be occupied without proper authority.

Multiple Main Tracks:

Two or more parallel or adjacent Main Tracks.

Overhead Structure:

A Roadway and/or Trail Structure over the Railroad right-of-way.

Railroad Local Representative:

The individual designated by the Railroad as the primary point of contact for the project.

Railroad:

Refers to BNSF Railway and/or Union Pacific Railroad.

Railroad Manager of Track Maintenance (MTM):

Railroad representative responsible for maintenance of the track and supporting subgrade.

Railroad Right-of-Entry Agreement:

An agreement between the Railroad and an Applicant or a Contractor allowing access to Railroad property.

Railroad Right-of-Way:

The private property limits owned by the Railroad.

Shoofly:

A temporary track built to bypass an obstruction or construction site.

Siding:

A track connected to the Main Track used for storing or passing trains.

Timetable:

A Railroad publication with instructions on train, engine or equipment movement. It also contains other essential Railroad information.

Trail:

A pathway impacting Railroad right-of-way or other Railroad operating locations regardless of track status being active or out of service. This includes pedestrian, bicycle, approved motorized recreational equipment and equestrian uses.

Underpass Structure:

Railroad Structure over a Roadway and/or Trail.

UPRR:

Union Pacific Railroad

Yard:

A system of tracks of defined limits, other than main tracks and sidings, for storing and sorting cars and other purposes.

Yard Limits:

A portion of main track designated by "yard limit" signs and included in the timetable special instructions or a track bulletin.

1.3 Guidelines and References

These Guidelines are provided for reference only and are subject to revision without notice. These Guidelines cannot be taken as authority to construct. Railroad approval of construction documents, execution of a C & M Agreement and Railroad Right-of-Entry Agreement (if applicable) are required prior to beginning construction.

These Guidelines supplement the current (AREMA) Manual for Railway Engineering, AASHTO and State Railroad Regulatory Body requirements.

The AREMA Manual is available from:

American Railway Engineering and Maintenance-of-Way Association
4501 Forbes Boulevard, Suite 130
Lanham, MD 20706
Phone: (301) 459-3200
FAX: (301) 459-8077
www.arema.org

The specific Railroad requirements for a Grade Separation Project, as addressed in this document, shall be followed at all locations where the Railroad operates, regardless of track ownership or track status, either active or out of service.

Any items affecting Railroad property not covered in these Guidelines shall be subject to the Railroad's prior review and approval.

All new or modified Overhead Structures or Underpass Structures shall be designed in accordance with the most current policies, requirements and standards of the Railroad. These guidelines do not apply to existing structures which are not impinged upon by the proposed project.

2. AGREEMENTS

2.1 Applicant and Contractor Responsibility

- a. The Applicant, at its expense, shall be solely responsible for all costs, design, construction, future replacement, maintenance and serviceability of the proposed Grade Separation Project, except as noted otherwise in the C & M Agreement with the Railroad. The Applicant shall develop design plans, including, without limitation, all procedures necessary to construct and maintain the proposed Grade Separation Project, which cause no interruption to Railroad operations during and after construction. The Applicant must verify with the Railroad Local Representative their receipt of the latest version of these guidelines prior to developing Construction Documents.
- b. The Applicant shall be responsible for obtaining all Federal, State, Local and other permits for construction of the Grade Separation Project.
 1. The Engineer-of-Record shall be registered in the state of the project location. The Engineer-of-Record may be Applicant's in-house staff or a consultant retained by the Applicant. The Contractor shall not employ the Engineer-of-Record as the Contractor's Engineer-of-Record or as a specialty engineer, with the exception of design build projects.
- c. The Applicant and/or the Engineer-of-Record have the ultimate responsibility and liability for the Construction Documents and liability for damages to Railroad property during and after construction of the project.
- d. The Contractor is responsible to comply with the construction documents prepared by the Applicant. The Contractor shall comply with Railroad requirements stated in the C & M Agreement prior to the commencement of any construction. The Contractor shall develop work plans that ensure the track(s) remain open to train traffic per Railroad requirements as stated in the C & M Agreement and meet the requirements of the Railroad Right-of-Entry Agreement (if applicable).
- e. The Applicant is responsible for the security and safety of all people including the general public and trespassers, and the protection of Railroad infrastructure within the limits of the proposed Grade Separation

Project. Any damage to Railroad property such as track, signal equipment or structure could result in a train derailment. All damages must be reported immediately to the Railroad Local Representative and to the local Railroad Manager of Track Maintenance (MTM).

- f. The Applicant and Contractor are required to meet all safety standards as defined by the Railroad, Federal Railroad Administration (FRA), Division of Occupational Safety and Health Administration (OSHA), Local, State and Federal Governments and the State Railroad Regulatory Body.

2.2 Railroad Right-of-Way

- a. The Railroad right-of-way accommodates existing tracks, drainage systems, multiple utilities, Access Roads, Railroad support facilities and space for future track(s).
- b. The proposed Grade Separation Project shall not limit existing or future Railroad operating capacity and utility accommodations within the Railroad right-of-way.
- c. Limits of Railroad right-of-way are to be located by the Applicant and identified on the plans.

2.3 Railroad Right-of-Entry Agreement

The Applicant, Contractor or their representatives must sign the Railroad's Contractor's Right-of-Entry Agreement (if applicable) and/or obtain a valid Right-of-Entry permit from the Railroad and comply with all Railroad requirements when working within the Railroad right-of-way limits.

2.4 Construction and Maintenance Agreement

- a. Any Overhead Structure or Underpass Structure impacting the Railroad will require the Applicant to execute a C & M Agreement prior to any construction on Railroad right-of-way.
- b. The C & M agreement shall include a funding source, cost estimate, insurance and indemnification requirements, method of payment, responsibility for design, construction, ownership, maintenance and future replacement.
- c. The Applicant shall own, maintain and replace the proposed Overhead Structure or Underpass Structure at no cost to the Railroad and with no interruption to Railroad operations during construction, maintenance and future replacement of the Structure.
- d. The Railroad shall, at its own expense, be responsible for ownership and maintenance of ballast and track components only.
- e. The Applicant shall provide, at no cost to the Railroad, traffic control and/or detours to allow occupation of the roadway by the Railroad or its Contractor to perform periodic inspections as required.
- f. The Applicant is responsible for performing the work in accordance with the terms specified in the C & M Agreement. This responsibility includes, without limitation, compliance with all Railroad requirements, Federal, State and Local Laws and applicable county or municipal ordinances and regulations.

2.5 Railroad Review of Submittals and Construction Observation

- a. Prior to any review, the Railroad Local Representative shall receive written notice from the Applicant agreeing to pay all costs associated with the Railroad's, or its consultant's, review of the design plans, construction documents and construction monitoring phase.
- b. The estimated costs shall not be the upper limit of the costs but will provide a guideline for budgeting purposes. Regardless, all actual costs incurred by the Railroad, or its consultants, during the review of design plans, construction documents, and construction monitoring phase shall be fully recoverable from the Applicant.

2.6 Approval Expiration

Written approval of Final Plans will be valid for two years from the date of approval by the Railroad unless otherwise provided in the C&M Agreement. If construction of the approved structure has not begun within this period, the Railroad shall have the right to perform a design review, at the cost of the Applicant, to confirm compliance with the Railroad's then-current Guidelines before a Railroad Right-of-Entry Agreement is issued to begin construction.

3. SUBMITTALS

3.1 Railroad Review Process

All design and construction submittals shall be transmitted to the Railroad Local Representative. The submittal will then be forwarded to the Railroad's engineering department. The engineering department shall have the option of reviewing the project documents in-house or by using an outside consultant. During the review process, the Railroad Local Representative shall be the point of contact for resolving outstanding issues.

It should be noted that the Railroad's review and approval of construction documents does not relieve the Applicant and/or Engineer-of-Record from the ultimate responsibility and liability for damages to Railroad property during and after construction of the proposed Grade Separation Project, nor does it relieve the Applicant and the Contractor from their responsibilities, obligations and/or liabilities under the C & M agreement and the Contractor's Right-of-Entry Agreement (if applicable). Railroad's approval of construction documents will be given with the understanding that the Railroad makes no representations or warranty as to the validity, accuracy, legal compliance or completeness of such documents and that any reliance by the Applicant, Engineer-of-Record or Contractor on such documents is at the risk of Applicant, Engineer-of-Record and Contractor.

3.2 Requests for Exception

- a. Requests for exception to Railroad requirements shall be submitted to the Railroad for review. The Railroad may approve or reject any request for exception. Approval from the Railroad is required prior to proceeding with an exception.
- b. Provide written engineering justification for proposed requests for exception
- c. The request should succinctly describe the geometric, structural and other constraints which justify the request. Cost alone should not be the determining factor.

3.3 Contractor Review

The Contractor must review all construction submittals to ensure that the materials and proposed method of construction are compatible with the existing site conditions. The Contractor's work plan must be developed to allow Railroad traffic to remain in service per Railroad requirements and the C&M agreement.

3.4 Applicant and/or Engineer-of-Record Review

The Applicant and/or Engineer-of-Record must review and approve each construction submittal for compliance with the construction documents, AREMA and/or AASHTO, and these Guidelines before forwarding the submittal to the Railroad for review and approval.

3.5 Design Calculations

Design calculations shall be provided for all structures except Overhead Structures. Design Calculations shall be clear, legible and easy to follow. Computer program generated output or data sheet calculations shall be accompanied by input data information and sample calculations to verify the accuracy of the computer output.

3.6 Geotechnical Report

A geotechnical report shall be provided addressing all bridges and retaining walls. The preliminary geotechnical report shall include enough information to support foundation design calculations and backfill design requirements. The final geotechnical report shall have recommendations consistent with those used in the final structural design.

3.7 Drainage Report

A hydraulic and hydrologic report is required if the Grade Separation Project changes existing drainage patterns and/or drainage flow on Railroad right-of-way or at the request of the Railroad. See [Section 4.5](#) for hydraulic criteria to be used.

3.8 Units

All controlling dimensions, elevations, design criteria, assumptions and material stresses shall be expressed in English units. Dual units with English units in parenthesis are acceptable for projects that require the use of Metric units per Federal, State and/or Local government requirements.

3.9 Submittal Schedule

- a. The Applicant shall schedule submittals per [Tables 3-1](#) or [3-2](#) to ensure adequate time for review.
- b. Submittals which do not follow the schedules as outlined in these tables may require greater review time than that shown in the table by the Railroad. Partial, incomplete or inadequate submittals will be rejected, thus delaying the approval.
- c. The Applicant shall not expect a lesser time for review than indicated in the tables nor shall the Railroad be responsible for delayed design and construction.
- d. Revised submittals will follow the same procedure as the initial submittal until all issues are resolved. At the Final Plan submittal, prior to submission to the Railroad, all design plans and calculations, project specifications/Special Provisions, the geotechnical report and the drainage report must be signed and stamped by a registered Professional Engineer familiar with the Railroad requirements and licensed in the State where the project is located.

3.10 Design and Construction Submittals

Following their own internal review and approval the Applicant or their representative shall submit, at a minimum, all applicable submittals defined in [Tables 3-1](#) or [3-2](#) to the Railroad Local Representative for review and approval. The Engineer-of-Record's review comments must be submitted to the Railroad along with the submittal.

Table 3-1, Overhead Structures

Phase		Type of Submittal	Format	Railroad Review Time
Design	A	Concept (Plans and Site Pictures)	PDF only*	4 weeks**
	B	30% (Applicant response, Design Plans, Project Specifications, Drainage Report & Plan, Shoofly Design, Construction Phasing Plans)	PDF only*	4 weeks**
	C	Final Plans (Applicant response, Design Plans, Project Specifications, Drainage Report & Plan, Shoofly Design, Construction Phasing Plans)	PDF only*	4 weeks**
Construction	(Including but not limited to the following) Shoring Falsework Demolition Erection Erosion Control Construction Phasing Plans		PDF only *	4 weeks**

* Submittal Format (The following submittal formats are all required.)

PDF – The pdf shall be formatted to reproduce legibly on 11" x 17" sheets.

** Submittals which do not follow the schedules as outlined in these tables, are partial, incomplete or inadequate may require greater review time.

(cont'd)

- A.** The Concept submittal shall, at a minimum, include the following:
1. Plan, Elevation and Typical Section of proposed grade separation. See [pg 37, Plan No. 711100, sheet 1](#).
 2. Preliminary phasing plan.
 3. Photo log with pictures of the proposed project location. Site pictures shall be in all controlling directions including but not limited to, North, East, South and West. The plan view should show a reference location and direction for each picture.
- B.** The 30% submittal shall, at a minimum, include the following:
1. Applicant response to Railroad review comments on the concept submittal. The 30% submittal shall reflect concept review comments.
 2. Design Plans showing a Plan View, Elevation View, Typical Section, Construction Notes and Railroad Profile Grade Diagram. See [pg 37 & 38, Plan No. 711100, sheet 1 & 2](#). Plans shall also indicate structure design criteria and construction methods.
 3. Project Specifications and/or Special Provisions, including Railroad coordination requirements.
 4. Drainage Report, as required. (See [Section 3.7](#)).
 5. Shoofly Design. Bridge general plan shall show the location of the shoofly and indicate the footprint of the structure in relation to centerline of shoofly and existing track(s). See [Section 4.2.1](#).
 6. Construction Phasing Plans. Construction phasing plans must show all required phasing, construction procedures, temporary shoring layout, controlling dimensions and elevations.
- C.** The Final Plans submittal shall, at a minimum, include the following:
1. Applicant response to Railroad review comments on the 30% submittal. The Final Plans submittal shall reflect all previous review comments.
 2. Design Plans showing a Plan View, Elevation View, Typical Section, Construction Notes and Railroad Profile Grade Diagram. See [pg 37 & 38, Plan No. 711100, sheet 1 & 2](#). Plans shall also indicate structure design criteria and construction methods.
 3. Project Specifications and/or Special Provisions, including Railroad coordination requirements.
 4. Drainage Report, as required. (See [Section 3.7](#)).
 5. Shoofly Design. Bridge general plan shall show the location of the shoofly and indicate the footprint of the structure in relation to centerline of shoofly and existing track(s). See [Section 4.2.1](#).
 6. Construction Phasing Plans. Construction phasing plans must show all required phasing, construction procedures, temporary shoring layout, controlling dimensions and elevations.

Following review of the Final Plans and resolution of any outstanding issues the Railroad Local Representative may issue a letter of project acceptance.

Table 3-2, Underpass Structures

Phase		Type of Submittals	Format	Railroad Review Time
Design	A	Concept (Plans and Site Pictures)	PDF *	4 weeks***
	B	30% (Applicant response, Type Selection Report, Design Plan, Shoofly, Construction phasing)	PDF *	
	C	60% (Applicant response, Design Plans and Calculations, Geotechnical Report, Project Specifications and/or Special Provisions, Drainage Report and Plan, Shoofly Design, Construction phasing)	PDF *	6 weeks***
	D	Final Plans (Applicant response, Design Plans and Calculations, Geotechnical Report, Project Specifications and/or Special Provisions, Drainage Report and Plan, Shoofly Design, Construction phasing)	PDF & 1 hard copy **	4 weeks***
Construction	(Including but not limited to the following) Construction Phasing Plan Shoring Falsework Demolition Erection Erosion Control Construction Material Certifications Concrete Mix Design Structural Steel, Rebar and Strand Certifications 28 day Cylinder Test of Concrete Strength Waterproofing Material Certification Test reports for fracture critical members Foundation Construction Reports (eg.: pile driving records, caisson drilling and/or crosshole sonic log testing for drilled shafts.) Other project specific information as requested by the Railroad		PDF *	4 weeks***
Project Closing	E	As Built (Final Plans, Construction Documents, Shop Plans, Pile Driving Records.)	PDF *	N/A

* Submittal Format (The following submittal formats are all required.)

PDF – The pdf shall be formatted to reproduce legibly on 11” x 17” sheets.

** Submittal Format (The following submittal formats are all required.)

PDF – The pdf shall be formatted to reproduce legibly on 11” x 17” sheets.

Hard copy – One legible hard copy on 11” x 17” sheets.

*** Submittals which do not follow the schedules as outlined in these tables, are partial, incomplete or inadequate may require greater review time.

A. The Concept submittal shall, at a minimum, include the following:

1. Plan, Elevation and Typical Section of proposed grade separation.
2. Preliminary phasing plan.
3. Photo log with pictures of the proposed project location. Site pictures shall be in all controlling directions including but not limited to, North, East, South and West. The plan view should show a reference location and direction for each picture.

- B.** The 30% submittal shall, at a minimum, include the following:
1. Applicant response to Railroad review comments on the concept submittal. The 30% submittal shall reflect concept review comments.
 2. Structure Type Selection Report.
 3. Design Plans showing a Plan View, Elevation View, Typical Section and Railroad Profile Grade Diagram. See [pg 41, Plan No. 711200, sheet 1](#) for additional details. Plans to include general notes to indicate structure design criteria, construction methods and material compliance specifications.
 4. Shoofly Design. Bridge general plan shall show the location of the shoofly and indicate the footprint of the structure in relation to centerline of shoofly. See [Section 4.2.1](#).
 5. Construction Phasing Plans. Must show all required phasing, construction procedures, temporary shoring layout, controlling dimensions and elevations.
- C.** The 60% submittal shall, at a minimum, include the following:
1. Applicant response to Railroad review comments on the 30% submittal. The 60% submittal shall reflect 30% review comments.
 2. Design Plans and calculations including superstructure and substructure details, bearing details, deck and waterproofing details, miscellaneous bridge details, and a complete set of structural calculations (See [Section 3.5](#)).
 3. Geotechnical Reports/recommendations (See [Section 3.6](#)).
 4. Project Specifications and/or Special Provisions, including Railroad coordination requirements.
 5. Drainage Report, as required. (See [Section 3.7](#)).
 6. Shoofly Design plans and alignment data.
 7. Construction Phasing Plans. Must show all required phasing, construction procedures, temporary shoring layout, controlling dimensions and elevations.
- D.** The Final Plans submittal shall, at a minimum, include the following:
1. Applicant response to Railroad review comments on the 60% submittal.
 2. Revisions to plans and calculations as dictated by review of the 60% submittal.
 3. Geotechnical Reports (See [Section 3.6](#)).
 4. Project Specifications and/or Special Provisions, including Railroad coordination requirements.
 5. Drainage Report, as required. (See [Section 3.7](#)).
 6. Shoofly Design plans and alignment data.
 7. Construction Phasing Plans. Must show all required phasing, construction procedures, temporary shoring layout, controlling dimensions and elevations.
- E.** The As-Built submittal shall, at a minimum include the following:
1. As-Built plans.
 2. Construction Documents.
 3. Shop Plans.
 4. Pile Driving Records.

The Applicant or their representative shall submit As-Built documents for all Underpass Structures to the Railroad Local Representative after completion of the bridge structure and prior to closing the project.

4. GENERAL REQUIREMENTS FOR GRADE SEPARATION PROJECTS

The recommendations provided within this Section are intended for all Grade Separation Projects impacting the Railroad. All Grade Separation Projects shall be designed in accordance with the requirements in this section and the specific requirements of all applicable sections within these Guidelines.

4.1 Grade Separation Structure Type

- a. The most effective method for reducing interference to Railroad operations for construction of Grade Separation Projects is to use an Overhead Structure and avoid an Underpass Structure.
- b. The Railroad discourages Underpass Structures due to safety concerns, possible interruption to Railroad operations, cost, and limitation of future replacement and maintenance.
 1. The Railroad recommends the use of an Overhead Structure which can be designed and constructed without interruption to Railroad operations.
- c. If an Underpass Structure is required the project must temporarily reroute train traffic around the construction site by utilizing a Shoofly track subject to local operating review and approval. Shoofly track(s) shall be designed per [Section 4.2.1](#).
- d. The analysis of Cost-Benefit ratio shall be fully considered before the structure type is finalized. Cost-Benefit ratio must include all costs associated with interruption to Railroad operations during construction of the proposed structure and/or future replacement structure in addition to future maintenance and other applicable costs. However, economy alone shall not be the governing factor in determining structure type.

4.2 Railroad Operational Requirements

- a. The proposed design plans shall allow the Contractor to execute a work plan that enables the track(s) to remain in service and shall cause no interruption to the Railroad's operation during construction.
- b. The Applicant shall contact the Railroad Local Representative in the concept design stages to determine the Railroad operation requirements.
- c. Construction activities that impact Railroad operations must be coordinated with the Railroad. The proposed staging and phasing must be reviewed and approved by the Railroad at the concept stage and subsequent stages. Special Provisions must include Railroad coordination to improve Contractor understanding of Railroad requirements prior to letting of the proposed Grade Separation project.

4.2.1 Shoofly Track(s)

- a. Shoofly track shall be designed for maximum authorized timetable speed, for freight and/or passenger trains, per Railroad track standards and operating requirements.
- b. The proposed shoofly must be designed to account for track settlement.
- c. Construction staging shall be designed to keep the Railroad tracks fully operational at all times except for pre-approved construction windows during cut over operations.
- d. The Applicant must schedule track related submittals per [Table 3-1 or 3-2](#) for Railroad review and approval.
- e. Temporary railroad bridges used for a shoofly must be designed in accordance with AREMA and these Guidelines. Temporary open deck bridges with walkways may be used if a protective cover over the roadway and sidewalks is provided or if the roadway is closed to traffic during construction.
- f. Applicant must contact the Railroad's Local Representative for additional specific restrictions which may apply to the individual Railroad.

4.2.2 Future Track(s)

It is required to investigate the need for future tracks during the conceptual design phase of grade separation structures. Future tracks shall be shown on the plans. See [Section 4.2.3](#) for future freight and commuter track spacing. Space is to be provided for one or more future tracks as required for long range planning or other operating requirements.

4.2.3 Track Spacing and Shifting

- a. The Railroad may require additional clearance to allow shifting of existing tracks according to current track spacing standards, business requirements, operating needs and safety standards. Future track shifting and

direction of shifting must be verified at the preliminary stage of the feasibility study for the proposed Grade Separation Project.

- b. Future freight track centerline shall be located a minimum of 20 feet from the centerline of the nearest existing track.
- c. Future commuter track centerline shall be located a minimum of 25 feet from the centerline of nearest existing or future freight track.
- d. Required spacing for yard or industrial tracks must be verified at the conceptual design stage.

4.2.4 Access Road

- a. It is required to investigate the need for access roads during the conceptual design phase of grade separation structures.
- b. The outside edge of the Access Road shall be located a minimum of 27 feet from the centerline of the nearest existing or future track.
- c. Grade Separation design should include adequate access to existing Railroad facilities along and/or within its right-of-way.
- d. Where provisions are made for more than two tracks, space is to be provided for an Access Road on both sides of the tracks.
- e. The minimum vertical clearance over the outside of access road(s) shall be 18 feet.
- f. For Underpass Structures, access may consist of a:

1. Road on the bridge.

If the bridge maintenance Access Road is part of the main railway structure, the structure shall be designed for Cooper E-80 live load to accommodate any future track needs or modifications. A removable barrier shall be provided to separate the nearest track from the Access Road by retaining the ballast.

2. Road on a separated bridge.

If the bridge maintenance access is a completely separate structure it shall be designed for applicable AASHTO live load. The Access Road width shall be 13 feet to accommodate one lane with curbs and railing.

3. Road with turnarounds.

If a bridge maintenance structure is not provided, an Access Road with a turnaround shall be designed and constructed in conjunction with the grade separation bridge structure. The turnaround pad shall start no further than 30 feet from the end of the bridge structure with the embankment shoulder a minimum of 60 feet from centerline of track. The radius for the turnaround shall be a minimum of 50 feet. Roadway grade shall not exceed 10% and shall terminate at the sub-ballast elevation. The roadway shall have sufficient width to provide for one 13 foot wide road, drainage ditch and shoulder. The turnaround pad and roadway shall be sloped to drain away from the track and carry the water to a drainage system or existing Railroad right-of-way ditches.

4.3 Structure Separation

- a. Vertical and horizontal structure separations shall be subject to the Railroad's existing, proposed or future structure type, size, location and other site constraints.
 1. Non Railroad Structures

All non Railroad structures, with the exception of Access Road structures running adjacent to existing or proposed Railroad structures, shall be outside the Railroad right-of-way limits or as far away as practical.

 - i. Clear horizontal separation between parallel structures shall never be less than 25 feet, measured perpendicular from proposed structure(s) to existing or future Railroad structure(s).
 - ii. Clear horizontal separation between structures perpendicular to Railroad structures shall never be less than 200 feet from the nearest Railroad structure abutment. Replacement of existing structures on existing roadway alignment may be granted exception, as approved by the Railroad.
 2. Railroad Structures

Horizontal separation between Railroad structures, including Railroad Access Road structures, shall be a minimum of 5 feet clear.

4.4 Construction

- a. Railroad's review and approval of construction submittals defined in [Table 3-1](#) or [3-2](#) are required.
- b. It is essential that the construction proceed with no interference to Railroad operations. Continuity of safe rail operation will be required for the duration of the project.
 1. The most effective method for maintaining Railroad traffic is to temporarily reroute Railroad traffic around the construction site using a Shoofly. Shoofly's shall be designed per [Section 4.2.1](#).
- c. The Applicant and its Contractor are responsible to comply with construction documents approved by the Railroad.
- d. The Engineer-of-Record and the Applicant shall evaluate the quality of materials furnished and work performed by the Contractor. All field inspection reports, quality control reports and final As-Built plans shall be submitted to the Railroad.
- e. The project site shall be inspected by the Railroad, at the Applicant's expense during construction and toward the end of construction, for final acceptance before the Contractor demobilizes.
- f. The review of construction submittals and observation of the construction site shall neither relieve the Applicant, Engineer-of-Record nor the Contractor from the ultimate responsibility and liability for the construction on or damages to Railroad property during and after construction of the project.

4.4.1 Temporary Construction Clearances

- a. Temporary horizontal and vertical construction clearances shall be shown on the plans for all Grade Separation Projects. Every effort must be made to design for greater clearances. [See pg 36, Plan No. 711000, Sheet 1.](#)
- b. Greater clearances may be required for special cases to satisfy local operating conditions such as required sight distance for signals.
- c. Reduced temporary construction clearances, which are less than construction clearances defined in [Section 4.4.1.1](#) and [4.4.1.2](#), will require special review and prior approval by the Railroad.

4.4.1.1 Vertical Construction Clearances

- a. A minimum temporary vertical construction clearance of 21'- 6" measured above top of high rail for all tracks shall be provided. The required minimum temporary vertical clearance shall not be violated due to deflection of formwork.

4.4.1.2 Horizontal Construction Clearances

- a. A minimum temporary horizontal construction clearance of 15'- 0", measured perpendicular from the centerline of the nearest track, to all physical obstructions including but not limited to: formwork, stockpiled materials, parked equipment, bracing or other construction supports, shall be provided.
- b. In curved track the temporary horizontal construction clearances shall increase either 6 inches total or 1.5 inches for every degree of curve, whichever is greater.
- c. Temporary horizontal construction clearance shall provide sufficient space for drainage ditches parallel to the standard roadbed section or provide an alternative system that maintains positive drainage.

4.4.2 Shoring

All temporary shoring systems that impact Railroad operations and/or support the Railroad embankment shall be designed and constructed per the Railroad Guidelines for Temporary Shoring.

4.4.3 Demolition

All demolition within the Railroad right-of-way, or which may impact Railroad tracks or operations, shall comply with Railroad demolition requirements.

4.4.4 Erection

- a. Erection over the Railroad right-of-way shall be designed to cause no interruption to Railroad operations. Erection plans shall be developed such that they enable the track(s) to remain open to train traffic per Railroad requirements.
- b. Prior to the release of Railroad traffic, components erected over Railroad tracks must be supported by falsework or permanent substructure, must be secured and stable and must not be supported by cranes or other construction equipment.

4.4.5 Falsework

Falsework clearance shall comply with minimum temporary construction clearances per [Section 4.4.1](#). The design of all structural members for falsework shall comply with AREMA as well as Railroad requirements.

4.4.6 Vegetation

Vegetation to be planted on or immediately adjacent to Railroad right-of-way shall not become a fire hazard to track-carrying structures and/or an obstruction to inspection and maintenance of the structures.

4.5 Drainage

- a. Maintaining Existing Drainage System
 1. The proposed construction shall safely pass high flows and not inhibit low flows, alter the path of the existing drainage system nor increase the drainage on to the Railroad right-of-way. Railroad corridors are constructed with a drainage system designed to keep runoff away from the tracks and ballast. This drainage system includes the parallel ditches along the embankments as well as the bridges, culverts, siphons and other structures that convey runoff beneath the tracks or serve as water-equalizing structures.
- b. Changes to Existing Drainage System
 1. When changes in the drainage system are contemplated by new or replacement construction, or because of drainage problems, the system shall be modified as required to accommodate current-condition runoff including any changes that have occurred in the drainage pattern. The size of the proposed drainage system must conform to the Railroad Hydraulic Criteria described in [Section 4.5.1](#) and [4.5.2](#).
 2. A complete hydrologic and hydraulic study is required whenever new or additional drainage is added to the Railroad right-of-way, or when a drainage structure is scheduled to be added, removed, modified or replaced. The Drainage Report must be in compliance with the requirements described in these Guidelines.

4.5.1 (UPRR only) Hydraulic Criteria for Bridge and Culvert Openings

- a. New and replacement structures as well as project effects to existing structures shall meet the following requirements.
 1. Structures shall be sized to not exceed two high water elevations designated "low chord" and "subgrade." [See Table 4-1](#).
 - i. Low Chord – The water surface elevation for a given flood, per [Table 4-1](#), will not rise above the crown of a culvert or low chord of a bridge.
 - ii. Subgrade – The energy grade line for a given flood, per [Table 4-1](#), will not rise above the bottom of the adjacent subgrade elevation. The bottom of subgrade is defined as 2'- 3" below base of rail elevation.
 2. Provide the energy grade line, water surface elevation and velocity flow for both the existing and proposed hydraulic opening.
 3. In sizing culverts, to the extent practicable, the maximum headwater-to-diameter ratio must be limited to 1.5.
 4. Both the Railroad criteria and local flood flow criteria shall be evaluated and the more conservative of the two shall be adopted in sizing the replacement.

(cont'd)

Table 4-1, High Water Criteria

	Low Chord (Water Surface Elevation limit)	Subgrade (Energy Grade Line limit)
Main Track	50-year flood	100-yr flood
* Secondary or Industry Track	25-year flood	50-year flood
Any Track in FEMA Floodplain	50-year flood (UPRR) 100-year flood (BNSF)	100-year flood

* If the proposed structure is immediately adjacent to a main line bridge(s), or will impact mainline track, the low chord criteria and subgrade criteria shall be as required for Main Track.

4.5.2 (UPRR only) Hydraulic Criteria for Drainage Systems Parallel to Railroad Tracks

- a. The Subgrade criterion per [Section 4.5.1.a.1.ii](#) is to be applied for parallel ditches, open channels and other drainage systems parallel to Railroad tracks.
- b. For open ditches conveying Railroad drainage, refer to the following design standards:
 1. [UPRR Standard Drawings 0001, 0002 & 0003 \(Web Link to Standards\)](#).
- c. Sufficient lateral and vertical clearance must be provided to accommodate construction of the standard flat-bottom railroad ditch or another ditch section based upon the 100 year event; whichever produces the larger ditch. Anything less than this standard is an exception and must be supported by a hydrology and hydraulics report which requires the prior review and approval of the Railroad.
- d. In cases where Railroad's standard hydraulic criteria is not applicable due to topography of the track bed and surrounding ground, the Railroad standard flat-bottom drainage ditch (trapezoidal, 10 ft bottom width, a minimum of 2:1 side slopes, with flowline elevation a minimum of 3 ft below the subgrade elevation) must be incorporated.
- e. Where acquisition of adequate right-of-way is a limiting factor or site characteristics justify smaller drainage systems, a request for variance with sufficient supporting documents must be submitted to the Railroad for consideration.
- f. The applicant must provide hydraulic data (energy grade line, water surface elevation and velocity) for both existing and proposed conditions.
- g. Consideration shall be given to the effects of localized and contraction scour and mitigation, if deemed necessary, and shall be shown on the design plans.

4.5.3 (BNSF only) Hydrologic and Hydraulic Design Criteria

- a. The BNSF Hydrologic and Hydraulic Design Criteria is available upon request.
- b. Systems parallel to Railroad tracks shall be sized according to the BNSF Hydrologic and Hydraulic Design Criteria or the most recent BNSF Standard Roadbed Sections which are available upon request.

4.6 Erosion and Sediment Control

- a. General plans for construction within the Railroad right-of-way shall indicate the proposed methods of erosion and sediment control. They must specifically provide means to prevent sediment accumulation in the ditches and culverts, to prevent fouling the track ballast and sub-ballast and to allow free flow of runoff in the drainage systems during and after construction.
- b. Corrective and/or mitigative construction due to the fouling of Railroad ballast, sub-ballast, ditches, culverts or drainage systems will be at the Applicant's expense. It is the Applicant's responsibility to document the condition of the site before and after construction.
- c. Existing track ditches shall be maintained open at all times throughout the construction period. After the construction is complete, all erosion and sediment control devices must be removed, all sediment deposits removed and the entire project area restored to the pre-construction condition.
- d. The Applicant and/or Contractor are responsible for securing the required permits from Local, State and Federal entities. The Applicant and/or Contractor shall furnish the Railroad all copies of the Storm Water Pollution

Prevention Plan (SWPPP) and approved permits, if required. Further, these documents shall be available on-site during all construction activities. Approval of the erosion and sediment control plan does not relieve the Contractor, Applicant and/or Engineer-of-Record of the ultimate responsibility and liability for compliance with erosion and sediment control requirements.

4.7 Fencing

- a. Where laws or orders of public authority prescribe a higher degree of protection than specified in this section, the higher degree of protection so prescribed shall be deemed a part of this section.
- b. Fence Types
 1. Chain Link – Openings shall not exceed 2 inches.
 2. Wrought Iron Picket Fence – Openings shall not exceed 3 inches and may be used in locations where trespassers may cut a chain link fence.
 3. All Architectural Fencing – Shall require prior review and approval by the Railroad. Architectural fencing shall not allow an opening of more than 2 inches and shall be designed to prevent climbing.
 4. High Security – Locations with trespasser issues, or for reasons deemed applicable by the Railroad, require high security fence design as approved by the Railroad.
- c. Right-of-way fencing
 1. Fencing shall be provided to safeguard the general public and prevent trespassers from entering the Railroad right-of-way and accessing the track or other Railroad structures. Each project will be evaluated on a case by case basis.
 - i. Location – Where possible, fencing shall be located outside the limits of the Railroad right-of-way. Fence may be required on top of abutments, wingwalls, retaining walls, and/or along the Railroad right-of-way.
 - ii. Height – The fencing shall be a minimum height of 8 feet.
 - iii. Length
 1. For projects crossing Railroad Tracks - Fencing shall extend 500 feet, or as site constraints permit, in each direction along the Railroad right-of-way, outside the Railroad right-of-way, at locations as deemed necessary by the Railroad to prevent trespassing.
 2. For projects parallel to Railroad Tracks - Fencing shall extend the entire length of the parallel encroachment on Railroad right-of-way at locations as deemed necessary by the Railroad to prevent trespassing.
- d. Overhead grade separation structure fencing, see [Section 5.4.c](#).

4.8 Retaining Walls

- a. Retaining walls shall be designed to withstand lateral earth and water pressures, any live load and dead load surcharge, the self-weight of the wall, temperature and shrinkage effects, earthquake load and any other applicable loads.
- b. Retained embankment within 50 feet of the centerline of Railroad tracks, supporting Railroad infrastructure and/or within the Railroad right-of-way, shall be of a type approved by the Railroad.
- c. Walls Supporting Railroad Embankment - Shall be of a type approved by the Railroad and shall be designed in accordance with Railroad requirements and the general design principles specified in AREMA.
- d. Walls Not Supporting Railroad Embankment - Shall be designed in accordance per the appropriate codes and specifications and shall be located outside the Railroad right-of-way limits.
- e. Mechanically Stabilized Earth (MSE)
 1. MSE walls are not acceptable for support of railroad embankment.
 2. MSE walls supporting roadways above track level are not acceptable within the Railroad right-of-way or within 50 feet of the centerline of existing or future tracks.
 - i. Use of MSE walls on the Railroad right-of-way, not supporting railroad embankment, require written justification and request for variance for the proposed design. Requests for variance may be rejected.
 - ii. Abutment Protection - Design of approved requests for MSE walls on the Railroad right-of-way, or within 50 feet of the centerline of existing or future track, shall meet the following requirements. The MSE wall shall be at least 2.5 feet thick for a height of at least 12 feet above the top of rail of

nearest existing or future track. Additionally, the bridge abutments shall be supported by deep foundations.

1. Abutments designed without the additional protection as described above should, at a minimum, be designed to:
 - i. Support the future additional weight of the abutment protection as required by Section 4.8.e.ii.
 - ii. Account for any additional width of the abutment protection which would reduce the clearance from the centerline of track to the near face of the abutment.
 2. Should the applicant require the future pier protection to be designed beyond the requirements of Section 4.8.e.2.ii, such designs shall be incorporated per Section 4.8.e.2.ii.1.
 - i. Design requirements greater than required by Section 4.8.e.2.ii shall not be the current nor future responsibility of the Railroad to identify, incorporate and/or design should any pier be deemed necessary of pier protection.
- f. Barrier rail and fencing needs for retaining walls are subject to the retaining wall location and Railroad operating requirements. Barrier rail and fencing shall be placed in a manner to safeguard the general public while securing the Railroad right-of-way. Barrier rail and fencing shall be designed per Section 5.4.

4.9 Embankment Surcharge

For all tracks located near a proposed embankment causing the track bed to be surcharged, the contractor must monitor and record top-of-rail elevations and track alignment. The movement shall be within the limits defined by local Railroad Manager of Track Maintenance (MTM). Displacements exceeding the limits defined by the MTM must be immediately reported to the Railroad. The track shall be adjusted as needed at the expense of the Applicant.

4.10 Utilities

- a. All new or relocated utilities within the Railroad right-of-way will require Railroads prior review and approval.
- b. The Applicant shall be responsible for the identification, location, protection and relocation of all existing overhead and underground utilities. The design plans for the proposed Grade Separation Project shall include complete information on existing and/or proposed relocation of said utilities.
- c. A Railroad Right-of-Entry Agreement (if applicable), per Section 2.3, is required to survey or abandon existing utilities within the Railroad corridor. The Railroad has no obligation to provide property for relocated utilities that do not comply with Railroad's standard specifications and requirements including, without limitation, AREMA and these Guidelines.
- d. No utility attachments will be permitted on Underpass Structures. Existing or future fiber optic lines shall be placed underground and away from the bridge structure.
- e. Appropriate measures for the installation, protection and relocation of fiber optic cables as well as Railroad signal and communication lines shall be addressed in the plans and contract documents. For Railroad requirements and additional information refer to:

UPRR: www.uprr.com

For UPRR Fiber Optic Engineering, "Call Before You Dig", call 1-800-336-9193

For UPRR Grade Crossing/Signal Hotline, call 1-800-848-8715

Please refer to UPRR web site for utility review and approval process and Application.

BNSF: www.bnsf.com

For BNSF Signal/Telecommunications Engineering, "Call Before You Dig", call 1-800-533-2891

For BNSF Grade Crossings, call 1-800-832-5452

Please refer to BNSF web site for utility review and approval process and Application.

4.11 Construction Management Team

For construction of grade separated structures an experienced Construction Management Team will be required during the construction of the bridge structure. Public agencies with qualified bridge structure staff placed on-site during construction will be acceptable; otherwise an outside team must be obtained. Railroad participation during construction is required as indicated in Section 4.11.

The following are minimum requirements for the Construction Management Team:

- a. The Applicant is to submit names and qualifications of person(s) to be used in the project and their assigned duties.
- b. Provide for a qualified quality control inspector to be present during fabrication of steel spans and any major prestressed concrete items.
- c. Provide a list of past projects that each person has actively worked on, including bridge structures (highway or rail), underground facilities and drainage structures.
- d. Provide a verifiable list of employment including a current resume for each person in the Construction Management Team.
- e. Minimum personnel for the Construction Management Team for a typical grade separation structure will consist of:
 1. Project Manager – Primary point of contact, with experience in managing construction projects, for the Construction Management Team.
 2. Resident Engineer – The resident Engineer for the project shall be a registered Civil Engineer with minimum 5 years experience in the field of bridge construction work.
 3. Construction Engineer – A Construction Engineer performs complex professional engineering work in the management of major construction projects from design through completion.
 4. Construction Inspector – Construction Inspector shall perform continuous inspection of construction projects for compliance with plans, specifications and contract documents. The inspector shall be familiar with concrete and steel bridge construction and have current certifications in the fields of inspection involved.
- f. Railroad review and approval of duties, responsibilities, education and experience for each of the above listed members of the Construction Management Team will be required.
- g. All field members of the Construction Management Team are required to have passed and comply with the FRA and Railroad requirements regarding Railroad track safety, bridge fall protection and/or contractor orientation training.

4.12 Railroad Site Observation During Construction

In addition to the office review of submittals, site observation will be performed by the Railroad at significant points during construction, including but not limited to the following, if applicable:

- a. Underpass Structure
 1. Pre-construction meeting.
 2. Shoring systems that impact the Railroad's operation and/or support the Railroads embankment.
 3. Demolition.
 4. Falsework.
 5. Erection.
 6. Acceptance observation of any shoofly before placing it in service.
 7. Foundation installation.
 8. Reinforcement and concrete placement for main bridge substructure and/or superstructure.
 9. Shop observation of fabricated steel spans and/or any major pre-stressed concrete items either by the Railroad or its designated representative.
 10. Erection of steel or precast concrete bridge superstructure.
 11. Deck installation.
 12. Acceptance of waterproofing (prior to placing ballast).
 13. Final observation and acceptance of the bridge structure.
- b. Overhead Structure
 1. Shoring systems that impact the Railroad's operation and/or support the Railroads embankment.
 2. Demolition within the Railroad's right-of-way.
 3. Falsework.
 4. Erection over the Railroad's right-of-way.
 5. Final observation and acceptance of the Overhead Structure.

Site observations are not limited to the milestone events listed above; rather, site visits to check progress of the work may be performed at any time throughout the construction as deemed necessary by the Railroad.

A construction schedule shall be provided to the Railroad Local Representative for their handling with the engineering department. Inform the Railroad's Local Representative of the anticipated dates when the listed events will occur. This schedule shall be updated as necessary, but at least monthly, so that site visits may be scheduled. Final observation and acceptance of the bridge by the Railroad is required before the contractor leaves the job site.

4.12.1 Full Time Inspector

At the Railroad's discretion, provision for a full-time Inspector to verify compliance with Railroad requirements during construction shall be included in the C&M agreement. The inspector may be a Railroad employee or outside party selected by the Railroad. The cost of this inspection shall be included in the total project cost.

5. OVERHEAD STRUCTURES

(Roadway Structures Over Railroad)

5.1 General Design

- a. The Overhead Structure shall be designed according to Sections 1, 2, 3, 4 and 5 of these Guidelines, AREMA and any applicable codes and specifications. Compliance with these Guidelines will expedite the review and approval process of submittals for the Grade Separation Project. Every effort shall be made to utilize a structure type that will not require interruption to Railroad operation during construction.
- b. See [Section 4](#) for General Requirements for Grade Separation Projects.
- c. The preferred Overhead Structure is one that will span the entire Railroad right-of-way. Designs which do not clear span the Railroad right-of-way and/or do not meet vertical clearance requirements should not progress beyond 30% without the Railroad's written approval. Else, the design will be considered 30% complete by the Railroad regardless of the Applicant's percent of completion.

5.2 Permanent Clearances

- a. Permanent clearances shall accommodate future tracks, future track raises, Access Roads and drainage ditch improvements as determined by the Railroad.
- b. Proposed permanent vertical and horizontal clearances shall be adjusted so that the sight distance to any Railroad signal is not reduced unless signal(s) are to be relocated as part of the proposed Grade Separation Project.

5.2.1 Permanent Vertical Clearance (under the structure)

- a. The minimum permanent vertical clearance shall be 23' - 4" (UPRR) or 23' - 6" (BNSF) measured from the top of the highest rail to the lowest obstruction under the structure.
 1. The extent of the permanent vertical clearance shall be a minimum of 9 feet to the field side of the outer most existing or future tracks, measured perpendicular to the centerline of said tracks. See [pg 37, Plan No. 711100, sheet 1](#).
 - i. **In curved track** the above minimum extent of 9 feet shall be increased either 6 inches total or 1.5 inches for every degree of curve, whichever is greater.
 2. The permanent vertical clearance shall extend to cover all existing and future tracks, including the space between.
- b. Additional vertical clearance may be required for adjustment of sag in vertical curve, future track raise, flood considerations, construction and maintenance purposes.
- c. The profile of the existing top-of-rail, measured 1000 feet each side of proposed Overhead Structure, shall be shown on the plans. If the profile indicates a sag at the proposed bridge location, the vertical clearance from the top of the highest rail to the bridge shall be increased sufficiently to permit raising the track to remove the sag. A note should be added to the profile stating, "The elevation of the existing top-of-rail profile shall be verified before beginning construction." All discrepancies shall be brought to the attention of the Railroad prior to the commencement of construction.

5.2.2 Permanent Horizontal Clearance (under the structure)

- a. The need and location for future track per [Section 4.2.3](#) and Access Road per [Section 4.2.4](#), of these Guidelines must be verified with the Railroad in advance of establishing horizontal clearances.
- b. The Railroad requires all piers and abutments to be located outside the Railroad right-of-way limits and to comply with [Section 4.2.3](#) and [4.2.4](#) of these Guidelines.
 1. Where it is impracticable to clear span the Railroad right-of-way, provide written justification and request for variance for the proposed design. The request should succinctly describe geometric, structural and other constraints which make a clear-span alternative unfeasible and shall show that all options have been exhausted. Cost alone should not be the determining factor. See [Section 5.6.1 & 5.6.2](#) for abutment and pier requirements within the Railroad right-of-way.

5.3 Temporary Construction Clearances

The proposed Overhead Structure shall be designed to satisfy temporary construction clearance requirements per [Section 4.4.1](#) and shown on the plans in accordance with [pg 36, Plan No. 711000, Sheet 1](#).

5.4 Barrier Rail and Fence

- a. General Requirements
 1. Barrier rail and fence, designed per this section, shall extend to the limits of the Railroad right-of-way or a minimum of 25 feet beyond the centerline of the outermost existing track, future track or Access Road, whichever is greater.
 2. The minimum combined height of a barrier rail with curved fence shall be 8 feet or with a straight fence shall be 10 feet. The barrier rail and fence shall be detailed in accordance with [pg 39, Plan No. 711100, sheet 3](#).
- b. Barrier Rail
 1. Cast-in-place concrete barrier rail without openings shall be provided on both sides of the superstructure to retain and redirect errant vehicles. The barrier rail shall keep the deck's storm runoff from being deposited onto Railroad right-of-way.
 2. Barrier rail for Overhead Structures shall be a minimum of 42 inches in height for structures in areas which may be subject to snow removal, and a minimum of 30 inches in height elsewhere.
- c. Fence
 1. Fence shall be provided on both sides of all Overhead Structures crossing Railroad right-of-way. It shall be designed to prevent climbing and provide positive means of protecting the Railroad facility and the safety of Railroad employees below from objects being thrown or falling off the structure.
 2. Allowable fence types per [Section 4.7](#).
 3. All parallel Overhead Structures that have a gap of 2 feet or more shall be protected with fencing. Structures with a gap of less than 2 feet shall either have the gap covered or be fenced on both sides.

5.5 Superstructures

- a. Deck drains, future utility installation and expansion or hinge joints for the Overhead Structure over Railroad tracks or inside Railroad right-of-way are not permitted.
- b. The Railroad discourages the use of cast-in-place superstructures and every effort shall be made to utilize a structure type that will not require interruption to Railroad operation during construction.
- c. The use of cast-in-place beams is not permitted. The use of stay in place deck forms for falsework between precast concrete beams or steel girders is encouraged.

5.6 Substructures

- a. Footings for all substructures shall be located and designed to account for temporary clearances per [Section 5.3](#) in order to facilitate shoring and footing construction. Temporary shoring shall be designed per [Section 4.4.2](#).
- b. Drilled shafts within the influence of track surcharge shall be designed and constructed with a permanent casing to protect the track against cave-in, subsidence and/or displacement of the surrounding ground. The casing shall be designed for live loads due to the Railroad surcharge in addition to all other applicable loads.

5.6.1 Abutments

- a. All abutment structures, including toe of abutment slopes, shall be located outside Railroad right-of-way.
- b. See [Section 4.8.e](#) for MSE wall design. Use of MSE walls to retain abutment fill require that the abutment be supported by deep foundations.
- c. Slope layout shall provide for the minimum drainage ditch(es) or culverts required by hydraulic studies in the area; see [pg 37, Plan No. 711100, sheet 1](#) details. The toe of the slope shall terminate at the bottom of drainage ditch and must have a cut-off wall as required to protect the slope from erosion. In all cases, the toe of slope shall be below the finished track or roadway subgrade.

- d. Top of paved slopes shall extend a minimum of 2 feet past the abutment wall face, and terminate with either a curb or gutter to divert runoff. Paving shall have a prepared sub-base and filter fabric. Reinforced concrete or grouted rip-rap, with a minimum thickness of 4 inches, shall be placed on prepared sub-base and filter fabric.

5.6.2 Piers

- a. Abutments and piers shall be located more than 25 feet (UPRR), 27 feet (BNSF) measured perpendicular from centerline of nearest existing or future track. Piers within Railroad right-of-way, or within 25 feet measured perpendicular from centerline of existing or future track, shall be protected per [Section 5.6.3](#) of these guidelines.
- b. A Pier footing within 25 feet of the nearest existing or future track shall be a minimum of 6 feet below the base of rail. This will allow the Railroad to modify its longitudinal drainage system in the future and/or provide an unobstructed area for placing signal, fiber optic or other utilities.
- c. For piers with greater than 25 feet of clearance from centerline of nearest existing or future track and located within the Railroad right-of-way, the Railroad requires language in the proposed Agreement mandating the Applicant to fund the construction of pier protection walls on the bridge piers should they ever be required due to additional trackage being constructed by the Railroad or for any other legitimate reason. The Applicant shall also be responsible for future modification to the pier protection wall if the Railroad deems necessary.
 - 1. Piers designed without pier protection should, at a minimum, be designed to:
 - i. Support the future additional weight of the pier protection as required by [Section 5.6.3](#).
 - ii. Account for any additional width of the pier protection which would reduce the clearance from the centerline of track to the near face of the pier and/or pier protection.
 - 2. Should the applicant require the future pier protection to be designed beyond the requirements of [Section 5.6.3](#), such designs shall be incorporated per [Section 5.6.2.c.1](#).
 - i. Design requirements greater than required by [Section 5.6.3](#) shall not be the current nor future responsibility of the Railroad to identify, incorporate and/or design should any pier be deemed necessary of pier protection.
- d. Inside guardrail may be required, between rails, for all piers located within 18 feet from the nearest existing or future track.

5.6.3 Pier Protection

All replacement or modified structures shall comply with AREMA requirements for pier protection walls.

- a. The pier protection wall shall be designed to resist the impact and redirect equipment in case of derailment. Piers shall be protected, by pier protection wall or heavy construction, where existing or future tracks are within 25 feet from the near face of piers.
 - 1. [Pier Protection Wall](#) – The pier protection wall design shall be in accordance with [pg 40, Plan No. 711100, sheet 4](#).
 - 2. [Heavy Construction](#) – Piers with cross-sectional area equal to or greater than that required for the pier protection wall (30 sq. ft.) with the larger of its dimensions parallel to the track.
- b. If seismic criteria are considered, pier design may require column isolation from the pier protection wall. The pier protection wall may also be required to be supported on an independent footing.
- c. In locations where pier columns and protection walls interfere with drainage, an alternative drainage facility shall be provided to collect and carry water to a drainage system.

5.7 Lighting

- a. All new or modified Overhead Structures which cover 80 linear feet of track or more shall provide a lighting system to illuminate the track area. However, at the discretion of the Railroad, lighting shall be provided for all structures covering less than 80 linear feet of track in areas where switching is performed or where high vandalism and/or trespassing have been experienced. Care shall be taken in lighting placement such that trains will not mistake the lights for train signals nor shall they interfere with the train engineer's sight distance for existing signal aspects. All lights shall be directed downward.
- b. Provide temporary lighting for all falsework and shoring areas.
- c. The minimum lighting design criteria shall be an average of one (1) foot-candle per square foot of structure at the Railroad tracks. Two (2) foot-candle or greater may be required at the discretion of the Railroad. The illuminated area shall extend to the limits of the overhead structure width and the width of the Railroad right-of-

way under the said structure. Fixtures shall be installed on the column walls or caps of the Overhead Structure without reducing the minimum horizontal and vertical clearances.

- d. Maintenance of lights shall be the responsibility of the Applicant. Access to perform any maintenance for lights shall be coordinated with the local Railroad operating unit.
- e. Structures with separation over ten (10) feet from each other shall be considered as independent structures for the purposes of lighting.

5.8 Drainage and Erosion

- a. Drainage from Overhead Structures shall be diverted away from the Railroad right-of-way at all times. Scuppers from the deck shall not be permitted to discharge runoff onto the track or Access Road areas at any time. If drainage of the deck uses downspouts they shall be connected to the storm drain system or allowed to drain into drainage ditches. Concrete splash blocks or aggregate ditch lining will be required at the discharge area of downspouts. Downspouts should be located opposite the track side on piers.
- b. If the layout of abutments, piers or columns with protection walls interferes with the drainage ditches, the designer shall provide an alternative method of handling the longitudinal drainage based on a hydraulic study. This may consist of pipe culverts.
- c. Track drainage ditch limits shall be shown to scale on the project plans and show the distance from the centerline of nearest track. A typical cross section detail shall be shown on the plans.
- d. If the proposed bridge structure will not change the quantity and characteristics of the flow in Railroad ditches and drainage structures, the plans shall include a general note stating so.
- e. Lateral clearances must provide sufficient space for construction of the required standard ditches, parallel to the standard roadbed section. Should the proposed construction change the quantity and/or characteristics of flow in the existing ditches, the ditches shall be modified as required to handle the increased runoff. The size of ditches will vary depending upon the flow and terrain and should be designed accordingly.
- f. All drainage systems shall be in compliance with [Section 4.5](#). Erosion and Sediment Controls shall be in compliance with [Section 4.6](#).

6 UNDERPASS STRUCTURES

(Railroad Structures Over Roadway)

6.1 General Design

- a. The Underpass Structure shall be designed according to Sections 1, 2, 3, 4 and 6 of these Guidelines, the current edition of AREMA and any applicable sections of AASHTO. Compliance with these Guidelines will expedite the review and approval process of submittals for the Grade Separation Project.
- b. See [Section 4](#) for General Requirements for Grade Separation Projects.
- c. Acceptable superstructure types are shown in [Section 6.9.1](#). The use of Railroad standard spans where possible is encouraged.
- d. Only simple spans with ballast decks are allowed. Cast-in-place concrete superstructures are unacceptable.
- e. Designs which do not meet the requirements as prescribed by this document should not progress beyond 30% without the Railroad's written approval. Else, the design will be considered 30% complete by the Railroad regardless of the Applicant's percent of completion.

6.1.1 Design Loads

The proposed Underpass Structure shall be designed for the following loads:

- a. Live load and Impact as specified in AREMA. For multiple track structures, live load shall be calculated based on the assumption that the track(s) can be located anywhere on the bridge with the horizontal clearance to the handrail defined in [Section 6.7.2](#), and a maximum track spacing of 13 feet. For actual track spacing refer to [Sections 4.2.3](#).
- b. Dead load shall include up to 30 inches of ballast from top of deck to the top of tie and all other applicable dead load.
- c. Seismic design shall comply with the criteria of the current edition of AREMA, Chapter 9 - Seismic Design for Railway Structures.
- d. Additional loads shall be applied as specified in Chapters 8, 9, and 15 of AREMA, as applicable.

6.1.2 Construction Material Requirements

Refer to the BNSF or UPRR Standard Construction Specifications for material requirements. Items not addressed specifically in the Railroad Construction Specifications, and this document, shall be in accordance with the applicable sections of the current edition of AREMA.

6.2 Concrete Requirements

All concrete material, placement and workmanship shall be in accordance with Chapter 8 of the current edition of AREMA and the following:

- a. Minimum Compressive Strength – 4000 lb. per square inch at 28 days.
- b. Exposed surfaces shall be formed in a manner that will produce a smooth and uniform appearance without rubbing or plastering. Exposed edges of 90 degrees or less are to be chamfered 3/4" x 3/4". Top surface to have a smooth finish, free of all float or trowel marks with the exception that a broom finish be used on all walkway surfaces.
- c. Concrete shall be proportioned such that the water-cementitious material ratio (by weight) does not exceed the values in AREMA Table 8-1-9. Precast concrete must contain a minimum of 610 pounds of cementitious material per cubic yard of concrete. Cast-in-place concrete must contain a minimum of 565 pounds of cementitious material per cubic yard of concrete. If fly ash is used with cement it shall be limited to 15% of cementitious material.
- d. Cement shall be Type I, II or III Portland Cement per ASTM C150.
- e. Course aggregate shall be size no. 67.
- f. Fine aggregate shall be natural sand.
- g. Admixtures, other than air entrainment, shall not be used without approval by the Railroad.
- h. Membrane curing compound shall conform to ASTM C309 Type 2.
- i. Apply ThoRoc Epoxy Adhesive 24LPL or approved alternate before placing new concrete against hardened surfaces.

- j. For precast elements, the fabricator shall stencil the fabricator's name, date of fabrication, the bridge number, lifting weight and piece mark on each component.
- k. The production facility must be pre-certified. Production procedures for the manufacture of precast members shall be in accordance with AREMA and the current edition of the Precast Concrete Institute's Manual MNL 116 for Quality Control.
- l. Dimensional tolerances governing the manufacture of precast members shall conform to Division VI, Section 6.4.6 of the Precast Concrete Institute's Manual MNL 116 for Quality Control. Tolerance for location of lifting devices shall be $\pm 1/2$ ".
- m. The area around all lifting loops shall be recessed so that the loops can be removed to a depth of $3/4$ " and grouted. Properly designed lift anchors are acceptable in lieu of lifting loops.
- n. The fabricator will be responsible for the loading and properly securing the precast concrete members for shipment. All concrete components shall be made available, at the Railroad's discretion, for inspection by the Engineer-of-Record and the Railroad at the fabricator's plant prior to shipment.
- o. Foam used to create internal voids in a precast concrete member, such as in box beams, shall be securely tied down to prevent displacement during concrete placement.

6.2.1 Reinforcing Steel Requirements

- a. Reinforcing Steel shall be deformed, new billet bars per current ASTM A615 Specifications and meet Grade 60 requirements.
- b. Reinforcing Steel requiring field welding or bending shall conform to ASTM A706 Specifications, Grade 60.
- c. Fabrication of reinforcing steel shall be per Chapter 7 of the CRSI Manual of Standard Practice. Dimensions of bending details shall be out to out of bars.
- d. Reinforcing steel is to be blocked to proper location and securely wired against displacement. Tack welding of reinforcing is prohibited. Minimum concrete cover not otherwise noted shall meet current AREMA requirements.

6.2.2 Prestressing Strand Requirements

- a. Prestressing strand shall be seven wire, uncoated and low relaxation which is in accordance with the requirements specified in ASTM A416, ACI 318 and AREMA Chapter 8.
- b. The strand shall have an ultimate tensile strength of 270 ksi.

6.2.3 Tie Rods

Transverse tie rods shall be provided for all concrete spans utilizing single cell box beams. Wherever possible, transverse tie rods in end and interior diaphragms shall be placed perpendicular to the centerline of webs to facilitate application of transverse post-tensioning.

- a. Transverse tie rods shall be used at span ends and intermediately spaced at maximum intervals of 25 feet.
- b. The minimum size of tie rod shall be 1-1/4 inches in diameter.
- c. Tie rods shall be threaded steel bars with a minimum $f_y = 36$ ksi.
- d. Tie rods shall be tensioned as necessary to ensure that all beam sides are in contact without causing any vertical displacement of the beams from the bearings.
- e. The tie rod shall be protected as follows:
 - 1. Rod, plates and nuts shall be hot dip galvanized per ASTM A123 and A153 specifications
 - 2. Void between rod and hole shall be pressure grouted.
 - 3. The tie rod anchor assembly shall be recessed into the concrete and shall have 1 inch minimum grout cover.

6.3 Structural Steel Requirements

- a. All major elements subjected to railroad live load shall conform to the following minimum specifications, except as otherwise noted:
 - 1. Painted structures: ASTM A709 Grade 50.
 - 2. Unpainted structures: ASTM A709 Grade 50W.
- b. All bolted connections shall be made with high strength bolts.
- c. Material over 4 inches in thickness that is subject to railroad live load shall conform to the following specifications:

1. Painted structures: ASTM A572 or ASTM A588.
 2. Unpainted structures: ASTM A588.
- d. Elements not subjected to direct railroad live load (intermediate stiffeners, lateral bracing, diaphragms, ballast curbs, etc.) shall conform to the following specifications:
 1. Painted structures: ASTM A572 Grade 50, ASTM A36 or ASTM A992.
 2. Unpainted structures: ASTM A588.
 - e. Steel bridge deck shall conform to A709 specifications, Grade 36, non-weathering steel.
 - f. Deck cover plates and closure plates may be per ASTM A36 specifications.
 - g. Anchor rods/bolts shall conform to ASTM F1554 specifications.
 - h. End welded studs shall be C1015, C1017 or C1020 cold drawn steel, which conforms to ASTM A108 specifications.
 - i. Cover plate, closure plates and anchor rods/bolts shall be galvanized after fabrication in accordance with ASTM A123, thickness Grade 100.
 - j. Anchor rod washers shall be zinc coated in accordance with ASTM A153 specifications.

6.4 Access Road

- a. See [Section 4.2.4](#).

6.5 Skewed Structure

- a. On skewed abutments an approach slab is required.
- b. The preferred angle of intersection between centerline of track and the centerline of bridge supports, transverse to the track, is 90 degrees.
- c. The minimum angle that will be allowed between the centerline of the track and the centerline of bridge supports, transverse to the track, is 75 degrees for a Concrete Superstructure and 60 degrees for a Steel Superstructure.
- d. Where conditions preclude compliance with these skew requirements, the skew proposal will require special structural consideration and proof of adequacy.
- e. Align bridge piers and abutments as required to comply with the above maximum skew limitations.

6.6 Approach Slab

- a. The approach slab shall be a minimum of 12 feet wide or greater as deemed necessary by the Railroad and extend parallel to the track a minimum of 3 feet beyond the back edge of the abutment.
- b. The approach slab shall be doweled into the abutment.
- c. For skewed bridge abutments, the approach slab shall also be skewed to match the abutment while the other end of the approach slab is perpendicular to the centerline of track.

6.7 Clearances

Permanent clearances shall be correlated with the methods of construction to ensure compliance with the temporary clearances specified in [Section 4.4.1](#).

6.7.1 Permanent Vertical Clearance (under the structure)

- a. Underpass Structures shall be designed to ensure that the structure will be protected underneath from oversized or unauthorized loads by providing sufficient vertical clearance and protective devices unless otherwise specified by the Railroad.
- b. Provide a minimum vertical clearance over the entire roadway width for all new or reconstructed structures as follows:
 1. 16'-6" for steel superstructure with 5 or more beams or 4 or more deck plate girders per track.
 2. 17'-6" for concrete superstructure or steel through plate girders with bolted bottom flanges.
 3. 20'-0" for steel through plate girders without bolted bottom flanges.
- c. The vertical clearance must not be violated due to the deflection of the superstructure, use of a sacrificial impact protection device or any other reason. Additional vertical clearance may be required by the Railroad.
- d. Variance from vertical clearances defined above shall require prior review by the Railroad. The variance request shall provide exhaustive justification. Cost shall not be the determining factor.

- e. If resurfacing or any other activity is to be performed below the Underpass Structure, the owner of the roadway must submit a request for approval from the Railroad. This request must provide the existing measured and posted clearances of the structure and the proposed configuration after work is completed.

6.7.2 Permanent Horizontal & Vertical Clearances (on the structure)

- a. Permanent Horizontal and Vertical Clearances on an Underpass Structure shall conform to the requirements of AREMA, Chapter 15, Part 1 and [Section 6.9.5](#).
 - 1. **In curved track** the horizontal clearances shall be increased either 6 inches total or 1.5 inches for every degree of curve, whichever is greater.
- b. Proposed structures that accommodate multiple tracks, both future and existing tracks, with spacing less than 20 feet shall be designed for a minimum of 20 foot spacing measured centerline to centerline.

6.8 Sacrificial Impact Protection Devices

- a. All structures with vertical clearances less than defined in [Section 6.7.1](#) shall be protected with a sacrificial device on each side of the structure.
- b. Protection may be in the form of a redundant steel or concrete fascia beam.
- c. Diaphragms connecting the redundant beam to the adjacent beams shall be designed to limit their impact and damage, if struck, to the adjacent beams.
- d. Concrete fascia beams used as walkways shall be installed adjacent to the proposed structure and may also serve as a sacrificial beam.
 - 1. If a concrete fascia beam is used as a sacrificial beam it shall have a 6" x 6" x 1" embedded steel angle and shall be adequately anchored to the bridge seats.

6.9 Superstructure

The size of the superstructure must accommodate future track(s) per [Section 4.2.3](#) and Access Road per [Section 4.2.4](#). For typical cross sections of select superstructures see [pg 42, 43 & 44, Plan No. 711200, sheets 2, 3 & 4](#).

6.9.1 Acceptable Superstructure Types

- a. The following is a list of Underpass Structure types that are acceptable to the Railroad and listed in the order of preference. The Railroad's preferred superstructure type is the highest listed feasible alternative unless a detailed type selection report provides justifications that a lower listed alternative is more beneficial to the Railroad and to the project.
 - 1. Rolled Beams with Steel Plate Deck. There shall be at least five beams per track.
 - 2. Steel Plate Girders with Steel Plate Deck. There shall be at least four girders per track.
 - 3. Rolled Beams with Concrete Deck. There shall be at least five beams per track.
 - 4. Steel Plate Girders with Concrete Deck. There shall be at least four girders per track.
 - 5. Railroad Standard Prestressed Precast Concrete Double Cell Box Beams.
 - 6. Prestressed Precast Concrete Box Beams, single or double cell for span of 50 feet or less.
 - 7. Prestressed Precast Concrete AASHTO Type Beams, (or similar) with Concrete Deck for spans of 100 feet or less.
 - 8. Steel Through Plate Girders with Steel Plate Deck will be considered by the Railroad when conditions preclude any other structure type.
- b. Underpass Structures of deck truss or through truss design are discouraged. However, in unusual circumstances, they will be considered by the Railroad if conditions preclude the use of any other type of structure.
- c. Where possible, use of Railroad standard spans are encouraged.

6.9.2 Deck Requirements

- a. Deck Type – In all cases when using a steel superstructure the use of a steel deck, per [Section 6.3.e](#), is preferred. The deck must be designed to prevent ballast or other material from falling through.
- b. Deck Width – The deck width shall be a function of future track, Access Road, existing track(s), minimum horizontal clearance per [Section 6.7.2](#) and a minimum of 20 foot spacing between centerlines of tracks.

- c. Ballast Depth – The minimum required depth of ballast shall be 12 inches measured from the top of deck to the bottom of tie, as required by the Railroad. The Railroad may require 13 inches of ballast depth below timber ties allowing for increased depth of future concrete ties.
- d. Ties
 - 1. (UPRR) Concrete ties on ballast deck structures and approach slabs require a bottom rubber pad meeting UPRR requirements.
 - 2. (BNSF) Concrete ties on ballast deck structures and approach slabs require BNSF approval and must meet BNSF requirements.
- e. Inside Guardrail – Inside guard rails are required across the following bridge span types. Contact the Railroad to receive the guard rail standards.
 - 1. Thru truss, pony truss, deck trusses on towers, deck plate girders on towers, thru plate girders (for span lengths over 100 feet), movable spans and others structures as designated by the Railroad.

6.9.3 Composite Deck

Steel superstructure design may utilize composite action with the deck according to the following:

- a. Steel superstructure with composite concrete deck.
 - 1. Shall be designed as composite for E80 live load and impact.
 - 2. Shall be checked as non-composite for E65 live load and impact.
 - 3. Shall satisfy the AREMA deflection requirements for E80 live load and impact as composite.
 - 4. Shall have shear transfer devices designed per AREMA.
- b. Steel superstructure with composite steel deck.
 - 1. Shall be designed as non-composite for E80 live load and impact.
 - 2. Shall satisfy the AREMA deflection requirements for E80 live load and impact as composite.
 - 3. Shall have shear transfer connections designed per AREMA.

6.9.4 Ballast Retainers, Fences and Handrails

- a. Ballast retainers must be designed to prevent ballast from falling on the roadway.
- b. Handrails shall be provided on both sides of the deck and shall meet FRA and OSHA requirements.
- c. Fencing may be included where required by the Applicant or the Railroad. Handrails and fences shall be simple designs that require minimum maintenance and shall meet clearance requirements of [Section 6.7.2](#).

6.9.5 Walkway

- a. Walkway ballast section or walkway structure shall be provided on both sides of Underpass Structures.
 - 1. Walkway Ballast – The ballast section may be used as walkway at the discretion of the Railroad provided that the clear distance from centerline of track to the ballast retainer is a minimum of 8'-0".
 - 2. Walkway Structure – If a non-ballast walkway surface is required, it shall be a minimum of 2'-6" wide.
- b. On bridges over roadways, or other locations, and where spillage of ballast or lading is possible, the walkways shall be constructed of solid material and a curb or toe board shall be provided at a height of 4 inches from top of walkway.
- c. To prevent cracking under live loads, 1/4 inch control joints shall be provided in concrete curbs, concrete walkways and concrete ballast retainers and shall be spaced at 10 feet or less for the length of the structure.
- d. When walkway structures are used, provide a detail showing the walkway transition from bridge to roadbed at bridge ends. Where there is a vertical distance from the roadbed walking surface to the bridge walkway, adjust the roadbed walkway profile to eliminate the vertical separation or provide other means to provide a safe transition. The design shall not restrict drainage at the abutments and shall be submitted to the Railroad for review.

6.9.6 Drainage

- a. General
 - 1. A minimum longitudinal grade of 0.2% on the superstructure shall be provided to ensure adequate drainage.
 - 2. The designer may provide drainage toward one end of the structure, or when the structure's length is excessive, provide adequate deck grades to drain the structure to both ends.

3. If the top-of-rail grade is less than 0.2% over the length of the structure then the depth of ballast may be varied along the structure.
 4. If an approach grade descends toward the bridge, drainage from the approach shall be intercepted by an appropriate system so that it will not drain onto the bridge.
 5. Inadequate drainage facilities can severely limit the life span of the superstructure. When designing drainage facilities for a structure, two important criteria to keep in mind are:
 - i. Drains should be constructed of corrosion resistant material and the use of PVC shall not be permitted.
 - ii. Drains should not discharge on other bridge elements or traffic passing underneath the structure.
- b. Concrete decks
1. The top of the concrete deck shall be sloped a minimum of 0.5% transversely.
 2. For concrete decks, a longitudinal collection system shall be provided on top of the waterproofing along the face of parapet or curb to drain water. Longitudinal drains shall be connected to the storm drain system or properly discharged at the toe of embankment slopes. See [pg 45, Plan No. 711200, sheet 5](#).
 3. The drip groove located on the bottom of the deck slab or fascia beam shall end 3 feet before the face of the abutment.

6.9.7 Waterproofing

- a. Waterproofing and protective panels shall comply with the recommendations of Chapter 8, Part 29 of AREMA and shall be the following type, as approved by the Railroad:
 1. Cold liquid spray on waterproofing meeting AREMA requirements, as approved by the Railroad.
 - i. Shall be protected with either a single 1/2 inch layer of asphalt panels or an additional spray on protection board layer, as approved by the Railroad.
- b. Six (6) inches of ballast shall be placed over waterproofing immediately upon acceptance by the Railroad. Construction traffic is not allowed on waterproofing until the ballast covering is in place.
- c. Waterproofing installation shall be observed and approved by the manufacturer's representative.

6.9.8 Steel Superstructure

The steel superstructure shall be designed per AREMA Volume 2, Chapter 15, unless otherwise required by the Railroad or herein.

- a. Fracture critical member material, fabrication, welding, inspection and testing shall be in accordance with AREMA, Volume 2, Chapter 15.
- b. The minimum diameter of high strength bolts shall be 7/8 inch diameter.
- c. Bolted joints shall be designed as slip critical using the allowable stresses for a slip coefficient of 0.33.
- d. The railroad may require critical structural elements to be designed with additional sacrificial thickness for future corrosion.
- e. Diaphragms or cross frames shall be provided for all steel spans.
- f. Jacking stiffeners or jacking beams are required for all steel structures.
- g. Girders shall have mechanically-connected bottom flanges and intermediate stiffeners when:
 1. The girder span is over a roadway and the use of two girders per span or track cannot be avoided (such as a through plate girder) and
 2. Twenty (20) feet of vertical clearance cannot be provided.
- h. Cover plates, flange elements and intermediate stiffeners shall comply with the following requirements:
 1. Cover Plates
 - i. Cover plates of girders with bolted flanges shall be equal in thickness or shall diminish outwardly in thickness.
 - ii. No plate shall be thicker than the flange angles.
 - iii. The gross area of cover plates in any flange shall not exceed 70% of the total flange.
 - iv. The total flange consists of cover plates, flange angles directly connected to the cover plates and side plates.
 - v. The area of any flange element (flange angle, cover plate or side plate) shall not exceed 50% of the total flange.
 2. Flange Elements

- i. Flange elements that are spliced shall be covered by extra material equal in section to the element spliced.
 - ii. There shall be enough bolts on each side of the splice to transmit to the splice material the stress value of the part cut.
 - iii. Flange angles may be spliced with angles or with a full penetration weld.
 - iv. No two elements shall be spliced at the same cross section or within the development length of another spliced element.
 - v. Welded splices will not be allowed in plate elements of bolted flanges.
3. All intermediate stiffeners shall have a bolted connection to the web.

6.9.9 Painting of Steel Structures

- a. Painting of steel structures shall comply with the current requirements of AREMA, AASHTO specifications and recommendations of the Steel Structures Painting Council (SSPC).
- b. Painting of existing Railroad structures is discouraged. Painting may be considered if the structure is free of existing defects, cracks, damage or otherwise which requires inspection.
- c. Paint shall be applied in accordance with the Manufacturer's recommendations or as recommended by the SSPC, whichever is most restrictive.
- d. The painting system, including primer and top coats, shall be submitted by the Applicant for review and approval by the Railroad and must be maintained by the Applicant.

6.9.10 Concrete Superstructure

- a. Live load distribution for precast prestressed concrete single or double cell box beams shall be in accordance with Chapter 8, Part 2, Reinforced Concrete Design, Article 2.2.3.c of AREMA. This means that it shall not be assumed that the live load is necessarily equally distributed to the number of boxes supporting the tracks.
- b. Box shaped (Single or Double void) or AASHTO type precast prestressed concrete beams for all spans shall be designed with end and interior diaphragms. Interior diaphragms shall be spaced equally across the span length.
- c. Ends of strands are to be cut flush with the end of the product and painted with an approved coating.
- d. For AASHTO type beams, the designer shall provide a minimum of eighteen (18) inches clear between the bottom flanges to accommodate inspection and repair.

6.10 Substructure

- a. Pier and or abutment dimensions must accommodate future track(s) and Access Road per [Section 4.2.3](#) and [4.2.4](#).
- b. Footings for all substructures shall be located and designed to allow a minimum of 12 feet measured perpendicular from centerline of nearest active track to face of shoring to facilitate footing construction. Temporary shoring shall be designed per [Section 4.4.2](#).
- c. Cross-hole Sonic Log (CSL) Testing is required for every drilled shaft to evaluate the integrity of drilled shafts/caissons. The Plans and Specifications shall include provisions for this testing. Use steel pipes and not PVC for testing holes.
 - 1. Other testing methods may necessary, as required by the Railroad.
- d. Drilled shafts within the influence of track surcharge shall be designed with permanent or temporary casing for protection against cave-in, subsidence and or displacement of surrounding ground. Casing shall be designed for live load due to the Railroad surcharge in addition to all other applicable loads. Drilled shafts shall be designed to allow the drilling operation to proceed without impacting the Railroad operation.

6.10.1 Piers

- a. Columns shall be at least 0.2H in thickness at the base.
- b. Slope the top of bridge seat to drain. If weathering steel is used for the superstructure, detail the bridge seat to minimize water staining concrete surfaces.
- c. Provide a minimum of 6 inches from edge of masonry plate or bearing to edge of concrete.
- d. Provide a minimum of 18 inches beyond the outside edge of outermost masonry plate or bearing to end of the pier.

- e. Single column piers shall not be considered for Underpass Structures. Piers with a minimum of two columns shall be provided. A solid pier wall with minimum of 4 feet thickness is preferable.
- f. Bridge piers adjacent to roadways shall be protected from vehicular traffic as required per AASHTO and State Department of Transportation standards.

6.10.2 Abutments

- a. Slope the top of bridge seat to drain. If weathering steel is used for the superstructure, detail the bridge seat to minimize water staining concrete surfaces.
- b. The abutments shall be wide enough to satisfy the Railroad standard roadbed. For multiple track bridges, the abutment width shall be sufficient to provide for the standard shoulder, plus 20 feet for each existing or future track.
- c. Provide a minimum of 6 inches from edge of masonry plate or bearing to edge of concrete.
- d. Sloping embankments in front of abutments shall be paved or have grouted rip-rap on top of filter fabric.
- e. The year of construction shall be shown at the face of abutment backwall. Numbers shall be embedded into the concrete and be 6 inches size and located where visible.
- f. Wing walls shall be designed to support 2:1 embankment slopes and provide positive ballast containment.

6.10.3 Signage and Miscellaneous

- a. The Railroad's standard "No Trespassing" and bridge number signs shall be furnished and installed as required by Railroad standards.
- b. Clearance signs, advance signs and other roadway signage shall be the responsibility of the roadway agency. Signs may not be attached to the bridge.
- c. The Applicant shall be responsible for graffiti removal from the structure, regardless of other provisions for division of maintenance responsibility.

7 TRAILS

(Non-Vehicular Crossing over or under the Railroad)

All Trails impacting the Railroad shall be designed in accordance with Section 1, 2, 3, 4 & 7 of these Guidelines, the Manual of Uniform Traffic Control Devices (MUTCD), AASHTO code and any applicable sections of AREMA.

7.1 At Grade Crossing

- a. The Railroad does not allow at grade Trail crossings. Alternative plans should be considered to avoid crossing Railroad tracks at grade.
- b. At grade crossings immediately adjacent to an existing public roadway crossing with existing Highway Railroad warning devices may be considered. However, all costs associated with the installation of the new crossing surface and crossing warning device changes or relocation will be borne by the Applicant.
- c. Scope of proposed crossing work will be determined at a joint diagnostic meeting between the Railroad and Applicant.
- d. The Trail must conform to Railroad and MUTCD requirements.

7.2 Trail Parallel to Track

- a. The Railroad does not allow Trails parallel to the track on Railroad right-of-way and does not permit the use of Railroad Access Roads for trail use.
- b. Railroad structures cannot be used to serve Trail traffic or support a structure serving Trail traffic.
- c. Fences or barriers such as vegetation, ditches, and/or berms shall separate Trails that are outside the Railroad right-of-way and running parallel to the track to stop trespassers from entering the Railroad right-of-way.

7.3 Grade Separated Crossing

Consider the use of existing structures to cross the Railroad tracks. In accordance with Homeland Security requirements some Railroad sites and structures are off limits for Trail use and crossing.

7.3.1 Overhead Crossing (Trail over Railroad)

New and existing Overhead Structures must be designed or modified with a protective curved fence. See [pg 39, Plan No. 711100, sheet 3](#). New Overhead Structures shall be designed per [Section 5](#) of these Guidelines.

7.3.2 Underpass Crossing (Railroad Structure over Trail)

The Railroad discourages the construction of new Underpass Structures. If an Underpass Structure is the only feasible structure type for the proposed site, a detailed type selection report must be submitted to justify its use. Underpass trail crossings which also serve to convey water are not permitted.

7.3.2.1 New Underpass Crossing

New Underpass Structures shall be designed per [Section 6](#) of these Guidelines.

All pipe and concrete box culverts shall be designed per Railroad requirements and any applicable sections of AREMA. Confined structures are discouraged. To improve safety and sight distance all structures shall be tangent without curvature. The clear width and height of pedestrian structures shall be subject to the project site and structure length. The line of sight, historical security data and lighting shall be used for determining the required size of opening. Vertical Clearance shall not be less than 8 feet.

7.3.2.2 Crossing Under Existing Structures

- a. The Railroad may reject, at its discretion, the use of any existing Underpass Structure for Trail use.
- b. Existing culvert pipe, box or arch structures, designed to convey water, are not permitted for trail crossing use.
- c. An open deck structure shall be modified to a ballast deck or solid deck structure to maintain a safe crossing under a Railroad structure. If modifying an existing open deck structure is not practical, provide a protective cover over the Trail.

- d. Protection from falling debris is required for the crossing of pedestrians safely under active rail bridges. The overhead protection shall extend a minimum of 30 feet out on each side of the Railroad structure, or further as designated by the Railroad's engineering department. However, the protective cover shall not reduce the existing hydraulic opening, shall not function as a debris catcher and shall not impact proper inspection of the structure by Railroad personnel.
- e. Measuring from bottom of the Railroad structure to the top of the protective cover shall not be less than 3 feet to allow for inspection and shall not be attached to the structure. If the Applicant can not meet these requirements then the Applicant shall provide a removable hatch to allow Railroad personnel to inspect the bridge structure.
- f. The protective cover shall be removable and can be removed, at the Applicant's expense, without advanced notice if deemed necessary by the Railroad.
- g. A protective cover shall be required, meeting the above criteria, for ballast deck bridges unless the superstructure meets the requirements of [Section 6.9.4](#) and retains the ballast to a sufficient degree as approved by the Railroad.

7.4 Drainage

The drainage pattern of the site before and after construction shall be analyzed. Adequate drainage provisions shall be incorporated into the plans and specifications. Detailed Hydraulic Report may be required subject to site condition. The Hydraulic report must meet the Railroad Hydraulic Criteria per [Section 4.5](#).

7.5 Fence

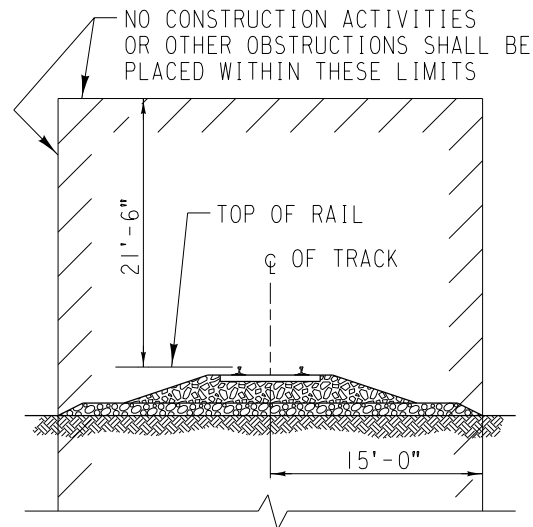
- a. The Applicant shall specify the appropriate fencing to contain the Trail traffic within the Trail, crossing the Railroad right-of-way. Fence limits are subject to each project site and must be determined on a case by case basis. Refer to [Section 4.7](#) for fence requirements.
- b. Fencing shall be located where it will not impede Railroad's access to the bridge for inspection and shall be removed and replaced at the Applicant's expense when necessary for access by the Railroad.
- c. All Railroad right-of-way fencing, for Trails adjacent to the Railroad right-of-way, must be provided, installed outside Railroad right-of-way and maintained by the Applicant.

7.6 Signs

- a. All access to Trails crossing railroad track shall be protected with bollard posts and signs prohibiting non-authorized vehicular access.
- b. All advisory and regulatory signs shall be in compliance with MUTCD and AASHTO. "No Trespassing" signs shall be posted every 500 feet.

7.7 Lighting

Adequate lighting shall be provided per AASHTO Roadway Lighting Design Guide requirements. Dark, confined, and isolated Trail crossings hidden from public view may attract illegal activities. Line of sight is extremely important when visibility is a matter of safety and security. The lighting design shall account for the impact on train operations. Lighting shall provide visibility for the Trail without directing light toward the train traffic.



MINIMUM CONSTRUCTION CLEARANCE ENVELOPE
(NORMAL TO RAILROAD)



BRIDGE STANDARDS

GRADE SEPARATION GUIDELINES

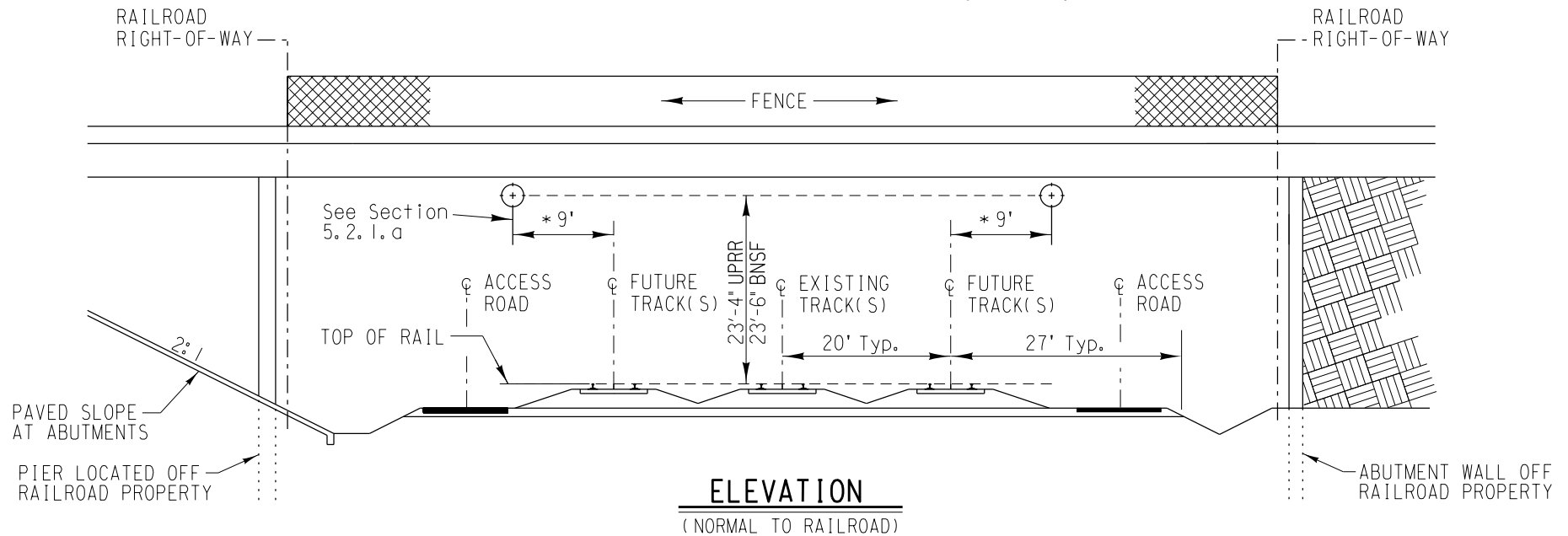
**TEMPORARY CLEARANCE
ENVELOPE**

DESIGN BY: RAF	CHECKED BY: AMH
APPROVED:	
<i>Rick Friesen</i>	
UPRR - SENIOR MANAGER STRUCTURES DESIGN	
<i>Austin M. Huest</i>	
BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN	

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PLAN NO.: 711000	SHEET: 1

PLOTTED: 5/12/2016 9:14:09 AM

Overhead bridges shall be designed to completely span the Railroad Right-Of-Way.
Piers shall be located outside Railroad Right-of-Way.



ELEVATION
(NORMAL TO RAILROAD)

CONSTRUCTION NOTES:

1. Any shoring system that impact the Railroad operations and/or supports Railroad embankment shall be designed and constructed per the Railroad temporary Shoring requirements.
2. All demolition within the Railroad right-of-way and/or demolition that may impact the Railroad tracks or operations shall comply with the Railroad demolition requirements.
3. Erection over the Railroad right-of-way shall be designed to cause no interruption to all Railroad operations.
4. The elevation of the existing top-of-rail profile shall be verified before beginning construction. All discrepancies shall be brought to the attention of the Railroad prior to construction.
5. The proposed grade separation project shall not change the quantity and/or characteristics of the flow in the Railroad ditches and/or drainage structures.
6. The contractor must submit a proposed method of erosion and sediment control and have the method approved by the Railroad prior to beginning any grading on the project site.
7. For Railroad coordination please refer to the Railroad's Coordination Requirements as part of the Specifications or Special Provisions of the project.
8. Temporary Construction Clearances, including falsework clearances, shall comply with Figure 1.
9. All permanent clearances shall be verified before project closeout.

* See Section 5.2.1.a for Curved Track adjustments.

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APPROVED:	
<i>Rick Friesen</i>	
UPRR - SENIOR MANAGER STRUCTURES DESIGN	
<i>Austin M. Huest</i>	
BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN	



BRIDGE STANDARDS

GRADE SEPARATION GUIDELINES

**GENERAL OVERHEAD
STRUCTURE DRAWING**

FILE OWNER: UPRR	DATE: 1/05/16
PLAN NO.: 711100	SHEET: 1

PLAN

1. North Arrow
2. Centerline of bridge and/or centerline of project.
3. Track layout and limits of Railroad right-of-way with respect to centerline of main lines.
4. Footprint of proposed superstructure and substructure including existing structure if applicable.
5. Future tracks, access roadways and existing tracks as main line, siding, spur, etc.
6. Vertical & Horizontal Clearances from Railroad Track:
 - a. Point of minimum vertical clearance and distance, measured perpendicular, from the centerline of nearest track.
 - b. Horizontal clearance at right angle from centerline of nearest existing or future track to the face of obstruction such as substructure above grade.
 - c. Horizontal clearance at right angle from centerline of nearest existing or future track to the face of nearest foundation below grade.
 - d. Horizontal spacing at right angle between centerlines of existing and/or future tracks.
7. Limits of shoring and minimum distance at right angle from centerline of nearest track.
8. Locate and show all existing facilities and utilities and their proposed relocation, if required.
9. Toe of slope and/or limits of retaining wall.
10. Limits of grading with existing and proposed contours.
11. Limits of barrier rail and fence.
12. Minimum structure separation for adjacent structures.
13. Railroad Milepost and direction of increasing Milepost.
14. Direction of flow for all drainage systems within project limits.
15. Timetable direction arrows, nearest Railroad station and end station of Railroad Subdivision.

ELEVATION

1. Individual span length and total bridge length.
2. Limits of barrier rail and fence with respect to centerline of track.
3. Depth of foundation below bottom of tie.
4. Horizontal clearance at right angle from centerline of nearest existing or future track to the face of obstruction such as substructure above grade.
5. Indicate horizontal spacing at right angle between centerlines of existing and/or future tracks.
6. Minimum horizontal clearance at right angle from centerline of nearest existing or future track to the face of foundation below grade.
7. Indicate top and bottom of pier protection wall elevation relative to top of rail elevation.
8. Controlling dimensions of drainage ditches and/or drainage structures.
9. Top of rail elevations for all tracks.
10. Minimum permanent vertical clearance above top of high rail to the lowest point under the bridge.
11. Existing and proposed groundline & roadway profile.
12. Show elevation of existing or relocated utilities.
13. Show slope and specify type of slope paving. Toe of slope shall be shown relative to drainage ditch and top of subgrade.

14. Show and label future tracks, access roads and existing tracks as main line, siding spur, etc.
15. Show location of deck joints.
16. Location of deck drains.

TYPICAL SECTION

1. Total width of superstructure.
2. Width of shoulder and/or sidewalk.
3. Height and type of barrier rail and fence.
4. Depth of superstructure.


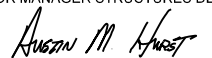
TITLE BLOCK



1. The name & logo of engineering firm or project owner.
2. Drawing title.
3. Railroad milepost number and subdivision.
4. City, county and state.
5. Project name and location.
6. Date.
7. Latitude and longitude.

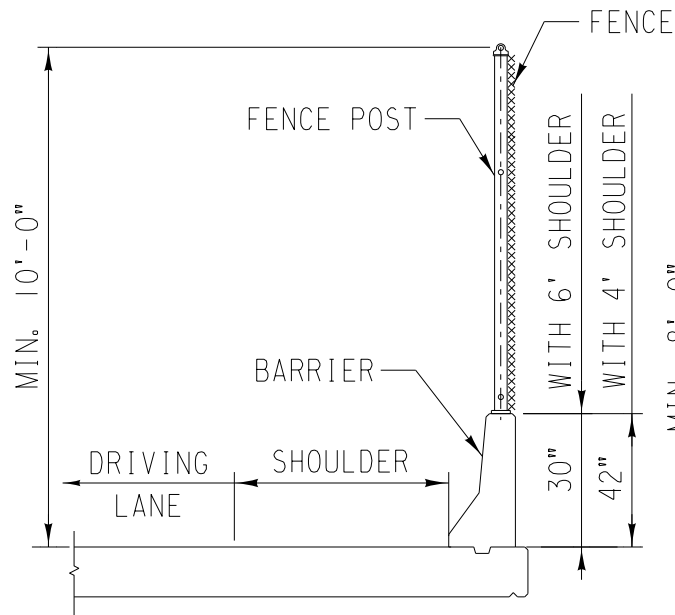
RAILROAD PROFILE GRADE DIAGRAM

1. Show existing and proposed track profile at the bridge location and a minimum of 1,000 feet past each edge of the bridge.

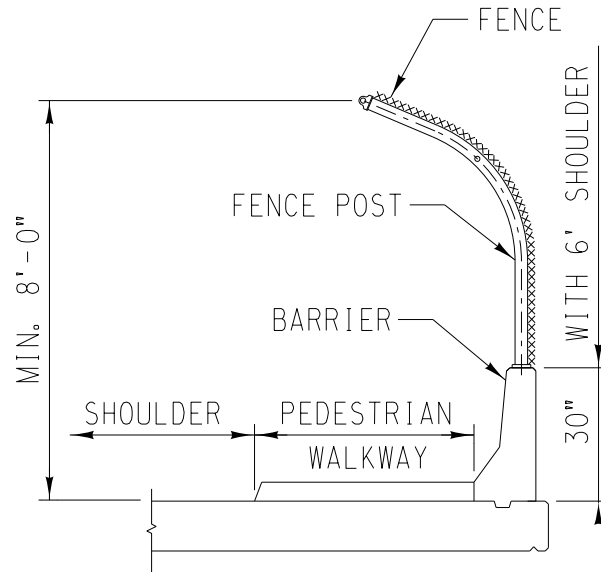
Note: The Railroad Milepost is calculated at the intersection of centerlines of the Overhead Structure and Existing Track. All separate Overhead Structures shall have individual Milepost designations.

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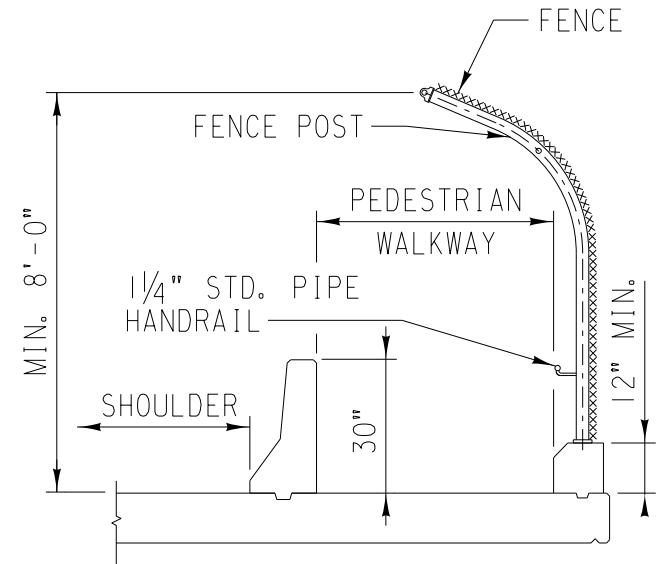
	
BRIDGE STANDARDS GRADE SEPARATION GUIDELINES MINIMUM LAYOUT REQUIREMENTS FOR OVERHEAD STRUCTURES	
FILE OWNER: UPRR	DATE: 1/05/16
PLAN NO.: 711100	SHEET: 2



FENCE ON BARRIER



WALKWAY FENCE ON BARRIER



WALKWAY FENCE ON CURB WITH BARRIER

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APPROVED:	
<i>Rick Friesen</i>	
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<i>Austin M. Hurst</i>	
BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN	



BRIDGE STANDARDS

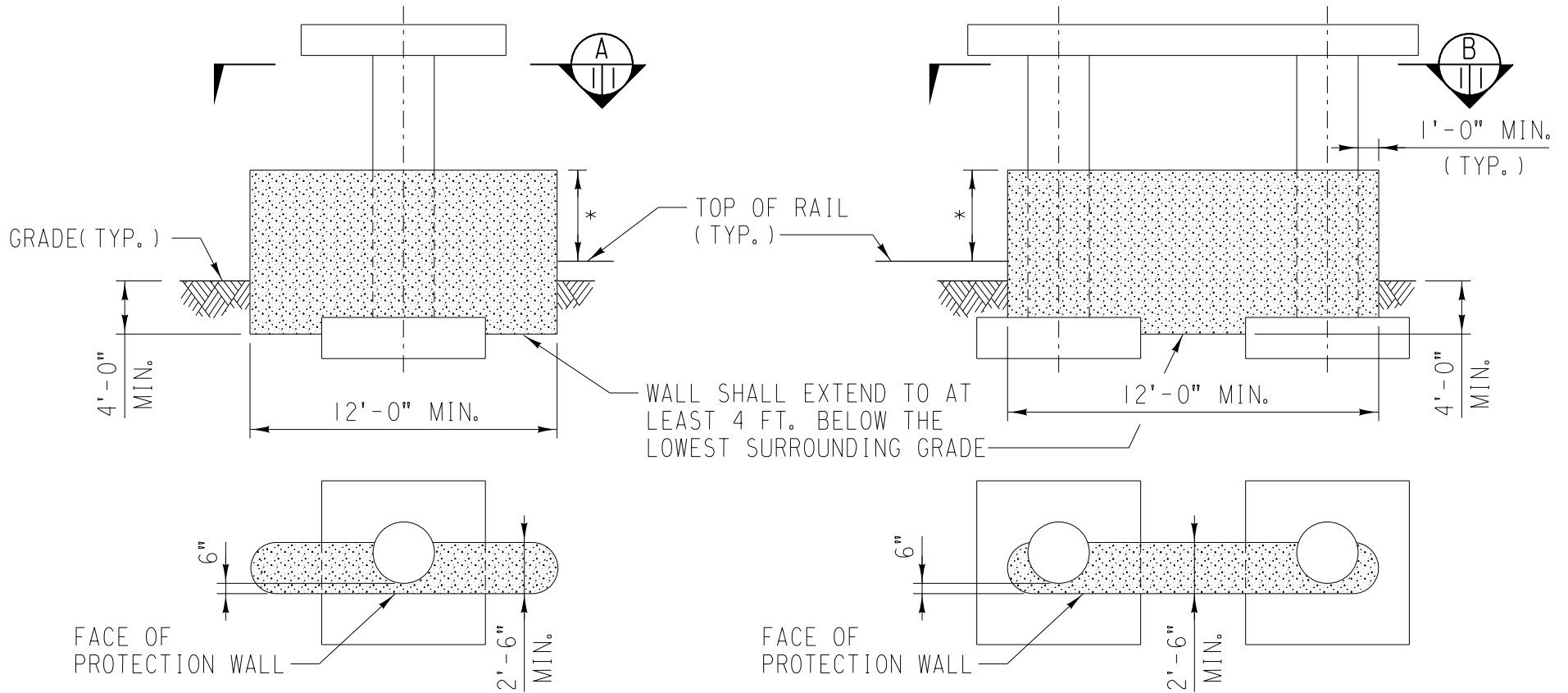
GRADE SEPARATION GUIDELINES

OVERHEAD STRUCTURE BARRIERS AND FENCES

FILE OWNER: UPRR	DATE: 1/05/16
PLAN NO.: 711100	SHEET: 3

SINGLE COLUMN DESIGN

MULTI-COLUMN DESIGN



SECTION A
SCALE: 1/8" = 1'-0"

SECTION B
SCALE: 1/8" = 1'-0"

* 6'-0" MINIMUM FOR PIERS FROM 12 FT. TO 25 FT. CLEAR FROM THE CENTERLINE OF EXISTING OR FUTURE TRACK.

12'-0" MINIMUM FOR PIERS LESS THAN 12 FT. CLEAR FROM THE CENTERLINE OF EXISTING OR FUTURE TRACK.

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APPROVED:	
<i>Rick Friesen</i>	
UPRR - SENIOR MANAGER STRUCTURES DESIGN	
<i>Auston M. Huest</i>	
BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN	



BRIDGE STANDARDS

GRADE SEPARATION GUIDELINES

**STANDARDS FOR
PIER PROTECTION WALLS**

FILE OWNER: UPRR	DATE: 1/05/16
PLAN NO.: 711100	SHEET: 4

PLAN

1. North Arrow.
2. Alignment of centerline of bridge and/or horizontal control line of project, centerline of existing track(s), centerline or future track(s), centerline of shoofly, centerline of roadway. Identify tracks as main, siding, etc.
3. Angle between centerline of roadway and centerline of bridge. Skew angle of substructure.
4. Horizontal distance between centerlines of main track(s) and adjacent existing and/or future tracks.
5. Individual span length(s) and total bridge length from face to face of backwalls.
6. Limits of Railroad right-of-way with respect to centerline of main track. Limits of Right-of-Way fencing.
7. Footprint of proposed superstructure and substructure including approach slabs and existing structure, if applicable.
8. Footprint of roadway, sidewalks, retaining walls, etc.
9. Location of access roadway(s) and turnarounds.
10. Timetable direction arrows, nearest railroad station and end station of railroad subdivision.
11. Railroad Milepost measured at the inside face of backwall, at the low milepost bridge end.
12. Point of minimum vertical clearance.
13. All existing facilities and utilities and their proposed relocation, if required.
14. Limits of shoring including minimum distance at right angle from centerline of nearest track.
15. Limits of grading with existing and proposed contours.
16. Minimum structure separation for adjacent structures.
17. Direction of flow for all drainage systems within project limits.
18. Location of geotechnical borings.

ELEVATION

1. Individual span length(s) and total bridge length from inside face to face of backwalls.
2. Distance from nearest Railroad Milemarker to inside face of backwall at the low milepost bridge end.
3. Profile grade of bridge.
4. Profile grade and top of rail elevations for main track.
5. Roadway section.
6. Minimum vertical clearance from roadway to bridge.
7. Limits of handrail/fence on bridge.
8. Location of fixed and expansion bearings.
9. Location and type of substructure with elevations.
10. Numbering of spans, abutments and piers.
11. Existing and proposed groundline, including slope paving.
12. Existing and proposed utilities.
13. Depth of foundation below roadway.

TYPICAL SECTION


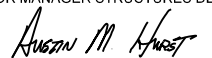
1. Centerline of bridge and/or horizontal control line of project, centerline of existing track(s), centerline of future track(s). Identify tracks as main, siding, etc.
2. AREMA clearance envelope.
3. Horizontal distance between centerline of tracks, distance from centerline of track to face of ballast retainer and handrail/fence.
4. Total width of superstructure.
5. Width of walkway.
6. Height and type of ballast retainer, handrail/fence.
7. Depth of superstructure.
8. Rail, tie and ballast system with vertical distance from top of rail to top of deck and minimum depth of ballast under the tie (12").
9. Cross slope of deck, if applicable, and waterproofing system.
10. Girder spacing.
11. Diaphragms: Steel - end and intermediate
Concrete - tie rods.


TITLE BLOCK

1. The name & logo of engineering firm or project owner.
2. Drawing title.
3. RR Milepost number and subdivision.
4. City, county and state.
5. Project name and location.
6. Date.
7. Latitude and Longitude.

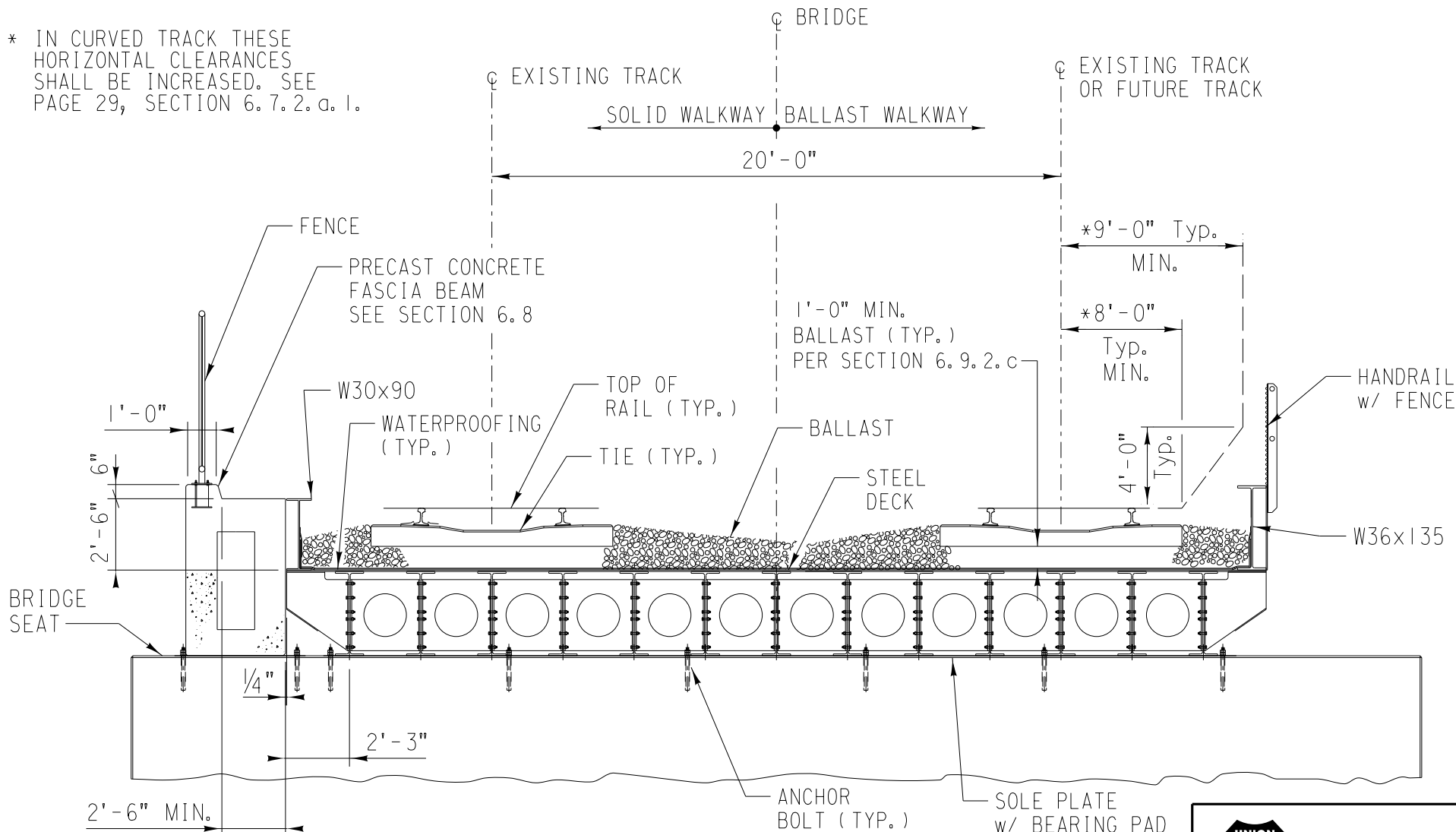
RAILROAD PROFILE GRADE DIAGRAM

1. Show existing and proposed track profile at the bridge location and a minimum of 1,000 feet past each end of the bridge.



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BRIDGE STANDARDS	
GRADE SEPARATION GUIDELINES	
MINIMUM LAYOUT REQUIREMENTS FOR UNDERPASS STRUCTURES	
FILE OWNER: UPRR	DATE: 1/05/16
PLAN NO.: 711200	SHEET: 1

* IN CURVED TRACK THESE HORIZONTAL CLEARANCES SHALL BE INCREASED. SEE PAGE 29, SECTION 6.7.2.a.1.



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<i>Rick Friesen</i>	
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<i>Auston M. Huest</i>	
BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN	

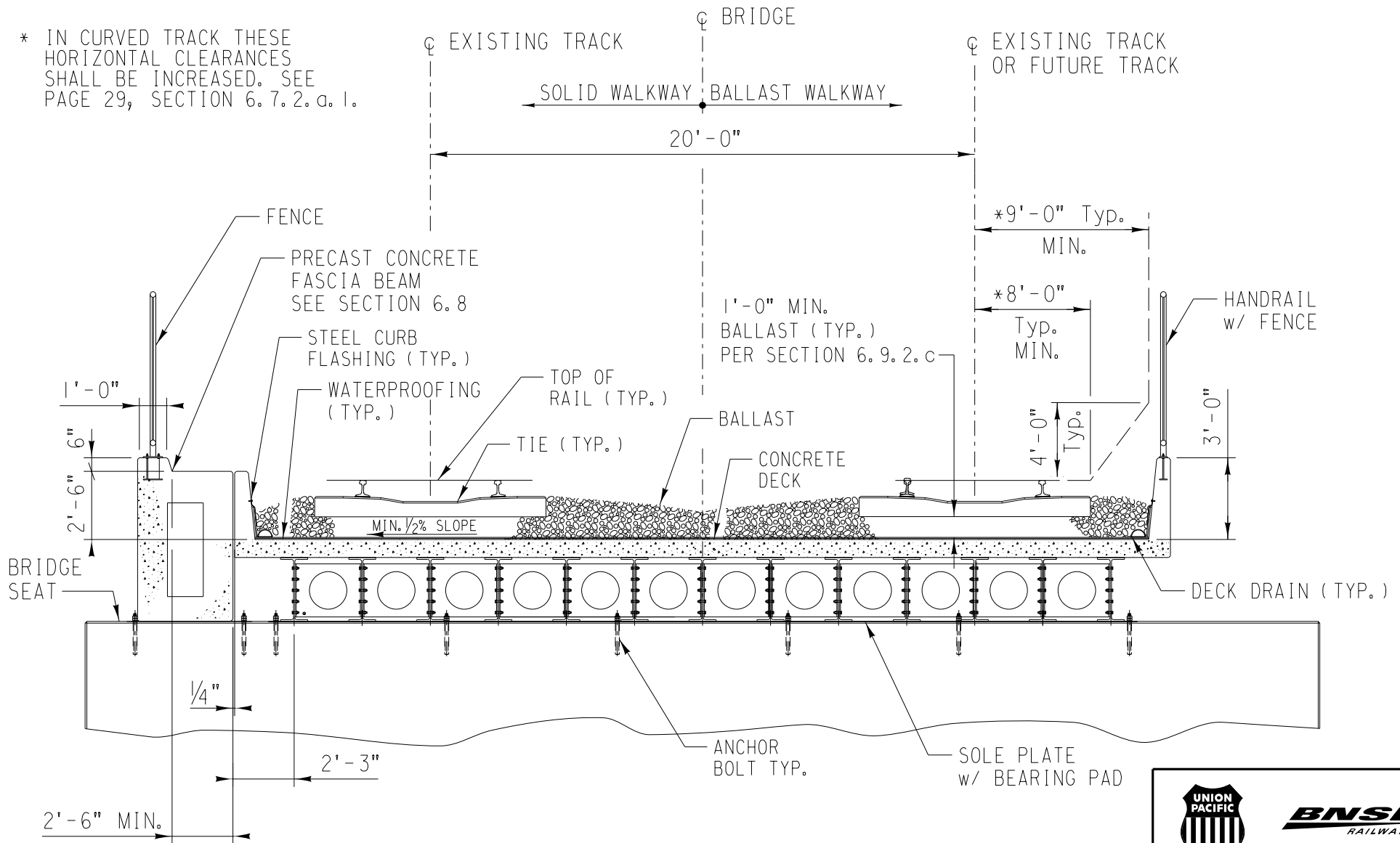



BRIDGE STANDARDS
GRADE SEPARATION GUIDELINES



**ROLLED BEAMS
w/ STEEL PLATE DECK**

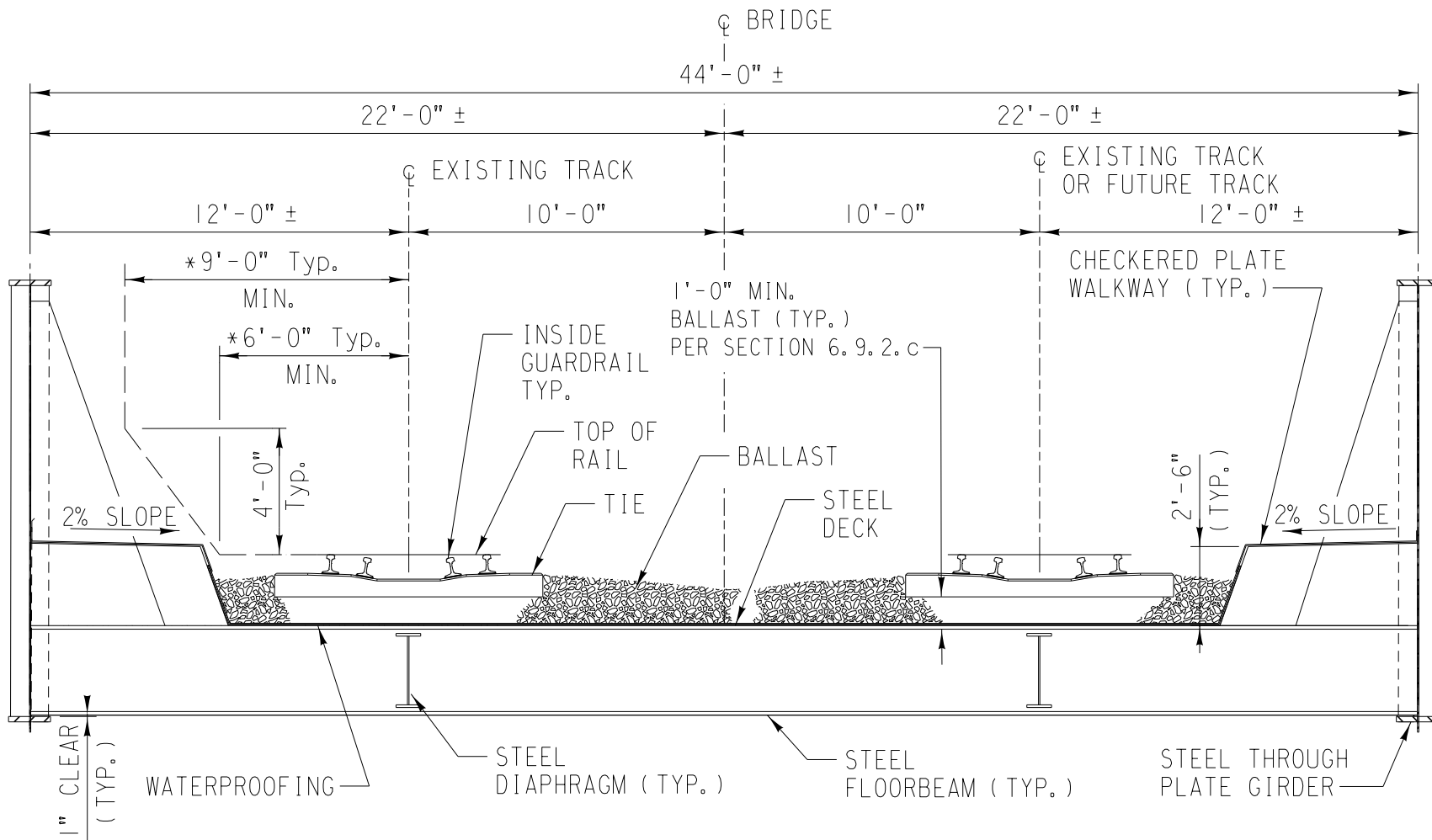
FILE OWNER: UPRR	DATE: 1/05/16
PLAN NO.: 711200	SHEET: 2

* IN CURVED TRACK THESE HORIZONTAL CLEARANCES SHALL BE INCREASED. SEE PAGE 29, SECTION 6.7.2.a.1.


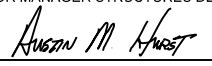


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APPROVED:	
<i>Rick Friesen</i>	
UPRR - SENIOR MANAGER STRUCTURES DESIGN	
<i>Auston M. Huest</i>	
BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN	

	
BRIDGE STANDARDS	
GRADE SEPARATION GUIDELINES	
ROLLED BEAMS w/ CONCRETE DECK	
FILE OWNER: UPRR	DATE: 1/05/16
PLAN NO.: 711200	SHEET: 3



* IN CURVED TRACK THESE HORIZONTAL CLEARANCES SHALL BE INCREASED. SEE PAGE 29, SECTION 6.7.2.d.1.

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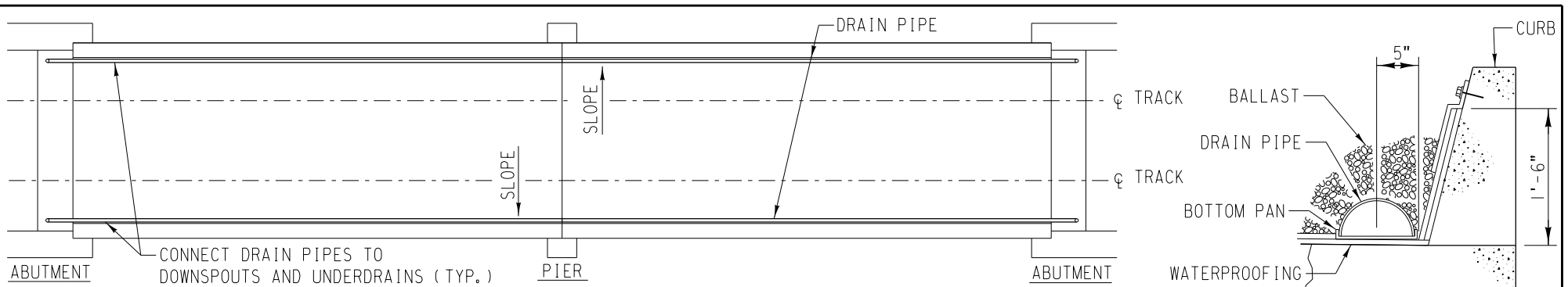


BRIDGE STANDARDS

GRADE SEPARATION GUIDELINES

STEEL THROUGH PLATE GIRDERS w/ STEEL PLATE DECK

FILE OWNER: UPRR	DATE: 1/05/16
PLAN NO.: 711200	SHEET: 4

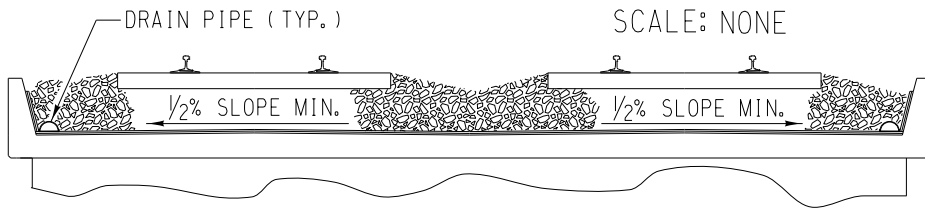


DECK PLAN

SCALE: NONE

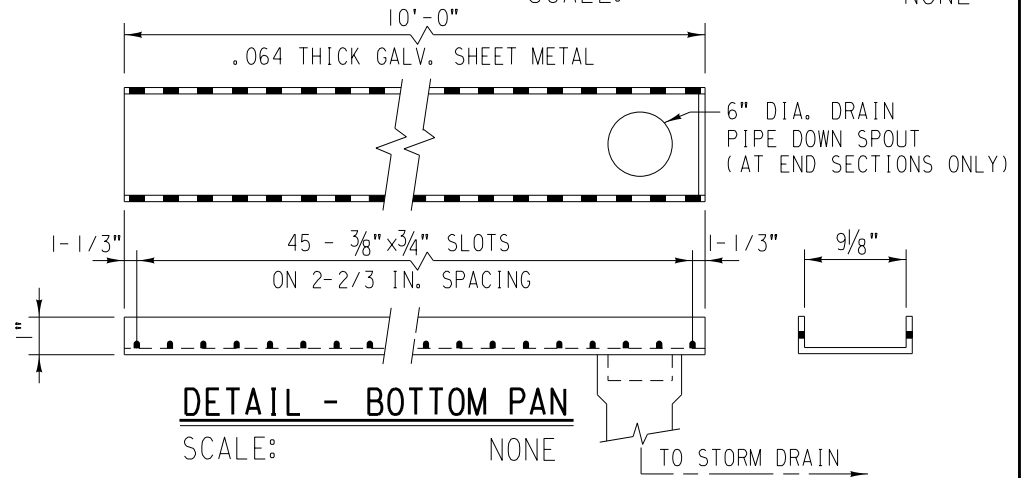
LOCATION OF DRAIN PIPE

SCALE: NONE



TYPICAL DECK SECTION

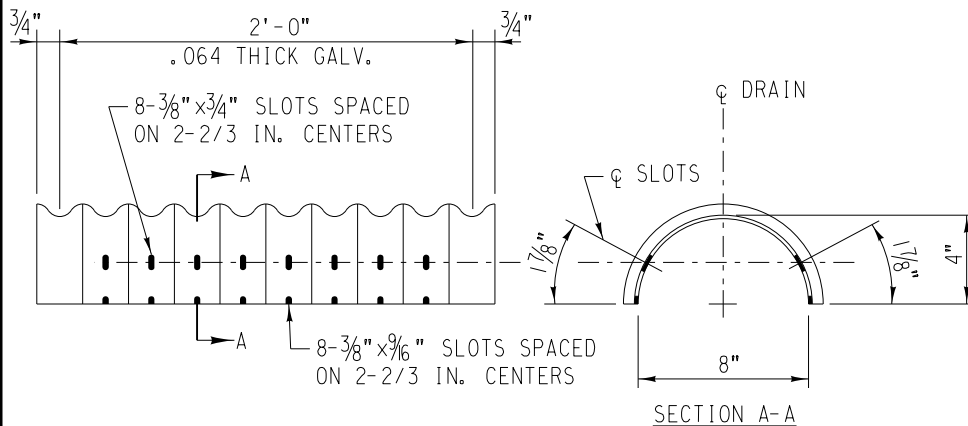
SCALE: NONE



DETAIL - BOTTOM PAN

SCALE: NONE

NOTE: LAP DRAIN PIPE ONE CORRUGATION AT EACH END.



DETAIL - DRAIN PIPE

SCALE: NONE



BRIDGE STANDARDS

GRADE SEPARATION GUIDELINES

CAST-IN-PLACE CONCRETE DECK DRAIN DETAILS

DESIGN BY: RAF	CHECKED BY: AMH
APPROVED:	
<i>Rick Friesen</i>	
UPRR - SENIOR MANAGER STRUCTURES DESIGN	
<i>Auston M. Huest</i>	
BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN	

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PLAN NO.: 711200	SHEET: 5