Public Projects Manual

BNSF Railway Public Projects Team

BNSF RAILWAY

November 2024

BEGIN

Emergencies: (800) 832-5452

If there is an emergency, contact BNSF's Resource Protection Command Center

Note: The information contained in this ***BNSF Railway Public Projects Manual*** is neither exhaustive nor exclusive; rather, it is intended to be a general resource only and all statements contained herein are intended to be for broad use. Nothing identified in this ***BNSF Railway Public Projects Manual*** can be taken as authority to construct or improve. Specific projects will be subject to analysis of all factors leading to formal agreements between all project parties. The purpose of BNSF review is solely to confirm compliance with the minimum standards of BNSF, and not for any other purpose.

French F. Thompson, III

General Director

Public Infrastructure
and Investments

Message from BNSF General Director Public Infrastructure and Investments

To the Local Communities, Businesses, and Agencies We Serve,

Our vision at BNSF Railway (BNSF) is to realize the tremendous potential of our network by providing transportation services that consistently meet our customers' expectations. We accomplish this by transporting goods by rail over a 32,500-mile network through 28 states and two Canadian provinces. We actively work with communities, businesses, and agencies across our network to execute projects of significance to you, our partners, and we place the highest value on the safety of our employees, the public, and those working on and around our property.

This ***BNSF Public Projects Manual*** is a resource for community partners that have projects on or near the BNSF right-of-way. The tools, guidance, and standards that are included in our manual include key contacts to work with at BNSF and articulate essential information for working with BNSF on your project. In today's fast-paced, digital world, we understand the importance of having access to accurate and readily available information so your projects progress efficiently. We have listened to your feedback and are pleased to offer a resource that is updated to help you, our partners, start, plan, and deliver your projects.

The ***BNSF Public Projects*** team serves as the primary point of contact for community projects and agency coordination. They are the driving force behind building and maintaining strong connections with our community partners and play a pivotal role in the development, progression, and delivery of agency-led projects.

The ***BNSF Public Infrastructure and Investments*** (Grants) team manages a multifaceted grant program across the BNSF network in collaboration with public agency partners. The USDOT and U.S. Congress at times provide discretionary grant funding which moves forward infrastructure projects of regional and national significance that will have substantial positive impacts on communities and the economy. By working collaboratively with public agency partners, we can maximize the impact of our combined investments and create opportunities for safer and more efficient, resilient, and sustainable rail transportation.

We hope our manual provides you with access to readily available information you need to deliver your critical projects. We believe in the power of working together to make positive impacts on our shared endeavors and are here to serve as sources of guidance and resources.

Thank you for your partnership. Together, we can achieve remarkable outcomes.

French F. Thompson, III

General Director
Public Infrastructure and Investments

Table of Contents

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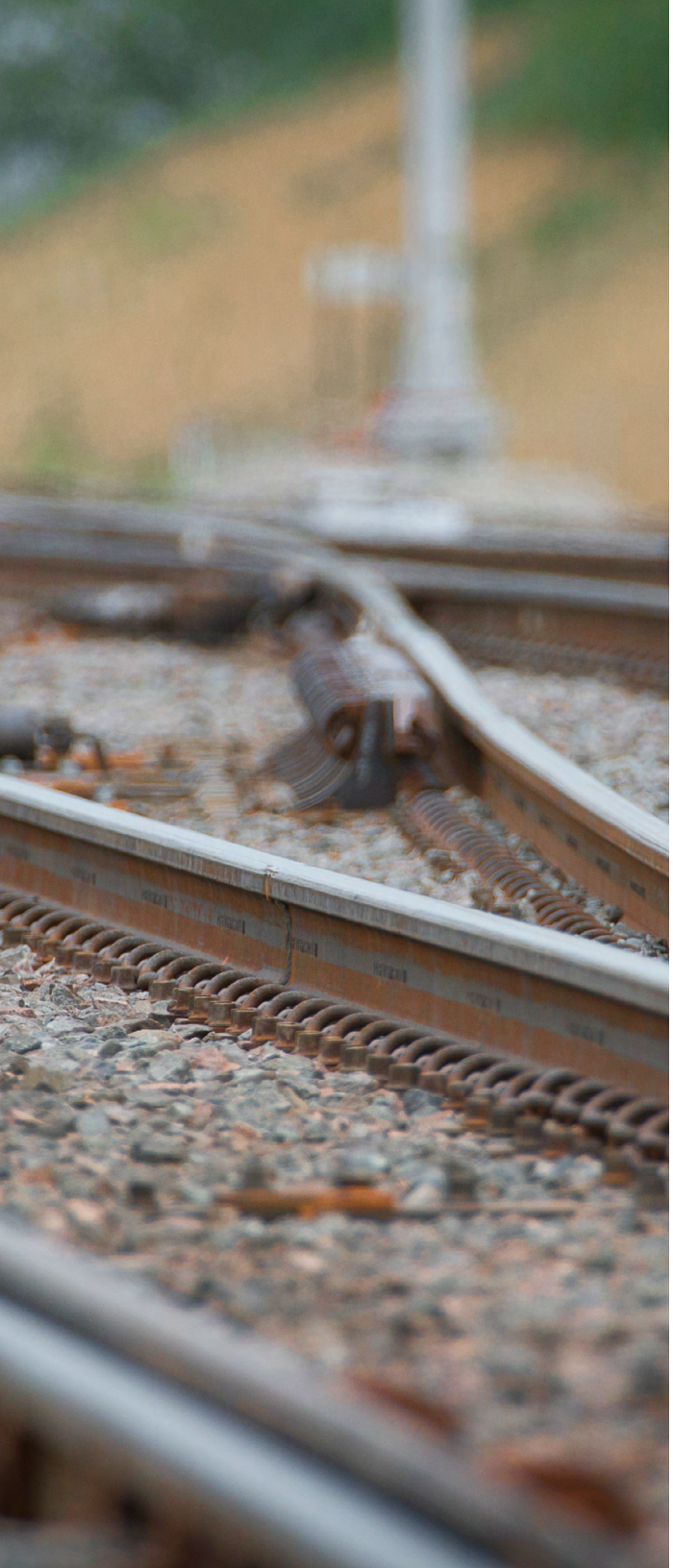


APPENDICES

This is an **interactive** document. Navigate through the chapters and pages along the footer of each page.

1

INTRODUCTION TO THIS MANUAL

1

Introduction to this Manual

The information contained in this ***BNSF Railway Public Projects Manual*** is intended to assist communities, public agencies, and other Proponents to coordinate, plan, design, and implement construction and improvement projects that may potentially involve BNSF and its property. Examples of common projects include:

Federal and State Grant Coordination and Support
BNSF manages a multifaceted grant program to advance of shared-benefit improvement projects across the BNSF network in collaboration with public agency partners, other stakeholders, and communities.

Highway-Rail Grade Crossings
Closure, consolidations, modifications, and grade separation of public highway-rail grade crossings.

Entry onto BNSF Property
Temporary rights of entry onto BNSF property, easements, utility installations, and other temporary access needs such as highway overhead bridge inspections.

Bridges Carrying BNSF
Construction, reconstruction, rehabilitation, repair, removal, and maintenance of bridges carrying railroad lines of BNSF over roadways and other public properties initiated by outside parties.

Bridges Over BNSF
Construction, reconstruction, rehabilitation, repair, removal, and maintenance of bridges over BNSF railroad lines by outside parties.

Parallel Roads and Facilities
Construction, reconstruction, modification, removal, and maintenance of parallel roads or other public facilities (including multi-use trails) potentially affecting BNSF property and/or operations.

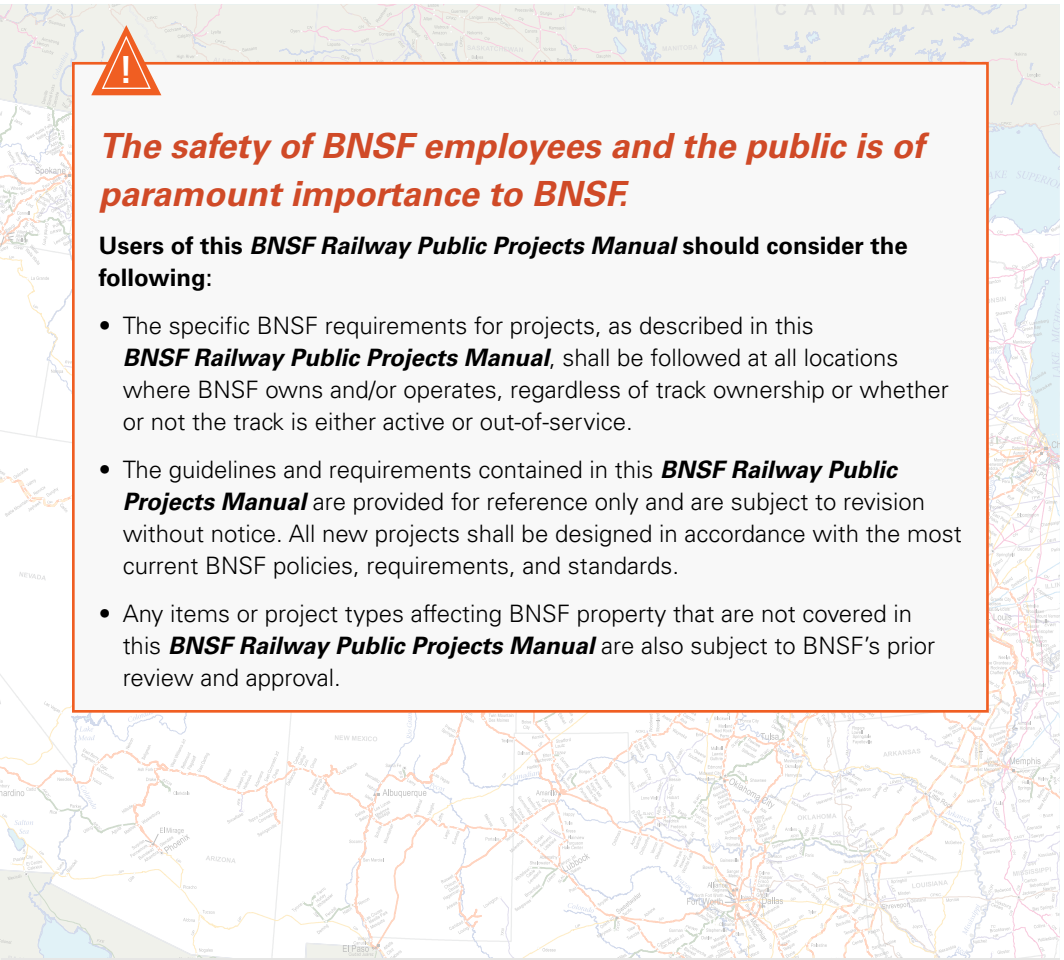
Quiet Zones
Information regarding a public agency's pursuit to establish a new Quiet Zone that encompasses the BNSF network.

Passenger Rail
Expansion of existing passenger rail services or implementation of new passenger rail services that encompasses the BNSF network.

Beautification and Bridge Painting
Modification or painting of structures over or adjacent to BNSF property.

Other Projects Involving BNSF Corridors
Publicly sponsored projects involving or altering BNSF facilities or its property. These projects may be on, above, below, across, adjacent to, or otherwise have the potential to impact BNSF property, operations, and access.

Users of this *BNSF Railway Public Projects Manual* should first ascertain whether or not the project potentially involves BNSF-owned property prior to initiating contact with the BNSF Public Projects team regarding a proposed project.



The safety of BNSF employees and the public is of paramount importance to BNSF.

Users of this *BNSF Railway Public Projects Manual* should consider the following:

- The specific BNSF requirements for projects, as described in this ***BNSF Railway Public Projects Manual***, shall be followed at all locations where BNSF owns and/or operates, regardless of track ownership or whether or not the track is either active or out-of-service.
- The guidelines and requirements contained in this ***BNSF Railway Public Projects Manual*** are provided for reference only and are subject to revision without notice. All new projects shall be designed in accordance with the most current BNSF policies, requirements, and standards.
- Any items or project types affecting BNSF property that are not covered in this ***BNSF Railway Public Projects Manual*** are also subject to BNSF's prior review and approval.

Consult the **BNSF Network Map** and other mapping resources on the BNSF website that identify BNSF-owned line segments, and all states and provinces and many cities served by BNSF.

The sources and strategies identified below can be used by the public with projects potentially involving BNSF-owned property.

- Consult the Federal Railroad Administration (FRA) Office of Safety Analysis Highway-Rail Crossing Database to make a query of a grade crossing by location for state, county/city, and street name. There is often more than one crossing on the same roadway. Grade Crossing Inventory Report database lists the precise latitude and longitude of the grade crossing for crossreference. Each grade crossing has a unique DOT inventory identification number that typically includes six digits and one letter – such as 123456A – which is indicated on the report, on the blue Emergency Notification Sign affixed to the crossbuck or on the signal bungalow at the crossing, if applicable. To avoid confusion, reference the DOT Crossing Number in any correspondence with the BNSF Public Projects team regarding the crossing. See **Chapter 15 Alterations to Highway-Rail Grade Crossing Warning Devices** for more information. The FRA Grade Crossing Inventory Database website can be accessed here: **FRA Safety Data & Reporting**.
- Interested parties can check with local tax assessors, County GIS maps, or consult local courthouse records to determine if a specific parcel of land is BNSF property. BNSF does not provide property maps to the general public.
- BNSF trains, locomotives, railcars, and equipment often operate over rail lines owned by other railroads. Observations of railroad operations should not be used by the public to verify whether or not a specific rail line is potentially owned by BNSF.

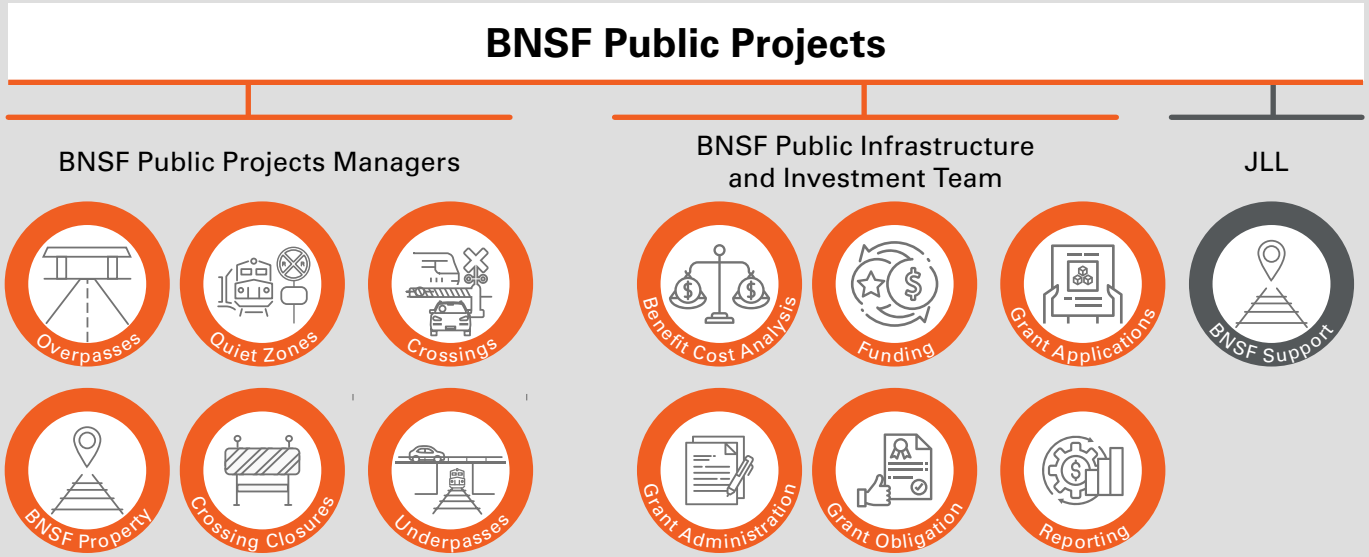
2

MEET THE TEAM

2

Meet The Team

Figure 1: *Organizational Chart for BNSF Public Projects*



PUBLIC PROJECTS

BNSF actively works with communities, businesses, and agencies across our network to execute public projects, and we place the highest value on the safety of our employees, those working on and around our property, and the public. Our Public Projects team is the point of contact for communities and other entities that have infrastructure projects that involve BNSF's network. They are the driving force behind building and maintaining strong connections with our community partners and play a pivotal role in the progression of these projects - providing information, resources, and guidance for how to work alongside BNSF.

PUBLIC INFRASTRUCTURE AND INVESTMENTS

The BNSF Public Infrastructure and Investments (PII) team manages a multifaceted grant program across the BNSF network in collaboration with our public agency partners to optimize federal resources available to eligible applicants. By working collaboratively with public agency partners on shared-benefit projects, we can maximize the impact of our combined investments and create new opportunities for safer and more efficient, resilient, and sustainable rail transportation throughout the BNSF network and your communities.

CONTACTS

Contact Us | BNSF

BNSF | JLL Contacts

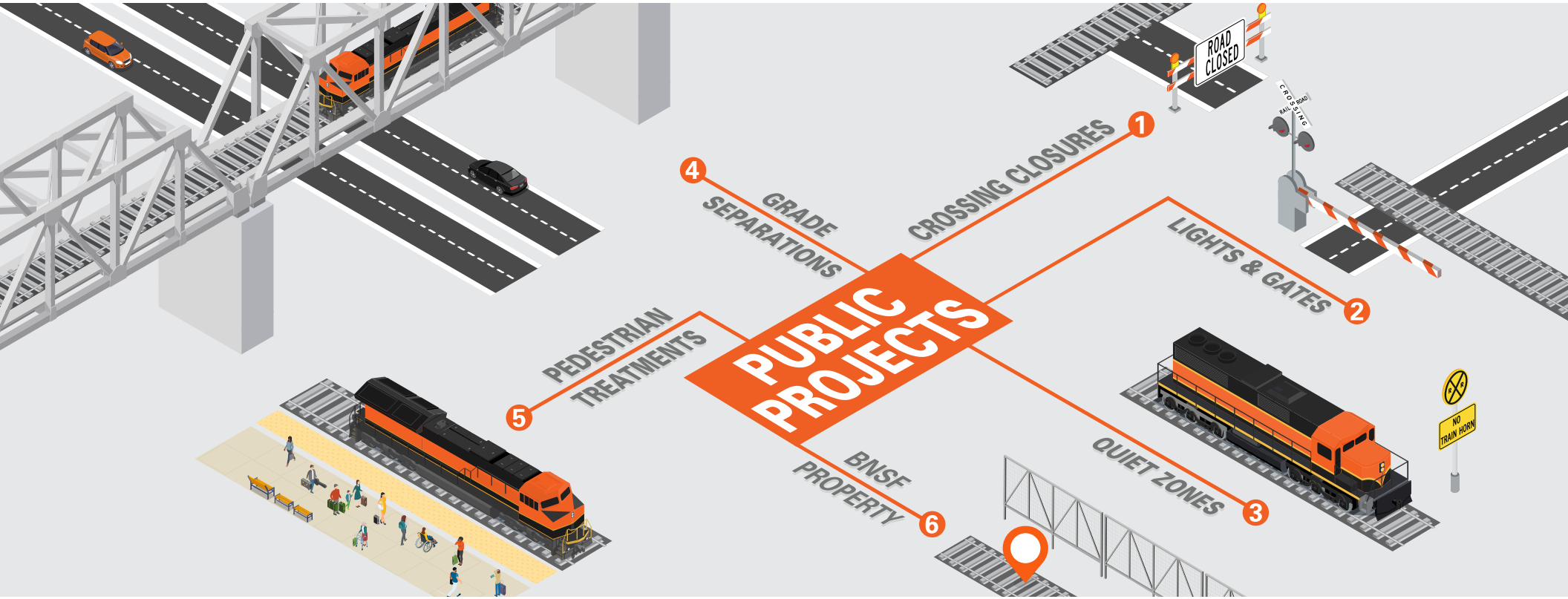
RESOURCES

In the Community

Public Projects

Public Infrastructure and Investments - Grants

Frequently Asked Questions | BNSF



PUBLIC PROJECTS – WHERE ROAD MEETS RAIL

Our goal of building strong, long-lasting partnerships and alignment with public agencies and stakeholders represents a shared commitment to safety, infrastructure development, and prosperity in the communities where BNSF operates. Through these collaborative efforts, we seek to improve our competitiveness in the rail industry, deliver superior value and infrastructure for our network, increase our return on investment, and make a positive and transformative contribution to the communities we serve.

1 CROSSING CLOSURES

- Identification
- Agency Negotiation
- Alternate Access
- Permitting

2 SAFETY PROJECTS

- Section 130 Program
- Crossbuck, Yield, Stop Signs
- Lights and Gates
- Crossing Surfaces

3 QUIET ZONES

- Community Coordination
- Supplemental Safety Measures

4 GRADE SEPARATIONS

- Negotiation and Coordination
- Planning and Design Review
- Flagging and Construction

5 PEDESTRIAN AND OTHER

- Pedestrian Treatments
- Bike Paths and Trails
- Flood Control

6 BNSF PROPERTY

- Property Management
- Right-of-Entry
- Leases
- Easements
- Occupancy Permits

To help facilitate the needs of government agencies and other Proponents regarding the Public Projects process, BNSF has partnered with Jones Lang LaSalle Brokerage, Inc. (JLL) to process permits, licenses, leases, and easements on BNSF property. JLL also handles the following additional roles for projects on BNSF property: private crossing permits, temporary occupancy permits, installation of new utilities, storing of material or equipment, performing minor construction work such as soil borings or grading, surveying, and geotechnical engineering. JLL also facilitates sales of BNSF real estate and any general property management for BNSF.

Additional details about the services JLL provides can be found on the BNSF web **FAQ: Permits**. Identification of any permits, licenses, agreements, and other documentation required by BNSF for the facilitation of public projects work is included by project type throughout this ***BNSF Railway Public Projects Manual.*** A flow chart showing the roles of the JLL team and contact information for the JLL team by function and territory is presented throughout this chapter (**Figure 1**). A JLL Permit Management Team Territory Map as well as the Lease Management Team Territory Map with related contact information can be found on the BNSF webpage **BNSF | JLL Contacts**.

Figure 2: *Flowchart of the Roles of BNSF and JLL Teams*

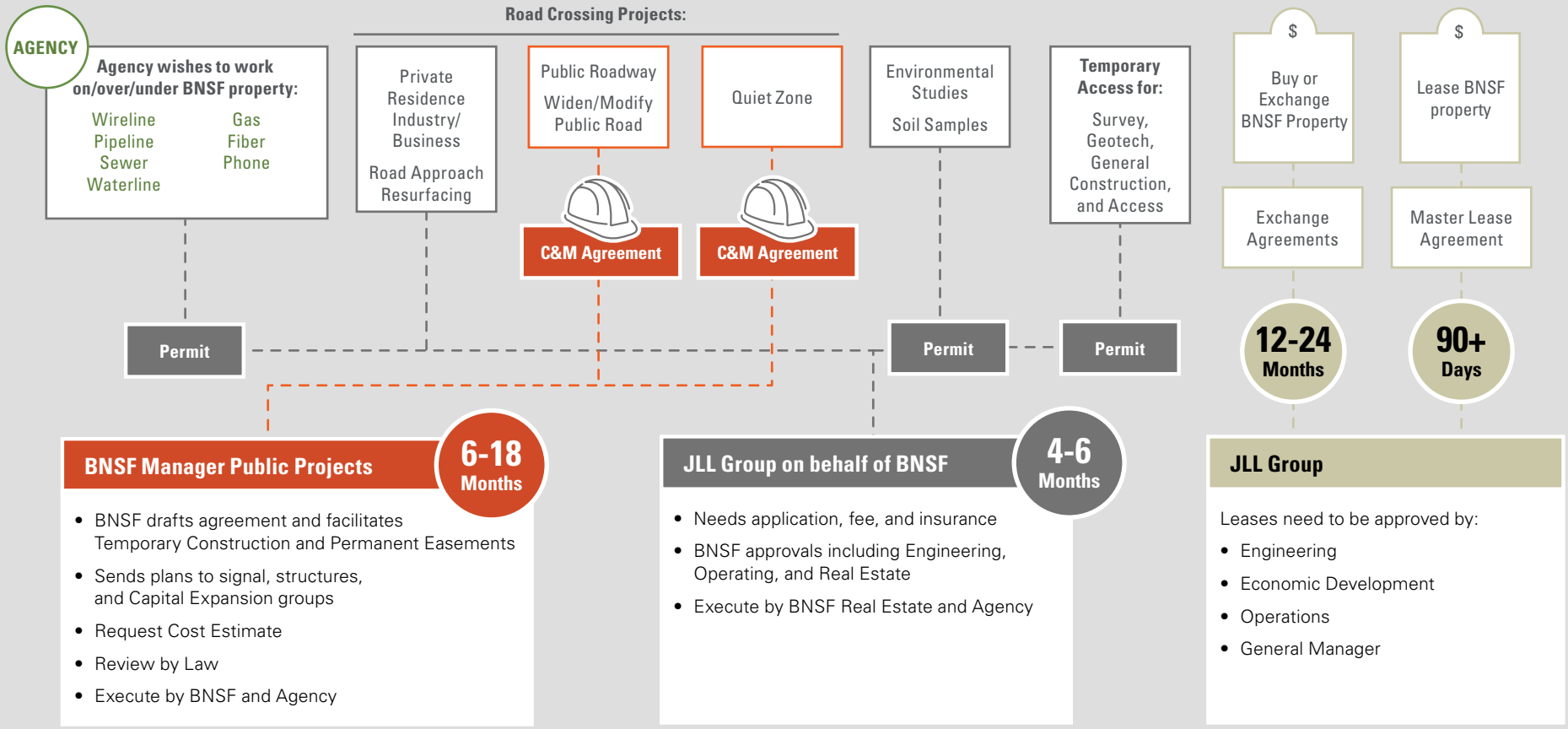


Figure 3: *Organizational Chart of Public Infrastructure and Investments*

French F. Thompson, III

General Director
Public Infrastructure and Investments

PUBLIC PROJECTS TEAM

Rich Scott

Assistant Director
Public Projects, Northern Region

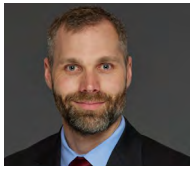
Cheryl Townlian

Assistant Director
Public Projects, Southern Region

PUBLIC INFRASTRUCTURE AND INVESTMENTS TEAM

Kritika Jetley

Assistant Director
Public Infrastructure and Investments



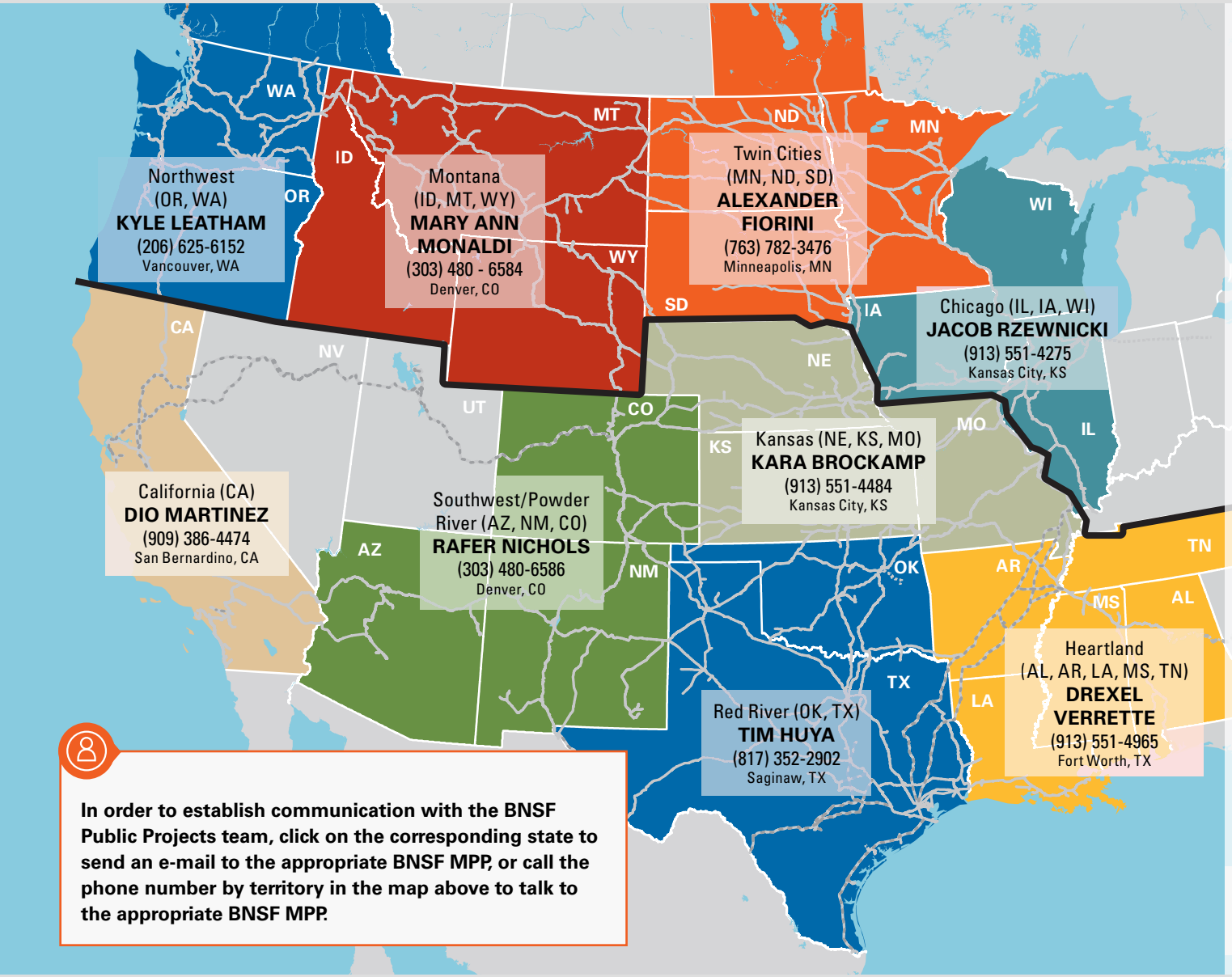
Michael Pruneau

Manager
Public Infrastructure and Investments, Northern Region

Jeremy Wegner

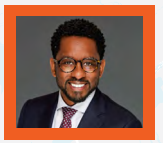
Manager
Public Infrastructure and Investments, Southern Region

Figure 4: *Map of Public Projects Managers by Territory*



In order to establish communication with the BNSF Public Projects team, click on the corresponding state to send an e-mail to the appropriate BNSF MPP, or call the phone number by territory in the map above to talk to the appropriate BNSF MPP.

PUBLIC PROJECTS MANAGERS



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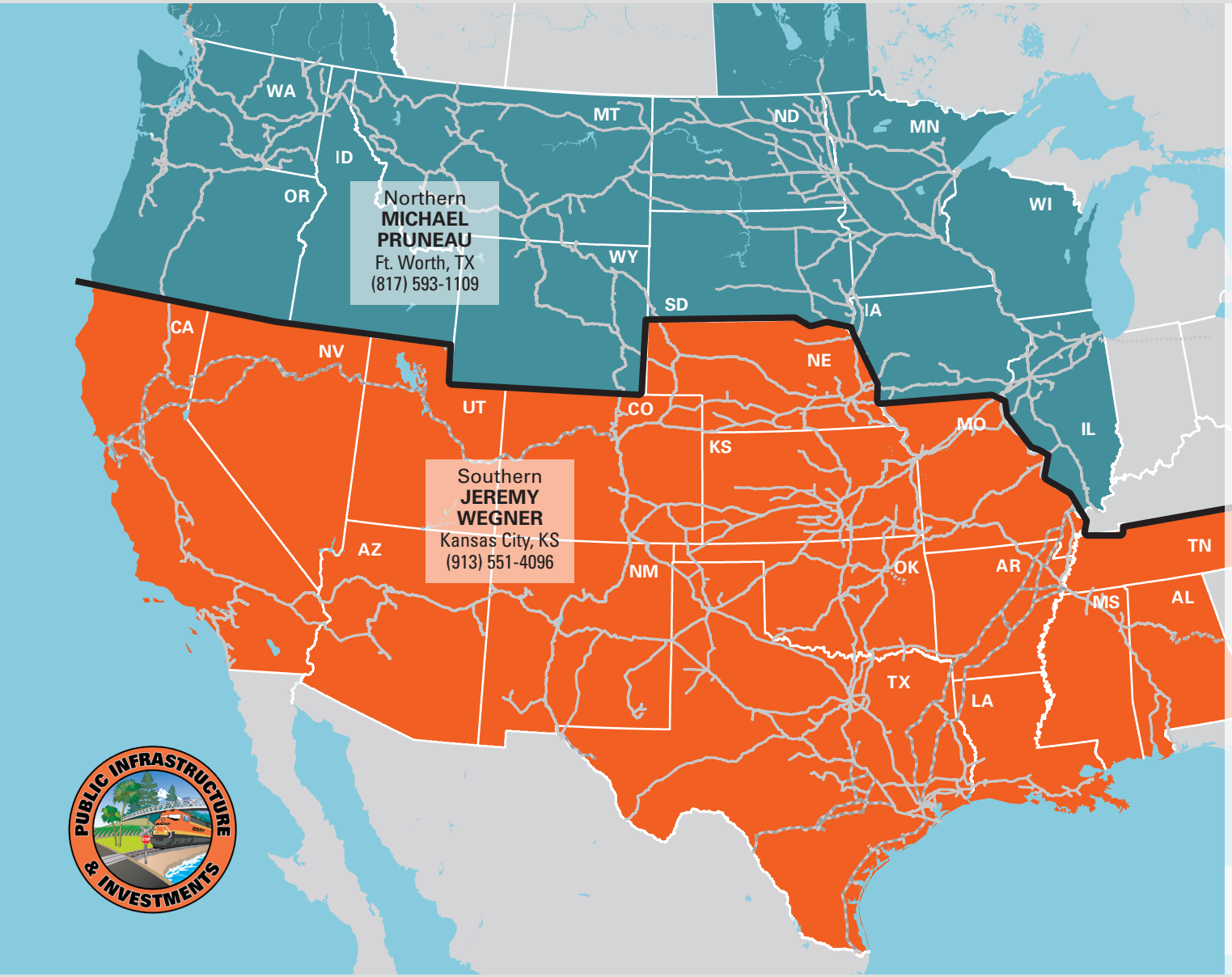
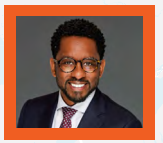
(417) 860-4122

Visit BNSF's Public Projects Team page.

Figure 4: *Map of Public Infrastructure and Investments Managers by Region*



PUBLIC INFRASTRUCTURE AND INVESTMENTS TEAM



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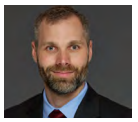

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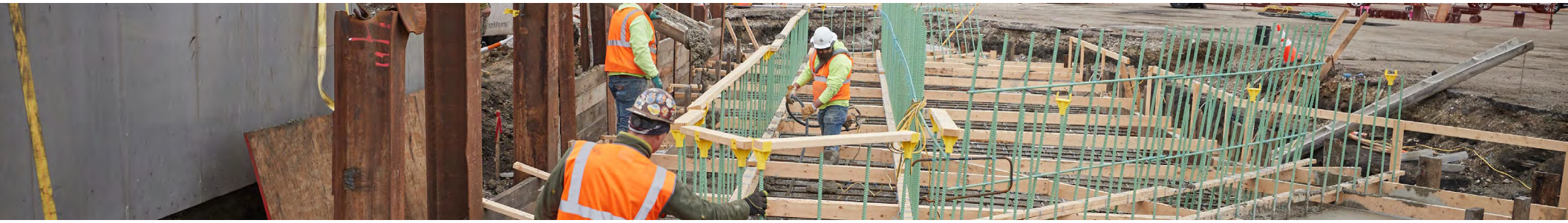
Visit BNSF's Public Infrastructure and Investments Team page.

3

ADDITIONAL BNSF RESOURCES AND CONTACTS

3 Additional BNSF Resources and Contacts



ADDITIONAL BNSF RESOURCES AND CONTACTS

Many areas of community interest are outside of the purview of the BNSF Public Projects, BNSF Public Infrastructure and Investments, and JLL teams and the scope of this ***BNSF Railway Public Projects Manual***. Identified below is a list of additional BNSF resources and contacts that may be helpful on other community matters and public inquiries.

Emergencies: (800) 832-5452

BNSF Resource Protection Command Center

Table 1: *BNSF Safety and Security Contact Information*

NAME	CONTACT
Report Emergencies	(800) 832-5452 (Option 1)
Report a Grade Crossing Signal Malfunction	(800) 832-5452 (Option 2)
Report Train Blocking Grade Crossing	(800) 832-5452 (Option 3)
Non-Emergency Calls	(800) 832-5452 (Option 4)
Other Railroad Departments and Reports	(800) 832-5452 (Option 6)

CONTACTS

Contact Us | BNSF

BNSF | JLL Contacts

RESOURCES

Government Affairs

Tribal Relations

BNSF Government Affairs

The BNSF state and federal government affairs teams work to educate and inform public policymakers at local, county, parish, regional, state, and federal levels. These teams primarily focus on legislative and regulatory matters as well as working with communities to seek solutions of mutual interest. These teams also serve as liaisons with the public and the media. Their contact information is available at the following link: **Contact Us | BNSF**.

BNSF Tribal Relations

The BNSF Tribal Relations team builds and strengthens relationships with the 86 tribal and first nation communities across the BNSF network. The BNSF Tribal Relations team also provides internal training and technical guidance on protecting cultural resources, interaction with tribal representatives, and other topics involving BNSF's interaction with tribal communities. For additional information, please visit **Tribal Relations | BNSF**.

BNSF Passenger Operations

Intercity and long-distance passenger trains of Amtrak operate over multiple corridors on the 28-state BNSF network. Commuter (or suburban) passenger trains operate over various segments of the BNSF network in four metropolitan areas and include **Metra** (Chicago-La Grange-Downers Grove-Naperville-Aurora, Illinois); **Metro Transit** (Minneapolis-Coon Rapids-Anoka-Big Lake, Minnesota); **Sound Transit** (Everett-Seattle-Tacoma-Lakewood, Washington); and **Metrolink** (Los Angeles-Fullerton-Riverside-San Bernardino, California).

Table 2: *BNSF Passenger Operations Contacts*

NAME		CONTACT
Amtrak	(U.S. Nationwide)	(800) 872-7245
Metra	(Chicago Area)	(312) 322-6777
Metro Transit	(Minneapolis Area)	(612) 373-3333
Sound Transit	(Seattle Area)	(206) 398-5000
Metrolink	(Los Angeles Area)	(800) 371-5465

Other BNSF Teams

BNSF has additional teams that may interact with communities, public agencies, and other Proponents. The BNSF Manager Public Projects can provide contact information for representatives of other BNSF teams in their respective territories that are not listed above (e.g. Engineering/Maintenance-of-Way, Economic Development, Strategic Sourcing, etc.).

State Department of Transportation, Public Utilities Commission, and Commerce Commission Contacts

The BNSF Manager Public Projects can provide contact information for State Department of Transportation, State Public Utilities Commission, and State Commerce Commission representatives, as appropriate.

4

DEFINITION OF TERMS

4

Definition of Terms

DEFINITION OF TERMS

This chapter defines some of the terms used throughout the ***BNSF Railway Public Projects Manual***.

A-C

Access Road – A road used and controlled by BNSF for the purpose of accessing, inspecting, and maintaining track, other railroad infrastructure, and railroad property.

Active Warning Device – Automatic traffic control devices, such as flashing light signals, gates, and/or traffic control signals that are located at a grade crossing and activated upon the detection of approaching rail traffic.

Alternative Safety Measure – An Alternative Safety Measure (ASM) is a safety system or procedure, other than a Supplemental Safety Measures (SSM), provided by the appropriate traffic control authority which, after individual review and analysis, is determined by the Federal Railroad Administration (FRA) to be an effective substitute for the locomotive horn at specific highway-rail grade crossings. A public authority seeking approval of a Quiet Zone (QZ) under public authority application to the FRA may include ASMs in its proposal.

American Railway Engineering and Maintenance-of-Way Association – The American Railway Engineering and Maintenance-of-Way Association (AREMA) is a North American railroad industry group that develops recommended practices for railroad-related projects. The use of this term shall be in specific reference to the AREMA Manual for Railway Engineering developed and maintained by AREMA.

At-Grade Crossings – See Highway-Rail Grade Crossing.

BNSF Railway or BNSF – Refers to BNSF Railway Company.

Construction & Maintenance Agreement – A Construction & Maintenance (C&M) Agreement is an agreement between BNSF and a Proponent that provides license and permission for a Proponent to perform work on BNSF property.

Constant Warning Time – Constant Warning Time (CWT) equipment detects the approach and speed of a train and measures its distance from a grade crossing in order to activate grade crossing warning devices (i.e. bells, flashing lights, and automatic gates) within a uniform minimum warning time selected, and thus reduce potential delays to vehicular traffic or the potential for motorists to disregard warning devices at the grade crossing.

Contractor – An individual, partnership, corporation or joint venture, and all principals and representatives (including Proponent's subcontractors) with whom the contract is made by the Proponent for the construction of a public project.

Crossing Surface – The area between track ties that are used by vehicles, bicycles, or pedestrians to cross the railroad. Typical crossing surface material could be concrete, asphalt, timber, rubber, or composite.

D-M

Diagnostic Team – A group of knowledgeable representatives of parties of interest in a highway-rail grade crossing, organized by the public authority responsible for that crossing, that leverage crossing safety management principles and evaluate conditions at a grade crossing to make determinations or recommendations for the public authority concerning potential safety needs at that crossing.

Engineer – BNSF Engineering Representative authorized to act on the behalf of BNSF.

Exhibit C and C-1 – Exhibit C and C-1 to the C&M Agreement is an agreement between BNSF and the Proponent's contractor which includes parameters for occupying and performing construction on BNSF property, including insurance, indemnification, notifications, and other requirements.

Federal Railroad Administration – The Federal Railroad Administration (FRA) is an agency of the U.S. Department of Transportation (USDOT). The FRA's mandate is to promulgate and enforce rail safety regulations, conduct research to support improved railroad safety and national transportation policy, administer railroad assistance programs, and support other rail transportation activities.

Flagger – A qualified BNSF employee with the sole responsibility to direct or restrict movement of trains, at or through a specific location, to provide protection for workers on or near BNSF property.

Force Account – Force Account is a common procurement method with U.S. railroads, under which extra work beyond that originally agreed to by the railroad and the contractor is reimbursed to the contractor at the contractor's actual costs plus a fixed overhead and profit percentage. Force Account is generally used to avoid delay and incidental costs that would be incurred to negotiate the amount and value of extra work required for each change in conditions.

Grade Separation – A project that includes construction of an overpass or underpass structure that crosses the railroad right-of-way or other railroad operating location, usually eliminating an at-grade highway-rail grade crossing.

Highway-Rail Grade Crossing – A location where a roadway (e.g., highway, street, avenue, road) and the BNSF right-of-way cross at the same level. The crossing footprint includes the railroad tracks, roadway, and traffic control devices for roadway traffic traveling over the tracks – and may also include a pedestrian facility such as sidewalk.

Horizontal Clearance – Distance measured perpendicularly from centerline of any track to the nearest obstruction at any elevation between the top of rail and the maximum vertical clearance of the track.

Inspector/Coordinator Consultant – The Inspector/Coordinator Consultant (I/C) is hired by BNSF to coordinate with the designated BNSF Project Engineer during certain types of projects involving BNSF property.

Main Track – A principal track designated by a railroad upon which train movements are typically authorized and controlled by a train dispatcher. The Main Track must not be occupied by trains, equipment, or forces without proper authority.

Multi-Use Trail – A multi-use trail (also known as a shared-use path) is a public, shared-use pathway that may be used by bicyclists, pedestrians, joggers, equestrians, and approved motorized recreational equipment. These pathways are typically located outside the traveled way and physically separated from motorized vehicular traffic by an open space or barrier and either within the roadway right-of-way or within an independent alignment.

Manual on Uniform Traffic Control Devices – The Manual on Uniform Traffic Control Devices (*MUTCD*) is a document published by the Federal Highway Administration (FHWA) that specifies the standards and requirements for the installation of traffic control devices such as traffic signs, markings, and signals to be used on all public roadways, bikeways, and private roads open to the public in the U.S. states and their subdivisions must either comply with the *MUTCD* or adopt an alternative manual approved by the FHWA. Highway-rail grade crossings are addressed in Section 8 of the *MUTCD*.

O-R

Operationally Critical Work – Work on or adjacent to BNSF right-of-way that impacts or could impact BNSF operations, which requires a specific design/constructability submittal and acceptance by BNSF in order for the work to be performed.

Overpass Structure – A roadway, pedestrian, or trail structure which passes over BNSF property or right-of-way.

Passive Warning Device – A traffic control device, such as a highway sign or pavement marking, located at or in advance of an at-grade roadway/railroad crossing that indicates the presence of an at-grade crossing but does not activate or change upon the approach or presence of a train. Passive warning devices may include crossbucks, stop or yield signs, and pavement markings.

Traffic Signal Preemption Timing – The transfer of normal operation of a traffic control signal to a special control mode of operation. In railroad preemption, the railroad warning system preempts the normal operation of the traffic signal and provides a green indication for traffic located on or near the track(s) to allow time for vehicles to clear the track area prior to the arrival of a train.

Preliminary Engineering – An early phase of project analysis and design work that typically involves development of design plans, specifications, and cost estimates prior to construction.

Preliminary Engineering Agreement – A Preliminary Engineering Agreement (PEA) is an agreement between BNSF and the Proponent for BNSF to facilitate internal and third-party review of the project as BNSF determines necessary.

Private Crossing – An at-grade crossing of a private roadway with a railroad line. Private grade crossings are on privately owned roadways, such as on a farm or in an industrial area and are intended for use by the owner or by the owner's licensees and invitees. A private crossing is not intended for public use and is not maintained by a public highway authority. The private crossing owner is responsible for having a private crossing permit in place with BNSF.

Professional Engineer – A Professional Engineer (PE) is an engineer who is licensed in the state in which the project is to occur. All plans, specifications, and supporting calculations shall be prepared or reviewed in detail by the PE and shall bear the PE's seal and signature.

Proponent – The project sponsor, which may be the roadway authority with jurisdiction over the roadway crossing BNSF right-of-way, a state Department of Transportation, a road authority, private developer, or other party.

Public Crossing – An at-grade crossing of a public roadway with a railroad line. Public grade crossings are roadways that are under the jurisdiction of, and maintained by, a public highway authority (e.g., city, county, parish, or state).

Public Project – A roadway, bridge, commercial development, parallel corridor, or utility project that is owned or used by the public or by a private entity and that encroaches upon BNSF property.

Quiet Zone – A Quiet Zone (QZ) segment of track over which routine sounding of train horns while approaching public grade crossings is not required owing to the installation of various Supplemental Safety Measures (SSMs) or Alternative Safety Measures (ASMs), as identified in the Final Rule on the Use of Locomotive Horns at Highway-Rail Grade Crossings (49 CFR Part 222).

Regulatory Agency – A public agency that regulates railroad safety (e.g., FRA, state public utilities commission or commerce commission).

Right-of-Way – Refers to BNSF right-of-way (ROW) as well as all BNSF property and facilities. This includes all aerial space within the property limits, and any underground facilities.

S-Z

Siding – A track connected to a Main Track that is used for accommodating meet-pass events between trains and for switching and storing railcars and staging equipment.

Supplemental Safety Measure – A Supplementary Safety Measure (SSM) is a safety system or procedure established in accordance with Federal rules governing Quiet Zones (QZs) which is provided by the appropriate traffic control authority or law enforcement authority responsible for safety at the highway-rail grade crossing, that is determined by the FRA to be an effective substitute for the locomotive horn in the prevention of highway-rail casualties. SSMs may be installed or enacted as part of the implementation of a QZ.

Temporary Occupancy Permit – A Temporary Occupancy Permit (TOP) is utilized by BNSF via JLL primarily in situations when outside parties or other Proponents desire to undertake investigative work such as performing survey work, taking borings, performing bridge inspections, or undertaking other activities requiring only access to BNSF property and not construction work activities.

Top of Rail – This is the base point for railroad vertical clearance measurements. It refers to the top of the steel rail, which is the point where train wheels bear on the steel rails. The higher of the two rails should be used when track is superelevated.

Track Center Spacing – The measured distance between adjacent track centers.

Track Structure – All load bearing elements that support the train. This includes, but is not limited to, the rail, ties, appurtenances, ballast, sub-ballast, embankment, retaining walls, and bridge structures.

Underpass Structure – A railroad structure over a roadway, pedestrian, or trail structure.

Utility Crossing – A crossing of BNSF right-of-way by a utility (third party) wireline or pipeline.

Vertical Clearance – Distance measured vertically from the top of the highest rail to the lowest obstruction under the structure; unless otherwise accepted by BNSF, the required minimum vertical clearance is 23'-6" from top of rail to the low point of the overhead structure.

Wayside Horn System – A stationary horn (or series of horns) located at a highway-rail grade crossing that is used in conjunction with a grade crossing active warning system to provide audible warning of approaching rail traffic to road users on the highway or pathway approaches to a grade crossing, either as a supplement or alternative to the sounding of a locomotive horn.

Yard – A system of tracks located in a defined footprint, and other than Main Tracks and sidings, that are used for switching and storing railcars, staging maintenance equipment, and other railroad purposes.

5

SUMMARY OF STEPS FOR OUTSIDE PARTY PROJECTS

5

Summary of Steps for Outside Party Projects

SUMMARY OF STEPS FOR OUTSIDE PARTY PROJECTS

This chapter provides a summary of typical steps for the design and construction of outside party projects that may potentially involve BNSF property.

CONTACTS

BNSF's Public Projects Team

BNSF | JLL Contacts

TYPICAL STEPS FOR DESIGN REVIEW

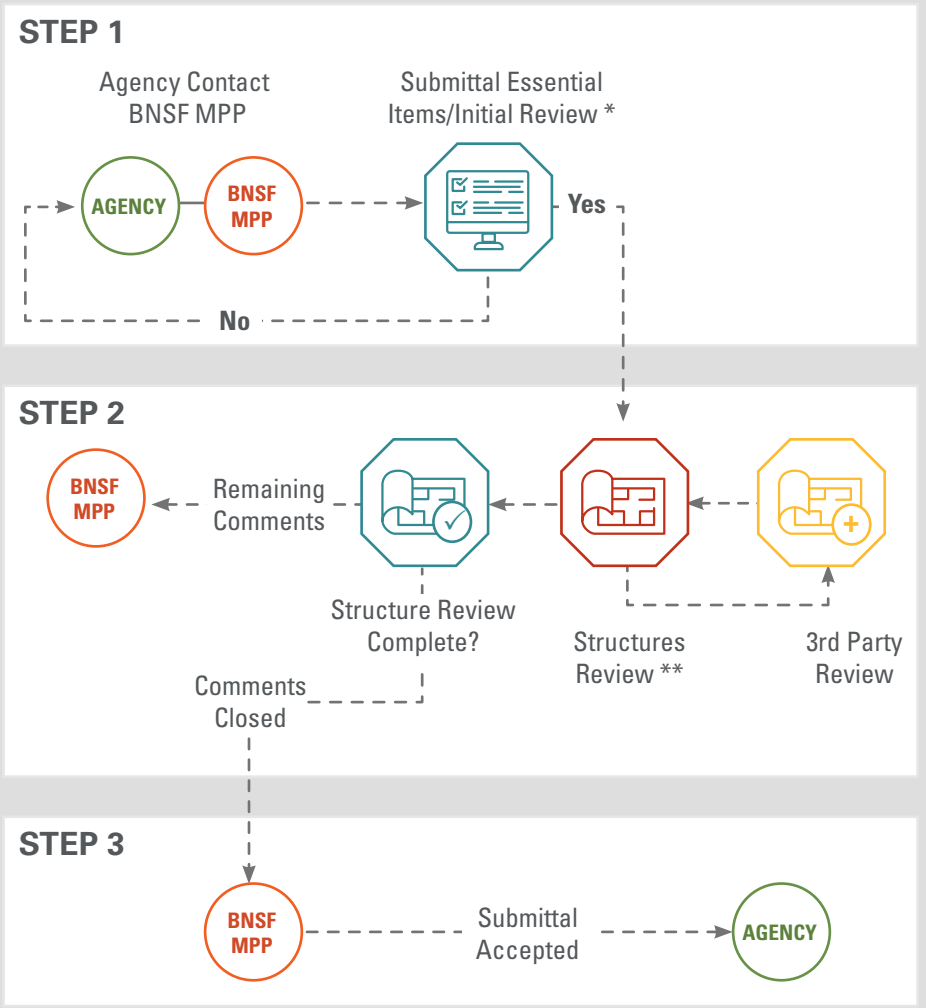
Typical steps during the design stage of the project are listed below and are presented in **Figure 5**:

- The Proponent notifies the BNSF Public Projects Manager of the project by providing location information and conceptual plans and other available preliminary project information.
- To initiate plan review, the Proponent will provide to BNSF the authorization to incur and be reimbursed for Preliminary Engineering costs by entering into a Preliminary Engineering Agreement (PEA). BNSF, at its discretion, may need to hire an outside firm for engineering review on all grade separation or other complex structures projects, adjacent road structure work (for hydraulics and hydrology [H&H]), tunneling, large jack and bore projects, complex crossing projects, etc.
- Provide project information, attend diagnostic and other meetings (as needed), and review site with BNSF or BNSF designee.
- Submit initial plans to BNSF for review and comment.
- Respond to BNSF comments and adjust design if necessary.
- Submit final design to BNSF for review and acceptance.
- BNSF will perform final review to ensure compliance with railroad requirements.
- BNSF will estimate the cost of the work to be done by BNSF, including flagging, engineering inspection and coordination and any track work that may be necessary.
- Once BNSF and the Proponent have reached concurrence on comments, the Design Submittal will be accepted, and may move onto the construction review.

Through the review process, a Proponent and/or its consultant/contractor will be required to complete a BNSF Review Comment Sheet. Examples of these BNSF Review Comment Sheets can be found in Appendix D.

For more information on BNSF Public Projects and JLL General Roles, Contacts, and Territories, of this ***BNSF Railway Public Projects Manual***, see Figure 2 in Chapter 2 – Meet the Team.

Figure 5: *BNSF Public Projects Design Plan Submittal Flow Chart*



* Check submittal essentials, and if not included, reject and request resubmittal
** 3rd party review needed for all undergrade project, adjacent road structure work (for H&H), tunneling, or large jack and bore projects.

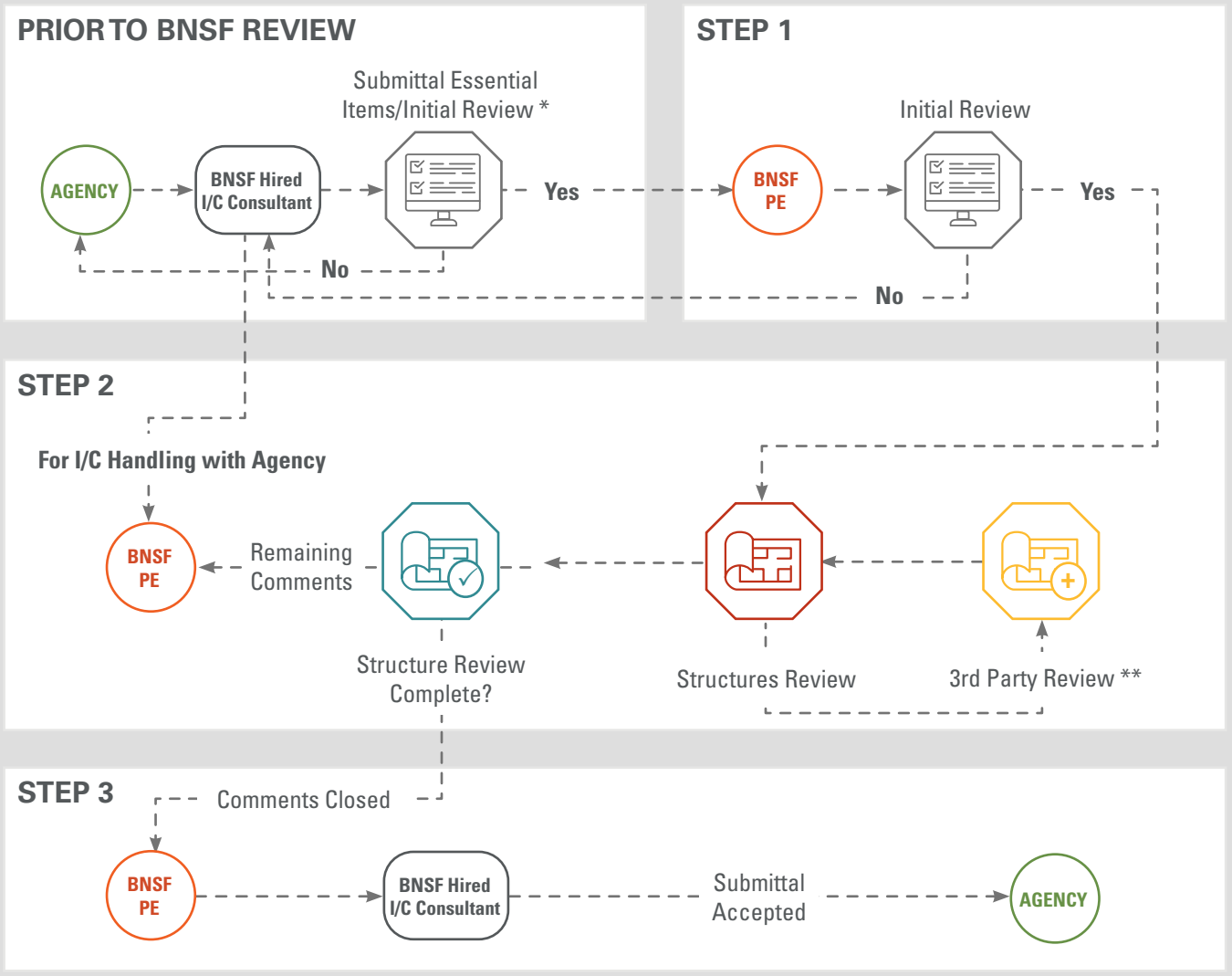
TYPICAL STEPS FOR CONSTRUCTION REVIEW

Typical steps during the construction stage of the project are listed below and are presented in **Figure 6**:

- The Proponent and BNSF Public Projects team will execute a Construction and Maintenance (C&M) Agreement.
- The Proponent will provide BNSF authorization to incur and be reimbursed for engineering costs with a Notice to Proceed (NTP).

BNSF may hire an Inspector/Coordinator Consultant (I/C) to coordinate with the designated BNSF Project Engineer. The I/C will be the all-around liaison to Engineering Services and Structures throughout the construction of the project, and will coordinate work, conduct quality control, and monitor construction. For more information about the I/C, see Chapter 11 – Construction Monitoring Requirements in this ***BNSF Railway Public Projects Manual***.

Figure 6: *BNSF Public Projects Construction Plan Submittal Flow Chart*



* Check submittal essentials, and if not included, reject and request resubmittal.
** Third-party review needed for complex shoring or adjacent BNSF asset

STATE DOT/PUC REQUIREMENTS

Proponents should also consider that a public project potentially involving BNSF property may also be subject to specific requirements of a state Department of Transportation and/or state regulatory authority such as a Public Utilities Commission. The BNSF Manager Public Projects can provide additional information regarding any state-specific project requirements for their respective territories, as appropriate.

BNSF FOURTH QUARTER CONSTRUCTION MORATORIUM

Proponents should also be mindful that BNSF has the right to shut down all construction activities on and adjacent to BNSF property during the fourth quarter of each year – October 1 to December 26 – to accommodate BNSF's peak holiday shipping season.

A formal request is required to be submitted and approved by BNSF's Project Engineer Representative and Operations team for all construction activities wishing to continue in the calendar year fourth quarter.

6

PROJECT ALTERNATIVE DELIVERY

6

Project Alternative Delivery

PROJECT ALTERNATIVE DELIVERY

BNSF recognizes that there may potentially be alternative methods for the construction and delivery of some types of public projects (e.g., design-build approach). Proponents should coordinate with the BNSF Manager Public Projects for the appropriate territory to learn more about alternative project delivery methods and their potential compatibility to public projects on or near BNSF property. BNSF requires the portion of the project impacting BNSF right-of-way to be designed to 100% plans and have specifications complete prior to construction starting. All plans and specs shall be accepted by BNSF prior to construction starting.

CONTACTS

BNSF's Public Projects Team

7

PAYMENT OF BNSF'S COST AND EXPENSE

7

Payment of BNSF's Cost and Expense

PAYMENT OF BNSF'S COST AND EXPENSE

Proponents developing a public project on BNSF property will pay BNSF's cost and expense both direct and indirect for work performed by BNSF.

All funding sources being used by the Proponent to advance the project must be identified upfront, and any time funding sources change, BNSF must be immediately informed. Preliminary Engineering costs associated with the project are billed directly to the Proponent by BNSF as determined by the Preliminary Engineering Agreement.

BNSF construction expenses will be estimated during Preliminary Engineering, and the estimate will be incorporated into the C&M Agreement. These are cost estimates only and BNSF has the ability to update at various frequencies. BNSF will bill the Proponent actual costs on a progressive basis during construction, or as determined by the C&M.
A final bill will be sent at the completion of the project.

CONTACTS

BNSF's Public Projects Team

GENERAL BILLING AND REIMBURSEMENT REQUIREMENTS

Under normal billing procedures during construction of the project, BNSF will send the Proponent progressive invoices detailing the costs of the railroad work performed by BNSF under the corresponding agreement. The Proponent must reimburse BNSF for completed Force Account work within thirty (30) days of the date of the invoice for such work. Parties may negotiate a lump sum with terms to be determined.

Upon completion of the project, BNSF will send the Proponent a detailed invoice of final costs, separated as labor and materials for each item in the recapitulation shown in original cost estimate provided by BNSF. Proponent must pay the final invoice within thirty (30) days of the date of the final invoice.

BNSF reserves the right to charge a finance fee for any reimbursable payments made after the terms stipulated in the agreement. The finance charge continues to accrue daily until the date payment is received by BNSF, not the date payment is made or the date postmarked on the payment. Finance charges will be assessed on delinquent sums and other charges as of the end of the month and will be reduced by amounts in dispute and any unposted payments received by the month's end. Finance charges will be noted on invoices sent to the Proponent.

The work to be completed by BNSF (Force Account Work) is identified below:

- Railroad-related construction activities, as required by union agreement or as indicated by BNSF.
- Railroad flagging protection when performed by a BNSF employee.
- Surface – Grade crossing maintenance and/or replacement of the track and grade crossing surface are performed by BNSF and may be billable to an outside party or highway authority as specified in an agreement. The responsibility for the maintenance of public crossing approach pavement varies by state and is specified in some individual crossing agreements or orders.
- Signal – Grade crossing signal construction, maintenance, or outage required by the proposed track work.
- Inspection/Coordination – I/C services during Proponent's construction.

The work to be completed by the Proponent is identified below:

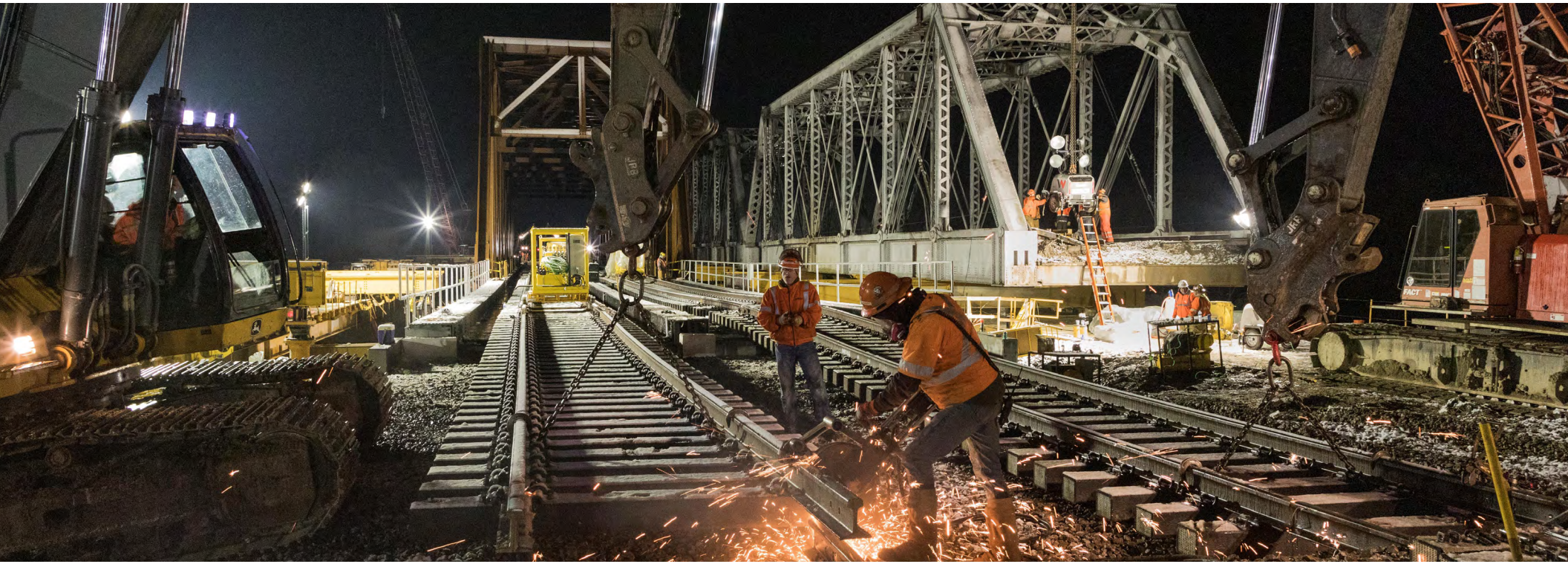
- The remaining work as outlined in the accepted construction documents and corresponding C&M Agreement. The cost of this work will be the responsibility of the requesting Proponent unless otherwise stipulated in the C&M Agreement.
- Procurement of contract flagger as may be approved or directed by BNSF.

8

REQUIREMENTS FOR BNSF ENGINEERING REVIEW

8

Requirements for BNSF Engineering Review



REQUIREMENTS FOR BNSF ENGINEERING REVIEW

Any project proposals that may impact BNSF operations or are in close proximity to BNSF right-of-way must be evaluated by BNSF. To initiate a construction or improvement project, a Proponent must contact the BNSF Manager Public Projects. The BNSF MPP will work with the Proponent to identify the scope, define the tasks to be accomplished, and specify the payment required. In parallel with the plan review, BNSF will draft a construction agreement.

CONTACTS

BNSF's Public Projects Team

OVERVIEW

- Beginning the BNSF Public Projects engineering review process early and providing conceptual plans may lower project costs and expedite the time required for BNSF review and acceptance.
- BNSF reviews plans for impacts to train operations and long-term implications for the BNSF franchise.
- Proponents are encouraged to engage a consultant familiar with BNSF policies, standards, and requirements to develop a single design and structural review.
- If the proposal requires an easement on BNSF property, the Proponent should contact JLL when beginning Preliminary Engineering.
- If the proposal requires a utility encroachment, the Proponent should refer to the **BNSF Utility Accommodation Policy**.
- If the Proponent is requesting a signal interconnection between an active railroad at-grade crossing and a traffic signal, the Proponent must enter into a Preliminary Engineering Agreement (PEA) with BNSF to provide for a BNSF qualified third-party consultant to review the city's design utilizing BNSF's standards.
- All new grade separations and substantial reconstructions will require a third-party consultant to perform design reviews through a PEA between BNSF and the Proponent in which review costs are reimbursed to BNSF by the Proponent.

PURPOSE

The purpose of Preliminary Engineering reviews is to identify issues related to safety, engineering, customer service, operations, legal and regulatory matters, expense, risk, and other considerations specific to any proposed project. BNSF review of plans is only to determine that the plans, and any improvements constructed in accordance with the plans, satisfy BNSF's requirements. Plans should be submitted early in project development so that BNSF requirements can be incorporated.

PROCESS STEPS

- Notify BNSF Public Projects team of the project by providing location information and conceptual plans.
- Provide project information, attend meetings (as needed), and review site with BNSF.
- Submit initial plans to BNSF for review.
- Respond to BNSF comments and adjust design if necessary.
- Submit final design for BNSF review.
- BNSF will perform final review to ensure compliance with railroad requirements.
- BNSF will estimate the cost of the work to be done by BNSF, including flagging. If flagging is to be performed by a contract flagger, BNSF will provide contact information for an approved flagging firm to be used by the Proponent and/or the Proponent's contractor.
- If BNSF takes no exceptions to the design plans (or once all BNSF concerns have been identified and reconciled), BNSF will draft and execute a C&M Agreement for execution.

TIMING

It is a requirement by BNSF, and in the best interest of all parties, to complete the Engineering reviews before any contracts are executed between a Proponent and BNSF or any construction steps begin. BNSF will work to be responsive, with timing depending upon the complexity of the project and the related schedule. Typical review times are 30 days per submittal to BNSF. The BNSF MPP will work with the Proponent to schedule PE and construction to meet project schedule objectives whenever possible, considering available resources.

STANDARD DOCUMENTS

BNSF executes many agreements for Preliminary Engineering and construction of projects annually. BNSF has developed standard agreements, which can be executed by BNSF without additional legal review. Non-standard agreements or modifications to the BNSF standard agreement terms will require additional legal review and may increase approval time, project duration and/or cost.

9

SUMMARY OF SUBMITTAL REVIEW SCHEDULES

9

Summary of Submittal Review Schedules

SUMMARY OF SUBMITTAL REVIEW SCHEDULES

This chapter summarizes the general process and schedule associated with Proponent submittals and reviews necessary to support development of a public project on, across, or adjacent to BNSF property. In general, the submission review period will require a minimum of thirty (30) days for the initial review response by BNSF. An additional thirty (30) days may be required by BNSF to review any subsequent submissions or resubmissions.

The submittal and review processes are facilitated by BNSF and JLL. BNSF will utilize third-party reviewers as necessary and at Proponent expense to supplement submittal reviews by BNSF. Please reference **Figure 2 in Chapter 2 – Meet The Team** for the roles of BNSF and JLL teams when examining general review schedules for the project types identified in **Table 3 on the following page**. JLL works with various departments at BNSF to review and approve all elements listed below. Contact the BNSF Manager Public Projects (MPP) for more information. Visit the **BNSF's Public Projects Team** site for a map of the BNSF MPP territories and contact information.

These timelines for design review are independent but may be in parallel with timelines for all applicable agreements necessary to progress the project, including those for preliminary engineering, construction and maintenance, and right of entry. All projects are subject to plans acceptable to BNSF and entering into those certain agreements for their implementation.

CONTACTS

- BNSF's Public Projects Team
- BNSF | JLL Contacts

RESOURCES

- Pipeline Process Instructions
- Utility Accommodation Policy
- BNSF | Demolition Guideline
- BNSF Railway - UP Railroad – Guidelines for Railroad Grade Separation Projects

REGULATION

- Train Horn Rule and Quiet Zones | FRA

TYPICAL DESIGN REVIEW PROCESS

Through the review process, a Proponent and/or its consultant/contractor will be required to complete a BNSF Review Comment Sheet for comment submittal and exchange. Examples of these BNSF Review Comment Sheets can be found in Appendix D.

Table 3: *Summary of Various Projects and Related Review Schedule*

PROJECT TYPE	GENERAL REVIEW SCHEDULE	RESOURCES
Assignment	Used for selling property or a name change. The average processing period is approximately twelve (12) weeks from when the application is received; handled by JLL.	BNSF | JLL Contacts
Bridge Demolition	A minimum of four (4) weeks shall be expected for BNSF's review after the complete submittal is received (*Guidelines for Preparation of Bridge Demolition and Removal Plan Over the BNSF Railway, 2008*).	BNSF | Demolition Guideline
Cleaning and Painting BNSF Bridges and Structures and Other Bridges over BNSF Property	These projects require a minimum of forty-five (45) days per submittal and are handled by the BNSF MPP and other staff, as appropriate.	BNSF's Public Projects Team
Environmental Access	The average processing period for an Application for Environmental Access (e.g. environmental studies, acquiring soil samples, etc.) is approximately sixty (60) days from when the application is received. These applications are handled by JLL.	BNSF | JLL Contacts
General License Permit	General License Permit for culvert, permanent ditch, drainage facility, stormwater fall-out, encroachments, and existing fence. A minimum of eight (8) weeks from when the application is received; handled by JLL.	BNSF | JLL Contacts
Highway-Rail Grade Crossing Surface Maintenance and Replacement (Private and Public)	The average processing period for an Application for Roadway Surfacing/Resurfacing is approximately six (6) weeks from when the application is received; handled by JLL. For in-kind replacement of an existing crossing only, including maintaining existing width, lane configurations, and any existing pedestrian facilities.	BNSF | JLL Contacts

Table 3: *Summary of Various Projects and Related Review Schedule continued*

PROJECT TYPE	GENERAL REVIEW SCHEDULE	RESOURCES
House or Structure Crossing	Used for low-clearance vehicles and those in excess of state Department of Transportation height and weight standards (and carrying houses, boilers, or transformers). The average processing period for a permit is approximately twelve (12) weeks from when the application is received; handled by JLL.	BNSF | JLL Contacts
Leases and Easements on BNSF Property	Leases and easements on BNSF property require a minimum of thirty (30) days per submittal and are handled by JLL in conjunction with the BNSF MPP.	BNSF's Public Projects Team BNSF | JLL Contacts
Modifications to Highway-Rail Grade Crossings	All crossing modifications require Proponent approval pursuant to the *Manual on Uniform Traffic Control Devices* (*MUTCD*) as well as an on-site diagnostic meeting with the BNSF MPP, appropriate regulatory agency, and third-party consultants, as may be applicable. The diagnostic meeting is typically initiated by the Proponent before plan review and acceptance is coordinated by BNSF MPP.	BNSF's Public Projects Team Manual of Uniform Traffic Control Devices (MUTCD)
New Bicycle/Pedestrian Pathways and Multi-Use Trails	These project types require a minimum of thirty (30) days per submittal and are handled by the BNSF MPP and other staff, as appropriate.	BNSF's Public Projects Team
New Public Crossing	It is BNSF policy to deny any requests for new public crossings unless a Proponent is closing multiple other existing public crossings similar in nature to the new crossing being proposed. Proponent should contact the BNSF MPP for more information.	BNSF's Public Projects Team
New Private Crossing	For a new permanent private crossing, the average processing time for an application is approximately ten (10) weeks from when the application is received. If the application is accepted, installation may take up to one (1) year. Temporary Private Crossings have an average processing time of forty-five (45) working days after an application is received. All private crossing applications are handled by JLL. Requesters will be responsible for all costs associated with installation and ongoing maintenance of the private crossing surface, signage, and approaches. Private crossing permits are non-transferable and crossings are subject to removal upon change in property ownership. It is BNSF policy to deny requests for a new private crossing where alternate access is available or could be established.	BNSF | JLL Contacts

Table 3: *Summary of Various Projects and Related Review Schedule continued*

PROJECT TYPE	GENERAL REVIEW SCHEDULE	RESOURCES
Overpass and Underpass Structure Projects (including Grade Separations)	A minimum of thirty (30) days should be allowed per design submittal. Construction submittals are handled by the BNSF Inspector/Coordinator (I/C) and designated BNSF Project Engineer.	BNSF Railway - UP Railroad Guidelines for Railroad Grade Separation Projects
Parallel Construction Projects	Projects parallel to the BNSF network require a minimum of forty-five (45) days per submittal and are handled by the BNSF MPP and other staff, as appropriate.	BNSF's Public Projects Team
Public Road Crossing Consolidation and Closures	BNSF strives to permanently consolidate and close at-grade crossings to improve safety along the BNSF network. This process may require state regulatory approval. The Proponent can work with the BNSF MPP, who is the main point of contact at BNSF to review crossing closures, on applicable state laws.	BNSF's Public Projects Team
Quiet Zone Proposals	Any party interested in putting a Quiet Zone (QZ) in place should reference the *Federal Railroad Administration (FRA) Train Horn Rule at Train Horn Rule and Quiet Zones* before contacting BNSF. A QZ must be initiated by a government agency, and not a private citizen or business. All QZ proposals require an on-site diagnostic meeting with the BNSF MPP and other BNSF designees prior to plan review and acceptance.	BNSF's Public Projects Team Train Horn Rule and Quiet Zones | FRA
Temporary Occupancy Permit	Used for surveying and other short-term non-intrusive work. The average processing period for an Application for Temporary Occupancy Permit is approximately six (6) weeks from when the application is received; handled by JLL.	BNSF | JLL Contacts
Utility Crossings	For pipeline/wire line processing (e.g., installation of a pipeline for water, natural gas, sewage, oil or petroleum, etc.; electric supply line for voltage, circuits, or electricity; communication line for phone, fiber optic, or CATV) approximately six (6) weeks from when the application is received should be expected for applicant review; handled by JLL. For other utilities, approximately thirty (30) to sixty (60) days from when the application is received; handled by JLL.	Pipeline Process Instructions Utility Accommodation Policy (2011) BNSF | JLL Contacts

10

ENTRY ONTO BNSF PROPERTY

10

Entry onto BNSF Property

Entry onto BNSF Property Navigation

ENTRY FOR CONSTRUCTION WORK VIA BNSF PUBLIC PROJECTS	ENTRY FOR OTHER PURPOSES VIA JLL	OTHER CONTRACTOR REQUIREMENTS	FLAGGING SERVICES FOR ACTIVITIES ON OR NEAR BNSF PROPERTY AND TRACKS	EXAMPLES OF ON-TRACK SAFETY PROTECTION	WHICH METHOD OF ON-TRACK SAFETY IS APPROPRIATE?	INJURY REPORTING AND SPILL REPORTING

ENTRY ONTO BNSF PROPERTY

To maintain efficient customer service and to ensure the safety of BNSF employees and of those parties requesting access to BNSF property, BNSF requires all parties accessing its right-of-way for investigative activities or for the performance of construction work to have a written agreement with BNSF fully detailing each party's responsibilities. Activities by others with the potential to affect BNSF's property, operations, and/or personnel without actually entering BNSF property must also be reviewed with BNSF and appropriate arrangements and agreements completed. The public should be aware that any unauthorized entry onto BNSF property could be considered trespassing by federal, state, or local law, and could lead to criminal prosecution.

The process by which an appropriate agreement covering entry and/or the other necessary conditions or requirements can be developed and implemented is typically dependent upon the scope of the activities proposed by an outside party or Proponent. Although the type of agreement may vary, most agreements include insurance and liability provisions, work procedures and conditions, and reimbursement provisions relating to payment to BNSF for costs it may incur in relation to the entry or work.

The following summarizes the various types of BNSF agreements and contracts most frequently utilized to accommodate the requested entry and the proposed work activities. Reference Figure 1 in Chapter 2 – Meet The Team (for roles of the BNSF and JLL teams) when performing the activities listed below.

CONTACTS

BNSF's Public Projects Team

Accident-Reporting.Center@BNSF.com

RESOURCES

Frequently Asked Questions | BNSF

USA | eRailSafe

BNSF Contractor Orientation

BNSF | Rail Permitting

ENTRY FOR CONSTRUCTION WORK VIA BNSF PUBLIC PROJECTS

Entry for construction work (not exclusively associated with utility work or an existing Construction & Maintenance [C&M] Agreement) will require a C&M Agreement, Temporary Occupancy Permit (TOP), or other form of right-of-entry as determined by the magnitude of potential impacts to BNSF.

A C&M Agreement will be required for construction work that could impact BNSF facilities or operations, and may include work such as construction or rehabilitation of a bridge over BNSF right-of-way, roadway construction, other highway improvements, heavy grading, or drainage work. C&M Agreements are drafted by the BNSF MPP and sent to the Proponent for review.

Construction work that will not impact BNSF facilities or operation may be handled by a TOP, as determined by the BNSF Public Projects team.

A TOP is utilized primarily in situations when outside parties or Proponents desire to undertake investigative work such as performing survey work, taking borings, performing bridge inspections, or undertaking other activities requiring only access to BNSF property and not construction work activities. It should be noted that different agreements are used for temporary Private Crossings.

Applications for TOPs for investigative and non-construction work activities (including movement of off-highway or oversized loads at grade crossings) within BNSF's right-of-way can be obtained by contacting Bartlett & West online at **BNSF | Rail Permitting**.

ENTRY FOR OTHER PURPOSES VIA JLL

BNSF may use other forms of agreements covering entry by outside parties or Proponents depending on work scope or other factors. The process to obtain right of entry for these purposes as listed below may also be initiated through JLL online at **Frequently Asked Questions | BNSF**.

- Environmental Right-of-Entry.
- Utility Permit/License Agreement for pipeline and wire line construction – for both specifications and applications.
- Land Lease applications.
- Movement of oversized loads across BNSF tracks at private or public highway-rail grade crossings.
- Movement of off highway construction equipment across BNSF tracks at private or public highway-rail grade crossings.

This Chapter 10 only concerns entry onto BNSF property for purposes relating to potential projects that are the subject-matter of this *BNSF Railway Public Projects Manual*. Other entries onto BNSF property, such as site inspections that occur during litigation, are subject to the applicable rules of civil procedure and are outside the scope of this Manual.

OTHER CONTRACTOR REQUIREMENTS

In order to protect BNSF's investment in its right-of-way, for the safety of BNSF employees, and for the safety of persons coming onto BNSF property, BNSF has established certain additional requirements. The following items listed in this chapter constitute minimum requirements for all persons coming on or near BNSF right-of-way. Contractors are encouraged to develop their own safety rules that meet or exceed the following requirements.

Before accessing BNSF property, contractors are required to complete BNSF contractor orientation/safety training and must possess valid eRailSafe identification.

eRailSafe

The contractor shall have a background investigation performed on all of its employees, subcontractors, and agents whom BNSF determines will require one of the following:

- To be on Railroad's property, or
- To require access to BNSF's critical infrastructure, railroad critical information systems, BNSF's employees, hazardous materials on BNSF's property, or is being transported by or otherwise in the custody of BNSF, or freight in transit involving BNSF.

The required background screening shall at a minimum meet the rail industry background screening criteria defined by the eRailSafe Program as outlined at eRailSafe.com, in addition to any other applicable regulatory requirements. Employees of government agencies are exempt from the eRailSafe requirements.

eRailSafe is the Class I railroad industry standard for contractor safety and security management. eRailSafe enables Class I railroads to monitor and maintain a history of all contractor employees that have access to their property. The purpose of the program is to improve the security of railroad employees, operations, and facilities. eRailSafe provides the testing, background checks, and badges for current employees and future applicants that is required by BNSF to meet U.S. Department of Homeland Security requirements.

The contractor shall obtain written consent from all its employees, subcontractors, or agents screened in compliance with the eRailSafe program to participate in the program on their behalf and to release completed background information to BNSF's designee. The contractor shall be subject to periodic audits to ensure compliance.

Contractors subject to the eRailSafe Program hereunder shall not permit any of its employees, subcontractors, or agents to perform services hereunder who are not first approved under eRailSafe Program standards.

Railroad contractors can register their company, and its personnel and/or employees performing work on BNSF property, with the eRailSafe program via the current risk assessment provider.

Participants must have their vendor number, as provided by BNSF, prior to calling eRailSafe. For more information visit: USA | eRailSafe. This qualification is good for two years.

BNSF shall have the right to deny entry onto its premises or access as described in this chapter above to any of the contractor's employees, subcontractors, or agents who do not display the authorized identification badge issued by a background screening service meeting the standards set forth in the eRailSafe Program. Further, BNSF shall have the right to deny entry to any individual or company, who, in BNSF's sole discretion, may pose a threat to the safety or security of BNSF's operations, assets, or personnel, or engages in discrimination and/or harassment of BNSF or its employees.

OTHER CONTRACTOR REQUIREMENTS (CONTINUED)

BNSF Contractor Orientation

BNSF Contractor Orientation Training must be completed annually by contractors working on or near BNSF property. No employee of the contractor, its subcontractors, agents, or invitees may enter BNSF property without first having completed the BNSF Contractor Orientation.

Additionally, **the contractor must ensure that each of its employees, subcontractors, agents, or invitees possesses a card certifying completion of the BNSF Contractor Safety Orientation before entering BNSF property.** The contractor is responsible for the cost of the BNSF Contractor Safety Orientation. The contractor must renew the BNSF Contractor Safety Orientation annually and may not use training required by and completed for another railroad as a replacement.

The training covers six sections, including: general safety, critical exposure work protection, work on or near the track (including roadway worker protection), intermodal operations, automotive operations, and the contractor's safety action plan.

BNSF business partners enrolled in the Contractor Safety Program must enter information pertaining to their safety performance while in service to BNSF and are also required to submit a Safety Action Plan. For more information visit the **BNSF Contractor Orientation** website.

General Safety Rules

Work in the proximity of railway track(s) is potentially hazardous where movement of trains and equipment can occur at any time and in any direction on any track. All work performed by contractors with 25 feet of any BNSF track must be in compliance with Roadway Worker Protection regulations and BNSF policies.

Contractor safety rules, including rules regarding Personal Safety Equipment (PPE), must not conflict with BNSF safety policies. Current PPE requirements for contractors on or near BNSF property include safety glasses with permanently affixed side shields (no yellow lenses); five point suspension hard hats; safety shoe with hardened toes, above the ankle lace-up, and a defined heel; and high visibility work gear such as American National Standards Institute (ANSI) Class 2 orange safety vests (and not yellow vests). Additional information on PPE requirements for contractors on or near BNSF property can be found online at **www.bnsfcontractor.com**. This website will discuss PPE and on-track protection requirements provided by BNSF. Any Proponent employees who wish to enter BNSF property, whether they are supervising or performing construction, will need to fulfill the requirements listed on this website.

Contractor personnel will obtain BNSF's safety orientation (BNSF Contractor Orientation) prior to entering BNSF property. A job safety briefing will be held prior to beginning work each day and any time work conditions change. All personnel will wear minimum PPE as described above while on BNSF property. Any person working on BNSF property may be subjected to a safety audit by BNSF personnel and is required to comply with the audit. The results of the audit will be presented to the contractor's supervisor immediately upon completion. Any questions regarding safety and requirements for working within 25 feet of the centerline of any BNSF track should be directed to the BNSF Project Representative.

Drug and Alcohol-Free Workplace

BNSF expects that all contractors performing work on BNSF property on behalf of a Proponent will maintain a drug and alcohol-free workplace. BNSF reserves the right to remove any contractor employee, agent, or invitee suspected of being under the influence of drugs or alcohol, or in the possession of the same. Any persons so remove will not be permitted to reenter BNSF property.

OTHER CONTRACTOR REQUIREMENTS (CONTINUED)

Insurance Requirements for Public Projects

This section identifies BNSF's general insurance requirements for public projects. To work on BNSF property, a Proponent's contractors must obtain several different types of insurance coverage, as applicable. Contractor insurance requirements are documented in Exhibit C-1 (see Appendix A-2) or the JLL documents issued. The contractor is obligated to provide and maintain in full force and effect the insurance called for under Section 3 of Exhibit C-1.

BNSF has the right to stop construction work on a project if the insurance described in the Exhibit C-1 is canceled during the course of the project. The work stoppage will continue until all necessary actions are taken by the contractor or its subcontractor to rectify the situation to the satisfaction of BNSF's Manager Engineer and/or until additional insurance has been delivered to and accepted by BNSF.

To the right are the types and levels of insurance coverage that a Proponent and/or its contractor must maintain in order to work on BNSF property. Circumstances unique to a particular project may necessitate a change to these requirements. For a complete description of BNSF's default requirements, including all necessary endorsements and coverage terms, see the sample Exhibit C-1 in Appendix A-2 of this ***BNSF Railway Public Projects Manual***. As used in this chapter, "RAILWAY" means Burlington Northern Santa Fe, LLC; BNSF Railway Company; and the subsidiaries, successors, assigns, and affiliates of each. "Licensee" means the Proponent and/or contractor required to meet BNSF's Insurance Requirements under the applicable agreement.

Commercial General Liability (CGL) Insurance

The policy will provide a minimum coverage of $2,000,000 per occurrence and an aggregate limit of at least $6,000,000. For projects involving overpasses, underpasses, or tunnels, these levels increase to $5,000,000 per occurrence and an aggregate limit of at least $10,000,000, but in no event will the coverage be in an amount less than the amount otherwise carried by Licensee.

Business Automobile Liability Insurance

The insurance will provide minimum coverage with a combined single limit of at least $1,000,000 per accident.

Workers' Compensation and Employers' Liability Insurance

The policy will provide coverage of all employees performing any part of the work or services including coverage for, but not limited to:

- Licensee's statutory liability under the workers' compensation laws of the state(s) in which the work or services will be performed. The policy will cover all of Licensee's employees, regardless of whether such coverage is optional under the law of that state(s).
- Employers' Liability (Part B) with limits of at least $500,000 per accident, $500,000 by disease policy limit, $500,000 by disease each employee.

Railroad Protective Liability Insurance (RPLI)

The policy will name only RAILWAY as the Insured and will provide coverage of at least $2,000,000 per occurrence and $6,000,000 in the aggregate. For projects involving overpasses, underpasses, or tunnels, these levels increase to $5,000,000 per occurrence and an aggregate limit of at least $10,000,000.

In lieu of providing a RPLI policy Licensee may participate, if available, in RAILWAY's Blanket Railroad Protective Policy.

FLAGGING SERVICES FOR ACTIVITIES ON OR NEAR BNSF PROPERTY AND TRACKS

In the interest of public safety and the safety of railroad employees, property, and operations, it is the responsibility of the Proponent, consultants, contractors and others who need to access BNSF property to arrange for protective flagging services for their project when work brings them in close proximity to BNSF tracks. Use of an approved vendor meeting BNSF requirements is required to ensure compliance with all applicable safety rules and processes.

Conditions When Flagging Services Are Required

The contractor shall have a background investigation performed on all of its employees, subcontractors, and agents whom BNSF determines will require one of the following:

- When any entity is working on, near, or adjacent to active BNSF tracks. A Flagger is required when a contractor's work activities are located anywhere on BNSF right-of-way, over, under, and/or within 25 feet measured horizontally from centerline of the nearest track and when cranes or other equipment positioned beyond 25 feet from the track centerline could foul the track in the event of tip over or other catastrophic occurrence.
- When an outside party is using BNSF property or performing operations that may affect BNSF property or facilities. This includes occasions when a party has been given express permission from BNSF to enter railroad property or perform such operations under the terms of a Construction & Maintenance (C&M) Agreement, Temporary Occupancy Permit (TOP), or other appropriate documentation.
- When off-highway construction equipment is crossing BNSF at a private or public grade crossing.
- When oversized equipment or highway vehicles are to cross BNSF at a private or public grade crossing.
- Any excavation work adjacent to BNSF tracks or facilities, within the Theoretical Railroad Live Load zone of influence, or where the active earth pressure zone extends within the BNSF property limits.
- The use of any equipment where, if tipped and laid flat in any direction (360 degrees) about its center pin, can encroach within 25 feet of the nearest track centerline. This is based upon the proposed location of the equipment during use, and may be a function of the equipment boom length. Note that hoisting equipment with the potential to foul must satisfy the required Factor of Safety of 1.5 (150 percent) for lifting capacities.
- Any work where the scatter of rock, debris, or other materials has the potential to encroach within 25 feet of the nearest track centerline.
- Any work where significant vibration forces may be induced upon the Track Structure or existing structures located under, over, or adjacent to the Track Structure.
- Any other work that poses the potential to disrupt rail operations, threaten the safety of railroad employees, or otherwise negatively impact railroad property, as determined by BNSF.
- In other instances as determined by BNSF.

Qualified Flagging Personnel

Flagging services may only be performed by rules qualified individuals approved by BNSF who are trained in the proper procedures related to rail operations and safety requirements, familiar with BNSF rail operations and procedures in a project area, and are able to communicate directly with BNSF dispatching personnel and train crews.

Arrangements for Flagging Services

When it is determined under the terms on the Permit, C&M Agreement, Environmental License, or other agreement that flagging protective services is required for a Proponent's project, it is the responsibility of the Proponent to use a qualified vendor, as well as ensure the vendor meets the requirements of BNSF.

If BNSF forces are requested to provide flagging protection for an outside parties work on or near BNSF property for projects unrelated to railroad operations and maintenance, the contractor must give BNSF's Roadmaster a minimum of 30 calendar days advance notice so that the Roadmaster can make appropriate arrangements. If flagging services are scheduled in advance by the contractor and it is subsequently determined by the parties hereto that such services are no longer necessary, the contractor must give the Roadmaster five working days advance notice so that appropriate arrangements can be made to cancel the flagging service.

FLAGGING SERVICES FOR ACTIVITIES ON OR NEAR BNSF PROPERTY AND TRACKS (CONTINUED)

In the case that flagging services are needed for an extended period of time, such as several months, the Flagger is assigned to that project Monday through Friday. The Proponent/contractor can be charged for five-day work weeks even if a Flagger is not required every day.

Flagging crew generally consists of one employee. However, additional personnel may be required to protect BNSF property and operations, if deemed necessary by the BNSF Roadmaster.

Responsibility for Costs and Expenses

The cost of Flagger services and all costs and expenses associated with Flagger services will be borne by the Proponent or the Proponent's consultant or contractor.

Once flagging personnel are formally accepted for a Proponent led project to a specific work location, the assignment can only be changed with appropriate advanced arrangements.

Generally, each time a Flagger is called, the minimum period for billing will be one, eight-hour basic day.

Where BNSF forces are requested to provide flagging protection, charges for providing flagging services beyond a normal eight-hour weekday are calculated and billed at an overtime rate with respect to BNSF labor or collective bargaining agreements.

For initial planning purposes, the estimated cost for one Flagger can be approximately $2,000 per basic eight-hour day, with time and one-half or double time for overtime, rest days, and holidays. Note that actual Flagger cost is subject to change and should be confirmed with BNSF Public Projects team.

Negotiations for BNSF labor or collective bargaining agreements and rate changes authorized by appropriate federal authorities may increase actual or estimated flagging rates.

Examples of Flagging Costs and Expenses

Costs for flagging services may include – but are not limited to – employee salary and benefits; overhead costs; employee expenses; and administrative, accounting, and billing services.

EXAMPLES OF ON-TRACK SAFETY PROTECTION

In order to determine which kind of Roadway Worker Protection is appropriate for the scope and duration of a given public project, the contractor shall coordinate with the BNSF Manager Public Projects, and the MPP will work with local BNSF transportation and track maintenance managers. Typical methods of on-track safety for roadway workers on BNSF are identified and described below for background purposes only.

Work Windows

Work windows (known also as track windows or track curfews) provide protection for workers and equipment during a predetermined date and span of time during which no train operations occur. If a contractor needs to block one or all of the railroad tracks for a set period of time, for construction purposes, a work window shall be requested 6-8 weeks in advance. Expected work window durations can be as short as 30 minutes and do not often exceed 6 hours. Work window durations are dependent on BNSF's existing and future train traffic volumes and schedules.

BNSF, the Proponent, or its contractor, will establish mutually agreeable work windows for the project. BNSF has the right at any time to revise or change the work windows due to train operations or service obligations. BNSF will not be responsible for any additional costs or expenses resulting from a change in work windows. Additional costs or expenses resulting from a change in work windows shall be accounted for in the contractor's expenses for the project. The contractor and subcontractors must plan, schedule, coordinate, and conduct the contractor's work in order to not cause delays to trains.

Form B

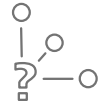
If there is any major work that is occurring within 25 feet of a railroad track, A form B will likely be established. The Form B is used to protect workers and equipment in an established work zone on the track and also allow the potential of train operations or work equipment movements through the work zone following a strict set of rules. Issued through a bulletin, a Form B notifies train crews and operators of on-track equipment of the time that a work zone is in effect, the name of the Employee-in-Charge/ Flagging Foreman, the railway milepost limits of the work zone, and other conditions as applicable. A qualified Flagger will be communicating with the trains, train dispatcher, and contractor any time a train or work equipment approaches the Form B limits. Trains and work equipment are then authorized to enter the work zone only after obtaining clearance from the Employee-in-Charge/Flagging Foreman.

In order to use a Form B as a form of on-track safety, BNSF and the contractor will establish mutually agreeable Form B curfews for the project. BNSF has the right at any time to revise or change the Form B curfew due to train operations or service obligations. BNSF will not be responsible for any additional costs or expenses resulting from a change in Form B curfews. Additional costs or expenses resulting from a change in Form B curfew planning shall be accounted for in the contractor's expenses for the project. The contractor and subcontractors must plan, schedule, coordinate, and conduct the contractor's work in order to not cause delays to trains.

Lookout Protection

When minor work will occur within 25 feet of a railroad track, BNSF may choose to use Lookout Protection to protect the contractor. Lookout Protection is facilitated by a rules qualified BNSF employee or BNSF representative.

Lookout Protection is intended to provide advanced warning to roadway workers of approaching trains or on-track equipment so that each roadway worker can reach a pre-determined place of safety at least 15 seconds before the arrival of the train or on-track equipment. This form of on-track safety protection is not intended for work equipment or for invasive track work that will foul the track or make the track unsafe for train traffic. Lookout Protection is not a guaranteed form of on-track safety since environmental conditions (e.g. weather, lighting, etc.) and sight distances can limit the lookout's ability to visually detect trains. BNSF will not be responsible for any additional costs or expenses resulting from Lookout Protection not being available at the time of work. Additional costs or expenses resulting from Lookout Protection not being available shall be accounted for in the contractor's expenses for the project.



WHICH METHOD OF ON-TRACK SAFETY IS APPROPRIATE?

BNSF or an approved third-party flagger will determine the method of on-track safety for each project. **Work is authorized only when on-track safety has been established.** The contractor shall coordinate with the BNSF MPP as early as possible during project development regarding on-track safety. The MPP will work with the local transportation manager (BNSF Trainmaster) and track maintenance manager (BNSF Roadmaster) to determine the most practical form of on-track safety for the contractor's project.

INJURY REPORTING

Call 911 if necessary for any medical emergency while on BNSF property.

BNSF is required to report certain injuries as a part of compliance with FRA reporting requirements. Any vehicle incident or personal injury sustained by an employee of the contractor, subcontractor, or contractor's invitees while on BNSF's property must be reported immediately to the BNSF Project Representative in charge of the project. A voicemail must be left if the contractor is unable to contact the BNSF Representative in person. A Non-Employee Personal Injury Data Collection Form shall be completed and sent by Fax to the BNSF at 1-817-352-7595 or Accident-Reporting.Center@BNSF.com and to the BNSF Project Representative no later than the close of shift on the date of the injury.

Note that if an injury is in connection with a rail equipment accident/incident, highway-rail grade crossing accident, or automobile accident, the contractor will ensure that appropriate information is obtained, forms completed, and that BNSF or its agent are aware that injuries relate to that specific event.

SPILL REPORTING

The contractor is responsible for determining and complying with all federal, state, and local laws and regulations, including, but not limited to environmental laws and regulations (such as the Resource Conservation and Recovery Act, as amended; the Clean Water Act; the Oil Pollution Act; Hazardous Materials Transportation Act; and Comprehensive Environmental Response, Compensation, and Liability Act or CERCLA), and health and safety laws and regulations.

The discharge, release, or spill on or adjacent to BNSF property of any hazardous substances, oil, petroleum, constituents, pollutants, contaminants, or any hazardous waste is prohibited and the contractor must immediately notify the BNSF's Resource Operations Center (1-800-832- 5452), of any discharge, release, or spills in excess of a reportable quantity. The contractor must also immediately take safeguards necessary to protect its employees, subcontractors, agents and/or third parties and exercise due care with respect to the release including taking any appropriate measure to minimize the impact of the release. The contractor must not allow BNSF property to become a treatment, storage, or transfer facility as those terms are defined in the Resource Conservation and Recovery Act (RCRA) or any state analogue. Any dirt excavated from BNSF property must be properly tested for contaminants and exported to a BNSF-approved disposal facility.

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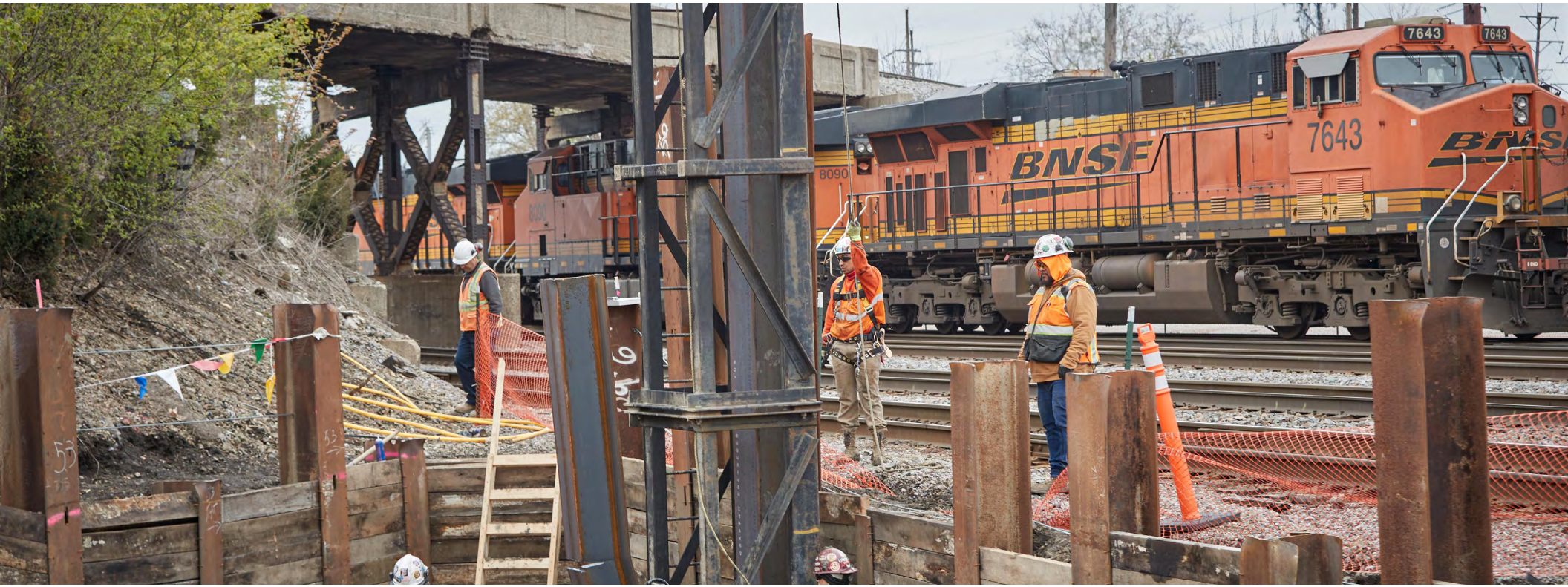
CONSTRUCTION MONITORING REQUIREMENTS

11

Construction Monitoring Requirements

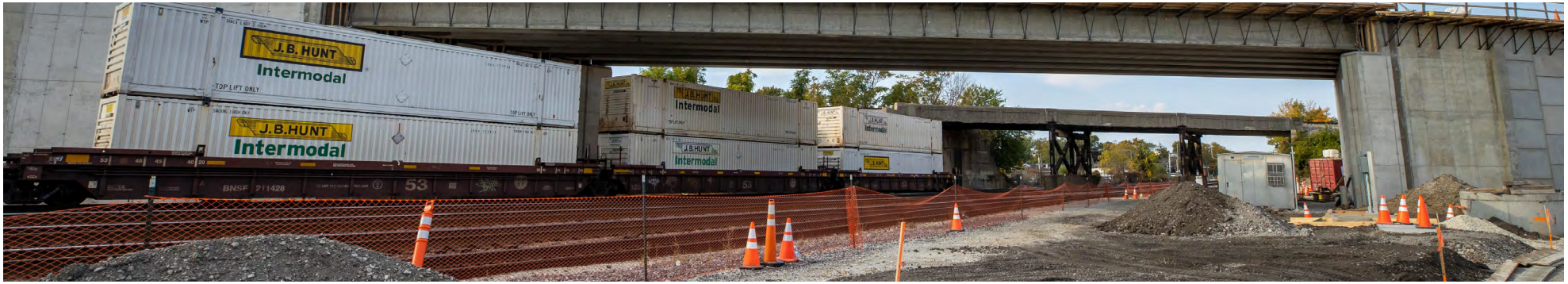


CONSTRUCTION MONITORING REQUIREMENTS

To promote the safety of the public and BNSF employees, maintain quality rail service to BNSF customers, and to protect BNSF property and assets, BNSF may require construction monitoring (in addition to flagging protection) for public projects. The construction monitoring will be conducted by BNSF and its consultants at the Proponent's expense.

CONTACTS

BNSF's Public Projects Team



GENERAL GUIDELINES

Construction monitoring includes intermittent or continuous on-site presence of BNSF or its consultants during construction activities, as summarized below.

- The construction owner or Proponent in charge will pay for the cost of construction monitoring. Construction monitoring will be specified, and the estimated cost will be included in the Construction & Maintenance (C&M) Agreement for the project.
- Construction monitoring is in addition to railroad flagging.
- Construction monitoring includes BNSF review and approval of all plan changes and required contractor submissions during the construction phase of the project.
- The Proponent is responsible for its safety and the safety of its property, contractors, and employees. BNSF, as part of its construction monitoring, will review the work site for activities that could interfere with safe operation of the railroad.
- BNSF and its consultants are not responsible for monitoring the general work activities under the direction of the Proponent for compliance with safety regulation. Any observed unsafe acts or conditions will be reported immediately to the Proponent or contractor representative.

INSPECTOR/COORDINATOR (I/C) CONSULTANT

BNSF or a BNSF-hired Inspector/Coordinator (I/C) Consultant will typically act as the construction monitor. The I/C Consultant's scope of work varies depending on the requirements of specific projects, but a typical summary of the I/C Consultant's work during field construction activities is listed below.

- Attend pre-construction meeting with BNSF, Contractor, and Proponent to clearly set expectations for the project.
- Attend initial job kick-off at site.
- Review contractor's Safety Action Plan and provide comments.
- Periodically attend morning job safety briefings.
- Attend weekly or regularly scheduled contractor project meetings with contractor(s).
- Monitor BNSF Contractor Orientation and eRailSafe compliance.
- Review vertical and horizontal clearance requirements for grade separations and ensure project is built according to accepted clearances for that portion of the project on BNSF right-of-way, as it affects BNSF. Monitor construction activities to ensure that improvements on BNSF property meet all requirements of BNSF and accommodate railroad operations.

INSPECTOR/COORDINATOR (I/C) CONSULTANT (CONTINUED)

- Monitor any material or performance test failures or suspected deviations from plans that could negatively impact BNSF.
- Coordinate the flagging requirements with local BNSF Manager Public Projects and Roadmaster. Coordinate track outage work window requirements with BNSF Project Engineer.
- Review all submittals from Proponent to BNSF.
- Track all submittals and verify BNSF has accepted all submittals prior to applicable work commencing.
- Review and monitor the project to ensure compliance with the applicable accepted submittals for all Operationally Critical (OC) work.
  - OC submittals included in the Guidelines are shoring, falsework, demolition, erection, and construction phasing.
  - Additional OC submittals required are all work plans that remove tracks from service and contingency plans for underpass structures only.
  - In-person safety review meetings at the job site for all OC work to review applicable submittals accepted by BNSF and ensure they are being followed.
- Assess job site housekeeping and general safety, including use of personal protective equipment (PPE). Discuss issues with the contractor and Proponent and elevate non-compliance to BNSF Project Engineer.
- Serve as BNSF liaison to Engineering Services and Structures as needed.
- Coordinate any required utility relocations/modifications. All utilities relocations/modifications need to be properly permitted through JLL.
- Notify contractor's employee, contractor, Proponent, and BNSF of any observed non-compliance with BNSF safety requirements and take appropriate action in an attempt to avoid imminent accident or injury if an unsafe condition is observed, then report non-compliance to the BNSF Project Engineer.
- Create and complete a punch list near project completion to ensure BNSF property and facilities are left in good and proper condition.
- Review Environmental Permit compliance and assists in reporting violations or spills on BNSF property.

Any BNSF employee or the I/C Consultant has authority to remove a contractor's employee from BNSF property if that employee fails to comply with the BNSF safety policy, does not have proper PPE, or otherwise does not comply with instructions regarding work on BNSF right-of-way. The I/C Consultant has authority to shut down work on BNSF right-of-way if the contractor works in a manner that is in violation of BNSF's safety policy or Roadway Worker Protection (RWP) rules.

Anytime a contractor does not comply with instructions issued by BNSF or the I/C Consultant, the I/C Consultant will shut down work and document these events. The I/C Consultant will immediately notify the Flagger and contact the BNSF Project Engineer when a contractor is shut down. All equipment and personnel will be removed from BNSF property until issues causing the shutdown are resolved to BNSF's satisfaction.

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SIGNAL AND COMMUNICATIONS CABLE LOCATES AND PROTECTION

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Signal and Communications Cable Locates and Protection

SIGNAL AND COMMUNICATIONS CABLE LOCATES AND PROTECTION

Many public projects that are developed on BNSF right-of-way or adjacent property have the potential to impact underground signal and communications assets. The protection of these BNSF assets is paramount to safe train operations. Contracted work that has the potential to impact existing signal and communications infrastructure shall be coordinated with the appropriate BNSF representative prior to the start of construction.

Of paramount importance, the contractor must call the BNSF **"Call Before You Dig!" hotline (1-800-533-2891) for telecom,** and **(800) 832-5452 for signal** to arrange for a BNSF underground cable locate or exploration before any work or excavation commences in addition to the other utility locate number for that region and state.

The appropriate measures for the installation and protection of the signal, communications, and fiber optic cables shall be addressed in the plans and contract documents and shall be accepted by BNSF prior to construction.

CONTACTS

Call Before You Dig! hotline:
1-800-533-2891 (telecom)
1-800-832-5452 (signal)

BNSF's Emergency Response hotline (1-800-832-5452)

GENERAL GUIDELINES

BNSF has the following general guidelines and process concerning the installation, protection, and relocation of signal and communications assets on BNSF property. There will be no exceptions to these instructions.

- Fiber optic cables may be presently buried on the BNSF right-of-way or such installations may be scheduled for installation. The presence of such facilities shall be considered in the project design and appropriate measures for the installation and protection of the fiber optic cables shall be addressed in the plans and contract documents.
- Appropriate measures for the installation, protection, and relocation of fiber optic cables as well as BNSF signal and communication lines shall be addressed in the plans and contract documents.
- Before excavating, the contractor must determine whether any underground electric wires or cables, including fiber optic cable systems for signals or communications (and underground pipelines) are present and located within the project work area. The contractor must determine whether excavation on BNSF's property could cause damage to buried cables resulting in delay to rail traffic and service disruption to users. Service delays may cause business interruptions involving loss of revenue and profits. Before commencing excavation, the contractor must contact its designated BNSF representative. All underground and overhead wires will be considered high voltage and dangerous until verified with the company having ownership of the line. The contractor is responsible for notifying any other companies that have underground utilities in the area and arranging for the location of all underground utilities before excavating.

The contractor must call the **"Call Before You Dig!" hotline (1-800-533-2891) for telecom,** and **(1-800 832-5452) for signal** to arrange for a BNSF underground cable locate prior to the start of construction. Note that the **"Call Before You Dig!" hotline** is specific to BNSF and will not include any utilities outside of BNSF property. The contractor should also call the appropriate regional locate number in addition to the BNSF number.

- A BNSF Underground Cable Location and Acknowledgment Form will be completed by a BNSF representative and copy provided to the contractor. A completed copy of the BNSF Underground Cable Location and Acknowledgment Form must be retained by the contractor on the jobsite at all times.
- The contractor must cease all work and notify BNSF immediately before continuing excavation in the area if obstructions are encountered that do not appear on drawings or were previously located, or if railroad utilities expected to be encountered are not found. If the obstruction is a utility and the owner of the utility can be identified, then the contractor must also notify the owner immediately. If there is any doubt about the location of underground cables or lines of any kind, no work must be performed until the exact location has been determined.

If a BNSF signal and communication asset is severed or damaged, the contractor must immediately contact **BNSF's Emergency Response hotline (1-800-832-5452)** and the BNSF representative. Contractor should note the type of signal protection at grade crossings and location of insulated joints in the BNSF track(s) where applicable, and whether modifications to any of these facilities are required.

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UNDERGROUND UTILITY CROSSINGS

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Underground Utility Crossings

UNDERGROUND UTILITY CROSSINGS

There are several locations on the BNSF network where a third-party utility owner has assets that are within, across, or adjacent to BNSF right-of-way. BNSF has developed a Utility Accommodation Policy to outline the procedure for a utility owner to have utility infrastructure located on BNSF. This policy and additional details can be found in the **Utility Accommodation Policy** on BNSF's website. The Utility Accommodation Policy, in general, outlines BNSF's policies and guidelines for utilities paralleling railroad property; utilities crossing railroad property; and plans, approvals, and procedures for utility installation. The policy was developed in the interest of safety, protection, utilization, and the accommodation of future BNSF development with due consideration given to public and private service afforded by adequate and economical utility installations.

This policy is applicable to new utility installations, additions to existing utility installations, and adjustments to or relocation of existing utilities. It is also applicable to existing or planned utility installations for which agreements with BNSF were entered prior to the adoption of the current policy. Existing utility installations that do not meet the licensing agreements may remain at the discretion of BNSF. Utilities covered by this policy include public or privately-owned lines, facilities, or systems. A Utility Agreement License allowing a utility owner the privilege of placing its facilities in or on BNSF property does not constitute permanent right for such usage. Any removal, remodeling, maintenance, or relocation of the facilities, whether or not required by BNSF, will be accomplished promptly by the utility owner at no cost to BNSF. JLL processes license requests on behalf of BNSF.

CONTACTS

BNSF's Public Projects Team

BNSF | JLL Contacts

RESOURCES

Utility Accommodation Policy

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HIGHWAY-RAIL GRADE CROSSING SURFACE MAINTENANCE AND REPLACEMENT

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Highway-Rail Grade Crossing Surface Maintenance and Replacement

HIGHWAY-RAIL GRADE CROSSING SURFACE MAINTENANCE AND REPLACEMENT

The objective of a highway-rail grade crossing is to provide a means for highway traffic to cross a railroad track. Crossings present unique safety challenges and require careful planning, design, and execution to provide for the continued safety of both the public and the railroad.

Beyond this, crossing maintenance and replacement require coordination between BNSF and the highway authority. Complete closure of the crossing is typically required to perform a renewal of a crossing surface, so identification of potential detour routes and impacts to traffic are important considerations.

CONTACTS

- BNSF's Public Projects Team
- Contact Us Form | BNSF

RESOURCES

- USDOT Grade Crossing Handbook
- FHWA Section 130 Program
- FRA Office of Safety Analysis (for USDOT Inventory Number Lookup)
- FRA Safety Map (for USDOT Inventory Number Lookup)
- Manual of Uniform Traffic Control Devices (MUTCD)

OVERVIEW

- BNSF is responsible for maintaining all public at-grade crossing surfaces up to and including approximately one foot outside of the rail, or to the edge of railroad tie. The roadway authority is typically responsible for all paving and approaches to the crossings, unless otherwise dictated by state law.
- All work must meet BNSF engineering standards and conform to the *MUTCD* Part 8 signage, striping, and pavement marking requirements.
- Coordination and agreements with BNSF are required for work near crossings.
- Crossings must be closed entirely for vehicular traffic during at-grade crossing surface replacement or maintenance work.
- Guidelines vary from state to state regarding a funding solution that shares the cost between the Proponent and BNSF.
- Proponents seeking to have a grade crossing renewed should contact the appropriate **BNSF MPP**.

CROSSING DESIGN AND CONSTRUCTION

The most familiar aspect of a crossing to the public is the driving surface. The surface material and construction method is chosen on a case-by-case basis and is based on a number of factors including the type and volume of traffic on both the highway and the railroad, past experience, and available funding from the highway agencies for individual projects. New standard crossing surfaces include concrete panels attached to wood ties. Approaches are typically paved with concrete or asphalt, or can also be surfaced with gravel in rural areas.

Other materials may be used in some cases with approval from BNSF.

The railroad track structure is continuous through the crossing and resembles what you see on either side, with rail, ties, and ballast. The crossing panels that make up the roadway surface are fastened to the ties. Approaches are paved up to the edges of these crossing panels.

Drainage is a critical consideration, as it can affect the quality of the driving surface for road users, the structure of the railroad track, and the reliability of the active crossing warning systems.

CROSSING MAINTENANCE AND REPLACEMENT

To renew a crossing, BNSF must remove the panels and a portion of the approaches, replace the ballast and ties, and then surface the track. Then the panels will be replaced and the approaches repaired. In some cases, additional subgrade improvements may be required, such as replacement of the base rock under the ballast. Drainage will be reestablished for all four quadrants of the crossing. Replacement of the track and crossing surface typically requires the entire roadway to be closed for several days.

MODIFICATIONS TO CROSSINGS

If modifications to a crossing are desired, the roadway authority should contact BNSF Public Projects. BNSF will review the request and prepare an agreement and cost estimate for the work. If a Proponent desires to improve ride quality or widen the roadway for additional lanes or sidewalks, it is typical that the entire crossing surface and approaches will need to be renewed. This approach can be discussed with the BNSF Manager Public Projects.

To add or modify grade crossing warning devices, see the Alterations to Highway-Rail Grade Crossing Warning Devices chapter in this ***BNSF Railway Public Projects Manual*** for more information.

If a grade separation of an existing crossing is desired, see **Chapter 16 – Public and Private Road Crossing Openings and Closures** and **Chapter 18 – Grade Separations** of this ***BNSF Railway Public Projects Manual*** for more information.

MAINTENANCE BLITZ

In some cases, BNSF may desire to address multiple crossings within a corridor at once by dedicating extra forces and resources over a period of time. BNSF will attempt to coordinate this maintenance blitz activity with local communities and the state DOT to arrange road closures and detours, and to maintain access for emergency services. The corridor may also be examined overall for opportunities for crossing closures.

CONTACTS

To report malfunctioning the false activation of lights and gates, damage to lights and gates or other grade crossing infrastructure, or any other grade crossing emergency, call **BNSF's emergency number at 1-800-832-5452** to make a report. This number will connect callers directly to BNSF's Resource Operations Command Center, which is staffed 24 hours a day, seven days a week.

To report a crossing in need of maintenance or repairs, use the Contact Us form on the BNSF website at **Contact Us Form | BNSF**. Provide details of the issue and the location including street, city, state, and USDOT Inventory Number.

Additional Information on Crossings

USDOT Grade Crossing Handbook

FHWA Section 130 Program

FRA Office of Safety Analysis (for USDOT Inventory Number Lookup)

FRA Safety Map (for USDOT Inventory Number Lookup)

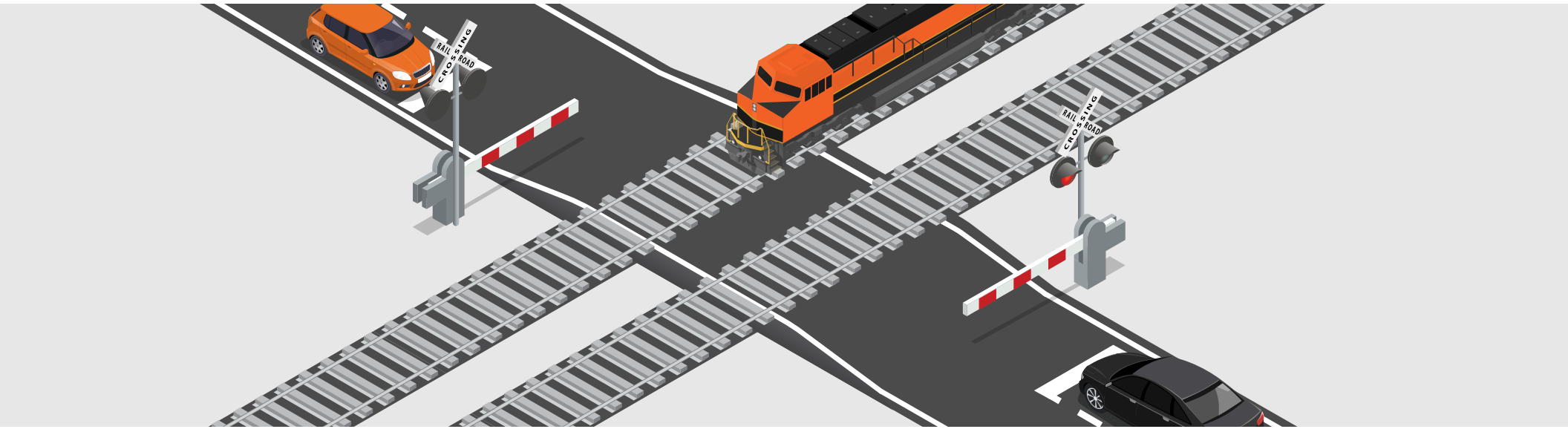
MUTCD

15

ALTERATIONS TO HIGHWAY-RAIL GRADE CROSSING WARNING DEVICES

15

Alterations to Highway-Rail Grade Crossing Warning Devices



ALTERATIONS TO HIGHWAY-RAIL GRADE CROSSING WARNING DEVICES

It is the responsibility of BNSF's Maintenance team to maintain all railroad crossing signals at public highway-rail grade crossings in accordance with federal, state, and local law and regulations. However, the BNSF Public Projects team will process all projects proposing alterations to public highway-rail grade crossing warning systems, including but not limited to: projects for opening new crossings, closing existing crossings, modifying or widening of existing crossings, installing new warning systems, removing and/or relocating existing warning systems, and modifying/upgrading existing warning systems. Requests to BNSF for new or modified public at-grade crossing warning devices must be initiated by the Proponent, not BNSF, as per Section 8 of the *MUTCD*. BNSF does not determine the adequacy of warning devices at highway-rail grade crossings; rather, this is determined through a diagnostic team led by the Proponent or applicable Transportation Authority. BNSF believes that any warning device that meets *MUTCD* requirements is sufficient if the motoring or pedestrian public adheres to the warning device and complies accordingly. In most cases, the requesting Proponent will be responsible for funding the installation of warning devices.

CONTACTS

BNSF's Public Projects Team

RESOURCES

Manual of Uniform Traffic Control Devices (MUTCD)

DEFINITIONS

A word or phrased defined in Chapter 15 has the same meaning throughout Chapter 15:

At-Grade (Highway-Rail) Grade Crossing
The location where a roadway and a railroad track intersect each other at the same elevation.

Diagnostic Review
An on-site evaluation of the existing conditions and safety of an at-grade crossing typically initiated by the Proponent, which typically consists of, among other factors, reviewing train and highway traffic volumes, speed, sight distance, existing warning devices, gate arm length, lamp configuration, pedestrian treatments, signal interconnections, and the placement of medians/curbs and guardrails.

Transportation Authority
Any government agency other than the Proponent proposing the modification to the at-grade crossing that has regulatory responsibility for determining the appropriate traffic control devices to be used on roadways in the state. Depending on state law, Transportation Authorities may include State Departments of Transportation, state Departments of Public Safety, and State Public Utility Commissions, among others.

Types of At-Grade Crossings:

Public Crossing – at-grade crossings that are under the jurisdiction of, and maintained by, a public highway authority.

Private Crossing – at-grade crossings located on privately owned roadways, such as on a farm or industrial area, and intended for use by the owner or by the owner's licensees and invitees. A private crossing is not intended for public use and is not maintained by a public highway authority.

Common Signal Standards:

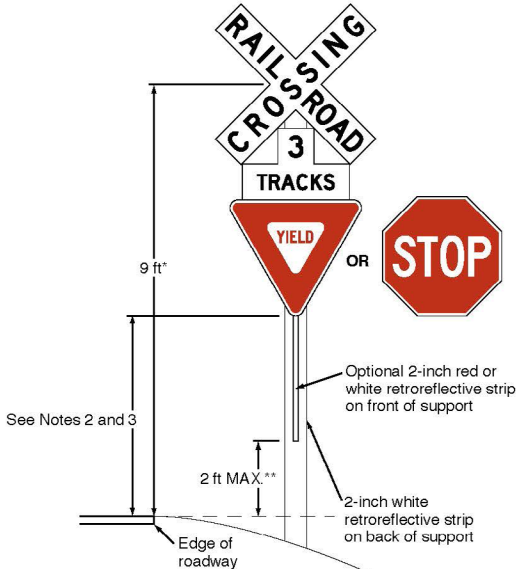
- BNSF has its own standards independent from the *MUTCD* and AREMA.
- BNSF prefers to keep the automated gate arms less than 28 feet, with a maximum allowed length at 32 feet.
- The maximum allowed pre-emption time is 50 seconds per BNSF and AREMA.

Crossings may be protected by either passive warning devices or active warning devices.

Figure 7: *Example Passive Warning System at an At-Grade Crossing Crossbuck Assembly with a Yield or Stop Sign on the Crossbuck Sign Support*

* Height may be varied as required by local conditions and may be increased to accommodate signs mounted below the Crossbuck sign

** Measured to elevation of the near edge of the roadway



Notes:

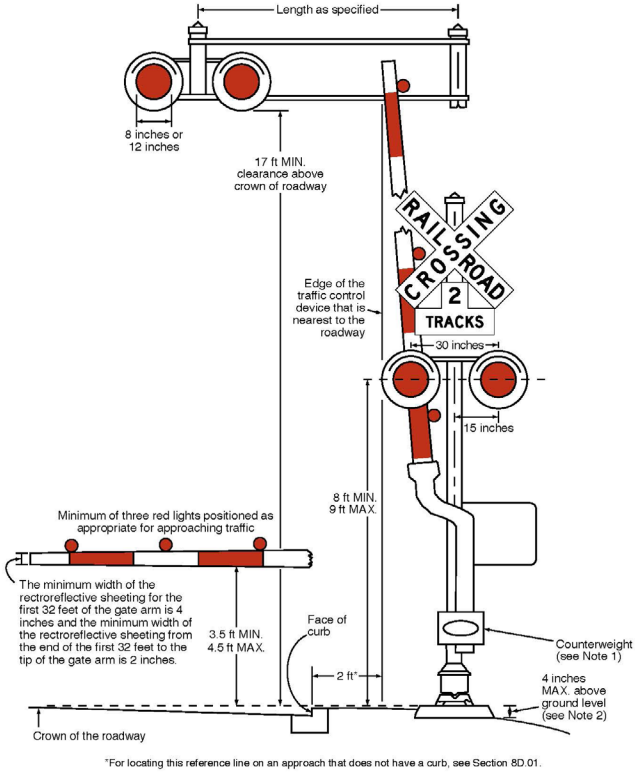
1. YIELD or STOP signs are used only at passive crossings. A STOP sign is used only if an engineering study determines that it is appropriate for that particular approach.
2. Mounting height shall be at least 4 feet for installations of YIELD or STOP signs on existing Crossbuck sign supports.
3. Mounting height shall be at least 5 feet for new installations in rural areas and at least 7 feet for new installations in areas where parking or pedestrian movements are likely to occur.

Source: *MUTCD, Chapter 8, 2023*

IDENTIFICATION OF THE CROSSING AND LOCATION

Each at-grade crossing has a unique DOT inventory identification number. There is often more than one at-grade crossing on the same roadway. The USDOT National Crossing Inventory Number, such as 123456A, must be used to identify the specific at-grade crossing in all communications with the railroad to reduce possible confusion about the specific location. The USDOT Inventory Number and other information about the characteristics of a specific at-grade crossing can be determined by accessing the **FRA Crossing Inventory Data Search** website. It can also be seen on blue and white Emergency Notification System (ENS) signs prominently displayed at every at-grade crossing, like the example shown below.

Figure 8: *Example Active Warning System at Grade Crossing Composite Drawing of Active Traffic Control Devices for Grade Crossings Showing Clearances*



Notes:

1. Where gates are located in the median, additional median width may be required to provide the minimum clearance for the counterweight supports.
2. The top of the signal foundation should be no more than four inches above the surface of the ground and should be at the same elevation as the crown of the roadway. Where site conditions would not allow this to be achieved, the shoulder side slope should be re-graded or the height of the signal post should be adjusted to meet the 17-foot vertical clearance requirement.

Source: *MUTCD, Chapter 8, 2023*

DESIGN CONSIDERATIONS

At-grade crossing warning systems must adhere to all applicable laws and regulations and BNSF standards. Per Section 8 of the *MUTCD*, the diagnostic team, not BNSF, is responsible for determining the level and configuration of warning devices for an at-grade crossing. In addition, the Proponent or other Transportation Authority responsible for making the warning system and equipment determinations is also responsible for selecting appropriate vehicular traffic control signs and/or devices for a specific public highway.

The recommended practices and additional information are available in *AREMA manuals, FRA's Railroad-Highway Grade Crossing Handbook, MUTCD,* and any documentation developed by state Departments of Transportation or Public Utilities Commissions, where applicable.

ENGINEERING, COST ESTIMATION, AND INSTALLATION

Each Proponent or Transportation Authority determines the location and types of at-grade crossing signals to be installed pursuant to the *MUTCD* and applicable laws and regulations. Section 130 funding is available from the Federal Highway Administration (FHWA) for crossing safety improvements and is traditionally managed by a state Transportation Authority. Crossing signals regulate motorists and pedestrians and are within the jurisdiction of Government Agencies and Transportation Authorities. Therefore, they are defined by the FHWA as highway control devices, not railroad signals.

Per the *MUTCD* and applicable law, BNSF cannot and does not install grade crossing signals on its own accord without Proponent approval as BNSF does not have the authority to regulate roadway traffic. Installation of traffic control devices must be done according to the procedures detailed by each state. BNSF will design the circuitry for each crossing and estimate the cost for each project. BNSF must be compensated for any and all costs incurred in completing environmental assessments, preliminary and final design, and construction of improvements necessary to carry out the proposed Proponent initiative without adverse effects, delays, or restrictions on current and future freight transportation mobility and growth, and to reflect fair market value of any interest in rail property affected by or acquired by the Proponent.

BNSF must retain operating control of rail facilities impacted by the proposed Proponent initiative. All final engineering and construction must be done under the control of BNSF. As such, BNSF will provide engineering, design, and cost estimates for the installation of at-grade crossing warning devices at the expense of the Proponent as part of the final engineering for a project. Changes to at-grade crossing surfaces may also require engineering and estimating by BNSF.

The Proponent will pay for the cost of all labor and material. Following a formal request from the Proponent, cost estimates and preliminary design from BNSF to the Proponent typically takes 90 to 120 days for signal work. Notwithstanding any prior practices, BNSF's current policy is to order material and schedule the project after an Agreement is executed and after receiving the Proponent's Notice to Proceed. Labor agreements with BNSF forces will require BNSF to install the at-grade crossing warning devices on main line tracks.

OPERATION OF AT-GRADE CROSSING WARNING DEVICES

Passive crossing warning systems are designed to alert roadway users of an at-grade crossing ahead so that users will be alert for an approaching train. Active at-grade crossing warning systems (i.e., bells, flashing lights, and automatic gates) are designed to activate in advance of a train entering the crossing. Train speed changes while approaching the crossing may cause a standard warning system to activate longer than expected. Trains stopping or making forward and reverse movements near the crossing may also cause a standard warning system to activate and then clear after an appropriate time without a train entering the crossing. Constant Warning Time (CWT) equipment detects the approach and speed of a train and measures its distance from an at-grade crossing in order to activate warning devices within a uniform minimum warning time selected and thus reduce potential delays to vehicular traffic or the potential for motorists to disregard warning devices at the crossing.

Contact BNSF MPP for a list of BNSF-approved traffic consultants that regularly work with BNSF on review of interconnected crossings; have familiarity with BNSF, AREMA, and *MUTCD* standards; and can assist a Proponent with submittals based on BNSF requirements.

TRAFFIC SIGNAL PREEMPTION INTERCONNECTION

The appropriate traffic control system to be used at an at-grade crossing should be determined by an engineering study (or Diagnostic Review meeting on-site) involving representatives of both the Proponent and BNSF.

Traffic signal preemption of the traffic signals at highway intersections near at-grade crossings requires careful review by an engineering team to determine the appropriate timing and sequence for both the traffic signal and the at-grade crossing warning system. Preemption for the traffic signal may be simultaneous with, or in advance of, the warning system activation. Per recent changes to the AREMA manual, which BNSF supports, advanced preemption timing on BNSF shall not exceed 50 seconds of total time, including advanced preemption time.

Information regarding the type of preemption and any related timing parameters shall be provided to BNSF so that BNSF can check the appropriate train detection circuitry. BNSF requires that all requests for preemption projects and proposed preemption timing and traffic signal operation be reviewed by a pre-approved traffic engineering consultant before being forwarded to BNSF Signal Design for estimation and final approval, listed below. As such, the Proponent shall review all preemption plans, layouts, traffic signal timing, and calculations with that Consultant.

BNSF has pre-approved traffic consultants who are familiar with BNSF, AREMA, and *MUTCD* standards; and can assist a Proponent in putting together required submittals based on BNSF requirements. Additional information is available through the BNSF MPP.

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PUBLIC AND PRIVATE ROAD CROSSINGS OPENINGS AND CLOSURES

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Public and Private Road Crossings Openings and Closures

CONTACTS

BNSF's Public Projects Team

BNSF | JLL Contacts

RESOURCES

USDOT Grade Crossing Handbook

Federal Railway-Highway Crossings (Section 130)

Manual of Uniform Traffic Control Devices (MUTCD)

PUBLIC AND PRIVATE ROAD CROSSINGS OPENINGS AND CLOSURES

Federal, state, and BNSF policy is to close or consolidate at-grade crossings to eliminate the possibility of a collision between a train and a motorist, pedestrian, or bicycle. BNSF strongly discourages any new at-grade crossings across its tracks and any such requests will be highly scrutinized by BNSF. The BNSF Public Projects team will address potential openings or closings of at-grade crossings, including both public and private crossings. BNSF will coordinate with the state transportation authority on public crossings or with the property owner on private crossings. This chapter covers only the opening and closing of public and private crossings at-grade, while grade separation projects will be specifically addressed in Chapter 18 – Grade Separations.

OVERVIEW

BNSF *strongly* discourages new at-grade crossings and rather works to close or consolidate existing crossings. Federal policy encourages closure of crossings and provides funding to develop such projects.

- As of July 2024, there were about 25,000 at-grade crossings on BNSF's network. Since 2000, BNSF has closed more than 6,600 at-grade crossings.
- BNSF may choose to offer financial incentives for permanent closure of a crossing, whether by closure/consolidation of the existing at-grade crossing (or by grade separation).
- If a Proponent desires a new public crossing, it must close multiple like-crossings, similar in nature to the new crossing being proposed. There must be a net reduction in crossings and increase in safety for BNSF to consider the project.
- Work on crossings is divided between BNSF and the Proponent in the manner described in this document.
- Private crossing permit requests for existing or new crossings are handled by JLL.

NEW CROSSINGS - PUBLIC

New and expanded public at-grade crossings are discouraged by BNSF. If a Proponent desires a new public crossing, it should contact BNSF Public Projects. Every effort must be made to provide alternate access or additional capacity by constructing grade separations or utilizing other roadways leading to existing crossings. Otherwise, the Proponent must provide a detailed explanation of why a new crossing is the only feasible solution and identify a minimum of two like-crossings within the Proponent's jurisdiction that can be closed. BNSF also reviews existing crossings for potential closures or consolidations.

Any new crossings requested across BNSF should generally be constructed with concrete surfaces and active warning devices where consistent with the requirements of the *MUTCD* and determinations of the diagnostic team. Costs for new crossings, including all future maintenance and routine replacement, shall be borne by the Proponent.

JLL will issue an easement for all new roadway crossings approved by BNSF. Application information can be found at Frequently Asked Questions | BNSF.

NEW CROSSINGS - PRIVATE

New private crossing applications and permits are handled by JLL but still require BNSF approval. BNSF discourages new private crossings and will encourage the applicant to find alternate access. Applicants should refer to Chapter 2 – Meet The Team for contact and permit information for this process, or visit Frequently Asked Questions | BNSF.

CLOSURE PROCEDURE - PUBLIC

The best way to reduce incidents between trains and vehicles is to close or consolidate crossings. Closing adjacent crossings can simplify the design of active warning devices for remaining crossings. This approach will also free up funding formerly dedicated to those closed crossings for the improvement of the remaining crossings.

The procedure varies by state, but generally approval from the state public utility commission is required to close or modify a public at-grade crossing. BNSF will work with the roadway authority to try to reach a consensus on closure and then make a formal application to the authority for closure. If the roadway authority disputes the closure, the dispute will be resolved under procedures established by state law. Once closure is approved and the road is formally closed to vehicular traffic, BNSF will remove the crossing surface and any/all passive and active warning devices. BNSF will enter into an agreement with the road authority and assist in development of a plan to remove the approaches and restore the railroad ditch line, as well as install any necessary end of road treatment. Any related work outside of the BNSF right-of-way is the responsibility of outside parties unless it specified otherwise in any agreements with BNSF.

In the case of grade separation, the at-grade crossing may or may not need to stay open during construction of the grade separation structure(s), but the same removal process outlined above applies. BNSF may provide a financial incentive for the roadway authority for such a closure on a case-by-case basis (to be confirmed through the local BNSF Manager Public Projects), which is typically paid at the end of the project when the grade crossing is permanently closed and the new structure is substantially complete. Additionally, federal funds are available for crossing closures via the federal Section 130 program.

CLOSURE PROCEDURE - PRIVATE

If no permit exists and the user(s) has alternate access, BNSF may remove the crossing at any time. If there is a 30-day cancellable permit and the user(s) has alternate access, BNSF may remove a crossing with 30-day written notice to the user(s). If a private crossing user may be land-locked from a crossing closure, BNSF may work with such property owner to facilitate an alternate means of access.

Once it is decided that a crossing will be removed, any related work outside of the BNSF right-of-way is the responsibility of outside parties unless it specified otherwise in any agreements with BNSF.

DIVISION OF WORK FOR NEW CROSSINGS

As mentioned above, the work associated with a crossing project will be divided between BNSF and the Proponent. For any of the tasks listed below, design and construction are included unless otherwise noted.

BNSF will perform the following tasks:

- Participate in and on-site Diagnostic Team meeting
- Review of Proponent plans
- Design related to railroad crossing signals or other crossing elements as needed
- Track modifications or construction
- Installation of crossing surface up to 1 foot outside of the rail, subject to state law
- Installation of railroad crossing signals and crossbuck signs where determined by the Proponent to be appropriate for the crossing
- Railroad bridge structure
- Construction inspection and coordination

The Proponent will be responsible for the following tasks:

- Participate in and on-site Diagnostic Team meeting
- Determining the need for and selection of the appropriate warning devices per the *MUTCD* and applicable laws and regulations
- Design of the roadway and civil work, including drainage and grading (except under tracks)
- Reimbursing BNSF for any work related to the crossing design and construction
- Paving and striping
- Signage in conformance with *MUTCD*, Part 8 (except for crossbuck signs and Emergency Notification Signs [ENS])
- Roadway overpass structures or underpass roadway design
- Fencing
- Traffic signals and cables for interconnection to a junction box
- Pedestrian accommodations, if applicable
- Securing and ensuring safety protection (i.e. flagging) is provided and approved by BNSF
- All other work

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QUIET ZONES

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Quiet Zones

Quiet Zones Navigation

JURISDICTIONAL AUTHORITY | BNSF COORDINATION | FUNDING | DIAGNOSTIC REVIEWS | CONSTRUCTION AND MAINTENANCE | SAFETY DEVICES

QUIET ZONES

A Quiet Zone (QZ) is a section of rail line, at least one-half mile long, that contains one or more consecutive public crossings at which train horns are not routinely sounded, owing to the installation of various Supplemental Safety Measures (SSMs) or Alternative Safety Measures (ASMs), as identified in the *Final Rule* on the *Use of Locomotive Horns at Highway-Rail Grade Crossings (49 CFR Part 222)*. BNSF strives to fully comply with the Final Rule, which provides requirements for the sounding of train horns. The Final Rule also provides guidance for conditions under which a public authority with jurisdiction over a grade crossing may apply for and establish continue a QZ through the Federal Railroad Administration process. To that extent, communities should note that just because a QZ is implemented, the train horn may still be sounded for specific circumstances. BNSF does not have authority to grant a QZ and expects the public authority to review and strictly comply with federal requirements.

CONTACTS

BNSF's Public Projects Team

RESOURCES

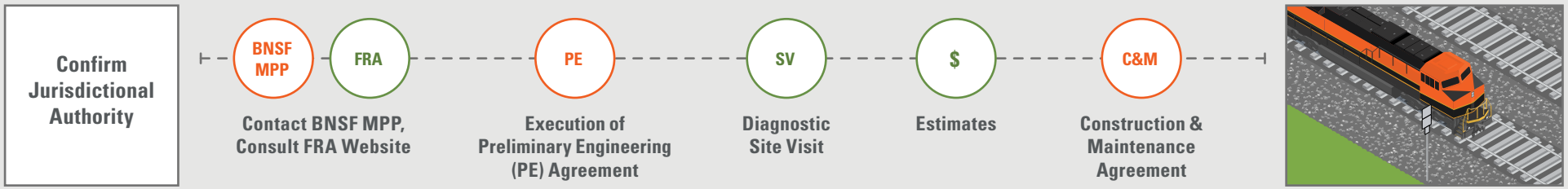
FRA Website

REGULATION

Final Rule (2006)
49 CFR Part 222
Appendix A

Federal Railway-Highway Crossings (Section 130)

Figure 9: *Summary of Implementing a Quiet Zone*



JURISDICTIONAL AUTHORITY

Groups or individuals interested in a QZ should first contact the Proponent responsible for the roadway(s) where it would be located.

- Any party interested in pursuing a QZ should reference the Final Rule before contacting BNSF.
- Only Proponent with jurisdiction over the relevant at-grade crossings may pursue a QZ.
- The Proponent with jurisdiction should consult the **FRA website** for information on QZ requirements and procedures.

BNSF COORDINATION

The public authority (Proponent) with jurisdiction is responsible for initiating coordination with the **BNSF MPP** and entering into a Preliminary Engineering Agreement. Proponents are encouraged to contact BNSF early in the process.

- The BNSF MPP will coordinate the preliminary engineering agreement and planning activities with the Proponent.
- BNSF will provide the QZ policy, BNSF required documents, and process for the initial planning activities that involve the BNSF.
- The Proponent is required to facilitate the diagnostic meeting(s) and review(s) with BNSF and other authorities.
- BNSF retains the right to review and comment on the requests.

FUNDING

The Proponent must identify a funding source for any SSMs or ASMs required to qualify for a QZ.

Cost Estimates

- If BNSF is installing the safety measure(s), BNSF will estimate the costs for design and construction.
- These charges will be billed to the Proponent.
- Standard BNSF Public Projects department estimating procedures will be used for projects related to QZs.

Reimbursements

- The Proponent with jurisdiction is expected to reimburse BNSF for its cost of design and installation of safety enhancements, including, but not limited to, its installation of SSMs and ASMs.

Federal Funding

- BNSF strongly urges the Proponent pursuing the QZ to petition the state DOT to use the **Federal Railway-Highway Crossings (Section 130)**Program to fund any modification to a crossing.

Maintenance

- The Proponent is responsible for the costs for installation, inspection, repairs, and maintenance.

DIAGNOSTIC REVIEWS

QZ proposals require an on-site diagnostic meeting with the BNSF MPP and other BNSF designees prior to plan review and acceptance. BNSF encourages public agencies to make the safety of the traveling public and BNSF employees a priority.

- BNSF will cooperate and work in good faith with local communities and the appropriate Proponent to champion the safety of local communities, citizens, and BNSF's employees.
- If the Proponent decides to proceed with preliminary planning for a QZ, BNSF will assist by providing crossing information and other information required in the Final Rule and by attending diagnostic review meetings.
- BNSF requires 30-45 days' notice following execution of a Preliminary Engineering (PE) Agreement to schedule an on-site meeting to permit BNSF representatives to attend.
- BNSF strongly encourages the Proponent pursuing a QZ to involve local public authority, state DOT, FRA, other state regulatory authority staff (if applicable), and BNSF staff in a diagnostic team process for review of each public, private, and pedestrian crossing located within the proposed QZ in order to assess physical and operating conditions at the grade crossing and to consider proper grade crossing treatments.
- Some states have public utility oversight agencies that are required to attend the diagnostic review meetings and approve crossing modifications before construction. The public authority should advise the BNSF MPP if this applies to requested QZ area.

CONSTRUCTION AND MAINTENANCE

BNSF requires execution of a Construction & Maintenance (C&M) Agreement between BNSF and the Proponent sponsoring the project before work commences.

Installation

- SSMs or ASMs installed and maintained by the Proponent are critical to traffic control at each crossing.
- The Proponent is responsible for periodic inspection and repair of these items, as well for any requirements outlined by local, state, or federal criteria for roadway authorities.

Maintenance

- If one or more SSMs or ASMs requires work by BNSF, a C&M Agreement will be used for implementation of the projects.
- The cost of this work is the responsibility of the requesting Proponent.

SAFETY DEVICES

According to the Final Rule, minimum requirements for a public crossing within the limits of a QZ may exist.

- Some of the minimum requirements for a public crossing within the limits of a QZ include flashing lights and gates, CWT track circuits on all tracks, and power-out indicators located on the signal bungalow.
- The Final Rule outlines the two types of safety measures for modifying public at-grade crossings to FRA standards for the implementation of a QZ, as noted in the following:
  - o **Supplementary Safety Measures (SSMs)** – include four-quadrant gate systems that fully block roadway traffic from entering the crossing when fully lowered, full-length medians or channelization devices, one-way streets with gates that fully block the roadway, temporary or temporal closures (i.e., nighttime closure), and permanent closures.
  - o **Alternative Safety Measures (ASMs)** – include modified SSMs (i.e., non-complying medians, three-quadrant gates, shortened medians or channelization devices), engineering ASMs (i.e., geometric improvements such as those that improve sight distance), and non-engineering ASMs (i.e., programmed or photo enforcement of motorists entering upon the crossing when grade crossing active warning devices are activated, public education about grade crossing safety).
- BNSF strongly recommends safety measures at all at-grade crossings within the limits of the QZ corridor.
- BNSF reserves the right to object to QZs that do not have safety measures at every public crossing.
- BNSF encourages implementation of SSMs and BNSF-preferred components including permanent closures, non-mountable concrete center medians compliant with **Appendix A of the Final Rule**, and one-way paired streets.
- The QZ must be fully compliant with the Final Rule, including completed construction projects for safety measures, prior to implementation.

Supplementary Safety Measures (SSMs)

Alternative Safety Measures (ASMs)

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GRADE SEPARATIONS

18

Grade Separations

Grade Separations Navigation

JURISDICTIONAL AUTHORITY	BNSF COORDINATION	FUNDING	DESIGN	CONSTRUCTION, OWNERSHIP, AND MAINTENANCE

CONTACTS

BNSF's Public Projects Team

RESOURCES

BNSF Railway-UP Railroad - Guidelines for Railroad Grade Separation Projects

23 CFR 646.216

GRADE SEPARATIONS

The safest grade crossing is one that doesn't exist, according to the Federal Railroad Administration's *Highway-Rail Grade Crossing Resource Guide*. Federal, state, and BNSF policy is to close, consolidate, or grade separate highway-rail grade crossings to eliminate the possibility of a collision or other incident between a train and a motorist, bicycle, or pedestrian. As of 2023, there are approximately 25,000 at-grade crossings on the BNSF network. Since 2000, BNSF has closed more than 6,600 grade crossings. Significant reductions in BNSF's Incident Frequency Ratio (IFR) have occurred at least partially as a result of grade separation projects developed through coordination with public agencies. Grade separations, such as overpass and underpass structures, enhance safety by eliminating the at-grade point of intersection.

JURISDICTIONAL AUTHORITY

The BNSF Public Projects team will address potential closings and separations of at-grade public crossings. BNSF will coordinate with the state transportation authority on public crossings.

BNSF COORDINATION

The public authority with jurisdiction is responsible for initiating coordination with the **BNSF MPP**. Proponents are encouraged to contact BNSF early in the process. Work associated with a grade separation project will be divided between BNSF and the Proponent.

General planning, design, and construction activities for development of a grade separation are listed below, unless otherwise noted. For more details, consult *BNSF Railway-Union Pacific Railroad - Guidelines for Railroad Grade Separation Projects.*

BNSF will perform the following tasks:

- Participate in and on-site Diagnostic Team meeting.
- Review of Proponent design plans for the grade separation.
- Provide design guidance on elements of the grade separation.
- Track modifications or construction.
- Railroad flagging during construction (or direction on contract flagging to be procured by the Proponent).
- Construction inspection and coordination.

The Proponent will be responsible for the following tasks:

- Participate in an on-site Diagnostic Team meeting.
- Design of roadway overpass or underpass structure
- Design of roadway and civil work, including drainage and grading (except under tracks).
- Reimbursing BNSF for any work related to the grade separation design and construction.
- Right-of-way and bridge fencing.
- Pedestrian accommodations, if applicable.
- All other work, as required.

FUNDING

The Proponent must identify a funding source to plan, design, and construct grade separations. Federal policy encourages closure and grade separation of crossings, and funding is provided through various federal, state, and local funding programs to develop grade separation projects. BNSF will typically provide funding consistent with the requirements of the Grade Crossing Closure Program. Other BNSF discretionary contributions may occur for partnership projects in pursuit of federal or state grant funding.

- BNSF may choose to offer financial incentives for permanent closure of a crossing, whether by grade separation or closure/consolidation of the existing at-grade crossing.
- Planning, design, and construction on grade separation projects is divided between BNSF and the Proponent in the manner described in this document and in ***BNSF Railway-Union Pacific Railroad - Guidelines for Railroad Grade Separation Projects*** and is subject to change.
- Very rarely, bridges over the railroad may be owned and maintained by BNSF and are often referred to as "wagon bridges." BNSF may desire to work with the Proponent to reconstruct these structures and transfer ownership and maintenance responsibilities to the Proponent. In these instances, BNSF may contribute more than the federally or state mandated funding contribution with the transfer of ownership and future maintenance responsibilities to the Proponent.

DESIGN

Proponents of a grade separation should consider a guiding principle of the *BNSF Railway-Union Pacific Railroad - Guidelines for Railroad Grade Separation Projects* when seeking to advance such a project on the BNSF network:

"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."

Before commencing a grade separation project, Proponents should consult the *BNSF Railway-Union Pacific Railroad - Guidelines for Railroad Grade Separation Projects* for:

- General requirements.
- Permanent clearances for overpass and underpass structures.
- Requirements and schedule associated with design and construction submittals.
- Agreement types and responsibilities.
- Other considerations.

CONSTRUCTION, OWNERSHIP & MAINTENANCE

BNSF requires execution of a Construction and Maintenance (C&M) Agreement – specifying the ownership and maintenance responsibilities – between BNSF and the Proponent sponsoring the project before work commences. Typical features of a C&M Agreement between a Proponent and BNSF for a grade separation are subject to coordination between the Proponent and the BNSF MPP and could include the following considerations, and terms and conditions:

- It is BNSF's position that the Proponent will own and maintain grade-separated structures as a result of the elimination of an at-grade crossing or the new construction of a grade separation, as follows:
  - For highway bridges (overpasses), the Proponent will own and maintain the new overpass structure, abutments, overpass bridge components, fencing, and drainage improvements upon completion of the project.
  - For railroad bridges (underpasses), the Proponent will generally be required to maintain, at its sole cost and expense, the railroad bridge structure, lighting, fencing, drainage, and all associated access for BNSF.
- Proponent is responsible for temporary construction requirements, such as for offset alignments (e.g., shoofly tracks immediately outside and adjacent to the work area over which trains will operate until project construction is complete); BNSF will construct, own, and maintain these at the sole cost of the Proponent.
- BNSF will complete routine inspection as required by FRA and BNSF irrespective of the ownership and maintenance responsibilities. Any major repairs to the structure requiring immediate repair shall be completed and communicated to the **BNSF MPP**, who will notify the appropriate Proponent.
- Future access to the grade separation structure and associated infrastructure by the Proponent for routine or emergency inspections, repairs, and maintenance, as required, is governed by BNSF procedures and through coordination with the **BNSF MPP**.
- Proponent is responsible for obtaining and meeting all obligations as may be necessary for any temporary construction and permanent easements through the terms of the C&M Agreement.
- Other considerations and terms and conditions, as appropriate for a specific grade separation project.

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BICYCLE/PEDESTRIAN PATHWAYS AND MULTI-USE TRAILS

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Bicycle/Pedestrian Pathways and Multi-Use Trails

BICYCLE/PEDESTRIAN PATHWAYS AND MULTI-USE TRAILS

The BNSF network interfaces with the multimodal transportation network – including public bicycle/pedestrian pathways and multi-use trails. Safety is of paramount importance to BNSF at these points of interface. Proponent-sponsored projects that include the development of public bicycle/pedestrian pathways and multi-use trails on, across, or immediately adjacent to BNSF right-of-way are subject to BNSF Policy.

RESOURCES

BNSF Railway-UP Railroad - Guidelines for Railroad Grade Separation Projects

Manual of Uniform Traffic Control Devices (MUTCD)

BNSF POLICY ON BICYCLE/PEDESTRIAN PATHWAYS AND MULTI-USE TRAILS CROSSING BNSF PROPERTY

Grade Separated Bicycle/Pedestrian Pathways and Multi-Use Trails

- BNSF prefers grade separated public bicycle/pedestrian pathways and multi-use trails. For guidance on grade separated public bicycle/pedestrian pathways and multi-use trails, refer to the ***BNSF Railway - Union Pacific Railroad -Guidelines for Railroad Grade Separation Projects.***

- Bicycle/pedestrian pathways and multi-use trails crossing BNSF tracks at-grade must cross adjacent to an existing public at-grade crossing.
- Stand-alone at-grade trail crossings of BNSF tracks are not allowed.
- The bicycle/pedestrian pathways and multi-use trails should cross the BNSF track(s) at a 90-degree angle, and the crossing must meet the requirements of the ***Manual on Uniform Traffic Control Devices (MUTCD)***.
- BNSF may require that the design developed by the Proponent include additional safety measures or specific trail features for at-grade pathways and multi-use trails within existing roadway easements.
- Bicycle/pedestrian pathways or multi-use trails combined with drainage structures are not allowed on BNSF property.
- Owners of the bicycle/pedestrian pathways and multi-use trails must enter into the proper license agreement with JLL and be responsible for the ownership and maintenance of the bicycle/pedestrian pathways and multi-use trails.

BNSF POLICY ON BICYCLE/PEDESTRIAN PATHWAYS AND MULTI-USE TRAILS PARALLEL TO BNSF PROPERTY

- In general, public parallel bicycle/pedestrian pathways and multi-use trails are not allowed on BNSF property. BNSF right-of-way is reserved for railroad infrastructure to ensure that current customer demands are met and to support future expansion needs.
- BNSF's maintenance and inspection roads are for the duties of operating, maintaining, and inspecting track and other railroad infrastructure. Public uses of railroad service roads are not acceptable for public trails or other purposes.
- BNSF bridges are designed to carry train traffic and are not designed for multimodal use. Bicycle/pedestrian pathways and multi-use trails parallel and/or attached to railroad bridges are not allowed.
- If a public parallel bicycle/pedestrian pathway or multi-use trail is located adjacent to BNSF property, fencing should be installed along the entire length of the pathway or trail to keep users off of BNSF property. Fencing is to be maintained by owner of the bicycle/pedestrian pathway or multi-use trail.
- Adjacent public parallel bicycle/pedestrian pathway or multi-use trail construction and maintenance shall not reduce the BNSF right-of-way or adversely impact train operations.
- Increased pedestrian activity adjacent to active BNSF track(s) increases exposure points to train movement and potential for trespassing. Efforts to deter trespassing on BNSF property should be included in any public bicycle/pedestrian pathway or multi-use trail project.

In general, parallel bicycle/pedestrian pathways and multi-use trails are not permitted on BNSF property.

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OVERPASS AND UNDERPASS STRUCTURE PROJECTS

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Overpass and Underpass Structure Projects

OVERPASS AND UNDERPASS STRUCTURE PROJECTS

Given the efficiencies and environmental benefits of moving freight by rail, BNSF continues to see strong demand for rail services across its network. It is critical that BNSF maintain the ability to expand its network in the future, as demands require. As such, all work on overpass and underpass structure projects impacting BNSF property must be reviewed and accepted by BNSF to make sure that they comply with any future expansion initiatives by BNSF. BNSF requires that new overhead bridges (including existing bridge replacements) span BNSF's right-of-way and have a minimum 23'–6" vertical clearance above the top of rail. BNSF requires that new underpass structures provide accommodations for future operating needs, as determined by BNSF.

All design and construction submittals shall be transmitted to the BNSF Manager Public Projects. The submittal will then be forwarded to the BNSF's Engineering Department. The Engineering Department shall have the option of reviewing the project documents in-house or by using an outside consultant (at the cost of the applicant through a Preliminary Engineering Agreement). During the review process, the MPP shall be the point of contact for resolving outstanding issues. 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 BNSF operations during construction. Temporary run-around or shoofly track(s) and/or phased construction may be necessary as determined by BNSF. Rail operations must not be impeded by project construction.

CONTACTS

BNSF's Public Projects Team

RESOURCES

BNSF Railway-UP Railroad - Guidelines for Railroad Grade Separation Projects.

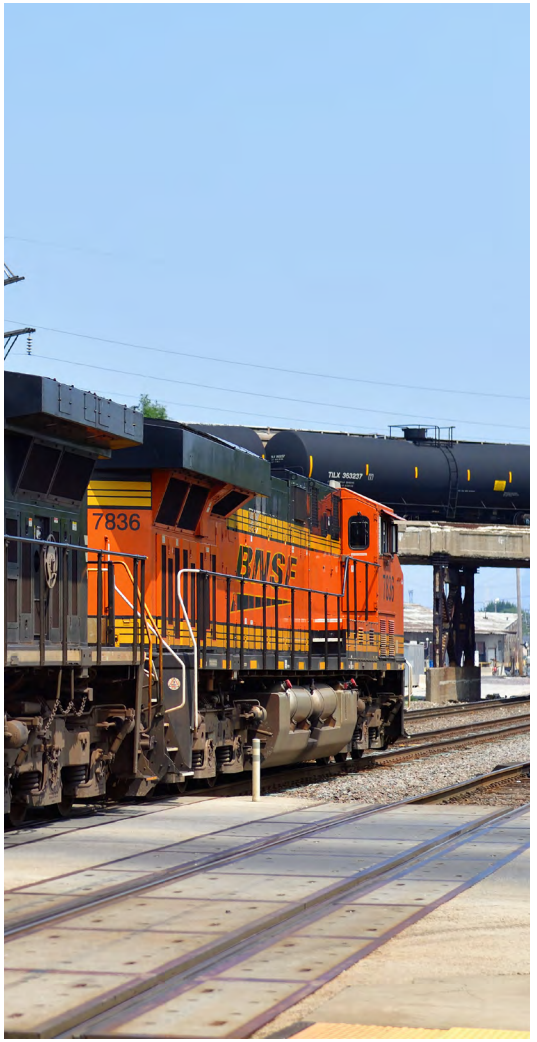
OVERVIEW

- Overpass and underpass structure projects must comply with BNSF's policies and standards, which can be found in the 2016 version of the **BNSF Railway-Union Pacific Railroad – Railway Guidelines for Railroad Grade Separation Projects** manual.
- All work on overpass and underpass structures must be reviewed and accepted by BNSF.
- The negotiations for grade separation projects are managed by the BNSF Public Projects team.
- BNSF approval of construction documents, execution of a Construction & Maintenance (C&M) Agreement, and some type of easement or railroad Right-of-Entry (ROE) permit (if applicable) are required prior to beginning construction.
- BNSF should be involved early in the project development phases to allow required bridge standards to be incorporated into the design of the project.
- BNSF property and operations (including train speeds) shall not be negatively impacted by the project.
- The preferred overhead structure is one that will span the entire BNSF right-of-way, with all piers and abutments to be located outside of railroad right-of-way.
- BNSF requires a minimum 23'¬–6" vertical clearance measured vertically from the top of the highest rail to the lowest obstruction under the structure.
- Reduced temporary construction clearances, which are less than the specified construction clearances, will require special review and prior approval by BNSF.
- All new underpass structures must be a simple span and have a ballast deck.
- Mechanically Stabilized Earth (MSE) walls are not acceptable for support of railroad embankment. MSE walls supporting roadways above track level are not acceptable within BNSF right-of-way or within 50 feet of the centerline of existing or future BNSF tracks.

GENERAL GUIDELINES

- All bridge projects over or under BNSF shall be governed by the ***BNSF Railway-Union Pacific Railroad - Guidelines for Railroad Grade Separations Manual.*** This includes, but is not limited to, bridge replacements, new construction, substructure modifications, or repairs; superstructure replacement or repair; and deck replacement or overlay.
- Railroad ditches are not designed or intended for conveyance of public water. For projects that change drainage on BNSF right-of-way, temporary and final drainage plans and capacities must be accepted by BNSF.
- BNSF's access to its property must be maintained at all times.
- Plans must show all tracks and horizontal and vertical track clearances for both the existing conditions, temporary conditions, and the conditions of the proposed project.
- All demolition within the BNSF right-of-way, or which may impact BNSF tracks or operations, shall comply with BNSF demolition requirements, which are identified in this ***BNSF Railway Public Projects Manual***.
- The attachment of signs to BNSF bridges is discouraged, other than signs directly related to traffic safety. Clearance signs, advance warning signs, and other roadway signs are generally acceptable with the understanding that they are the maintenance responsibility of the roadway authority. These signs may be attached to BNSF bridges by the roadway authority with written concurrence and coordination with BNSF's Public Projects team. The signs, mounting fixtures, and related attachments must not interfere with the integrity, clearances, or accessibility of BNSF structures. The attachment of temporary signs to BNSF bridges is prohibited.
- The Proponent or its representative shall submit as-built documents for all underpass structures to the MPP after completion of the bridge structure and prior to closing the project.
- All new overhead bridges and structures, including those without sidewalks, constructed over BNSF right-of-way, shall include fencing along exterior edges. The intent of the fencing is to prevent objects or debris from being thrown onto the track. "Throw" fences are not solely for the protection of pedestrians, but for protection of BNSF's employees, equipment, and infrastructure. Barrier rail and fencing shall be constructed according to the *BNSF Railway-Union Pacific Railroad – Guidelines for Railroad Grade Separation Projects* manual.

Additional information about grade separation projects can be found in the Chapter 16 – Public Road Crossing Openings and Closures and Chapter 18 – Grade Separations chapters presented in this ***BNSF Railway Public Projects Manual***. Information on ownership and maintenance for grade separations can be found in Chapter 18 – Grade Separations of this manual.



TEMPORARY AND PERMANENT CONSTRUCTION CLEARANCES

The information below is a summary from the *BNSF Railway-Union Pacific Railroad – BNSF Railway Guidelines for Railroad Grade Separation Projects* manual. Refer to that manual for current information regarding temporary and permanent construction clearances on BNSF.

Temporary Vertical Clearance

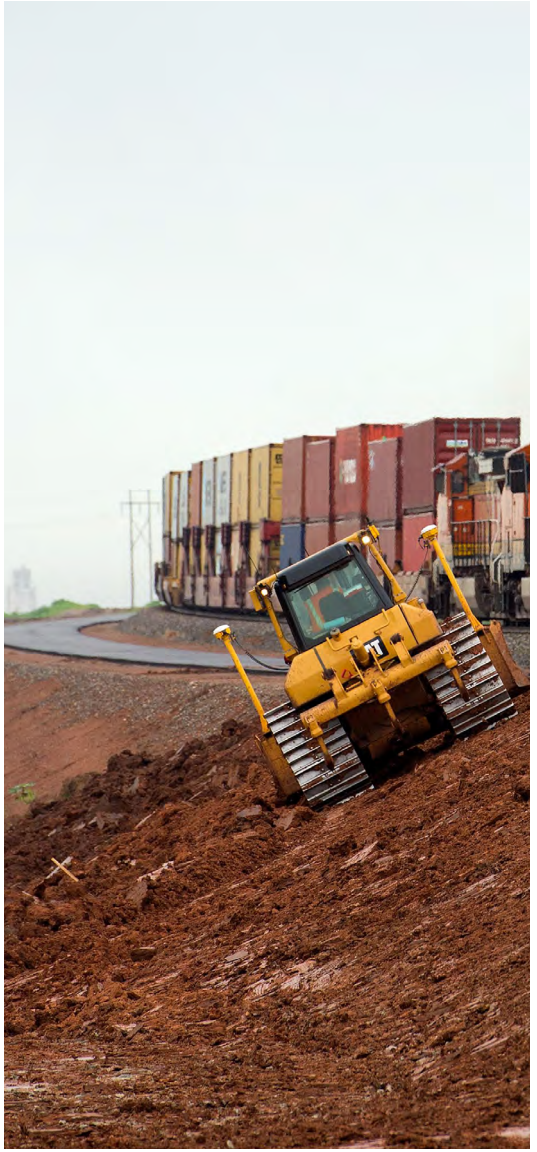
- The Contractor must abide by the following temporary clearances during construction:
- 27'–0" Vertically above top of rail for overhead electric wires carrying less than 750 volts.
- 28'–0" Vertically above top of rail for overhead electric wires carrying 750 volts to 15,000 volts.
- 30'–0" Vertically above top of rail for overhead electric wires carrying 15,000 volts to 20,000 volts.
- 34'–0" Vertically above top of rail for overhead electric wires carrying more than 20,000 volts.
- Temporary horizontal and vertical construction clearances shall be shown on the plans for all grade separation projects.
- A minimum temporary vertical construction clearance as determined by state statutory minimums, but in no case less than 21'-0", 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.

Temporary Horizontal Clearance

- A minimum temporary horizontal construction clearance no less than 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.
- 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.
- 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.

Permanent Clearances

- Permanent clearances shall accommodate future BNSF tracks, future track raises, access roads, and drainage ditch improvements as determined by BNSF Manager Public Projects. Proposed permanent vertical and horizontal clearances shall be adjusted so that the sight distance to any BNSF wayside signal is not reduced unless such signal(s) are to be relocated as part of the proposed grade separation project.



TEMPORARY AND PERMANENT CONSTRUCTION CLEARANCES (CONTINUED)

Permanent Vertical Clearance (Under the Structure)

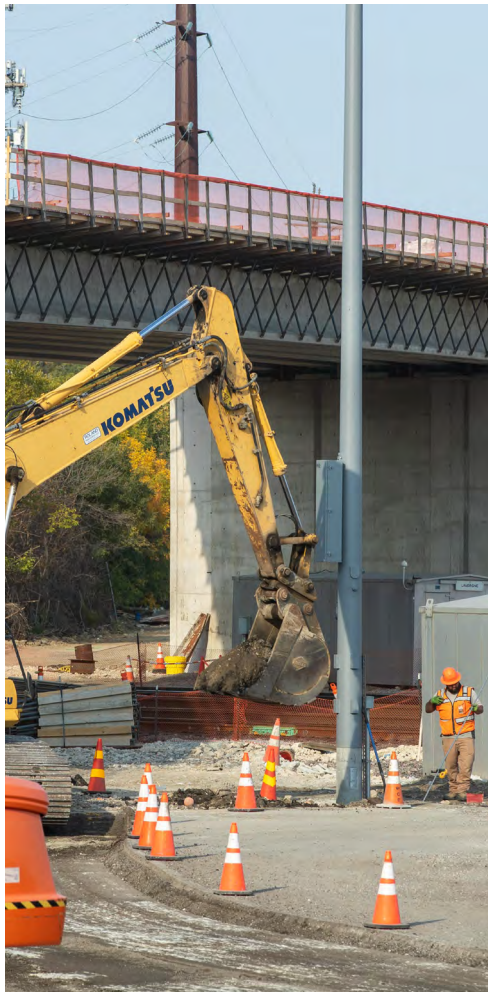
- The minimum permanent vertical clearance shall be 23'–6" measured from the top of the highest rail to the lowest obstruction under the structure.
- The extent of the permanent vertical clearance shall be a minimum of 9'–0" horizontally to the field side of the outer most existing or future tracks, measured perpendicular to the centerline of said tracks. 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.
- The permanent vertical clearance shall extend to cover all existing and future tracks, including the space between.
- Additional vertical clearance may be required for adjustment of sag in vertical curve, future track raise, flood considerations, construction, and maintenance purposes. The vertical clearance should mirror the final negotiated design clearance.

Permanent Horizontal Clearance (Under the Structure)

- 25'–0" Horizontally from centerline of nearest track. More clearance may be required for additional future tracks or access roads.

Conclusions

Any infringement within state statutory clearances due to the Contractor's operations must be submitted to BNSF and to the Proponent and must not be undertaken until accepted in writing by BNSF and until the Proponent has obtained any necessary authorization from the State Regulatory Authority for the infringement. No extra compensation will be allowed in the event the Contractor's work is delayed pending BNSF acceptance and the State Regulatory Authority's approval.



In the case of impaired vertical clearance above top of rail, BNSF will have the option of installing telltales or other protective devices that BNSF deems necessary for protection of its operations. The cost of telltales or protective devices will be borne by the Proponent.

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RETAINING WALLS

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Retaining Walls

RETAINING WALL PROJECTS

Some public projects require the modification or construction of retaining walls, which are rigid structural components used for supporting soil so that it can be retained at different levels on two sides. Retaining walls are used on or adjacent to BNSF property to support right-of-way embankments at or near grade separated overpasses and underpass and at other locations along the right-of-way with differences in elevation.

CONTACTS

BNSF | JLL Contacts

GENERAL GUIDELINES AND PROCESS

There are two distinct types of retaining wall projects that could be developed on BNSF with different requirements. Retaining walls which retain the railroad grade have some differences from walls meant to support adjacent soil to keep them off the railroad grade. BNSF uses the term Mechanically Stabilized Earth (MSE) walls for walls that are not self-supporting. BNSF prefers, and in most cases requires, retaining wall types that are self-supporting. If an MSE wall has a damaged panel, embankment fill is compromised by excavation, or the straps damaged, the entire wall can fail and will likely need to be rebuilt.

Walls Supporting Railroad Embankment

- Retaining walls which retain the railroad embankment should be self-supporting. In other words, wall types that utilize the soil stability as part of the strength of the wall are not generally acceptable for this application.
- Walls for this application shall be designed in accordance with BNSF requirements and general design principle specific in AREMA.

Walls Not Supporting Railroad Embankment

- Self-supporting walls should not be utilized for any applications within BNSF right-of-way, or within 50 feet of existing or future tracks. The applications may include supporting roadway or railroad above track level.
- In consideration of allowing MSE walls, the following will apply:
  - For locations less than 25 feet from centerline of track (existing and future), MSE walls are not allowed.
  - For locations greater than 25 feet and less than 50 feet from centerline of tracks (existing and future), a wall thickness of at least 2.5 feet is acceptable since it meets the AREMA "heavy construction" recommendations and are represented as having a 100 year design service life. The height of the 2.5-foot-thick section must be at least 6 feet above top of rail of the nearest existing or future track.
  - Additionally, bridge abutments shall be supported by deep foundations within these limits.
  - The 25-foot boundary should be applied to existing or future track centerline, as applicable. Otherwise, there would be a potential compromise of standards and utility of use of BNSF property.
- The responsibilities for maintenance and inspection of walls are stipulated by a Construction & Maintenance (C&M) Agreement. In general, the maintenance of walls is the responsibility of the Proponent for both structural items and aesthetic issues such as graffiti removal. In some cases, a Proponent may construct and maintain pursuant to a lease processed by BNSF's consultant JLL.

Designers and Proponents that sponsor projects that involve MSE or similar wall types understand that lower construction costs and/or less robust design criteria comes with inherent risks during future operation. In the event that walls require reconstruction or any maintenance, the full cost (both direct and indirect) will be borne solely by the Proponent.

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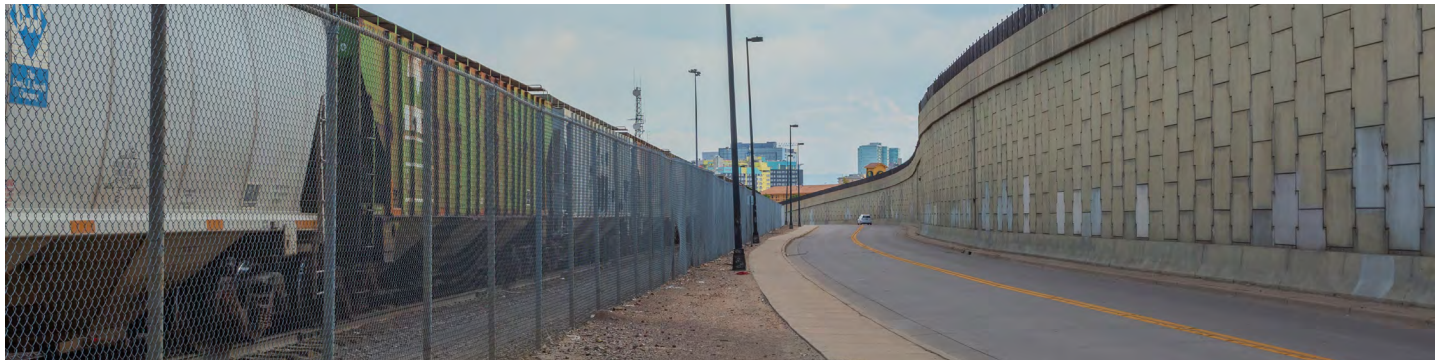
PARALLEL ROADWAY CONSTRUCTION PROJECTS

22

Parallel Roadway Construction Projects



CONTACTS

BNSF's Public Projects Team

RESOURCES

Manual of Uniform Traffic Control Devices (MUTCD)

PARALLEL ROADWAY CONSTRUCTION PROJECTS

This chapter generally addresses Proponent sponsored projects that include parallel roadways on or adjacent to BNSF right-of-way.

In general, public parallel roadways are not allowed on BNSF property, as BNSF right-of-way is reserved for railroad infrastructure to ensure that current customer demands are met and to support future expansion needs. In the interest of public safety, parallel public roads shall be located off BNSF right-of-way. BNSF will consider accommodating parallel roadways within BNSF right-of-way on a case-by-case basis, only when the new roadway will eliminate one or more at-grade crossings.

Note that, in general, a new parallel public road must not adversely impact safety at existing highway-rail grade crossings (consider that construction may result in the need for alterations to grade crossing warning systems or facilities), must not impede BNSF's access to its property at any time, and must not direct additional public drainage onto BNSF property.

Parallel roads involving intersections with existing or proposed roadways where public or private crossings are present should be aligned to provide sufficient distance from the grade crossing for the largest vehicle (design vehicle) permitted to use the road to stop between the railroad and the parallel road traffic control signs, markings, and warning devices without interfering with railroad operations, obstructing or preventing the operation of traffic control devices, or obstructing the crossing in any manner.

GENERAL GUIDELINES

The design of highways, highway intersection, and configuration of highway-rail grade crossings is the responsibility of the Proponent. Drainage for highway runoff, the railroad corridor, and adjacent property must be designed to reduce or maintain existing railroad drainage and to prevent standing water and potential erosion. Access for BNSF equipment to the railroad property, structures, and track cannot be restricted or prevented.

Federal and state design manuals, the *Manual of Uniform Traffic Control Devices (MUTCD)*, and additional recommended practices available in *American Railway Engineering and Maintenance of Way Association (AREMA)* manuals provide design information to be considered by the Proponent responsible for the project engineering.

OTHER CONSIDERATIONS

Proponents should also consider the following:

- BNSF's access roads are for the duties of operating, maintaining, and inspecting track and other infrastructure. Public uses of railroad access roads are prohibited.
- BNSF rail bridges are designed to carry train traffic and are not designed for multimodal use.
- Increased pedestrian activity adjacent to active track increases exposure points to train movement and potential for trespassing. Efforts to deter trespassing should be included in any roadway project.
- All expenses associated with the design, installation, and maintenance of the roadway, including the costs of signs, crossing surfaces, and warning systems associated with an at-grade crossing, will be paid by the Proponent.

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CLEANING AND PAINTING BNSF BRIDGES AND STRUCTURES AND OTHER BRIDGES OVER BNSF PROPERTY

23

Cleaning and Painting BNSF Bridges and Structures and Other Bridges over BNSF Property

CLEANING AND PAINTING BNSF BRIDGES AND STRUCTURES AND OTHER BRIDGES OVER BNSF PROPERTY

BNSF understands the desire of communities to improve the appearance of bridges and other structures. BNSF does not typically paint its railroad bridges including, but limited to, exposed steel beams, concrete abutments or piers, and hand railing. BNSF carefully inspects railroad bridges to ensure safety and structural integrity, and the appearance of surface rust or loose paint does not impair the structural integrity of a bridge. Painting over defects, cracks, or other damage can hinder the routine visual inspection of bridges and structures. Requests are occasionally made by outside parties for various beautification projects, including painting of overhead and underpass structures, and these requests may be considered by BNSF on a case-by-case basis only. BNSF will make every reasonable effort to cooperate, consistent with maintaining public safety and the safe operation of the railroad.

CONTACTS

BNSF's Public Projects Team

CONSIDERATION OF RAILROAD BRIDGE CLEANING AND PAINTING PROJECTS

Railroad bridge painting proposals must be reviewed and accepted by BNSF Director of Bridge Engineering to ensure compliance with safety and environmental regulations and BNSF specifications, and to ensure that the proposal will not impact BNSF property or operations.

- A written request should be submitted to BNSF's Public Projects team to initiate consideration of such projects.
- BNSF will require a Bridge Painting Agreement for all bridge painting proposals.
- The Proponent must be a party to the agreement.
- BNSF will incur no costs or liabilities as a result of the project.
- The Proponent will bear all costs associated with the painting project and future aesthetic maintenance (including, but not limited to, vandalism and damage caused by motor vehicles).
- A railroad Flagger will be required during painting of the bridge or structure, at the requesting Proponent's expense. See **Chapter – 10 Entry onto BNSF Property** of this manual for more information about flagging.
- BNSF will not accept proposals to attach signage to BNSF bridges with the exception of those related to traffic safety, such as clearance signage.

SUBMISSION OF RAILROAD BRIDGE CLEANING AND PAINTING PROJECT REQUESTS

A Bridge Painting Agreement is required to cover BNSF's review of the project and preparation of a cost estimate and construction agreement. To ensure safety, a railroad employee Flagger must be present to control railroad operations in the immediate area during the planned work. Proponents must submit a written request to undertake such projects to BNSF's Manager Public Projects team for handling. To assist BNSF with completion of its review, the following information should be included:

- The Proponent that will execute appropriate agreements for implementation as well as future aesthetic maintenance of the painted surfaces.
- Paint specifications that meet BNSF standards and methods for surface preparation, cleanup, and paint application.
- Qualifications and experience of the painting contractor. BNSF will accept state-qualified bridge painting contractors working for the responsible Proponent.
- Containment system, clean up, and disposal of all paint and other material removed from the bridge. The clean-up and disposal of material from the surface preparation for painting and actual painting must comply with all appropriate regulations.
- The materials removed during the surface preparation must not affect the surrounding area including ground, water, or air impacts. Materials must not be stored on BNSF property.
- Regarding control of paint overspray and vapors during application, the work must be done complying with appropriate regulations and overspray controlled to prevent damage to adjacent property and vehicles in the area.
- Pictures and conceptual drawing should be submitted, along with the initial request from the Proponent to simplify the initial review and comment process by BNSF.
- Work site safety plan that includes keeping all personnel away from BNSF tracks and proper fall protection measures, where required.

CLEANING AND PAINTING OF OTHER BRIDGES

All work over BNSF has the potential to impact BNSF property and rail operations. BNSF will review bridge painting and cleaning projects to ensure environmental and engineering standards are met. This review, flagging protection, and construction monitoring costs will be paid by the Proponent.

- BNSF understands that maintenance of non-railroad owned bridges over BNSF may include cleaning and painting. The safety of BNSF employees, the general public, and the Proponent's contractors is critical to BNSF.
- A written request should be submitted to BNSF's Manager Public Projects to initiate consideration of such projects.
- If the request is accepted, Proponents will enter into a Bridge Painting Agreement with BNSF prior to work and bear all costs associated with the painting and cleaning project.
- An agreement is required to accommodate engineering, review of plans, flagging, right-of-entry, and payment of costs incurred by BNSF during the review process.

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USE OF CRANES, LIFTING OF MATERIAL, AND DEMOLITION ON OR OVER BNSF RIGHT-OF-WAY

24

Use of Cranes, Lifting of Material, and Demolition On or Over BNSF Right-of-Way

USE OF CRANES, LIFTING OF MATERIAL, AND DEMOLITION ON OR OVER BNSF RIGHT-OF-WAY

This chapter generally addresses lifting activities for overhead bridge construction and demolition, but also covers other work using cranes or material lifting near BNSF property which has the potential to impact railroad operations.

The intent is to ensure necessary planning, engineering, and execution to avoid equipment or material failures that can lead to safety issues or unplanned interruptions of BNSF train operations. Demolition procedures other than those considered as lifting activities are covered in a Demolition Plan Submittal. The use of cranes and the lifting of materials on or over BNSF right-of-way shall not cause interruption to BNSF operations.

CONTACTS

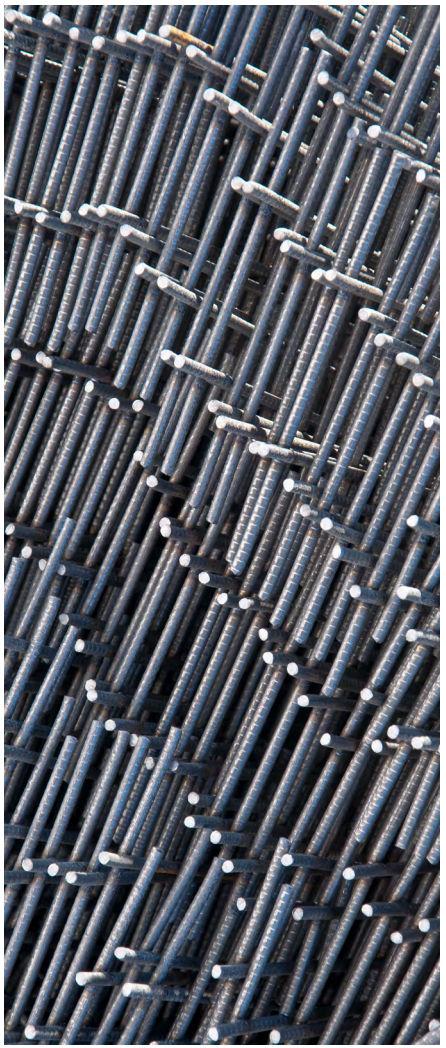
BNSF's Public Projects Team

GENERAL GUIDELINES

- A lifting plan or demolition plan sealed by a Professional Engineer registered in the state that the work is to be executed is necessary for any lifting activities requiring authority or protection over BNSF tracks. The PE is responsible for addressing all required parameters of the lifting plan or demolition plan. BNSF has minimum submittal requirements for specific lifting activities and requirements should be confirmed with BNSF.
- For Public Agency sponsored projects, the Public Agency shall accept the lifting or demolition plan and advise BNSF of acceptance of plan(s) prior to submittal.
- An onsite, pre-lift safety meeting is mandatory for all lifting activities covered by the lifting or demolition plan. Representatives of the contractor, Public Agency, and BNSF shall be present.
- Purpose is to confirm all processes and equipment are in place to proceed per the lifting plan, or otherwise BNSF track authority will not be provided.
- Deviations or modifications to the plan require additional review by BNSF.
- BNSF train operations will not be permitted during splicing, post tensioning, or any activities performed during a suspended load until structural stability is achieved. For these reasons, superstructures of these types are not recommended. The method of erection permissible will be dependent upon track time available. This is to be coordinated through the BNSF site representative during construction.
- Prior to the release of railroad traffic, components lifted over BNSF tracks shall be supported by falsework or permanent substructure, shall be secured and stable, and shall not be supported by cranes or other construction equipment.

FALSEWORK

Falsework clearance shall comply with minimum temporary construction clearances per the *BNSF Railway - Union Pacific Railroad - Guidelines for Railroad Grade Separation Projects* manual and any additional BNSF Shoring Guidelines. The design of all structural members for falsework shall comply with American Railway Engineering and Maintenance-of-Way Association (AREMA) and BNSF requirements.



DEMOLITION

- All demolition within the BNSF right-of-way, which may impact BNSF tracks or operations, shall comply with BNSF demolition requirements; see **Appendix C**. The Proponent and its demolition contractor shall submit a detailed bridge removal plan to BNSF for its review and approval.
- As with all other projects on BNSF property, safety is BNSF's top priority. The contractor shall be responsible for planning and executing all procedures necessary to remove the structure in a safe, predictable manner.
- The contractor's work shall in no way impede the train operations. The contractor shall develop a demolition plan only after consulting with BNSF to get an estimate of the range of track windows that might be normally available for the job site.
- BNSF tracks and property shall be protected at all times, and demolition procedures shall account for severe weather conditions, site security, and site accessibility.
- No work is allowed within 25 feet of the nearest track unless protected by a BNSF Flagger. When trains approach the work site, all demolition activity within 50 feet of the track shall stop until the entire length of the train has passed the work site and the Flagger has instructed that demolition can resume. See **Chapter 10 – Entry onto BNSF Property** of this manual for more information on flagging.
- The staged demolition of any portion of a structure over or adjacent to operational tracks will not jeopardize the stability of other parts of the structure awaiting demolition.
- No blasting will be permitted on BNSF right-of-way. If blasting is planned to occur off of BNSF property that may impact BNSF property or train operations, this work must be coordinated with the BNSF Manager Public Projects. BNSF will work with the party requesting to perform blasting in order to minimize impacts to train traffic and BNSF infrastructure.

Other Considerations

- A track window is the time period provided to a contractor to perform work between approaching trains.
- The estimated track window is a guideline and is not a guarantee for available working time. The contractor small estimate work based on the smallest track windows on the BNSF corridor where work is taking place.
- A track window is highly variable, depending on the location. Low speed - low train density tracks have more predictable track windows. The opposite is true for high density - high speed main tracks. BNSF can furnish a range of track windows that might be expected at a specific location under normal train traffic conditions.
- All substructures shall be removed to at least 3 feet below the final finished grade or at least 3 feet below base of rail whichever is lower, unless otherwise specified by BNSF.
- The Bridge Removal Plan must be executed such that stability is continuously maintained for the standing portions of the structure above all tracks.
- At the conclusion of the project, the area must be left in a clean and graded condition to the exclusive satisfaction of BNSF.
- Beam removal and all other demolition procedures shall take place as much as practicable with equipment positioned above the track. If beam removal or other demolition procedures require removal from below the structure, extra coordination will be required between the contractor and BNSF per the BNSF demolition guidelines.
- Fire suppression equipment is required when welding or torch cutting equipment is used in the demolition process. Details are listed in the BNSF Demolition Guideline document.
- The demolition operations shall be planned such that the utility lines are operating safely at all times. The utility lines shall be protected if affected by demolition operation. All the work associated with utility lines should be coordinated by the contractor with the respective utility companies.
- If any hazardous materials are discovered, the contractor must provide material protection as specified in local hazardous material codes and immediately contact the designated BNSF Representative. Fuel spills, hydraulic fluid releases, equipment oil leaks, or any other release of contaminants must be reported to BNSF immediately. Contaminated soils must be removed and replaced to the satisfaction of BNSF.

ERECTION

Erection over BNSF right-of-way shall be designed to cause no interruption to BNSF operations. Erection plans shall be developed such that they enable the BNSF track(s) to remain open to train traffic per BNSF requirements.

- Prior to the release of BNSF traffic, components erected over BNSF 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.
- When cranes are operated over or adjacent to the tracks the contractor shall verify that the foundations and soil conditions under the crane and crane outriggers can support the loads induced by the crane under an assumed maximum capacity lift. The size and material type of crane mats shall be rigid and of sufficient capacity to safely distribute the crane loads.
- Additional track protection may be required for a crane when crossing over the track. The protection methods shall be submitted to BNSF for review and comment in advance of intended use.
- Cranes and other equipment utilizing outriggers shall not place outriggers on the railroad tracks or ballast.
- During passage of a train, the crane operator must stop all movements. Crane operators shall remain in the cab with motor at idle with the load lines, boom, rotation, and travel controls locked and stationary until the full length of the train has passed the job site and the Flagger has instructed that demolition can resume.

VIBRATORY PILE DRIVING

This section generally addresses the use of vibratory pile drivers to install and/or remove pile, sheeting, casing, and other material. In certain situations based on site specific characteristics, soil properties, and equipment utilized, BNSF may allow the use of vibratory pile driving. The use of vibratory pile drivers can be a risk to the stability of nearby railroad track, structures, and other facilities, which can cause impact to railroad operations. To ensure track and structures do not incur damage due to vibratory installation and/or removal methods, BNSF requires that estimated settlement and deflection of track and foundation system, method of monitoring movement, and trigger values be provided for BNSF review. In certain situations, BNSF and/or project specifications may prohibit the use of vibratory pile driving.

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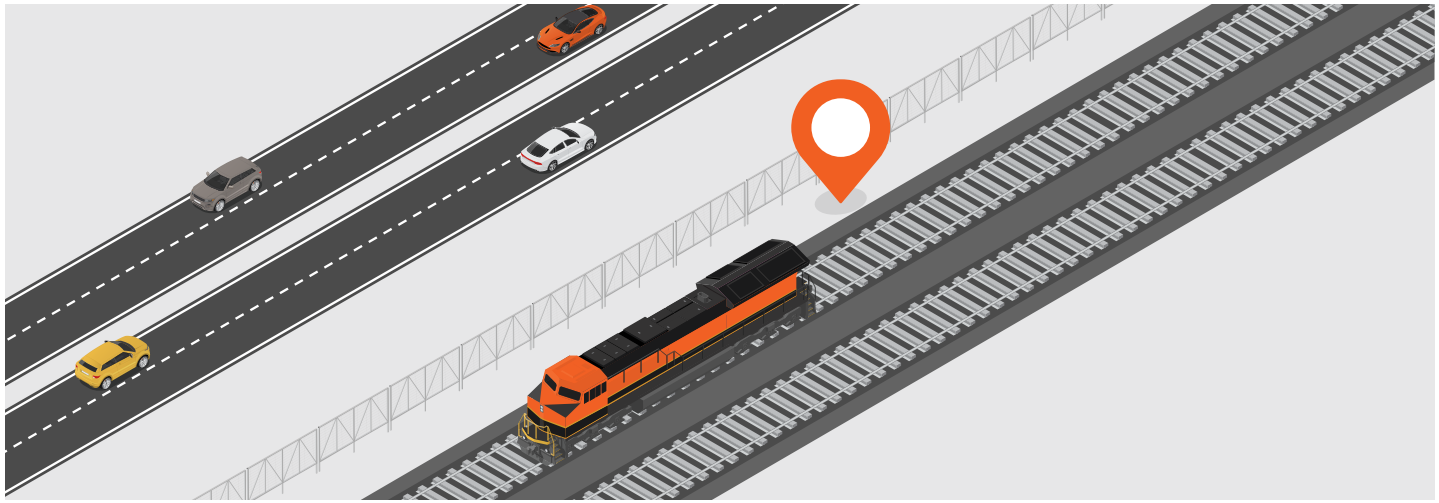
LEASES, EASEMENTS, AND PROPERTY PURCHASES

25

Leases, Easements, and Property Purchases



LEASES, EASEMENTS, AND PROPERTY PURCHASES

Proponents must obtain easements, leases, or permits to permanently occupy BNSF property associated with development of a project. And BNSF understands that there may also be requests to permanently purchase BNSF property or to sell private property to BNSF.

BNSF will work with any responsible Proponent to evaluate a proposed Proponent initiative. However, prior to the initiation of any Preliminary Engineering work, BNSF will need to confirm with the sponsoring Proponent that it is willing and able to:

- Implement the project.
- Negotiate and, when found to be mutually acceptable and necessary, execute property purchase, property use (e.g., perpetual easements), and operating and maintenance or capital construction agreements, as applicable.
- Reimburse BNSF for any fees associated with the easement, permit, or lease. This may include upfront costs as well as long-term costs.

CONTACTS

BNSF's Public Projects Team

BNSF | JLL Contacts

Frequently Asked Questions | BNSF

Bartlett&West BNSF Maps

PROCESS

Jones Lang LaSalle (JLL) facilitates real property management for BNSF and assists third parties with the purchase, lease, or permit of BNSF real estate and any other property management transactions. JLL can also be contacted for requests to permanently purchase BNSF property or sell private property to BNSF. JLL Land Sales and Lease Management contacts are location specific and can be found at **BNSF | JLL Contacts**. The **BNSF MPP** will be able to help direct if a proponent needs support with who to contact.

JLL will act as the intermediary between the third party and BNSF in order to expedite real estate sales and any other property management issues on behalf of the BNSF Corporate Real Estate team. More information about the BNSF Corporate Real Estate team and contacts can be found at **Frequently Asked Questions | BNSF**. Please reference the JLL and BNSF flow chart in **Figure 1 of Chapter 2** of this ***BNSF Railway Public Projects Manual*** that presents the specific roles of BNSF PPM and JLL teams.

To determine if a certain parcel of land is BNSF property, interested parties can generally check with a local tax assessor, County GIS map where available, or consult local courthouse records. For informational purposes, railroad maps that provide the width of the railroad corridor and other information are available to assist with project references. To obtain a copy of a map for a cost, interested parties should fill out a contact form through the **BNSF Maps | Bartlett West website**. These requests are handled through another BNSF consultant, Bartlett and West. Release of BNSF maps must be approved by the BNSF MPP.

GENERAL GUIDELINES

Understanding what actions require permitting or easements is crucial to BNSF's consideration of a proposed Proponent initiative. JLL should be contacted to provide guidance in completing permitting, leases, easements, as well as purchases of BNSF property. Easements shall be requested by Proponents to permanently occupy BNSF property or for construction and maintenance improvements that affect BNSF right-of-way. Terms of the easement will be established in the C&M Agreement.

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PASSENGER RAIL

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Passenger Rail

Passenger Rail Navigation

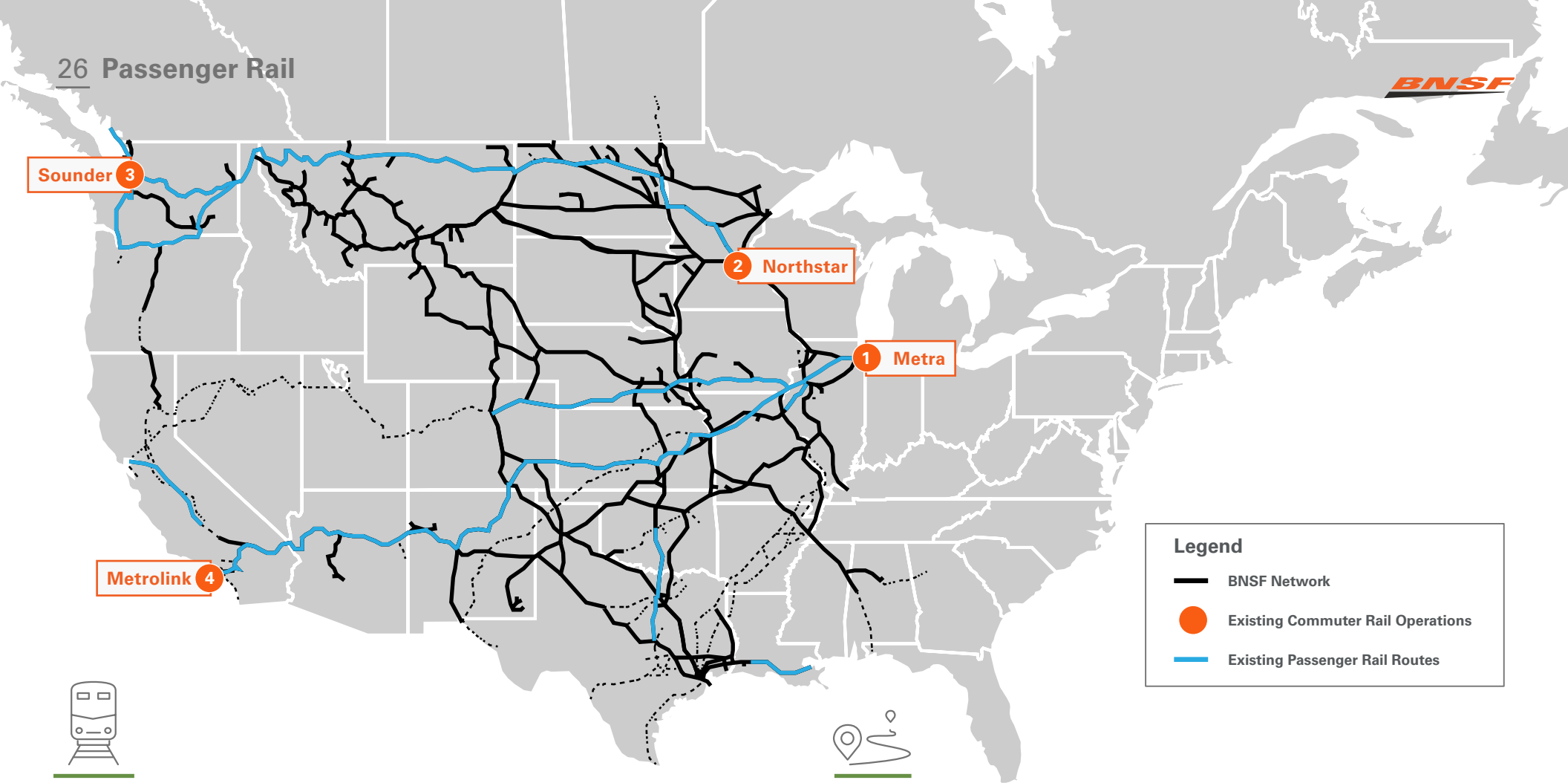
COMMUTER RAIL SERVICE	INTERCITY AND LONG-DISTANCE PASSENGER RAIL SERVICE	PURCHASE OF BNSF PROPERTY FOR PASSENGER RAIL SERVICE	PROPOSED NEW PASSENGER RAIL SERVICE ON BNSF PROPERTY

CONTACTS

BNSF's Public Projects Team

PASSENGER RAIL

BNSF currently hosts passenger rail services on its network. BNSF understands that agencies may seek to expand existing passenger services or implement new passenger services. As stated in its *Passenger Principles*, BNSF is willing to cooperate on passenger rail studies and provide federal, state, and local officials with information, as required.



COMMUTER RAIL SERVICE

BNSF currently operates commuter rail services on the BNSF network under agreements with public agencies in the following areas:

1. Chicago, Illinois — Metra
2. Minneapolis, Minnesota — Northstar
3. Seattle-Tacoma, Washington — Sounder
4. Los Angeles, California — Metrolink

INTERCITY AND LONG-DISTANCE PASSENGER RAIL SERVICE

BNSF also hosts intercity and long-distance passenger trains of Amtrak over longer segments of its network in the U.S. Midwest, West, and South. These routes are indicated in blue in the map above.

BNSF's relationship with Amtrak on passenger service is governed by Federal regulation supplemented by an operating contract between BNSF and Amtrak.

Please direct questions about passenger rail service on BNSF Railway to Contact Us | BNSF or the passenger rail sponsoring agency.

PURCHASE OF BNSF PROPERTY FOR PASSENGER RAIL SERVICE

Where passenger rail service is proposed on a minimally used line that BNSF is willing to sell, BNSF expects to be paid fair market value for the property.

Questions about passenger rail service on BNSF should be directed to the appropriate passenger rail sponsoring agency or the BNSF's Public Projects Team.

PROPOSED NEW PASSENGER RAIL SERVICE ON BNSF PROPERTY

Where passenger rail service is proposed on a line BNSF intends to continue owning, to be jointly used for passenger and freight use, the following principles apply:

Acknowledgements

- Any passenger rail operation cannot degrade BNSF's freight service, negatively affect BNSF's freight customers, or BNSF's ability to provide customers with service.
- Studies of how passenger rail service might be provided must take into account not only the current freight traffic levels, but projected freight traffic growth.
- Studies must reflect BNSF's actual operating conditions and cost structures. Construction work estimates must reflect BNSF labor contract costs. Schedules cannot assume that BNSF will not operate any freight trains during peak commuter periods, etc.

Compensation

- BNSF must be compensated for any and all costs incurred in providing passenger rail service and make a reasonable return for providing the service.

Capital Investments

- Capital investments necessary for passenger rail service are the responsibility of the public, including future investments for future capacity which is potentially more expensive, particularly in urbanized areas.

Liability and Safety

- BNSF will not incur any liability for passenger rail operations that it would not have but for those operations. These operations are provided by BNSF primarily as a public service; the relatively modest compensation BNSF receives does not begin to justify assuming the significant liability associated with passenger service.
- Improvements must include grade crossing protection and intertrack fencing as required to minimize the risk of accidents, due to liability and service interruption concerns.

Tax

- Investments made for passenger rail projects must not result in BNSF incurring a higher tax burden. Property improvements should not become part of BNSF tax base; materials used should be exempt from all sales and use taxes, etc. or BNSF must be made whole for any increased tax burden.

Operations

- BNSF must retain operating control of rail facilities used for passenger rail service. All dispatching, maintenance, and construction must be done under the control of BNSF. Passenger stations, parking lots, and other non-rail facilities may be publicly owned and operated.

Passenger Rail Schedules

- BNSF will limit passenger rail operations to the passenger schedules initially agreed upon and for which the capital improvement plan has been designed. Future expansions will have to undergo the same analysis and provide any required capital improvements before schedules can be altered, service added, or stations added.

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RAIL LINE ABANDONMENT

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Rail Line Abandonment

RAIL LINE ABANDONMENT

Abandonment, or retirement, of BNSF rail lines is considered on a case-by-case basis, and only as a last resort. BNSF prefers to retain railway lines for potential future need, customer, and economic development across its network; and encourages communities to find ways to leverage existing railway lines for continued economic expansion.

CONTACTS

BNSF's Public Projects Team

OVERVIEW

A rail line abandonment is the discontinuance of rail service and maintenance on certain tracks or line segments of a railroad subject to approval by the appropriate federal and state agencies. Rail line abandonment, including the following specific topics, is outside the scope of this ***BNSF Railway Public Projects Manual***:

- Forms of railroad right-of-way ownership and related use (i.e., fee simple property or easements).
- Rail line abandonment process, including any related public agency coordination and public outreach conducting during an abandonment as well as any regulatory and legal aspects associated with rail-line abandonment.
- Railbanking is a process through which rail lines proposed for abandonment may be preserved for future rail use through an interim conversion to public use. Railbanking of a railroad corridor is typically pursued for potential recreational purpose (e.g., multi-use trail) or a public use condition for other public purpose (e.g., light rail transit line development) in lieu of abandonment.
- Potential for property reversion or sale after abandonment of a rail line.

DISPOSITION AND ACQUISITION OF SURPLUS AND USED TRACK MATERIAL

The BNSF Manager Asset Disposition on the **BNSF Strategic Sourcing and Supply Team** is responsible for the disposition of rail and other track materials that BNSF designates as surplus or used. Rail and some other track materials may be sold on as-is, where-is basis to purchasers of surplus railroad material. The purchaser is responsible for removing purchased rail and other track materials from designated BNSF job sites and property, as appropriate. The purchaser may use off-track or on-track methods and equipment to remove rail and other track materials, subject to BNSF coordination and approval.

BNSF removes, replaces, and disposes of roughly 3.5 million ties annually from BNSF property. Ties that BNSF deems as reusable are often sold to outside parties for landscaping, fencing, and other purposes. Restrictions and certain state requirements apply. For more information about availability of reusable ties and the process to acquire them, contact the BNSF Manager Asset Disposition on the BNSF Strategic Sourcing and Supply team via email at Asset.Disposition@BNSF.com. Request for donations of ties will be processed through the **BNSF Government Affairs team**, and interested parties should contact the representative by appropriate territory, as listed in Chapter 2 – Meet The Team of this ***BNSF Railway Public Projects Manual***.

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BNSF GRANT PROGRAM

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BNSF Grant Program

BNSF GRANT PROGRAM

Our vision is for BNSF Railway to be an industry leader in the advancement of innovative rail infrastructure investment that drives economic growth and development for our customers, stakeholders, and communities across the United States. We believe that by collaborating with public agency partners on mutually beneficial project opportunities and leveraging federal funding sources, we can maximize the impacts of our investments and create new opportunities for rail transportation that underscore BNSF's commitment to enhancing safety, efficiency, capacity, mobility, sustainability, and resiliency of rail transportation.

CONTACTS

grantsupport@BNSF.com

Michael.Pruneau@BNSF.com (BNSF Northern Region)

Jeremy.Wegner@BNSF.com (BNSF Southern Region)

RESOURCES

Public Projects

Public Infrastructure and Investments

FORMS

Request a Letter of Support

PUBLIC INFRASTRUCTURE AND INVESTMENTS (PII) TEAM'S GRANT PROGRAM ROLE

BNSF Railway's Public Infrastructure and Investments (PII) team manages a multifaceted strategic grant program in response to the federal Bipartisan Infrastructure Law (BIL) which provides unprecedented transportation funding through multiple discretionary grant programs during 2022-2026. The U.S. Congress appropriation of funding to the U.S. Department of Transportation (USDOT) will help move forward infrastructure projects of regional and national significance that will also have substantial positive impacts on communities and domestic and global economies and supply chains.

Our BNSF PII Grant Program works with agency partners to align strategic priority projects with the eligibility and merit criteria of federal programs to pursue grant funding competitively. Our PII team builds strong partnerships and facilitates joint planning and development of rail infrastructure projects that play a vital role in connecting communities, supporting industry, and promoting economic growth across the United States and into Canada.

These funds help close the gap for transportation projects that achieve critical national objectives for partners that seek to advance projects of mutual benefit. Through collaboration with public agencies, BNSF can work with communities to build stronger, more resilient, and more sustainable rail infrastructure that benefits the BNSF and US freight network.

Partner with BNSF

BNSF works with local public agency partners to optimize federal funding opportunities to advance public projects that will help our growing communities and networks. Here's how we can partner with you:

STRATEGIC PLANNING

Effectively navigate the grant process and align your project with the right funding opportunities.

LETTER OF SUPPORT

BNSF's online Letter of Support form provides the key information of a project's importance.

GRANT APPLICATION AUTHORING

Our expertise in navigating the grant process resulted in dozens of successful applications and wins.

BENEFIT-COST ANALYSIS

We can help you identify, quantify and compare expected benefits and costs of a potential project.

GRANT ADMINISTRATION

We can build internal capacity to meet the specific requirements of receiving federal funds.

COMMUNITY OUTREACH

Working directly with communities is key to transforming communities with the right infrastructure.

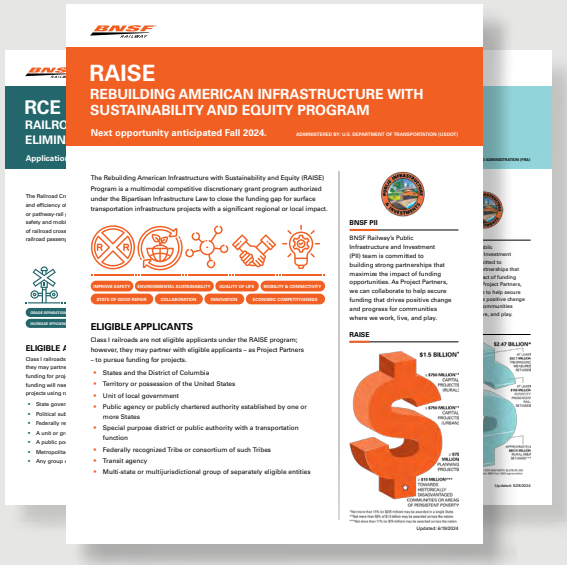
FEDERAL GRANT PROGRAM OPPORTUNITY SUMMARIES

BIL funds help close the gap for transportation projects that achieve critical national objectives for partners that seek to advance projects of mutual benefit. The funding landscape under BIL has opened tremendous potential to seek opportunities that make the most of available funds, with projects that demonstrate the capacity to generate unprecedented positive benefits and transformative impacts. Through collaboration with eligible grantees, BNSF can help support projects that build stronger, more resilient, and more sustainable rail infrastructure that benefits the BNSF and US freight network.

To learn more about these programs and projects that interface with the BNSF network, visit our **Public Projects and Public Infrastructure and Investments** page to learn more about our process and how we collaborate with communities and networks across the country. We have a great team that is ready to connect and collaborate with you to deliver transformative projects.

Learn more at: BNSF | Public Infrastructure and Investments Grants

- **Program Highlights and Successful Partnerships**
- **Request a Letter of Support**
- **Connect with PII Team**



A-1

BNSF CONTRACTOR REQUIREMENTS (EXHIBIT C)

Contract Number: Document ID

EXHIBIT "C"

CONTRACTOR REQUIREMENTS

1) General

A. The Contractor must cooperate with BNSF RAILWAY COMPANY, hereinafter referred to as "Railway" where work is over or under on or adjacent to Railway property and/or right-of-way, hereafter referred to as "Railway Property", during the construction of _____ _____ _____.

B. The Contractor must execute and deliver to the Railway duplicate copies of the Exhibit “C-1” Agreement, in the form attached hereto, obligating the Contractor to provide and maintain in full force and effect the insurance called for under Section 3 of said Exhibit “C-1”. Questions regarding procurement of the Railroad Protective Liability Insurance should be directed to Rosa Martinez at Marsh, USA, 214-303-8519.

C. The Contractor must plan, schedule and conduct all work activities so as not to interfere with the movement of any trains on Railway Property.

D. The Contractor's right to enter Railway's Property is subject to the absolute right of Railway to cause the Contractor's work on Railway's Property to cease if, in the opinion of Railway, Contractor's activities create a hazard to Railway's Property, employees, and/or operations. Railway will have the right to stop construction work on the Project if any of the following events take place: (i) Contractor (or any of its subcontractors) performs the Project work in a manner contrary to the plans and specifications approved by Railway; (ii) Contractor (or any of its subcontractors), in Railway’s opinion, prosecutes the Project work in a manner which is hazardous to Railway property, facilities or the safe and expeditious movement of railroad traffic; (iii) the insurance described in the attached Exhibit C-1 is canceled during the course of the Project; or (iv) Contractor fails to pay Railway for the Temporary Construction License or the Easement. The work stoppage will continue until all necessary actions are taken by Contractor or its subcontractor to rectify the situation to the satisfaction of Railway’s Division Engineer or until additional insurance has been delivered to and accepted by Railway. In the event of a breach of (i) this Agreement, (ii) the Temporary Construction License, or (iii) the Easement, Railway may immediately terminate the Temporary Construction License or the Easement. Any such work stoppage under this provision will not give rise to any liability on the part of Railway. Railway’s right to stop the work is in addition to any other rights Railway may have including, but not limited to, actions or suits for damages or lost profits. In the event that Railway desires to stop construction work on the Project, Railway agrees to immediately notify the following individual in writing:

_____
_____
_____
_____

E. The Contractor is responsible for determining and complying with all Federal, State and Local Governmental laws and regulations, including, but not limited to environmental laws and regulations (including but not limited to the Resource Conservation and Recovery Act, as amended; the Clean Water Act, the Oil Pollution Act, the Hazardous Materials Transportation Act, CERCLA), and health and safety laws and regulations. The Contractor hereby indemnifies, defends and holds harmless Railway for, from and against all fines or penalties imposed or assessed by Federal, State and Local Governmental Agencies against the Railway which arise out of Contractor's work under this Agreement.

F. The Contractor must notify **(Agency)** at (____) _____ and Railway's Manager Public Projects, telephone number (____) _____ at least thirty (30) calendar days before commencing any work on Railway Property. Contractor's notification to Railway must refer to Railway's file _____.

G. For any bridge demolition and/or falsework above any tracks or any excavations located with any part of the excavations located within, whichever is greater, twenty-five (25) feet of the nearest track or intersecting a slope from the plane of the top of rail on a 2 horizontal to 1 vertical slope beginning at eleven (11) feet from centerline of the nearest track, both measured perpendicular to center line of track, the Contractor must furnish the Railway five sets of working drawings showing details of construction affecting Railway Property and tracks. The working drawing must include the proposed method of installation and removal of falsework, shoring or cribbing, not included in the contract plans and two sets of structural calculations of any falsework, shoring or cribbing. For all excavation and shoring submittal plans, the current "BNSF-UPRR Guidelines for Temporary Shoring" must be used for determining the design loading conditions to be used in shoring design, and all calculations and submittals must be in accordance with the current "BNSF-UPRR Guidelines for Temporary Shoring". All submittal drawings and calculations must be stamped by a registered professional engineer licensed to practice in the state the project is located. All calculations must take into consideration railway surcharge loading and must be designed to meet American Railway Engineering and Maintenance-of-Way Association (previously known as American Railway Engineering Association) Coopers E-80 live loading standard. All drawings and calculations must be stamped by a registered professional engineer licensed to practice in the state the project is located. The Contractor must not begin work until notified by the Railway that plans have been approved. The Contractor will be required to use lifting devices such as, cranes and/or winches to place or to remove any falsework over Railway's tracks. In no case will the Contractor be relieved of responsibility for results obtained by the implementation of said approved plans.

H. Subject to the movement of Railway's trains, Railway will cooperate with the Contractor such that the work may be handled and performed in an efficient manner. The Contractor will have no claim whatsoever for any type of damages or for extra or additional compensation in the event his work is delayed by the Railway.

2) Contractor Safety Orientation

A. No employee of the Contractor, its subcontractors, agents or invitees may enter Railway Property without first having completed Railway's Engineering Contractor Safety Orientation, found on the web site www.BNSFContractor.com. The Contractor must ensure that each of its employees, subcontractors, agents or invitees completes Railway's Engineering Contractor Safety Orientation through internet sessions before any work is performed on the Project. Additionally, the Contractor must ensure that each and every one of its employees, subcontractors, agents or invitees possesses a card certifying completion of the Railway Contractor Safety Orientation before entering Railway Property. The Contractor is responsible for the cost of the Railway Contractor Safety Orientation. The Contractor must renew the Railway Contractor Safety Orientation annually. Further clarification can be found on the web site or from the Railway's Representative.

3) Railway Requirements

A. The Contractor must take protective measures as are necessary to keep railway facilities, including track ballast, free of sand, debris, and other foreign objects and materials resulting from his operations. Any damage to railway facilities resulting from Contractor's operations will be repaired or replaced by Railway and the cost of such repairs or replacement must be paid for by the Agency.

B. The Contractor must notify the Railway's Division Engineer _____ at (_____)_____ and provide blasting plans to the Railway for review seven (7) calendar days prior to conducting any blasting operations adjacent to or on Railway's Property.

C. The Contractor must abide by the following temporary clearances during construction:

- 15'-0" Horizontally from centerline of nearest track
- 21'-6" Vertically above top of rail
- 27'-0" Vertically above top of rail for electric wires carrying less than 750 volts
- 28'-0" Vertically above top of rail for electric wires carrying 750 volts to 15,000 volts
- 30'-0" Vertically above top of rail for electric wires carrying 15,000 volts to 20,000 volts
- 34'-0" Vertically above top of rail for electric wires carrying more than 20,000 volts

D. Upon completion of construction, the following clearances shall be maintained:

- 25’ Horizontally from centerline of nearest track
- 23’ 6” Vertically above top of rail

E. Any infringement within State statutory clearances due to the Contractor's operations must be submitted to the Railway and to the **(Agency)** and must not be undertaken until approved in writing by the Railway, and until the **(Agency)** has obtained any necessary authorization from the State Regulatory Authority for the infringement. No extra compensation will be allowed in the event the Contractor's work is delayed pending Railway approval, and/or the State Regulatory Authority's approval.

F. In the case of impaired vertical clearance above top of rail, Railway will have the option of installing tell-tales or other protective devices Railway deems necessary for protection of Railway operations. The cost of tell-tales or protective devices will be borne by the Agency.

G. The details of construction affecting the Railway's Property and tracks not included in the contract plans must be submitted to the Railway by **(Agency)** for approval before work is undertaken and this work must not be undertaken until approved by the Railway.

H. At other than public road crossings, the Contractor must not move any equipment or materials across Railway's tracks until permission has been obtained from the Railway. The Contractor must obtain a "Temporary Construction Crossing Agreement" from the Railway prior to moving his equipment or materials across the Railways tracks. The temporary crossing must be gated and locked at all times when not required for use by the Contractor. The temporary crossing for use of the Contractor will be constructed and, at the completion of the project, removed at the expense of the Contractor.

I. Discharge, release or spill on the Railway Property of any hazardous substances, oil, petroleum, constituents, pollutants, contaminants, or any hazardous waste is prohibited and Contractor must immediately notify the Railway's Resource Operations Center at 1(800) 832-5452, of any discharge, release or spills in excess of a reportable quantity. Contractor must not allow Railway Property to become a treatment, storage or transfer facility as those terms are defined in the Resource Conservation and Recovery Act or any state analogue.

J. The Contractor upon completion of the work covered by this contract, must promptly remove from the Railway's Property all of Contractor's tools, equipment, implements and other materials, whether brought upon said property by said Contractor or any Subcontractor, employee or agent of Contractor or of any Subcontractor, and must cause Railway's Property to be left in a condition acceptable to the Railway's representative.

4) Contractor Roadway Worker on Track Safety Program and Safety Action Plan

A. Each Contractor that will perform work within 25 feet of the centerline of a track must develop and implement a Roadway Worker Protection/On Track Safety Program and work with Railway Project Representative to develop an on track safety strategy as described in the guidelines listed in the on track safety portion of the Safety Orientation. This Program must provide Roadway Worker protection/on track training for all employees of the Contractor, its subcontractors, agents or invitees. This training is reinforced at the job site through job safety briefings. Additionally, each Contractor must develop and implement the Safety Action Plan, as provided for on the web site **www.BNSFContractor.com**, which will be made available to Railway prior to commencement of any work on Railway Property. During the performance of work, the Contractor must audit its work activities. The Contractor must designate an on-site Project Supervisor who will serve as the contact person for the Railway and who will maintain a copy of the Safety Action Plan, safety audits, and Material Safety Datasheets (MSDS), at the job site.

B. Contractor shall have a background investigation performed on all of its employees, subcontractors and agents who will be performing any services for Railroad under this Agreement which are determined by Railroad in its sole discretion **a)** to be on Railroad's property, or **b)** that require access to Railroad Critical Infrastructure, Railroad Critical Information Systems, Railroad's Employees, Hazardous Materials on Railroad's property or is being transported by or otherwise in the custody of Railroad, or Freight in Transit involving Railroad.

i) The required background screening shall at a minimum meet the rail industry background screening criteria defined by the e-RAILSAFE Program as outlined at **www.erailsafe.com**, in addition to any other applicable regulatory requirements.

ii) Contractor shall obtain written consent from all its employees, subcontractors or agents screened in compliance with the e-RAILSAFE Program to participate in the Program on their behalf and to release completed background information to Railroad's designee. Contractor shall be subject to periodic audit to ensure compliance.

iii) Contractor subject to the e-RAILSAFE Program hereunder shall not permit any of its employees, subcontractors or agents to perform services hereunder who are not first approved under e-RAILSAFE Program standards. Railroad shall have the right to deny entry onto its premises or access as described in this section above to any of Contractor's employees, subcontractors or agents who do not display the authorized identification badge issued by a background screening service meeting the standards set forth in the e-RAILSAFE Program, or who in Railroad's opinion, which may not be unreasonable, may pose a threat to the safety or security of Railroad's operations, assets or personnel.

iv) Contractors shall be responsible for ensuring that its employees, subcontractors and agents are United States citizens or legally working in the United States under a lawful and appropriate work VISA or other work authorization.

5) Railway Flagger Services

A. The Contractor must give Railway's **Roadmaster (telephone _____)** a minimum of thirty (30) calendar days advance notice when flagging services will be required so that the Roadmaster can make appropriate arrangements (i.e., bulletin the flagger's position). If flagging services are scheduled in advance by the Contractor and it is subsequently determined by the parties hereto that such services are no longer necessary, the Contractor must give the Roadmaster five (5) working days advance notice so that appropriate arrangements can be made to abolish the position pursuant to union requirements.

B. Unless determined otherwise by Railway's Project Representative, Railway flagger will be required and furnished when Contractor's work activities are located over, under and/or within twenty-five (25) feet measured horizontally from centerline of the nearest track and when cranes or similar equipment positioned beyond 25-feet from the track centerline could foul the track in the event of tip over or other catastrophic occurrence, but not limited thereto for the following conditions:

i) When, upon inspection by Railway's Representative, other conditions warrant.

ii) When any excavation is performed below the bottom of tie elevation, if, in the opinion of Railway's representative, track or other Railway facilities may be subject to movement or settlement.

iii) When work in any way interferes with the safe operation of trains at timetable speeds.

iv) When any hazard is presented to Railway track, communications, signal, electrical, or other facilities either due to persons, material, equipment or blasting in the vicinity.

v) Special permission must be obtained from the Railway before moving heavy or cumbersome objects or equipment which might result in making the track impassable.

C. Flagging services will be performed by qualified Railway flaggers.

i) Flagging crew generally consists of one employee. However, additional personnel may be required to protect Railway Property and operations, if deemed necessary by the Railways Representative.

ii) Each time a flagger is called, the minimum period for billing will be the eight (8) hour basic day.

iii) The cost of flagger services provided by the Railway will be borne by **(Agency)**. The estimated cost for one (1) flagger is approximately between $1,200.00-$2,000.00 for an eight (8) hour basic day with time and one-half or double time for overtime, rest days and holidays. The estimated cost for each flagger includes vacation allowance, paid holidays, Railway and unemployment insurance, public liability and property damage insurance, health and welfare benefits, vehicle, transportation, meals, lodging, radio, equipment, supervision and other costs incidental to performing flagging services. Negotiations for Railway labor or collective bargaining agreements and rate changes authorized by appropriate Federal authorities may increase actual or estimated flagging rates. **THE FLAGGING RATE IN EFFECT AT THE TIME OF PERFORMANCE BY THE CONTRACTOR HEREUNDER WILL BE USED TO CALCULATE THE ACTUAL COSTS OF FLAGGING PURSUANT TO THIS PARAGRAPH.**

The cost of **inspector coordinator services** provided by the railway will be borne by **Contractor**. The estimated cost for inspector coordinator services is approximately $1,200 per day. The contractor shall reimburse the railroad for actual costs of inspection services.

iv) The average train traffic on this route is _____ freight trains per 24-hour period at a timetable speed _____ MPH and _____ passenger trains at a timetable speed of _____ MPH.

6) Contractor General Safety Requirements

A. Work in the proximity of railway track(s) is potentially hazardous where movement of trains and equipment can occur at any time and in any direction. All work performed by contractors within 25 feet of any track must be in compliance with FRA Roadway Worker Protection Regulations.

B. Before beginning any task on Railway Property, a thorough job safety briefing must be conducted with all personnel involved with the task and repeated when the personnel or task changes. If the task is within 25 feet of any track, the job briefing must include the Railway's flagger, as applicable, and include the procedures the Contractor will use to protect its employees, subcontractors, agents or invitees from moving any equipment adjacent to or across any Railway track(s).

C. Workers must not work within 25 feet of the centerline of any track without an on track safety strategy approved by the Railway's Project Representative. When authority is provided, every contractor employee must know: (1) who the Railway flagger is, and how

to contact the flagger, (2) limits of the authority, (3) the method of communication to stop and resume work, and (4) location of the designated places of safety. Persons or equipment entering flag/work limits that were not previously job briefed, must notify the flagger immediately, and be given a job briefing when working within 25 feet of the center line of track.

D. When Contractor employees are required to work on the Railway Property after normal working hours or on weekends, the Railway's representative in charge of the project must be notified. A minimum of two employees must be present at all times.

E. Any employees, agents or invitees of Contractor or its subcontractors under suspicion of being under the influence of drugs or alcohol, or in the possession of same, will be removed from the Railway's Property and subsequently released to the custody of a representative of Contractor management. Future access to the Railway's Property by that employee will be denied.

F. Any damage to Railway Property, or any hazard noticed on passing trains must be reported immediately to the Railway's representative in charge of the project. Any vehicle or machine which may come in contact with track, signal equipment, or structure (bridge) and could result in a train derailment must be reported immediately to the Railway representative in charge of the project and to the Railway's Resource Operations Center at 1(800) 832-5452. Local emergency numbers are to be obtained from the Railway representative in charge of the project prior to the start of any work and must be posted at the job site.

G. For safety reasons, all persons are prohibited from having pocket knives, firearms or other deadly weapons in their possession while working on Railway's Property.

H. All personnel protective equipment (PPE) used on Railway Property must meet applicable OSHA and ANSI specifications. Current Railway personnel protective equipment requirements are listed on the web site, **www.BNSFContractor.com,** however, a partial list of the requirements include: a) safety glasses with permanently affixed side shields (no yellow lenses); b) hard hats; c) safety shoe with: hardened toes, above-the-ankle lace-up and a defined heel; and d) high visibility retro-reflective work wear. The Railway's representative in charge of the project is to be contacted regarding local specifications for meeting requirements relating to hi-visibility work wear. Hearing protection, fall protection, gloves, and respirators must be worn as required by State and Federal regulations. **(NOTE – Should there be a discrepancy between the information contained on the web site and the information in this paragraph, the web site will govern.)**

I. THE CONTRACTOR MUST NOT PILE OR STORE ANY MATERIALS, MACHINERY OR EQUIPMENT CLOSER THAN 25'-0" TO THE CENTER LINE OF THE NEAREST RAILWAY TRACK. MATERIALS, MACHINERY OR EQUIPMENT MUST NOT BE

STORED OR LEFT WITHIN 250 FEET OF ANY HIGHWAY/RAIL AT-GRADE CROSSINGS OR TEMPORARY CONSTRUCTION CROSSING, WHERE STORAGE OF THE SAME WILL OBSTRUCT THE VIEW OF A TRAIN APPROACHING THE CROSSING. PRIOR TO BEGINNING WORK, THE CONTRACTOR MUST ESTABLISH A STORAGE AREA WITH CONCURRENCE OF THE RAILWAY'S REPRESENTATIVE.

J. Machines or vehicles must not be left unattended with the engine running. Parked machines or equipment must be in gear with brakes set and if equipped with blade, pan or bucket, they must be lowered to the ground. All machinery and equipment left unattended on Railway's Property must be left inoperable and secured against movement. (See internet Engineering Contractor Safety Orientation program for more detailed specifications)

K. Workers must not create and leave any conditions at the work site that would interfere with water drainage. Any work performed over water must meet all Federal, State and Local regulations.

L. All power line wires must be considered dangerous and of high voltage unless informed to the contrary by proper authority. For all power lines the minimum clearance between the lines and any part of the equipment or load must be; 200 KV or below - 15 feet; 200 to 350 KV - 20 feet; 350 to 500 KV - 25 feet; 500 to 750 KV - 35 feet; and 750 to 1000 KV - 45 feet. If capacity of the line is not known, a minimum clearance of 45 feet must be maintained. A person must be designated to observe clearance of the equipment and give a timely warning for all operations where it is difficult for an operator to maintain the desired clearance by visual means.

7) Excavation

A. Before excavating, the Contractor must determine whether any underground pipe lines, electric wires, or cables, including fiber optic cable systems are present and located within the Project work area. The Contractor must determine whether excavation on Railway's Property could cause damage to buried cables resulting in delay to Railway traffic and disruption of service to users. Delays and disruptions to service may cause business interruptions involving loss of revenue and profits. Before commencing excavation, the Contractor must contact **BNSF's Field Engineering Representative (_____).** All underground and overhead wires will be considered HIGH VOLTAGE and dangerous until verified with the company having ownership of the line. **It is the Contractor's responsibility to notify any other companies that have underground utilities in the area and arrange for the location of all underground utilities before excavating.**

B. The Contractor must cease all work and notify the Railway immediately before continuing excavation in the area if obstructions are encountered which do not appear on drawings. If the obstruction is a utility and the owner of the utility can be identified, then the Contractor

must also notify the owner immediately. If there is any doubt about the location of underground cables or lines of any kind, no work must be performed until the exact location has been determined. There will be no exceptions to these instructions.

C. All excavations must be conducted in compliance with applicable OSHA regulations and, regardless of depth, must be shored where there is any danger to tracks, structures or personnel.

D. Any excavations, holes or trenches on the Railway's Property must be covered, guarded and**/**or protected when not being worked on. When leaving work site areas at night and over weekends, the areas must be secured and left in a condition that will ensure that Railway employees and other personnel who may be working or passing through the area are protected from all hazards. All excavations must be back filled as soon as possible.

8) Hazardous Waste, Substances and Material Reporting:

A. If Contractor discovers any hazardous waste, hazardous substance, petroleum or other deleterious material, including but not limited to any non-containerized commodity or material, on or adjacent to Railway's Property, in or near any surface water, swamp, wetlands or waterways, while performing any work under this Agreement, Contractor must immediately: (a) notify the Railway's Resource Operations Center at 1(800) 832-5452, of such discovery: (b) take safeguards necessary to protect its employees, subcontractors, agents and/or third parties: and (c) exercise due care with respect to the release, including the taking of any appropriate measure to minimize the impact of such release.

9) Personal Injury Reporting

A. The Railway is required to report certain injuries as a part of compliance with Federal Railroad Administration (FRA) reporting requirements. Any personal injury sustained by an employee of the Contractor, subcontractor or Contractor's invitees while on the Railway's Property must be reported immediately (by phone mail if unable to contact in person) to the Railway's representative in charge of the project. The Non-Employee Personal Injury Data Collection Form contained herein is to be completed and sent by Fax to the Railway at 1(817) 352-7595 and to the Railway’s Project Representative no later than the close of shift on the date of the injury.

Contract Number: Document ID

NON-EMPLOYEE PERSONAL INJURY DATA COLLECTION

(If injuries are in connection with rail equipment accident/incident, highway rail grade crossing accident or automobile accident, ensure that appropriate information is obtained, forms completed and that data entry personnel are aware that injuries relate to that specific event.)

Injured Person Type:

- ☐ Passenger on train (C)
- ☐ Non-employee (N) *(i.e., emp of another railroad, or, non-BNSF emp involved in vehicle accident, including company vehicles)*
- ☐ Contractor/safety
- ☐ Contractor/non-safety sensitive (G)
- ☐ Volunteer/safety sensitive (H)
- ☐ Volunteer/other non-safety sensitive (I)
- ☐ Non-trespasser (D) - to include highway users involved in highway rail grade crossing accidents who did not go around or through gates
- ☐ Trespasser (E) - to include highway users involved in highway rail grade crossing accidents who went around or through gates
- ☐ Non-trespasser (J) - Off railroad property

If train involved, Train ID:

_____

Transmit attached information to Accident/Incident Reporting Center by:
Fax 1-817-352-7595 or by Phone 1-800-697-6736 **or email to:** Accident-Reporting.Center@BNSF.com

Officer Providing Information:

_____ _____ _____
(Name) (Employee No.) (Phone #)

REPORT PREPARED TO COMPLY WITH FEDERAL ACCIDENT REPORTING REQUIREMENTS AND PROTECTED FROM DISCLOSURE PURSUANT TO 49 U.S.C. 20903 AND 83 U.S.C. 490

Contract Number: Document ID

NON-EMPLOYEE PERSONAL INJURY DATA COLLECTION

Please complete this form and provide to the BNSF supervisor, who will input this information into the EHS Star system. For questions, call (817) 352-1267 or email Safety.IncidentReporting@BNSF.com.

Accident City/State: _____ Date: _____ Time: _____

County: _____ Temperature: _____ Weather: _____
(if non-BNSF location)

Name (Last/First/MI): _____

Age: _____ Gender (if available): _____

Company: _____

eRailsafe Badge Number: _____ Expiration Date: _____

BNSF Contractor Badge Number: _____ Expiration Date: _____

Injury: _____ Body Part: _____
(e.g., laceration) (e.g., hand)

Description of accident (including how accident occurred, potential cause, etc.):

_____

_____

Work activity in progress at time of accident: _____

Tools, machinery, or hazardous materials involved in accident: _____

_____

Treatment:

- ☐ First Aid Only
- ☐ Required Medical Treatment
- ☐ Other Medical Treatment: _____

Dr. Name: _____ Date: _____

Dr. Street Address: _____ City: _____ State: _____ Zip: _____

Hospital Name: _____

Hospital Street Address: _____ City: _____ State: _____ Zip: _____

Diagnosis: _____

THIS REPORT IS PART OF BNSF'S ACCIDENT REPORT PURSUANT TO THE ACCIDENT REPORTS STATUTE AND, AS SUCH SHALL NOT "BE ADMITTED AS EVIDENCE OR USED FOR ANY PURPOSE IN ANY SUIT OR ACTION FOR DAMAGES GROWING OUT OF ANY MATTER MENTIONED IN SAID REPORT…." 49 U.S.C. § 20903. See 49 C.F.R. § 225.7(b).

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BNSF CONTRACTOR RIGHT-OF-ENTRY AGREEMENT (EXHIBIT C-1)

Contract Number: Document ID

EXHIBIT "C-1"

Agreement Between

BNSF RAILWAY COMPANY

and the

CONTRACTOR

Railway File: _____

Agency Project: _____

_____, a/an _____ (hereinafter called "Contractor"), has entered into an agreement (hereinafter called "Agreement") dated _____, 20__, with _____ [AGENCY] for the performance of certain work in connection with the following project:_____. Performance of such work will necessarily require Contractor to enter **BNSF RAILWAY COMPANY** (hereinafter called "Railway") right of way and property (hereinafter called "Railway Property"). The Agreement provides that no work will be commenced within Railway Property until the Contractor employed in connection with said work for **Agency** (i) executes and delivers to Railway an Agreement in the form hereof, and (ii) provides insurance of the coverage and limits specified in such Agreement and Section 3 herein. If this Agreement is executed by a party who is not the Owner, General Partner, President or Vice President of Contractor, Contractor must furnish evidence to Railway certifying that the signatory is empowered to execute this Agreement on behalf of Contractor.

Accordingly, in consideration of Railway granting permission to Contractor to enter upon Railway Property and as an inducement for such entry, Contractor, effective on the date of the Agreement, has agreed and does hereby agree with Railway as follows:

1) RELEASE OF LIABILITY AND INDEMNITY

A. Contractor hereby waives, releases, indemnifies, defends and holds harmless Railway for all judgments, awards, claims, demands, and expenses (including attorneys' fees), for injury or death to all persons, including Railway's and Contractor's officers and employees, and for loss and damage to property belonging to any person, arising in any manner from Contractor's or any of Contractor's subcontractors' acts or omissions or any work

performed on or about Railway's property or right-of-way. **THE LIABILITY ASSUMED BY CONTRACTOR WILL NOT BE AFFECTED BY THE FACT, IF IT IS A FACT, THAT THE DESTRUCTION, DAMAGE, DEATH, OR INJURY WAS OCCASIONED BY OR CONTRIBUTED TO BY THE NEGLIGENCE OF RAILWAY, ITS AGENTS, SERVANTS, EMPLOYEES OR OTHERWISE, EXCEPT TO THE EXTENT THAT SUCH CLAIMS ARE PROXIMATELY CAUSED BY THE INTENSIONAL MISCONDUCT OR GROSS NEGLIGENCE OF RAILWAY.**

B. THE INDEMNIFICATION OBLIGATION ASSUMED BY CONTRACTOR INCLUDES ANY CLAIMS, SUITS OR JUDGMENTS BROUGHT AGAINST RAILWAY UNDER THE FEDERAL EMPLOYEE'S LIABILITY ACT, INCLUDING CLAIMS FOR STRICT LIABILITY UNDER THE SAFETY APPLIANCE ACT OR THE LOCOMOTIVE INSPECTION ACT, WHENEVER SO CLAIMED.

C. Contractor further agrees, at its expense, in the name and on behalf of Railway, that it will adjust and settle all claims made against Railway, and will, at Railway's discretion, appear and defend any suits or actions of law or in equity brought against Railway on any claim or cause of action arising or growing out of or in any manner connected with any liability assumed by Contractor under this Agreement for which Railway is liable or is alleged to be liable. Railway will give notice to Contractor, in writing, of the receipt or dependency of such claims and thereupon Contractor must proceed to adjust and handle to a conclusion such claims, and in the event of a suit being brought against Railway, Railway may forward summons and complaint or other process in connection therewith to Contractor, and Contractor, at Railway's discretion, must defend, adjust, or settle such suits and protect, indemnify, and save harmless Railway from and against all damages, judgments, decrees, attorney's fees, costs, and expenses growing out of or resulting from or incident to any such claims or suits.

D. In addition to any other provision of this Agreement, in the event that all or any portion of this Article shall be deemed to be inapplicable for any reason, including without limitation as a result of a decision of an applicable court, legislative enactment or regulatory order, the parties agree that this Article shall be interpreted as requiring Contractor to indemnify Railway to the fullest extent permitted by applicable law. **THROUGH THIS AGREEMENT THE PARTIES EXPRESSLY INTEND FOR CONTRACTOR TO INDEMNIFY RAILWAY FOR RAILWAY'S ACTS OF NEGLIGENCE.**

E. It is mutually understood and agreed that the assumption of liabilities and indemnification provided for in this Agreement survive any termination of this Agreement.

2) TERM

A. This Agreement is effective from the date of the Agreement until (i) the completion of the project set forth herein, and (ii) full and complete payment to Railway of any and all sums or other amounts owing and due hereunder.

3) INSURANCE

Contractor shall, at its sole cost and expense, procure and maintain during the life of this Agreement the following insurance coverage:

A. Commercial General Liability "CGL" Insurance

i) The policy will provide a minimum of $5,000,000 each occurrence and an aggregate limit of at least $10,000,000 but in no event less than the amount otherwise carried by the provider. Coverage must be purchased on a post 2004 ISO occurrence form or equivalent and include coverage for, but not limited to, the following:

(1) Bodily Injury and Property Damage

(2) Personal Injury and Advertising Injury

(3) Fire legal liability

(4) Products and completed operations

ii) This policy shall also contain the following endorsements or language, which shall be indicated on the certificate of insurance:

(1) definition of "Insured Contract" will be amended to remove any exclusion or other limitation for any work being done within 50 feet of RAILWAY's property.

(2) Waiver of subrogation in favor of and acceptable to RAILWAY; and

(3) Additional insured endorsement in favor of and acceptable to RAILWAY and include coverage for ongoing operations and completed operations; and

(4) Separation of insureds; and

(5) The policy will be primary and non-contributing with respect to any insurance carried

by RAILWAY.

iii) It is agreed that the workers' compensation and employers' liability related exclusions in the Commercial General Liability insurance policy(s) required herein are intended to apply to employees of the policy holder and shall not apply to ***Railway*** employees.

iv) No other endorsements limiting coverage as respects obligations under this Agreement may be included on the policy with regard to the work being performed under this agreement.

B. Business Automobile Insurance

i) The insurance will provide minimum coverage with a combined single limit of at least $1,000,000 per accident, and include coverage for, but not limited to the following:

(1) Bodily injury and property damage

(2) Any and all vehicles owned, used or hired

ii) The policy will include the following endorsements or language, which will be indicated on or attached to the certificate of insurance:

(1) Waiver of subrogation in favor of and acceptable to RAILWAY;

(2) Additional insured endorsement in favor of and acceptable to RAILWAY;

(3) Separation of insureds;

(4) The policy shall be primary and non-contributing with respect to any insurance carried by RAILWAY.

C. Workers Compensation and Employers Liability Insurance

i) Workers Compensation and Employers Liability insurance including coverage for, but not limited to:

(1) Contractor's statutory liability under the worker's compensation laws of the state(s) in which the work is to be performed. If optional under State law, the insurance must cover all employees anyway.

(2) Employers' Liability (Part B) with limits of at least $500,000 each accident, $500,000

by disease policy limit, $500,000 by disease each employee.

ii) This policy shall also contain the following endorsements or language, which shall be indicated on the certificate of insurance:

(1) Waiver of subrogation in favor of and acceptable to Railway.

D. Railroad Protective Liability insurance

i) Railroad Protective Liability insurance naming only the ***Railway*** as the Insured with coverage of at least $5,000,000 per occurrence and $10,000,000 in the aggregate. The policy Must be issued on a standard ISO form CG 00 35 12 04 and include the following:

(1) Endorsed to include the Pollution Exclusion Amendment

(2) Endorsed to include the Limited Seepage and Pollution Endorsement.

(3) Endorsed to remove any exclusion for punitive damages.

(4) No other endorsements restricting coverage may be added.

(5) The original policy must be provided to the ***Railway*** prior to performing any work or services under this Agreement.

(6) Definition of "Physical Damage to Property" shall be endorsed to read: "means direct and accidental loss of or damage to all property owned by any named insured and all property in any named insured' care, custody, and control arising out of the acts or omissions of the contractor named on the Declarations.

In lieu of providing a Railroad Protective Liability Policy, Licensee may participate (if available) in Railway's Blanket Railroad Protective Liability Insurance Policy.

E. Other Requirements:

i) Where allowable by law, all policies (applying to coverage listed above) shall contain no exclusion for punitive damages.

ii) Contractor agrees to waive its right of recovery against ***Railway*** for all claims and suits against ***Railway***. In addition, its insurers, through the terms of the policy or policy endorsement, waive their right of subrogation against ***Railway*** for all claims and suits.

Contractor further waives its right of recovery, and its insurers also waive their right of subrogation against ***Railway*** for loss of its owned or leased property or property under Contractor's care, custody or control.

iii) Allocated Loss Expense shall be in addition to all policy limits for coverages referenced above.

iv) Contractor is not allowed to self-insure without the prior written consent of ***Railway.*** If granted by ***Railway***, any self-insured retention or other financial responsibility for claims shall be covered directly by Contractor in lieu of insurance. Any and all ***Railway*** liabilities that would otherwise, in accordance with the provisions of this Agreement, be covered by Contractor's insurance will be covered as if Contractor elected not to include a deductible, self-insured retention or other financial responsibility for claims.

v) Prior to commencing services, Contractor shall furnish to ***Railway*** an acceptable certificate(s) of insurance from an authorized representative evidencing the required coverage(s), endorsements, and amendments. The certificate should be directed to the following address:

BNSF Railway Company
c/o CertFocus
P.O. Box 140528
Kansas City, MO 64114
Toll Free: 877-576-2378
Fax number: 817-840-7487
Email: BNSF@certfocus.com
www.certfocus.com

vi) Contractor shall notify Railway in writing at least 30 days prior to any cancellation, non-renewal, substitution or material alteration.

vii) Any insurance policy shall be written by a reputable insurance company acceptable to Railway or with a current Best's Guide Rating of A- and Class VII or better, and authorized to do business in the state(s) in which the service is to be provided.

viii) If coverage is purchased on a "claims made" basis, Contractor hereby agrees to maintain coverage in force for a minimum of three years after expiration, cancellation or termination of this Agreement. Annually Contractor agrees to provide evidence of such coverage as required hereunder.

ix) Contractor represents that this Agreement has been thoroughly reviewed by Contractor's insurance agent(s)/broker(s), who have been instructed by Contractor to procure the insurance coverage required by this Agreement.

x) Not more frequently than once every five years, Railway may reasonably modify the required insurance coverage to reflect then-current risk management practices in the railroad industry and underwriting practices in the insurance industry.

xi) If any portion of the operation is to be subcontracted by Contractor, Contractor shall require that the subcontractor shall provide and maintain insurance coverage(s) as set forth herein, naming Railway as an additional insured, and shall require that the subcontractor shall release, defend and indemnify Railway to the same extent and under the same terms and conditions as Contractor is required to release, defend and indemnify Railway herein.

xii) Failure to provide evidence as required by this section shall entitle, but not require, Railway to terminate this Agreement immediately. Acceptance of a certificate that does not comply with this section shall not operate as a waiver of Contractor's obligations hereunder.

xiii) The fact that insurance (including, without limitation, self-insurance) is obtained by Contractor shall not be deemed to release or diminish the liability of Contractor including, without limitation, liability under the indemnity provisions of this Agreement. Damages recoverable by Railway shall not be limited by the amount of the required insurance coverage.

xiv) In the event of a claim or lawsuit involving Railway arising out of this agreement, Contractor will make available any required policy covering such claim or lawsuit.

xv) These insurance provisions are intended to be a separate and distinct obligation on the part of the Contractor. Therefore, these provisions shall be enforceable and Contractor shall be bound thereby regardless of whether or not indemnity provisions are determined to be enforceable in the jurisdiction in which the work covered hereunder is performed.

xvi) For purposes of this section, Railway shall mean "Burlington Northern Santa Fe LLC", "BNSF Railway Company" and the subsidiaries, successors, assigns and affiliates of each.

4) SALES AND OTHER TAXES

A. In the event applicable sales taxes of a state or political subdivision of a state of the United States are levied or assessed in connection with and directly related to any amounts invoiced by Contractor to Railway ("Sales Taxes"), Railway shall be responsible for paying only the Sales Taxes that Contractor separately states on the invoice or other billing documents provided to Railway; *provided, however,* that (i) nothing herein shall preclude Railway from claiming whatever Sales Tax exemptions are applicable to amounts Contractor bills Railway, (ii) Contractor shall be responsible for all sales, use, excise, consumption, services and other taxes which may accrue on all services, materials, equipment, supplies or fixtures that Contractor and its subcontractors use or consume in the performance of this Agreement, (iii) Contractor shall be responsible for Sales Taxes (together with any penalties, fines or interest thereon) that Contractor fails to separately state on the invoice or other billing documents provided to Railway or fails to collect at the time of payment by Railway of invoiced amounts (except where Railway claims a Sales Tax exemption), and (iv) Contractor shall be responsible for Sales Taxes (together with any penalties, fines or interest thereon) if Contractor fails to issue separate invoices for each state in which Contractor delivers goods, provides services or, if applicable, transfers intangible rights to Railway.

B. Upon request, Contractor shall provide Railway satisfactory evidence that all taxes (together with any penalties, fines or interest thereon) that Contractor is responsible to pay under this Agreement have been paid. If a written claim is made against Contractor for Sales Taxes with respect to which Railway may be liable for under this Agreement, Contractor shall promptly notify Railway of such claim and provide Railway copies of all correspondence received from the taxing authority. Railway shall have the right to contest, protest, or claim a refund, in Railway's own name, any Sales Taxes paid by Railway to Contractor or for which Railway might otherwise be responsible for under this Agreement; provided, however, that if Railway is not permitted by law to contest any such Sales Tax in its own name, Contractor shall, if requested by Railway at Railway's sole cost and expense, contest in Contractor's own name the validity, applicability or amount of such Sales Tax and allow Railway to control and conduct such contest.

C. Railway retains the right to withhold from payments made under this Agreement amounts required to be withheld under tax laws of any jurisdiction. If Contractor is claiming a withholding exemption or a reduction in the withholding rate of any jurisdiction on any payments under this Agreement, before any payments are made (and in each succeeding period or year as required by law), Contractor agrees to furnish to Railway a properly completed exemption form prescribed by such jurisdiction. Contractor shall be responsible for any taxes, interest or penalties assessed against Railway with respect to withholding taxes that Railway does not withhold from payments to Contractor.

5) EXHIBIT "C" CONTRACTOR REQUIREMENTS

A. The Contractor must observe and comply with all provisions, obligations, requirements and limitations contained in the Agreement, and the Contractor Requirements set forth on Exhibit "C" attached to the Agreement and this Agreement, including, but not be limited to, payment of all costs incurred for any damages to Railway roadbed, tracks, and/or appurtenances thereto, resulting from use, occupancy, or presence of its employees, representatives, or agents or subcontractors on or about the construction site. Contractor shall execute a Temporary Construction Crossing Agreement or Private Crossing Agreement (http://www.bnsf.com/communities/faqs/permits-real-estate/), for any temporary crossing requested to aid in the construction of this Project, if approved by BNSF.

6) TRAIN DELAY

A. Contractor is responsible for and hereby indemnifies and holds harmless Railway (including its affiliated railway companies, and its tenants) for, from and against all damages arising from any unscheduled delay to a freight or passenger train which affects Railway's ability to fully utilize its equipment and to meet customer service and contract obligations. Contractor will be billed, as further provided below, for the economic losses arising from loss of use of equipment, contractual loss of incentive pay and bonuses and contractual penalties resulting from train delays, whether caused by Contractor, or subcontractors, or by the Railway performing work under this Agreement. Railway agrees that it will not perform any act to unnecessarily cause train delay.

B. For loss of use of equipment, Contractor will be billed the current freight train hour rate per train as determined from Railway's records. Any disruption to train traffic may cause delays to multiple trains at the same time for the same period.

C. Additionally, the parties acknowledge that passenger, U.S. mail trains and certain other grain, intermodal, coal and freight trains operate under incentive/penalty contracts between Railway and its customer(s). Under these arrangements, if Railway does not meet its contract service commitments, Railway may suffer loss of performance or incentive pay and/or be subject to penalty payments. Contractor is responsible for any train performance and incentive penalties or other contractual economic losses actually incurred by Railway which are attributable to a train delay caused by Contractor or its subcontractors.

D. The contractual relationship between Railway and its customers is proprietary and confidential. In the event of a train delay covered by this Agreement, Railway will share information relevant to any train delay to the extent consistent with Railway confidentiality

obligations. The rate then in effect at the time of performance by the Contractor hereunder will be used to calculate the actual costs of train delay pursuant to this agreement.

E. Contractor and its subcontractors must give Railway's representative (_____) _____ (__) weeks advance notice of the times and dates for proposed work windows. Railway and Contractor will establish mutually agreeable work windows for the project. Railway has the right at any time to revise or change the work windows due to train operations or service obligations. Railway will not be responsible for any additional costs or expenses resulting from a change in work windows. Additional costs or expenses resulting from a change in work windows shall be accounted for in Contractor's expenses for the project.

F. Contractor and subcontractors must plan, schedule, coordinate and conduct all Contractor's work so as to not cause any delays to any trains.

SIGNATURE PAGE FOLLOWS

Contract Number: Document ID

IN WITNESS WHEREOF, each of the parties hereto has caused this Agreement to be executed by its duly authorized officer the day and year first above written.

BNSF RAILWAY COMPANY	_____**[CONTRACTOR]**
Signature:_____	Signature:_____
Printed Name:_____	Printed Name:_____
Title: Manager Public Projects	Title:_____
Date:_____	Date:_____

Accepted and effective this _____day of 20__.

Contact Person:_____

Address:_____

City:_____

State:_____

Zip:_____

Fax:_____

Phone:_____

E-mail:_____

B-1

BNSF UTILITY ACCOMMODATION POLICY

UTILITY ACCOMMODATION POLICY

BNSF RAILWAY

Engineering Services
February 15, 2024

TABLE OF CONTENTS

PART 1

GENERAL POLICY

I. PART 1 - GENERAL POLICY

A. Policy Application

1. Purpose

   This policy is to prescribe the accommodation, location and method of installation, adjustments, removal, relocation, and maintenance of utility facilities within the property of BNSF. The policy was developed in the interest of safety, protection, utilization, and future development of BNSF with due consideration given to public and private service afforded by adequate and economical utility installations.

2. Application

   The policy concerning utility accommodations shall apply to all:

   a. New utility installations

   b. Additions to existing utility installations

   c. Adjustment and relocation of utilities

   d. Existing or planned utility installations for which agreements with BNSF were entered prior to the date of the adoption of this policy.

   e. Existing utility installations that do not meet the current license requirements may remain at the discretion of **BNSF.**

   Various types of utility lines not specifically discussed herein shall be considered within the provisions of this policy. It shall be the general practice to consider all lines carrying caustic, flammable, or explosive materials under the provisions for high-pressure gas and liquid fuel lines.

3. Scope

   Utilities include lines, facilities, and systems for producing, transmitting, or distributing communications, power, electricity, light, heat, gas, oil, crude products, water, steam, waste, storm water and other similar commodities which are privately, publicly, or cooperatively owned and which serve directly or indirectly the public or any part thereof.

   A Utility Agreement License allowing a Utility Owner the privilege of placing its facilities in or on railroad property does not constitute permanent right for such usage. Whether required by BNSF or not, any removal, remodeling, maintenance, or relocation of the facilities, will be accomplished promptly by the Utility Owner at no cost to BNSF.

4. Exceptions

   Exceptions to any design, location or methods of installation provisions contained in this policy must be authorized by BNSF. Requests for exceptions will be considered only where it is shown that extreme hardship and/or unusual conditions provide justification and where alternate measures can be prescribed in keeping with the intent of this policy. All requests for exceptions shall be fully documented by identifying what variance is needed, and why, including design data, cost comparisons and other pertinent information. Please Note: BNSF authorization may cause additional processing time for the application.

5. Liability

   The Utility Owner, its successor(s), or assignees shall assume all risk and liability for accidents and damages that may occur to persons or property on account of this work, and shall indemnify and hold BNSF harmless from any and all costs, liabilities, expenses, suits, judgments or damages to persons or property, or claims of any nature whatsoever, arising out of or in connection with the permit, or the operation and performance thereunder by the utility, its agents, employees or subcontractors. In this regard, it is further understood and agreed that the utility may be required to obtain insurance coverage as determined by BNSF.

   The Utility Owner agrees that if liability insurance is required, it will file with the designated office, prior to granting of the license, "Certificates of Insurance" or other evidence to show that the appropriate insurance is carried.

   Insurance, as may be required, shall be maintained in force until the final release of the Utility Owner by BNSF from all obligations under the terms of the license. The insurance contract shall cover claims for such length of time as law permits said claims. The insurance document shall include a clause requiring the insurer to notify BNSF at least ten (10) days in advance of any cancellation or change in insurance contracts.

   The Utility Owner is responsible for any subcontractor to be knowledgeable of this policy and require all work to be conducted in compliance with it. Subcontractors must carry a liability insurance policy unless the subcontractor is covered by the Utility Owner's insurance.

6. Replacement/Relocation of Facility

   Replacement or relocation of an existing facility with the same facilities or facilities of a different type, or design, is to be considered as a new utility installation and all work shall adhere to this policy. This includes such things as extension of an existing casing, replacing with a larger / smaller pipe diameter, etc. When replacing an underground pipeline or conduit, an abandonment plan must be included in the general plans.

7. Change in Ownership

   It is the Utility Owner's responsibility to inform BNSF, in writing, of any name, ownership or address changes.

8. Non-compliance

   Non-compliance with any terms of this Utility Accommodation Policy or Utility License Agreements may be considered as cause for discontinuance of construction or operations until compliance is assured. Continued non-compliance will result in the revocation of the license. The cost of any work required by BNSF in the removal of non-complying construction will be assessed against the Utility Owner.

9. Discharge of Waste Material

   Applications for a Utility License Agreement for the installation of utility facilities which will discharge materials into the nation's waters, must comply with all applicable requirements of the Corps of Engineers, and other federal, state, or local environmental protection agencies. Identification of applicable requirements and administration of compliance procedures are the responsibility of the Utility Owner.

B. Utility License Agreement Requirements

1. General

   Utility License Agreements are required when utility facilities are installed, relocated, removed, or maintained along or across all BNSF property.

   If liability insurance is required, then evidence of adequate liability insurance is to be on file with BNSF for each agreement prior to any construction activity.

2. Applications

   Approved requests to install, maintain, relocate, or remove a utility within the property of BNSF shall be authorized by a Utility License Agreement. All applications for utility license agreements along with plans for the proposed installation shall be submitted to BNSF and approved before construction has commenced. Any exceptions to this policy will require the completion of an exception form and may cause additional processing time.

3. Plans and Approvals

   a. Approval of plans and application forms is required for all installations of utilities prior to initiation of work on railroad property. A Professional Engineer's seal is required for plans detailing:
      - Pipelines installed within Shoring Zone A as shown in Figure 1, Pg 3-4, with an outside diameter greater than 8 inches; or

- Temporary shoring on the right-of-way; or
- Overhead pipeline bridge crossings; or
- Overhead electric transmission lines greater than 12.5kV.

b. If surveying, or environmental/geotechnical study on BNSF right-of-way is necessary for the completion of an application, a "Temporary Occupancy Permit" must be executed and referenced. Additionally, a BNSF qualified flagman will be required when working within twenty-five (25) feet of the track.

4. License Procedures:

a. Submit applications online by going to https://bnsf.railpermitting.com and complete the application process and pay the application fee.

b. Upon receipt of the application, an email confirmation will be forwarded acknowledging receipt and advising of the Permit tracking number that has been assigned.

c. Agreements will be required for all encroachments on railroad property.

d. Generally, agreement-processing time will be thirty to sixty days or longer depending on plan revisions, the complexity of the project(s) and/or permit redlines. Please allow sufficient lead-time for document handling prior to desired construction date. Before construction begins, agreements must be executed by Utility Owner and returned. Verbal authorizations will not be granted or permitted. All work must be set up, in advance, with the BNSF Utility Coordinator to coordinate the Construction Inspector and flagger.

e. License fees must be paid online through https://bnsf.railpermitting.com for the agreement to be fully executed.

5. Location

a. Utility lines shall be located to avoid, or minimize, the need for adjustments for future railroad improvements and to permit access to the utility lines for their maintenance with minimum interference to railroad traffic.

b. Pipelines shall be installed under tracks by boring, jacking, or in some cases, open trenching (must be pre-approved by BNSF). **WATER JETTING IS NOT PERMITTED.**

c. Where practical, pipelines carrying liquefied petroleum gas shall cross the railway where the tracks are carried on an embankment.

d. All high-pressure pipelines (greater than 60-psi internal pressure), except those in public roads, shall be prominently marked and maintained at the property line (on both sides of the track for under crossings) by signs which state the utility owner, size of the

line and its depth as well as a 24-hour emergency contact number, which will be maintained if the utility is in service. These signs will be inspected annually and replaced should they become unreadable.

Example:
CAUTION: Bob's Gas Service, 1-800-123-4567, 30-inch diameter high-pressure Gas main 7 feet deep.

6. Design Considerations

a. The design of any utility installation will be the responsibility of the Utility Owner. Any proposed installation within the railroad property must be reviewed and approved by the railroad regarding location and the method of construction, installation, and replacement. This includes the measures to be taken to preserve the safety and flow of rail traffic, insure it does not obstruct right of way access for BNSF, structural integrity of the roadway or structure, ease of maintenance and the integrity of the utility facility. Utility installations, on, over or under BNSF property shall conform with the requirements contained herein, or the appropriate requirements outlined in the following, whichever is deemed most safe:

(1) Safety Rules for the Installation and Maintenance of Electric Supply and Communication Lines-National Electric Safety Code.

(2) Title 49 C.F.R. Part 192, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards.

(3) Title 49 C.F.R. Part 195, Transportation of Hazardous Liquids by Pipelines.

(4) American Society for Testing and Materials (ASTM) Specifications - latest edition.

(5) Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) - latest edition, published by the Federal Highway Administration (FHWA) of the United States Department of Transportation (USDOT).

(6) Rules and Regulations for Public Water Systems - latest edition, published by the appropriate State Health Department.

(7) Occupational Safety and Health Administration (OSHA) Title 29 C.F.R. Standard 1926 – Safety and Health Regulations for Construction.

b. All utility installations on, over or under BNSF property shall be of durable materials designed for long service life and relatively free from routine servicing and maintenance requirements. Conformance with current applicable material specifications and codes is mandatory.

c. References given to any manual, publication or specification are intended to be the most current edition. If a conflict occurs between any publication and this manual, the specification deemed most safe will be used.

d. Geo-technical Study is required for pipeline installations crossing under the tracks greater than twenty-six (26) inches in diameter, and less than twelve (12) feet below base of rail, using a method other than jack-and-bore. Refer to part B.3.b., found on page 1-4 of this document for requirements of the study and review.

e. Temporary Shoring is required for all excavations on BNSF right of way, including boring pits, and design plans are subject to review and approval by BNSF. Refer to Appendix for the review sheet that lists items to be included in the Temporary Shoring Plans.

C. Construction

1. Coordination with the Construction Inspector and/or flagging company, along with any required deposits, will be arranged prior to any construction on BNSF property.

2. The execution of the work on railroad property shall be subject to the inspection and direction of the Construction Inspector.

3. A representative of BNSF Signal Department must be present during installation if railroad signals are in the vicinity of the proposed construction.

4. Any dirt that is excavated for pits, poles, bores, etc. will remain on BNSF property. BNSF Environmental will be consulted before any soils are removed from BNSF property which can be coordinated through the Construction Inspector.

5. Spills, of any quantity, must be reported to the Service Interruption Desk. This can be coordinated through the Construction Inspector.

6. A plan to monitor for settlement or heave of the railroad facilities must be developed, accepted, and implemented to assure no adverse effect on the railroad's activities because of the work. The plan should detail the types of settlement points that will be installed and monitored as well as the frequency of monitoring and the reporting mechanism. Because the track will tend to bridge over the area affected by the drilling / boring / trenching operation, the monitoring plan should include checking for settlement or heave at a depth below the track. Surveying of the monitoring points may be accomplished by traditional means or an automated system. A baseline survey should be conducted before the start of construction.

   Most settlement plans include a two-step process against which the monitoring data is measured. The alert threshold limit is the value intended to bring attention to the movement so that it can be managed without reaching the maximum level. The maximum level is the highest allowable movement value and should be less than the value that could result in damage to the railroad facilities.

Reaching the threshold limit may trigger the following actions:

(1) Discussion of the data and its implications
(2) Increase in the frequency of monitoring.
(3) Independent confirmation of the monitoring data
(4) A review of construction methods to determine if changes are required to mitigate further movement.

Reaching the maximum limit may trigger the following actions:

(1) Immediate stoppage of construction and notification to the railroad
(2) Independent confirmation of movement
(3) Review of construction methods and implementation of contingency plans, if needed
(4) Re-evaluation of critical structures in the area and installation of additional monitoring devices if needed.

Alert threshold values are from ¼ to ¾ inch with maximum values from ½ to 1 inch.

7. The utility installation is not considered complete until as-built drawings are submitted and verified as correct by the Construction Inspector.

D. Safety

The BNSF Contractor orientation course must be completed by all workers prior to entering BNSF property. It is the contractor's responsibility to implement a safety program for its employees. Training materials are available on the web site: www.bnsfcontractor.com. The contractor must comply with all federal, state, and local safety regulations.

1. Construction Inspector

   a. A Construction Inspector shall be required for all utility installations, and projects involving excavation, grading, construction and building demolition on BNSF right of way, with the total cost borne by the Utility Owner.

   b. The Construction Inspector will be notified of the construction monitoring methods and frequency to be used.

   c. Once construction is complete, the Utility Owner will provide the Construction Inspector with as-built drawings noting any changes from the original specifications approved when the permit was issued. These as-built drawings must be verified by the Construction Inspector and submitted to BNSF for their records.

2. Flagging

   a. When work is performed within BNSF right-of-way, railroad flagging and construction inspection will be required.

b. Railroad flagging will be required:

   i. During the period of construction when it is necessary for the Contractor to operate equipment in the vicinity of, under, or over, BNSF property which may endanger railroad operations, or

   ii. Two or more railroad flagmen may be required at other times that the Railway Company's sole discretion shall deem necessary.

c. Flagging services shall be performed by a BNSF qualified flagger and the total cost borne by the Utility Owner.

d. The Utility Owner will be billed monthly, or as required to maintain required services, at a rate to be determined by BNSF to include labor and associated costs plus any expenses incurred for inspection and/or flagging services.

e. A written request for inspection and flagging services will be required at least two (2) weeks prior to the time when such services are needed. This request is made to the BNSF scheduling agent, as noted in executed agreement.

E. Material Storage

Storage of materials, parking of equipment and vehicles when not being used in actual utility work, will not be permitted on railroad property without an executed temporary easement.

F. Call Before You Dig!

Call 811 to schedule a utility locate and call 1-800-533-2891 (for BNSF Telecom) and 800-832-5452 (For BNSF Signal) to arrange for a BNSF underground cable locate. BNSF form "Underground Cable Location & Acknowledgement" will be completed by a BNSF representative with a copy provided to the contractor. The contractor must always have this completed form available for review at the job site.

G. Maintenance and Servicing Utilities

1. Utility Owner's Responsibility

   a. Maintenance of the utility is the responsibility of the Utility Owner.

   b. Maintenance must be performed to keep the facility in an as-constructed condition, and in a good state of repair in accordance with the requirements of Federal, State and Local laws, regulatory standards, and utility codes.

   c. It is the Utility Owner's responsibility to replace and stabilize all earth cover and vegetation when it has eroded over an underground utility facility where such erosion is due to, or caused by, the placement or existence of the underground utility facility.

d. The Utility Owner shall be responsible for any settlement of backfill, fills, and embankments that may occur.

2. Emergency Maintenance

a. Emergency maintenance of utilities located on railroad property is permissible without obtaining a Utility License Agreement if an emergency exists that is dangerous to the life, safety, or welfare of the public and which requires immediate repair. The Utility Owner shall take all necessary and reasonable safety measures to protect the public and the railroad.

b. The Utility Owner, in such an event, will advise the Railway as soon as possible. Damage to the right-of-way and facilities will be restored to its original condition. A Utility License Agreement should be requested by the Utility Owner within the second working day provided the work is not covered under any previously granted license. Flagging requirements described earlier apply in all situations.

H. Preservation, Restoration and Cleanup

1. Disturbed Areas

a. Areas of railroad property disturbed by the installation, maintenance, removal, and relocation of utilities shall be kept to a minimum.

b. After review and concurrence from the BNSF Environmental Group, disturbed areas shall be returned to normal grade and elevation, with compaction of backfill material and all excess or undesirable material removed by the Utility Owner. The Utility Owner shall replace destroyed vegetation by sodding, or seeding, fertilizing, and mulching, or a combination thereof.

c. The Utility Owner shall provide protection against erosion in disturbed areas that are subject to erosion. Such protection may be in the form of rock riprap, wash checks, hay or straw cover, or other material that is approved and does not interfere with railroad maintenance.

2. Drainage Facilities

    a. Care shall be taken to avoid disturbing existing drainage facilities. Underground utility facilities shall be bedded with pervious material and outlets provided for entrapped water. Underdrains should be provided where necessary.

    b. Grades shall be sloped away from the track roadbed and towards the ditch, when possible, with the goal of no standing water on railroad property.

3. Cleanup

    a. Unused material or debris shall be removed from the work site area. At the end of every construction day, construction equipment and materials shall be removed as far from the operating railroad tracks as possible (minimum twenty-five (25) feet from centerline). All machines will be disabled when not in use to prevent unauthorized operation. No equipment or materials will be allowed to be staged on BNSF property without an executed temporary easement.

I. Protection of Vegetation

1. Trimming, Clearing or Removal of Vegetation

    a. Consistent with the preservation of planted vegetation, consideration will be given to Utility Owners for the necessary trimming, clearing or removal of vegetation to provide adequate clearance of overhead wires. Such work will be done in accordance with established practices and standards; however, approval will not be granted for wasteful or wanton trimming, or removal to provide easy solutions to a difficult situation.

    b. No trees, shrubs, bushes, vines, or ground cover on railroad property shall be sprayed, trimmed, cut down, rooted up, removed, or mutilated in any manner unless a permit is granted by BNSF to do such work.

2. Chemical Brush Control

    a. Spraying brush and seedling tree growth to prevent re-sprouting may be permitted, and when permitted, shall be carried out with extreme caution and careful performance. The Utility Owner shall be responsible for the performance of their employees or contractors in the application of brush control with methods and proposed chemicals approved by BNSF Environmental Department.

    b. All spraying shall be done by an herbicide applicator that is licensed in the state where the work is to be performed.

c. Permit applications for spraying shall list the kinds of chemical weed and brush killers that will be used. When liability insurance is required, it shall be provided by the herbicide applicator, or be insured under the liability insurance of the Utility Owner.

d. Plants over five (5) feet in height should not be sprayed for control. Brush over five (5) feet in height, which is to be removed, should be cut and the stumps treated to prevent growth. Shrubbery type growth such as dogwood, sumac, redbud, plum, etc., should not be sprayed as a rule. Steep slopes, where brushy growth is a major factor in preventing erosion, should not be sprayed.

3. Tree Pruning

a. Tree pruning on railroad property for utility lines will utilize the best horticultural practices. All cut branches, dead limbs, etc., shall be removed. Such materials shall not be burned or disposed of on railroad property unless permission is granted by the Utility License Agreement.

b. Should burning be permitted, the Utility Owner will be held liable for any damage to grass, crops, native shrubs, and trees arising from careless burning of such brush.

c. All limbs trimmed shall be removed with a clean cut and all limb scars over one (1) inch in diameter shall be treated with appropriate tree paint.

PART 2

UTILITIES PARALLELING RAILROAD PROPERTY

PART 2 - UTILITIES PARALLELING RAILROAD PROPERTY

A. General Provisions

This section of the policy applies to all public and private utilities, including electric power, telephone, fiber optics, telegraph, cable television, water, gas, oil, petroleum products, steam, chemicals, sewage, drainage, irrigation, and similar lines that are located, adjusted, or relocated within the property under the jurisdiction of BNSF, but not actually crossing the tracks. Such utilities may involve underground, surface, or overhead facilities.

Any such utility line will be considered a parallel line and is to be located on a uniform alignment, within ten (10) feet or less of the property line and a minimum of forty (40) feet from centerline of track to provide a safe environment and to preserve space for future railroad improvements or other utility installations. BNSF Engineering must approve any installation over one mile.

Utilities will be located to provide a safe environment and shall conform to the current "National Electrical Safety Code," "American Waterworks Association Specifications," "Federal Pipeline Safety Regulations," and "The American Railway Engineering and Maintenance Association (AREMA) recommendations." Where laws or orders of public authority prescribe a higher degree of protection, then the higher degree of protection prescribed shall supersede the provisions of this manual.

Approval of plans and application forms is required for all installations of utilities prior to initiation of work on railroad property. A Professional Engineer's seal is required for plans detailing:

- Pipelines installed within Shoring Zone A as shown in Figure 1, Pg 3-4, with an outside diameter greater than 8 inches; or
- Temporary shoring on the right-of-way; or
- Overhead pipeline bridge crossings; or
- Overhead electric transmission lines greater than 12.5 kV.

B. Overhead Installations

1. Must comply with all requirements of Part 1 – General Policy of this manual.

2. The design of all utility installations will be the responsibility of the Utility owner. Plans shall be drawn to scale showing the relationship of the proposed utility line to the railroad tracks, the angle of crossing, location of valves and vents, the railroad mile post and engineering station, railroad property lines and general layout of tracks and other railroad facilities. The plans should include a cross-section (or sections) from the field survey that will show utility placement in relation to actual profile of ground and tracks.

3. Applications can be submitted along with plans detailing location, both horizontal and vertical, of proposed utility with dimensions from track and/or right-of-way boundaries at https://bnsf.railpermitting.com.

4. A minimum of four (4) feet clearance is required above existing signal and communication lines.

5. Pole height and distance from centerline of nearest track must be shown on an aerial exhibit and included with the application along with a profile that includes the wire attachment height and anticipated maximum sag.

   Poles must be located a minimum of fifty (50) feet out from the centerline of railroad mainline, branch and running tracks, CTC sidings, and heavy tonnage spurs. Pole locations adjacent to industry tracks; must provide at least a ten (10) foot clearance from the centerline of track, when measured at right angles. If located adjacent to curved track, then said clearance must be increased at a rate of one and one-half (1-1/2) inches per degree of curved track.

   Regardless of the voltage, un-guyed poles shall be located a minimum distance from the centerline of any track, equal to the height of the pole above the ground-line plus ten (10) feet. If guying is required, the guys shall be placed in such a manner as to keep the pole from leaning/falling in the direction of the tracks.

   Poles (including steel poles) must be located a minimum distance from railroad signal and communication lines equal to the height of the pole above the ground-line or else be guyed at right angles to the lines. High voltage towers (34.5 kV and higher) must be located off railroad right of way. All poles will contain a sign stating the utility owner, voltage of the lines and a 24-hour emergency contact phone number that will be maintained if the utility is in service. The utility owner will be responsible to de-energize, sleeve, etc. in the event a BNSF emergency requires access.

   For proposed electrical lines paralleling tracks, BNSF may request that an inductive coordination study be performed at the expense of the utility owner. Inductive interference from certain lines has the potential to disrupt the signal system in the track causing failures in the track signals and highway grade crossing warning devices. Generally, if the proposed electrical line exceeds 12.5 kV *and* runs parallel to the track for at least 1,000 feet, a study will be required. A study will be required if a new sub-station is to be located within 1,000 feet of the track. The General Director of Signals will determine the need for a study on a case-by-case basis.

6. Abandonment/Removal/Replacement of Facilities

   - Upon termination of license the utility needs to be removed from BNSF property.
   - Abandoned or replaced poles shall be removed from BNSF property or cut off to a depth at least six (6) feet below ground; and the hole filled with BNSF approved material and compacted to surrounding ground level.

- All metal such as rebar, cable, anchor systems, and strain relief must be removed and disposed of in accordance with local, state and federal regulations.
- An abandonment or replacement plan must be included in the general plans.

C. Underground Installations

1. Must comply with all requirements of Part 1 – General Policy of this manual.

2. The design of all utility installations will be the responsibility of the Utility owner. Plans shall be drawn to scale showing the relationship of the proposed utility line to the railroad tracks, the angle of crossing, location of valves and vents, the railroad mile post and engineering station, railroad property lines and general layout of tracks and other railroad facilities. The plans should include a cross-section (or sections) from the field survey that will show utility placement in relation to actual profile of ground and tracks.

3. Applications can be found at https://bnsf.railpermitting.com and must be completed and submitted along with plans detailing location, both horizontal and vertical, of proposed utility with dimensions from track and/or right-of way boundaries.

4. The plans should contain the following data for carrier and casing pipe:

   - Contents to be carried
   - Inside diameter
   - Pipe material
   - Specifications and grade of pipe material
   - Wall thickness
   - Actual working pressure
   - Type of joints
   - Longitudinal joint factor
   - Coating
   - Method of Installation
     - Bore pit locations (measured perpendicularly from centerline of nearest track, must be 30’ or more)
   - Vents-Number, Size, Location including Height above ground
   - Seals-Both ends, One end
   - Cover (top of tie to top of pipe casing)
   - Cover (other than under tracks)
   - Cover (at ditches)
   - Cathodic protection
   - Type, Size and Spacing of insulators or supports

5. Underground utility installations should be located on top of the back slope at the outer limits of railroad property as follows:

a. Electric power / Fiber Optic / Communication Lines

i. A minimum depth of six (6) feet Below Natural Grade (BNG) for Electric and Fiber Optic Lines.

ii. Whenever feasible, all cable should be laid within five (5) feet from property lines.

iii. A 6-inch-wide warning tape will be installed, one (1) foot BNG directly over the underground fiber optic line when located on Railroad right-of-way outside the track ballast sections.

b. Pipelines

i. Any pipeline installation paralleling BNSF property shall be within ten (10) feet of property line and a minimum of forty (40) feet from track.

ii. If the pipeline is proposed to be located forty (40) feet or less from centerline of nearest track, the pipeline shall be encased in a steel pipe subject to approval from BNSF. No pipe may be placed closer than twenty-five (25) feet from centerline of any track. Pipe must be buried with a minimum cover of six (6) feet. If less than minimum depth is necessary because of existing utilities, water table, ordinance or similar reasons, the line shall be rerouted.

iii. Locations where it will be difficult to attain minimum depth due to wet or rocky terrain shall be avoided. Any location change from plan must be approved by BNSF.

iv. The use of plastic carrier pipe for sewer, water, natural gas, and other liquids is acceptable under specific circumstances. The use of plastic pipe is satisfactory if the pipe is designed to meet AREMA and all applicable federal and state codes, and if the carrier pipe is properly encased with a steel casing pipe for the entire length on BNSF right of way.

v. Manholes shall be limited to those necessary for installation and maintenance of underground lines. Manholes vary as to size and shape depending on the type of utility they serve. To conserve space, their dimensions should be minimally acceptable by good engineering and safety standards. In general, the only equipment to be installed in manholes located on railroad property is that which is essential to the normal flow of the utility, such as circuit reclosers, cable splices, relays, valves, and regulators. Other equipment should be located outside the limits of the railroad property. Manholes shall not protrude above the surrounding ground nor be in the shoulder, shoulder slope, ditch, backslope,

or within twenty-five (25) feet of the centerline of track without approval of BNSF.

vi. Pipelines must be marked every five hundred (500) feet and at every road crossing, streambed, other utility crossings, and at locations of major change in direction of the line.

c. Abandonment/Replacement/Removal of Facilities

i. Upon abandonment, replacement or termination of license the utility needs to be removed from BNSF property except for the portion under the track embankment.

ii. Portion of abandoned pipe under track embankment to remain in place shall be filled by pressure grouting. The grout material should be a sand cement slurry with a minimum of two (2) sacks of cement per cubic yard and a minimum amount of water to assure satisfactory placement. Open trenches shall be back-filled with BNSF approved materials and compacted to surrounding ground level.

iii. An abandonment plan must be included in the general plans.

D. Attachment to Bridges and Other Structures

The Utility Owner will not be permitted to attach to BNSF bridges or route facilities through drainage structures or cattle passes. Utilities are not to be attached to other railroad structures without the written approval of BNSF Engineering. As a rule, overhead power, communication, and cable television line crossings at railroad bridges must be avoided. Pipelines laid longitudinally on railroad property shall be located as far as practical from any tracks or other important structures. If located within forty (40) feet of the centerline of any track, the carrier pipe shall be encased or be of special design as approved by BNSF Engineering.

E. Drains for Steep Slopes (Tight Lines)

Drainage onto BNSF property from adjacent land that is significantly higher than the track elevation should be directed through a pipe anchored into the steep slope. The pipe needs to be designed to withstand the weight of the water in the pipe. The drainage system will include a diffuser at the bottom to prevent erosion on BNSF property. See “Drains for Steep Slopes” diagram in the Appendix.

PART 3

UTILITIES PERPENDICULAR TO RAILROAD PROPERTY

PART 3 - UTILITIES PERPENDICULAR TO RAILROAD PROPERTY

A. General Provisions

This section of the policy applies to all public and private utilities, including electric power, telephone, fiber optics, telegraph, cable television, water, gas, oil, petroleum products, steam, chemicals, sewage, drainage, irrigation, and similar lines that are located, adjusted, or relocated within the property under the jurisdiction of BNSF. Such utilities may involve underground, surface, or overhead facilities.

Installations crossing the property of the railroad, to the extent feasible and practical, are to be perpendicular to the railroad alignment and preferably at not less than forty-five (45) degrees to the centerline of the track. Utilities shall not be placed within culverts or under railroad bridges, buildings, or other important structures. New utilities should be placed at least twelve (12) feet from curb or edge of roadway pavement to avoid conflicts with existing or future active warning devices (crossing signals).

Utilities will be located to provide a safe environment and shall conform to the current "National Electrical Safety Code," "American Waterworks Association Specifications," "Federal Pipeline Safety Regulations," and "The American Railway Engineering and Maintenance Association (AREMA) Recommendations." Where laws or orders of public authority prescribe a higher degree of protection, then the higher degree of protection prescribed shall supersede the provisions of this manual.

Approval of plans and application forms is required for all installations of utilities prior to initiation of work on railroad property. A Professional Engineer's seal is required for plans detailing:

- Pipelines installed within Shoring Zone A as shown in Figure 1, Pg 3-4, with an outside diameter greater than 8 inches; or
- Temporary shoring on the right-of-way; or
- Overhead pipeline bridge crossings; or
- Overhead electric transmission lines greater than 12.5 kV.

B. Overhead Installations

1. Must comply with all requirements of Part 1 – General Policy of this manual.

2. The design of all utility installations will be the responsibility of the Utility owner. Plans shall be drawn to scale showing the relationship of the proposed utility line to the railroad tracks, the angle of crossing, location of valves and vents, the railroad mile post and engineering station, railroad property lines and general layout of tracks and other railroad facilities. The plans should include a cross-section (or sections) from the field survey that will show utility placement in relation to actual profile of ground and tracks.

3. Applications can be found at https://bnsf.railpermitting.com and must be completed and submitted along with plans detailing location, both horizontal and vertical, of proposed utility with dimensions from track and/or right-of way boundaries.

4. Minimum four (4) feet clearance is required above existing signal and communication lines.

5. Poles must be located a minimum of fifty (50) feet out from the centerline of railroad main, branch and running tracks, CTC sidings, and heavy tonnage spurs. Pole location adjacent to industry tracks; must provide at least a 10-foot clearance from the centerline of track, when measured at right angles. If located adjacent to curved track, then said clearance must be increased at a rate of one and one-half (1-½) inches per degree of curved track.

6. Regardless of the voltage, un-guyed poles shall be located a minimum distance from the centerline of any track, equal to the height of the pole above the ground-line plus 10 feet. If guying is required, the guys shall be placed in such a manner as to keep the pole from leaning/falling in the direction of the tracks.

7. Poles (including steel poles) must be located a minimum distance from the railroad signal and communication line equal to the height of the pole above the ground-line or else be guyed at right angles to the lines. High voltage towers (34.5 kV and higher) must be located off railroad right of way.

8. Overhead crossings must not be installed within 500 feet of any railroad bridge, or 300 feet from the centerline of any culvert or track switch area.

9. Complete spanning of the property is encouraged with supportive structures and appurtenances located outside railroad property.

    a. For electric supply lines, normally the crossing span shall not exceed 150 feet with adjacent span not exceeding 1-1/2 times the crossing span length.

    b. For communication lines, the crossing span shall not exceed 100 feet in heavy loading districts, 125 feet in medium loading districts, and 150 feet in light loading districts; and the adjacent span shall not exceed 1-1/2 times the crossing span length. See Appendix for map of Loading Districts.

    c. For heavier type construction, longer spans will be considered.

10. Joint-use construction is encouraged at locations where more than one utility or type of facility is involved. However, electricity and petroleum, natural gas or flammable materials shall not be combined. Pipe truss design and layout shall be sealed by a Professional Engineer and will need to be reviewed and approved by BNSF Engineering.

11. To ensure that overhead wire crossings are clear from contact with any equipment passing under such wires, lines shall be constructed with a minimum clearance above top of rail (ATR) as required by NESC + 3 feet or greater. Electric lines must have a florescent ball marker on lowest wire over centerline of track.

    a. </= 750 volts (includes fiber optic) = 27’0” ATR (NESC + 3’)
    b. > 750 V and < 50,000 V = 29’ 6” ATR (NESC + 3’)
    c. >/= 50,000 V = 27’ (NESC) + 3 = 30’ 0” ATR plus 0.4” per 1,000 V over 50kV

12. The utility owner will label the posts closest to the crossing with the owner’s name and telephone number for emergency contact.

13. All overhead flammable and hazardous material lines will need BNSF Engineering approval but should be avoided if possible.

14. For proposed electrical lines crossing tracks, BNSF may request that an inductive coordination study be performed at the expense of the utility owner. Inductive interference from certain lines has the potential to disrupt the signal system in the track causing failures in the track signals and highway grade crossing warning devices. The General Director of Signals will determine the need for a study on a case-by-case basis.

C. Underground Installations

1. General

   a. Must comply with all requirements of Part 1 – General Policy of this manual.

   b. The design of all utility installations will be the responsibility of the Utility owner. Plans shall be drawn to scale showing the relationship of the proposed utility line to the railroad tracks, the angle of crossing, location of valves and vents, the railroad mile post and engineering station, railroad property lines and general layout of tracks and other railroad facilities. The plans should include a cross-section (or sections) from the field survey that will show utility placement in relation to actual profile of ground and tracks.

   c. Applications can be found at https://bnsf.railpermitting.com and must be completed and submitted along with plans, stamped by a Professional Engineer, detailing location, both horizontal and vertical, of proposed utility with dimensions from track and/or right-of way boundaries.

   d. The plans should contain the following data for carrier and casing pipe:

      - Contents to be carried
      - Inside diameter
      - Pipe material
      - Specifications and grade of pipe material
      - Wall thickness of pipe
      - Actual working pressure
      - Type of joints
      - Longitudinal joint factor
      - Coating
      - Method of Installation
        - Bore pit locations (measured perpendicularly from centerline of nearest track, must be 30’ or more)
      - Vents-Number, Size, Location and Height above ground
      - Seals-Both ends, One end
      - Cover (top of tie to top of pipe casing)
      - Cover (other than under tracks)
      - Cover (at ditches)
      - Cathodic protection
      - Type, Size and Spacing of insulators or supports

e. All underground utility crossings of railroad trackage shall be designed to carry Cooper's E-80 Railroad live loading with diesel impact (*Design Loads* Section Found in AREMA Manual for Railway Engineering, Chapter 8 section 2.2.3) and on page 3-10 of this manual for reference. This 80,000-lb. axle load may be distributed laterally a distance of three (3) feet, plus a distance equal to the depth from structure grade line to base of rail, on each side of centerline of single tracks, or centerline of outer track where multiple tracks are to be crossed. In no case shall railroad loading design extend less than ten (10) feet laterally from centerline of track. Longitudinally, the load may be distributed between the five-foot axle spacing of the Cooper configuration. Railroad loading criteria will also apply where future tracks on BNSF are contemplated, to the extent this information is available.

f. All utilities crossing under ditches and railroad trackage using jacking and dry boring installation should have a minimum depth of cover of six (6) feet below the flowline of the ditch or ground surface and eight (8) feet – three (3) inches from base of rail. In fill sections, the natural ground line at the toe of slope will be considered as ditch grade.

i. Boring pits shall be located outside railroad property, when possible, at a minimum of thirty (30) feet from the centerline of track and kept to the minimum size necessary. Do not locate the bore pits in the slope of a cut or fill section of the roadbed. Keep the bore pit size to a minimum. Use shoring, temporary or permanent, conforming to the most restrictive of state, OSHA, or AREMA recommended practices in all excavations, where required. A list of items to be included in the Shoring Plan is shown on the Review Comments Sheet in the Appendix.

1) Shoring Zones (see Figure 1 below):
   a. All dimensions are measured perpendicular to the centerline of track.
   b. For ALL excavations within Zone A, shoring plans and calculations, sealed by a Professional Engineer, shall be submitted with the application.
   c. All shoring within the limits of Zone A must be placed prior to the start of excavation.

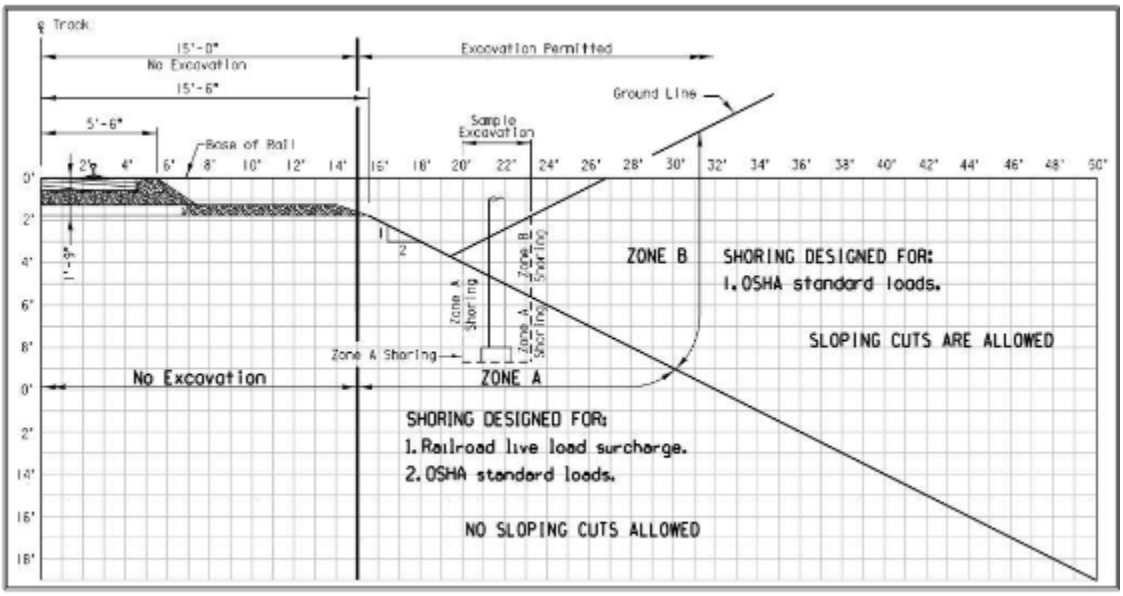


FIGURE 1

ii. All excavations will be attended or protected. Fence, fill or guard each site prior to leaving. Monitor shored excavations continuously during work for signs of instability and failure.

iii. Under-track bores using jack-and-bore method shall be located greater than forty-five (45) feet from the nearest bridge, culvert, track switch area, building or other major structure, regardless of commodity.

iv. For any installation other than jack and bore under main and siding tracks greater than twenty-six (26) inches in diameter and less that twelve (12) feet below base of rail, a geotechnical study will need to be performed to determine the presence of granular material and/or high-water table elevation, at the sole expense of the Permittee. The study will include recommendations and a plan for a procedure to prevent failure and a potential collapse of the bore. Generally, core samples are to be taken near the ends of tie at the proposed location, at least as deep as the bottom of the proposed horizontal bore. Test results must be reviewed and approved by BNSF, or its agent, prior to boring activities commencing. BNSF reserves the rights, based on test results, to require the Permittee to select an alternate location, or to require additional engineering specifications be implemented, at the sole expense of the Permittee, to utilize existing location.

v. BNSF Engineering will not need to review projects involving underground crossings of uncased gravity-flow sewer pipelines provided the material is one of the following:

1) Class V reinforced concrete pipe (RCP).
2) Steel pipe with proper wall thickness as prescribed in this policy.
3) HOBAS pipe.

g. All utilities crossing under ditches and railroad trackage using horizontal directional drilling (HDD) installation should have a minimum depth of cover of six (6) feet below the flowline of the ditch or ground surface and twelve (12) feet from base of rail. In fill sections, the natural ground line at the toe of slope will be considered as ditch grade. Detailed drawings should be included with the application.

Example detailed drawings to be submitted:

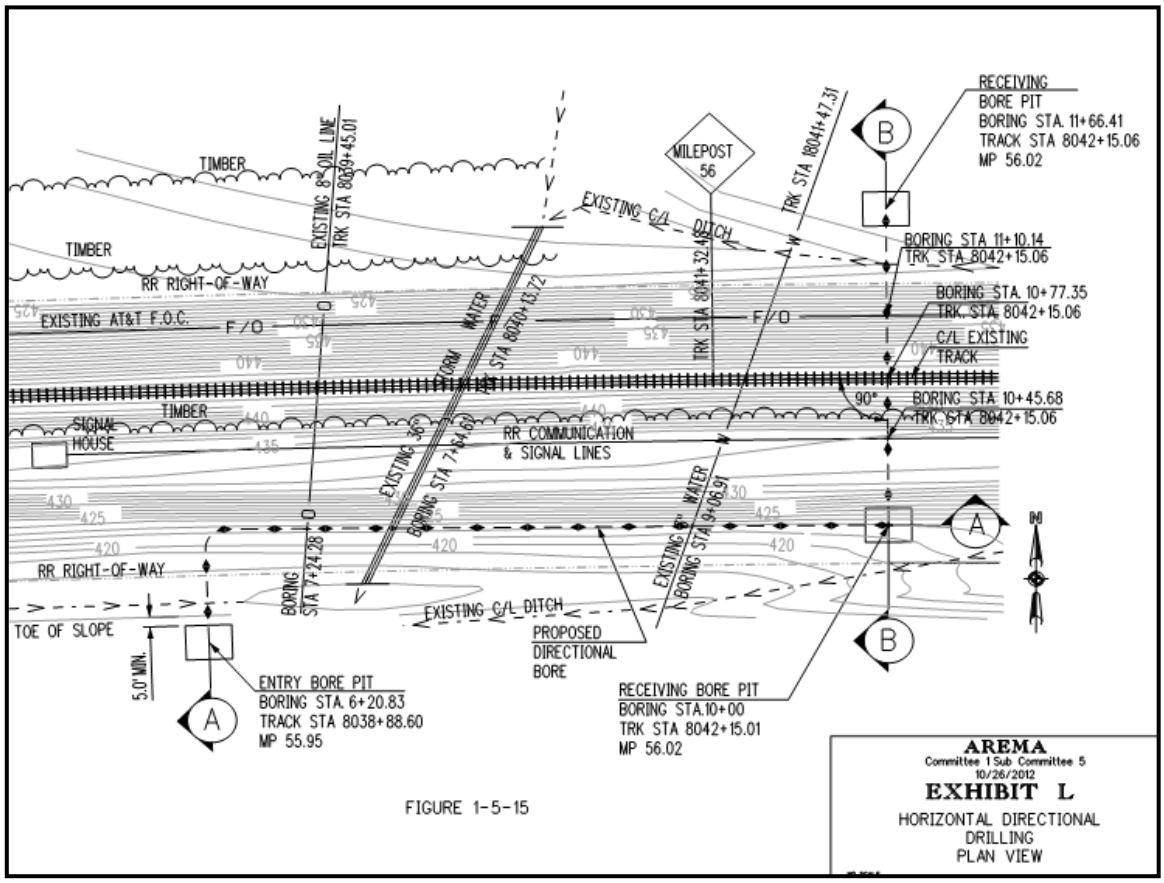
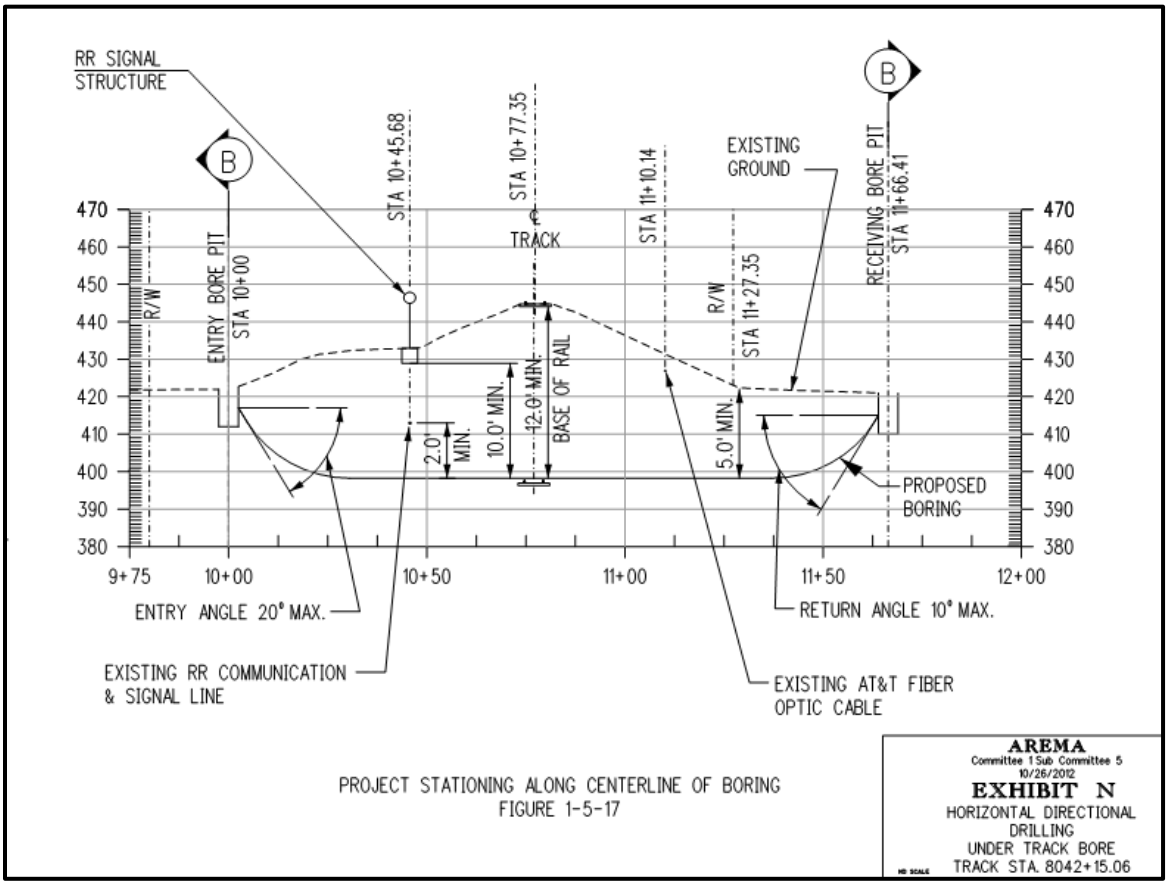


FIGURE 1-5-15



PROJECT STATIONING ALONG CENTERLINE OF BORING
FIGURE 1-5-17

h. Underground installations may be made by open trenching from the property line to the toe of the fill slope in fill sections and to the toe of the shoulder slope in cut sections but to no closer than thirty (30) feet of the centerline of track.

i. Underground installations crossing or paralleling BNSF will need to be a minimum of six (6) feet below natural ground / ditches regardless of installation method.

j. The use of plastic carrier pipe for sewer, water, natural gas, and other liquids is acceptable under specific circumstances. The use of plastic pipe is satisfactory if the pipe is designed to meet all applicable federal and state codes, and if the carrier pipe is properly encased within a steel casing pipe per AREMA standards. This casing must extend the full width of the right of way.

k. If the minimum depth is not attainable because of existing utilities, water table, ordinances, or similar reasons, the line shall be rerouted.

l. Locations that are considered unsuitable or undesirable are to be avoided. These include deep cuts and in wet or rocky terrain or where it will be difficult to obtain minimum depth.

m. Manholes should be located outside railroad property, when possible. No manhole may be in the shoulder, shoulder slope, ditch or backslope, or within twenty-five (25) feet of the centerline of any track and shall not protrude above the surrounding ground without approval of BNSF.

n. Utilities, except temporary water lines, will not be attached to or routed through drainage structures or cattle passes. Utilities are not to be attached to other railroad structures without written approval of the BNSF Structures Department.

o. Crossings shall not be installed under or within forty-five (45) feet of any Railroad bridge, track switch area or the centerline of any culvert unless installed at a depth equal to or greater than twelve (12) below base of rail.

p. A BNSF signal representative must be present during installation if railroad signals are in the vicinity of wireline crossings unless signal representative authorizes otherwise.

q. Markers that identify the Utility Owner shall be placed at both property lines for utilities crossing the railroad property. Parallel lines must be marked every five hundred (500) feet and at every road crossing, streambed, other utility crossings, and at locations of major change in direction of the line. The markers should identify the owner, type of cable and emergency telephone number. A six (6) inch wide warning tape will be installed one (1) foot BNG directly over the underground power line when located on Railroad right-of-way and outside the track ballast sections.

r. Above-ground utility appurtenances installed as a part of an underground installation shall be located at or near the railroad property line and shall not be any closer than twenty-five (25) feet to the centerline of track.

2. Pipeline Requirements

a. Pipeline designs are to specify the type and class of material, maximum working pressures, test, and design pressure. All pipes are to be constructed per most recently published or regulated standard of the USDOT Hazardous Material Regulation Board.

b. Pipelines carrying oil, liquefied petroleum gas, natural or manufactured gas and other flammable products shall conform to the requirements of the current AREMA, ANSI/ASME B 31.4 Code for pressure piping - Liquid Petroleum Transportation Piping Systems; ANSI B 31.8 Code for pressure piping - Gas Transmission and Distribution Piping Systems; other applicable ANSI codes and 49 C.F.R. Part 192 – Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards or Part 195 - Transportation of Hazardous Liquids by Pipeline, except that the maximum allowable stress of design of steel pipe shall not exceed the specified minimum yield strength (multiplied by longitudinal joint factor) of the pipe as defined in the ANSI codes.

c. New and relocated sewer lines shall be constructed with satisfactory joints, materials and designs which will provide protection and resistance to damage from sulfide gases and other corrosive elements to which they may be exposed. Where non-metallic pipe is permitted and installed, a durable metal wire shall be concurrently installed; or other means shall be provided for detection purposes.

d. Pipelines under railroad tracks and across railroad property shall be encased in a larger pipe or conduit called “casings.” Generally, casings shall extend from right-of-way line to right-of-way line, unless otherwise approved.

e. Pipelines and casing pipes shall be suitably insulated from underground conduits carrying electric wires on railroad property.

f. Reinforced concrete pipe, with storm water and sewer being the exception, will need to be encased for a distance as wide as the embankment at the utility crossing. This is to protect against track failure due to joint separation.

3. Encasement of Utilities

a. Casings are oversized load-bearing conduits or ducts through which a utility is inserted:

i. To protect the railroad from damages and to provide for repair, removal, and replacement of the utility without interference to railway traffic.

ii. To protect the carrier pipe from external loads or shock, either during or after construction.

iii. To convey leaking fluids or gases away from the area directly beneath the railroad trackage to a point of venting at the railroad property line.

iv. Casing may be omitted for **gaseous products only** if the carrier pipe is steel, the wall thickness conforms to E-80 loading shown in the table on page 3-10, the pipe is cathodically protected with an active induced current, or a passive system that could include sacrificial anodes and/or a protective coating rated for "cathodic protection;" and is placed twelve (12) feet minimum below the base of rail per AREMA standards.

v. Underground electric and fiber installations must be encased completely across the Railroad right-of-way with a rigid conduit. The conduit can be steel, HDPE SCH 80, HDPE SDR-11, or HDPE SDR-9 (with no casing pipe for a single conduit). Any installations crossing BNSF with multiple duct installations must be in a single casing unless they are placed 5' or more apart. A metallic ribbon or wire must be included in the pipe to allow for radio locating later.

vi. Casing may be omitted for other products under all three of the following circumstances:

(a) When carrier pipe is steel, and the wall thickness conforms to E-80 loading for casing pipe shown in the table on page 3-10 and as included in AREMA manual Chapter 1, Part 5 for Utility Crossings. The length of the pipe shall extend from railroad right-of-way line to right-of-way line, and

(b) When steel carrier pipe is cathodically protected with an active induced current, or a passive system that could include sacrificial anodes and/or a protective coating rated for "cathodic protection," and

(c) When the depth from base of rail to top of pipe is equal to or greater than thirty (30) feet and minimum depth of cover is six (6) feet below the flowline of the ditch or ground surface.

b. In circumstances where it is not feasible to install encasement from right-of-way line to right-of-way line, casing pipe under railroad tracks and across railroad property shall extend to the greater of the following distances, measured at right angles to the centerline of track:

   i. Two (2) feet beyond toe of slope.

   ii. Three (3) feet beyond ditch line.

   iii. Twenty-five (25) feet from centerline of outside track when casing is sealed at both ends.

   iv. Forty-five (45) feet from centerline of outside track when casing is open at both ends.

   v. Extend across the entire length of Shoring Zone A as shown in Figure 1, Pg 3-4.

   vi. If additional track is planned for future construction, casing must extend far enough to meet above distances given the additional track requirement.

c. Pipelines and casing pipe shall be suitably insulated from underground conduits carrying electric wires on railroad property.

d. Casing pipe and joints shall be made of metal, and of leakproof construction. Casings shall be capable of withstanding the railroad loadings and other loads superimposed upon them.

e. Wall thickness designations for steel carrier and casing pipe for E-80 loading (including impact) are:

Nominal Diameter (inches)	Minimum Wall Thickness (inches)
12-3/4 and under	0.188
14	0.188
16	0.219
18	0.250
20 and 22	0.281
24	0.312
26	0.344
28	0.375
30	0.406
32	0.438
34 and 36	0.469
38	0.500
40	0.531
42	0.562
44 and 46	0.594
48	0.625
50	0.656
52	0.688
54	0.719
56 and 58	0.750
60	0.781
62	0.812
64	0.844
66 and 68	0.875
70	0.906
72	0.938

i. Steel pipe shall be in conformance with ASTM A1097 and of leakproof construction, such as butt welded or interlocking joints which are capable of withstanding railroad loading. Pipe shall have a specified minimum yield strength, SMYS, of at least 35,000 psi (pounds per square inch / 241,317kPa).

ii. All metallic casing pipes are to be designed for effective corrosion control, long service life and relatively free from routine servicing and maintenance. Corrosion control measures for metallic casing pipe must include cathodic protection which can be an active induced current, or a passive system that could be sacrificial anodes and/or protective coating rated for cathodic protection such as fusion bonded epoxy with an abrasion resistant overcoating.

iii. Cast iron may be used for casing. It shall conform to ANSI A21. The pipe shall be connected by mechanical-type joints. Plain-end pipe shall be connected by compression-type couplings. The strength of the cast iron pipe to sustain external

loads shall be computed in accordance with the most current ANSI A21.1 "Manual for the Computation of Strength and Thickness of Cast Iron Pipe."

f. The inside diameter of the casing pipe shall be such that the carrier pipe can be removed without disturbing the casing. All joints or couplings, supports, insulators or centering devices for the carrier pipe shall be considered in the selection of the casing diameter.

g. For flexible casing pipe, a maximum vertical deflection clearance of the casing pipe shall be three percent (3%) of its diameter plus one-half (1/2) inch so that no loads from the roadbed, track, railroad traffic or casing pipe are transmitted to the carrier pipe. When insulators are used on the carrier pipe, the relationship of the casing size to the size of the carrier pipe is:

Diameter of Carrier Pipe	Inside Diameter of Casing Pipe Equals Outside Diameter of Carrier Pipe Plus
0" – 7.9"	2"
8" - 16"	3-1/4"
Over 16"	4-1/2"

4. Casing and Pipeline Installation

a. Casing and pipeline installations should be accomplished by Horizontal Directional Drilling (HDD), dry jack-and-bore, tunneling or other approved methods. Tunneling construction under tracks will be permitted only under direct supervision of a BNSF Engineer. Tunneling procedures and equipment, as well as structural design, must have BNSF Engineering approval prior to starting any work on BNSF property. Generally, tunneling shall not be considered where less than six (6) feet of cover exists, or where excessively sandy, loose, or rocky soils are anticipated.

All utilities crossing under ditches and railroad trackage using jacking and dry boring installation should have a minimum depth of cover of six (6) feet below the flowline of the ditch or ground surface and eight (8) feet – three (3) inches from base of rail. In fill sections, the natural ground line at the toe of slope will be considered as ditch grade.

Jacking/boring pits shall be located outside railroad property, when possible, at a minimum of thirty (30) feet from the centerline of track and kept to the minimum size necessary. Do not locate the bore pits in the slope of a cut or fill section of the roadbed. Keep the bore pit size to a minimum. Use shoring, temporary or permanent, conforming to the most restrictive of state, OSHA, or AREMA recommended practices in all excavations, where required. Submit shoring plans sealed by a Professional Engineer with application for approval prior to construction.

Under-track bores using jack-and-bore method shall be located greater than forty-five (45) feet from the nearest bridge, culvert, track switch area, building or other major structure, regardless of commodity.

All encased utility pipeline crossings under ditches and railroad trackage using horizontal directional drilling (HDD) installation should have a minimum depth of

cover of six (6) feet below the flowline of the ditch or ground surface and twelve (12) feet from base of rail. In fill sections, the natural ground line at the toe of slope will be considered as ditch grade. Detailed drawings should be included with the application.

Rail elevations over the work must be monitored at intervals prescribed by BNSF to detect any track movement. Movements of over one-quarter (1/4) inch vertically shall be immediately reported to the BNSF Roadmaster. Due to the danger to rail traffic that is caused by only small amounts of track movement, BNSF forces may have to be called to surface the track several times. The cost of any work required by BNSF in the repair of track caused by utility installation will be assessed against the Utility Owner.

The following requirements shall apply to these construction methods:

i. The use of water under pressure, jetting or puddling will not be permitted to facilitate boring, pushing or jacking operations. Some boring may require water to lubricate cutter and pipe, and under such conditions, is considered dry boring.

ii. Where unstable soil conditions exist, boring or tunneling operations shall be conducted in such a manner as not to be detrimental to the railroad being crossed.

iii. If excessive voids or too large of a bored hole is produced during casing or pipeline installations, or if it is necessary to abandon a bored or tunneled hole, prompt remedial action should be taken by the Utility Owner.

iv. All voids or abandoned holes caused by boring, or jacking are to be filled by pressure grouting. The grout material should be a sand cement slurry with a minimum of two (2) sacks of cement per cubic yard and a minimum of water to assure satisfactory placement.

v. For bored or tunneled installations less than seventeen and one-half (17-1/2) feet deep, less than 300 feet long and pipe diameters less than or equal to 20 inches, the hole diameter shall not exceed the outside diameter of the utility pipe, cable, or casing (including coating) by more than one and one-half (1-1/2) inches for pipes with an inside diameter of twelve (12) inches or less, or two (2) inches on pipes with an inside diameter greater than twelve (12) inches.

vi. For bored or tunneled installations seventeen and one-half (17-1/2) feet deep or deeper, 300 feet long or longer, or greater than 20 inches in pipe diameter, the hole diameter shall not exceed one and one-half (1-1/2) times the diameter of the pipe.

This is further clarified as follows:

Hole Diameter	Depth	Length	Pipe Outside Diameter
Pipe OD + 1-1/2"	< 17.5'	<300'	<=12"
Pipe OD + 2"	< 17.5'	<300'	12" <= 20"
Pipe OD x 1.5	> 17.5'	>= 300'	> 20"

b. Vents. In casing pipe installations, vents are appurtenances by which fluids or gases between carrier and casing may be inspected, sampled, exhausted, or evacuated.

i. Vent standpipes shall be located and constructed so as not to interfere with maintenance of the railroad or to be concealed by vegetation. Where possible, they shall be marked and located at the property line. The markers shall give the name, address of the owner, and a 24-hour phone number to contact in case of emergency.

ii. Casing pipe, when sealed, shall be properly vented. Vent pipes shall be of sufficient diameter, but in no case less than two (2) inches in diameter and shall be attached near each end of casing projecting through ground surface at property lines.

Seals and vents shall be required for all encased pipelines carrying flammable substances under pressure to ensure the flammable substances are evacuated away from the track and subgrade in the event of a pipe failure. Vents shall be located at both ends of the casings.

Venting is not required for encased water lines; however, sealing will be required if the ends of the casing are not above the high-water table.

Where casing pipe is used on sewer lines, venting, and sealing of casing will be required on pressurized lines.

iv. Vent pipes shall extend not less than four (4) feet above ground surface. Top of vent pipes shall be fitted with a down-turned elbow, properly screened, or a relief valve.

v. Vent pipes on casings shall be at least four (4) feet (vertically) from aerial electric wires. Casings shall be suitably insulated from underground conduits carrying electric wires on Railroad right-of-way.

c. Shut-Off Valves

i. The Utility Owner shall install accessible emergency shut-off valves on each side of the railroad. Locating a shut-off valve on railroad property should be avoided. If approval is acquired, a guardrail must protect the shut-off valve.

ii. When a guardrail is required, its height shall be four (4) feet above the ground line. All four corner posts shall be driven to a minimum depth of four (4) feet below ground line. There shall be a minimum clearance of two (2) feet from the valve to the guardrail. The steel pipes for the four corner posts and guardrail shall have a minimum diameter of four (4) inches. All joints will be welded with a one-quarter (1/4) inch fillet weld all around.

iii. Where pipelines are provided with automatic control stations, no additional valves will be required.

5. Abandonment/Replacement/Removal of Facilities

a. Upon abandonment, replacement or termination of license the utility needs to be removed from BNSF property except for the portion under the track embankment (as shown in Appendix “Retirement/Removal of Pipelines on BNSF Property”).

b. Portion of abandoned pipe under track embankment to remain in place shall be filled by pressure grouting. The grout material should be a sand cement slurry with a minimum of two (2) sacks of cement per cubic yard and a minimum amount of water to assure satisfactory placement. Open trenches shall be back-filled and compacted to surrounding ground level.

c. Abandoned or replaced poles shall be removed from BNSF property or cut off to a depth at least six (6) feet below ground; and the hole filled with BNSF approved material and compacted to surrounding ground level.

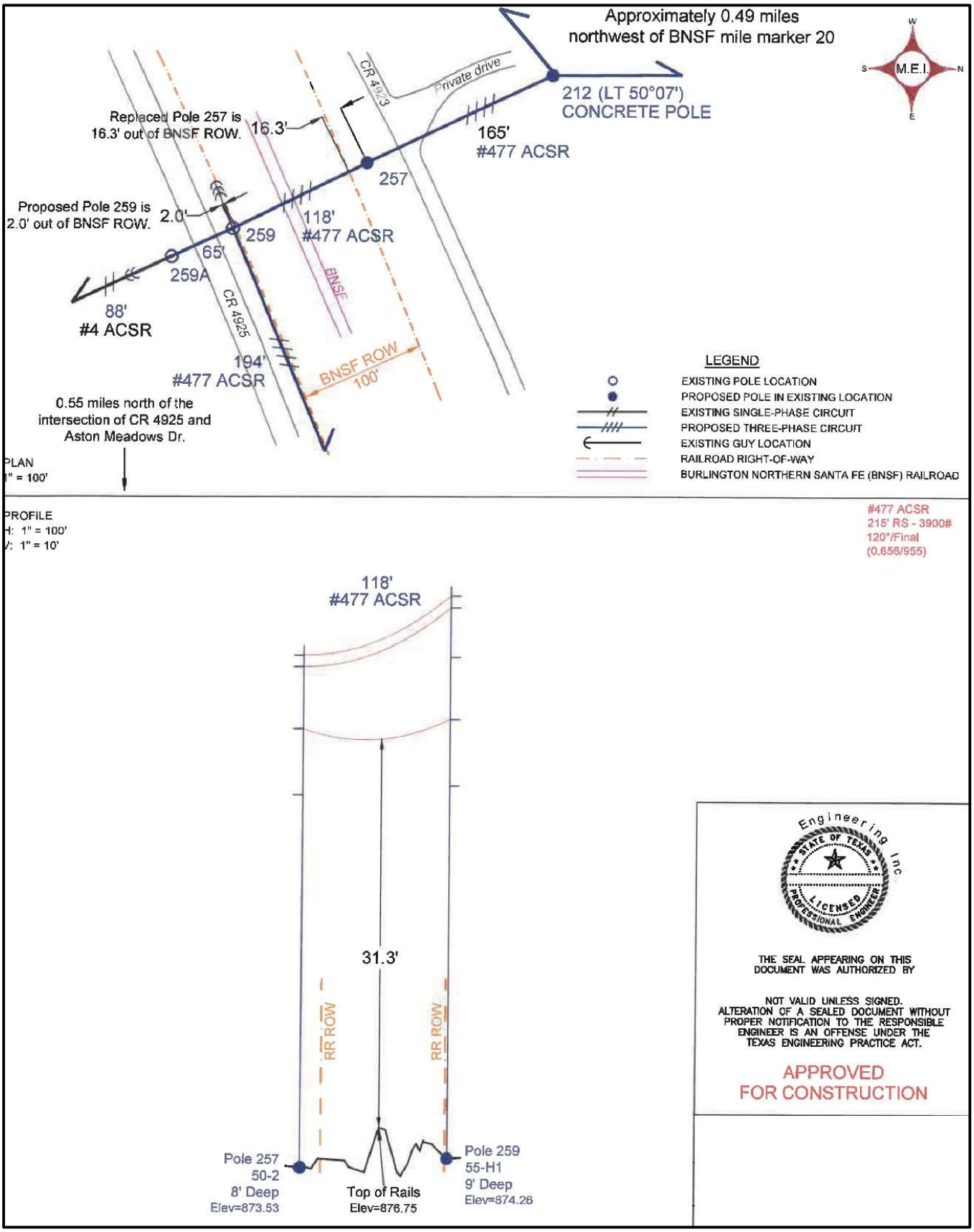
d. All metal such as rebar, cable, anchor systems, and strain relief must be removed and disposed of in accordance with local, state and federal regulations.

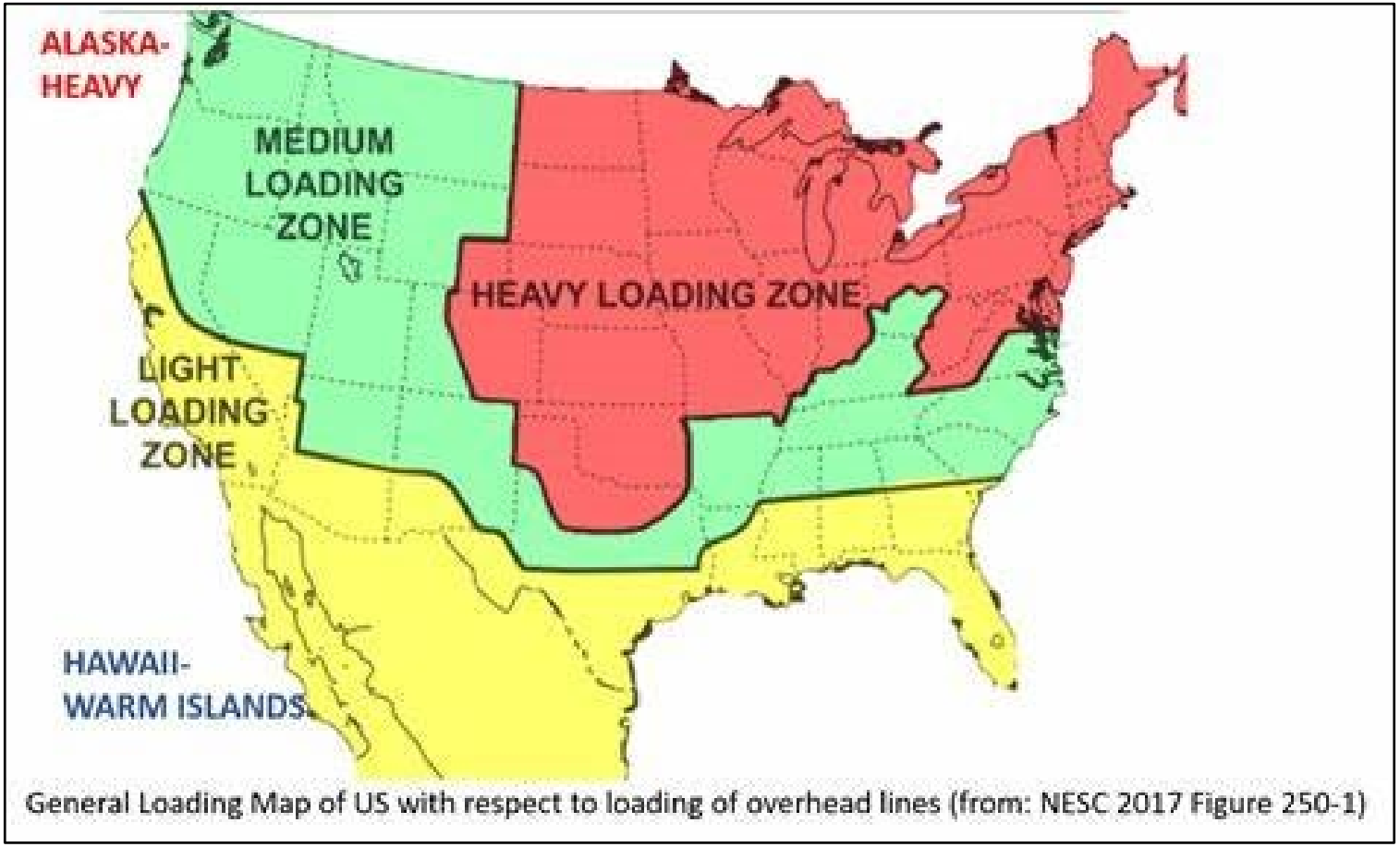
e. An abandonment plan must be included in the general plans.

APPENDIX

Feb 2024

OVERHEAD INSTALLATIONS

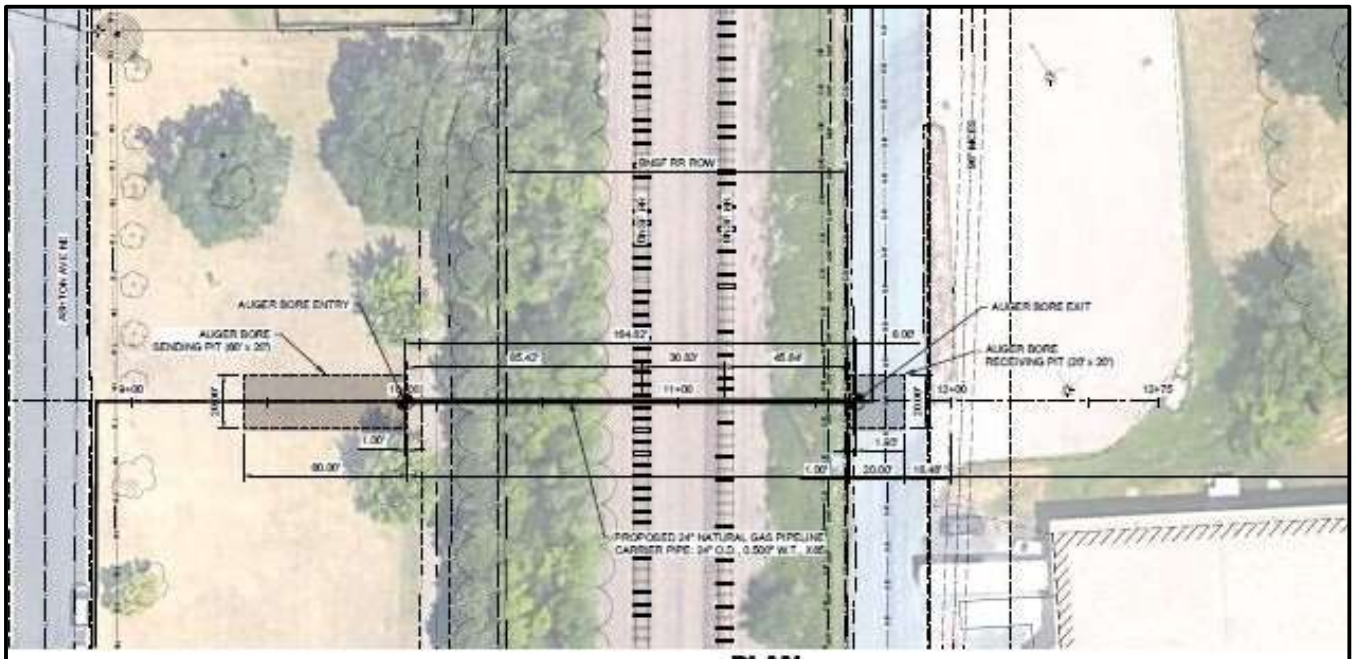




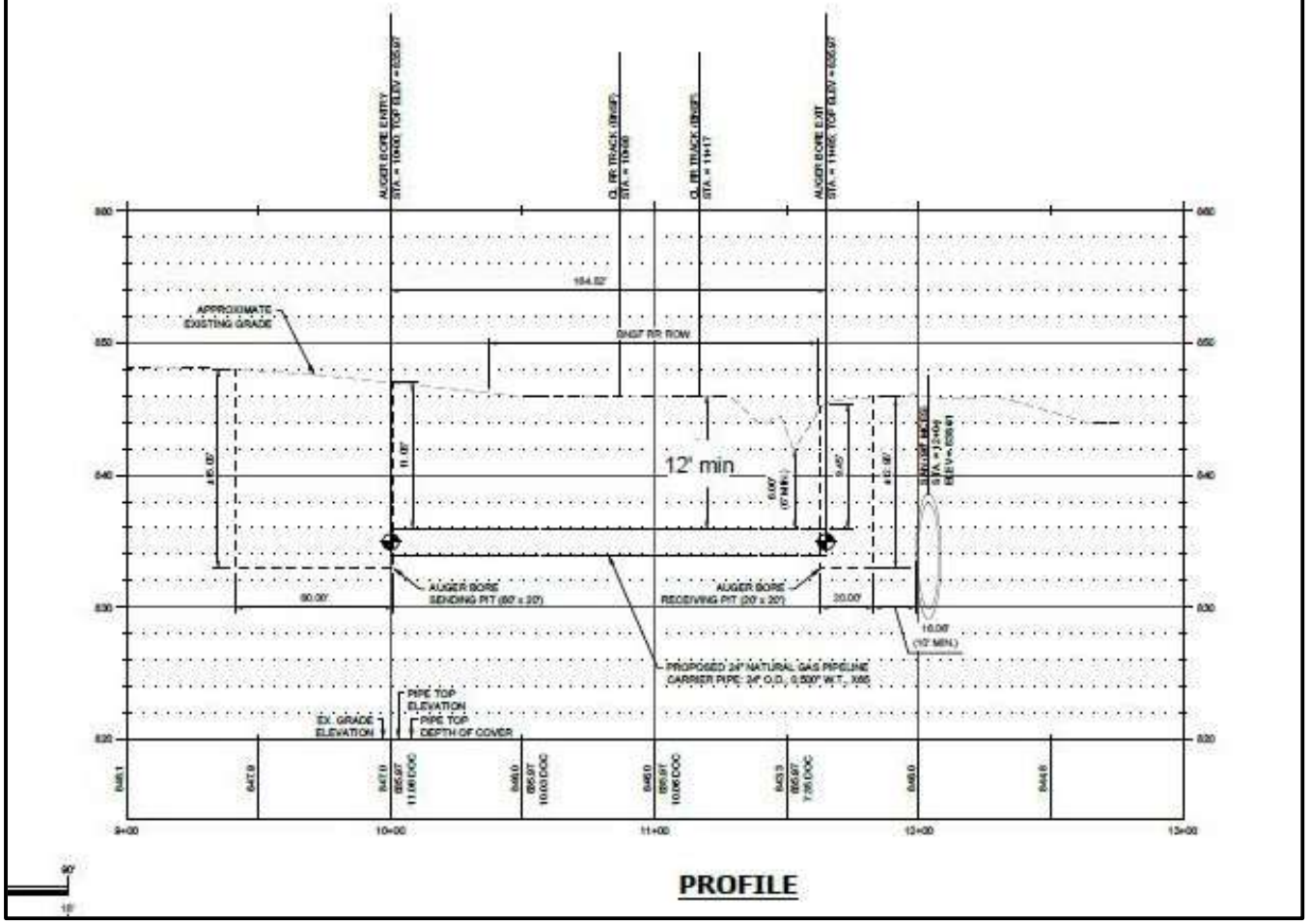
General Loading Map of US with respect to loading of overhead lines (from: NESC 2017 Figure 250-1)

Loading districts (or zones) to determine minimum span length for overhead wirelines crossing over tracks. If location is in question with reference to load rating, use the higher rating.

UNDERGROUND INSTALLATIONS

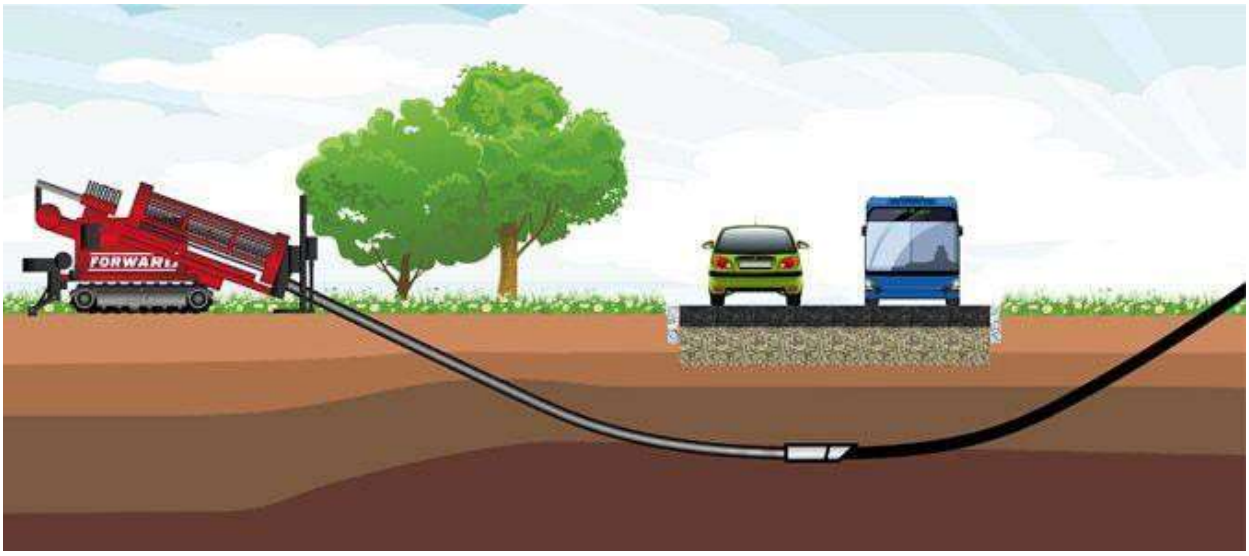


PLAN

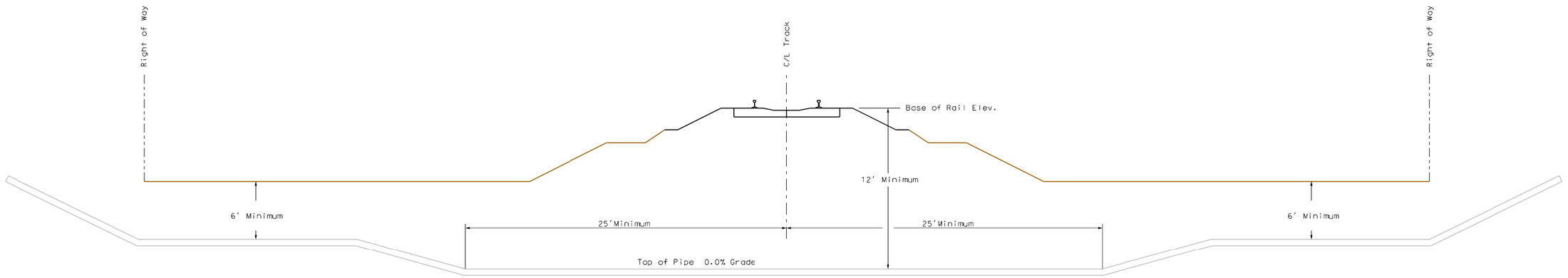


PROFILE

UNDERGROUND INSTALLATION
JACK AND BORE EXAMPLE



UNDERGROUND INSTALLATION
HORIZONTAL DIRECTIONAL DRILLING (HDD) EXAMPLE



Cutting head must travel at 0.0% grade (or downward) beginning 25' (minimum) from centerline of track until it reaches a point 25' (minimum) from the centerline of track. Minimum pressure must be applied to pumping the slurry to the cutting head during drilling. This will deter the bentonite slurry used for lubrication from seeping up and fouling the track roadbed.

The plans submitted with the application must show the planned travel path of the cutting head.

A construction observer must be present during installation and will monitor the ballast and roadbed.

APPROVALS	TITLE	DATE

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	Added "minimum" to distance from track	9/19/08	JRG
2	Revised minimum depth requirements	9/8/20	BAL

DESIGNED:
DRAWN:
CHECKED:

ENGINEERING SERVICES
www.bnsf.com/tools/fieldengineering/index

FILE NO.
RFA / AFE NO.
STATUS

BNSF RAILWAY

DATE: 06/20/08
LS/mp:
DIVISION:
SUBD:
\utilaccom\hdd.dgn

HORIZONTAL DIRECTIONAL DRILLING STANDARDS NOT TO SCALE

Version Dated 2017-11-06

No Comment / All Items CLOSED* ☐

Submittal Essentials in RED **

I/C & Project Engineer Review Items; KC Structures Review Items

BNSF Engineering Services-Structures Review Comments

Temporary Shoring Review Comments Sheet

Check for compliance with current AREMA and BNSF/UP Temporary Shoring Guidelines

Project Name:		BNSF Point of Contact:	
Submittal Name:		Project CM Contact:	
Plan File Name:		Asset MP Name:	
Plan File Date:		Plan %:	

Professional Engineer Seal & Signature (Plans and Calculations)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

No Tiebacks under track
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Need Shoring Loading Zones shown
☐Within Zone A ☐ Zone B Only ☐ Zone C Only

Show offset face of shoring to CL Tracks at all Changes in Horizontal Alignment
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Substructure Removal Limits (Lesser of 3' below GL or TOT)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

TOT, Top of Wall Elevations Shown on General Plan
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Show BNSF ROW Limits, all tracks labeled w/ track spacing
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Provide geotechnical report (in-situ soil classification, P_a, P_p, etc.)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Horizontal Clearance to CL Tracks at right angle to Nearest Obstruction
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Show Grading at Wall Ends, No More than 2:1 Slopes
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Drainage Along the Wall, Through the Wall
☐No Exceptions Taken ☐ Comments Below ☐ N/A A

Show Total Depth of Shoring System w/ controlling dimensions
☐No Exceptions Taken ☐ Comments Below ☐ N/A

All OH and underground utilities located (include fiber, BNSF signal, telecom)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Handrail Heights and Lengths Detailed
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Call Before You Dig" Numbers - BNSF Fiber - 1-800-533-2891
BNSF Signal - 1-800-832-5452
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Provide Calculations (Include sample hand calcs w/ assumptions listed)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Check FS of overturning for sheeting
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Temp Shoring Specific: E80 Loading Properly Applied
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Meets deflection criteria
☐No Exceptions Taken ☐ Comments Below ☐ N/A

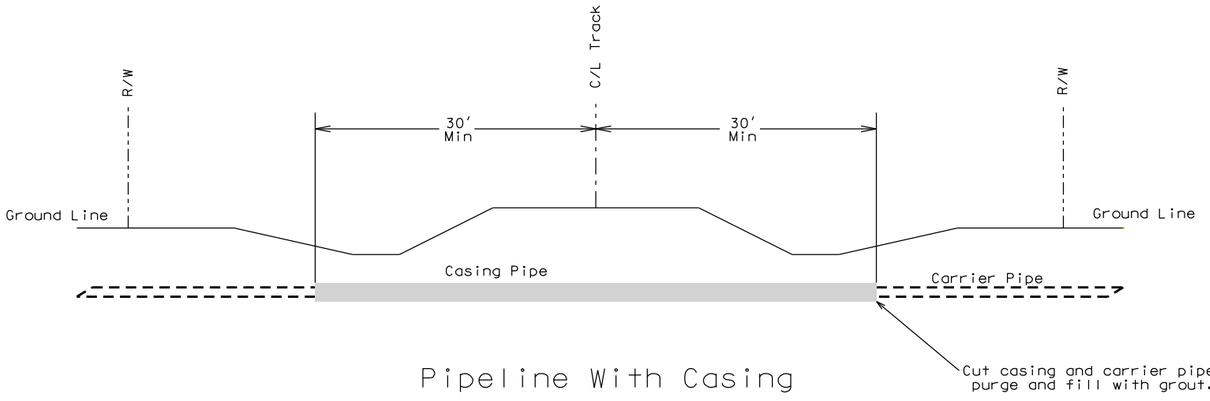
Gravity shoring systems analyzed for OT, SL and global stability
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Monitoring Plan: Triggering & max values, survey locations and frequency
☐No Exceptions Taken ☐ Comments Below ☐ N/A

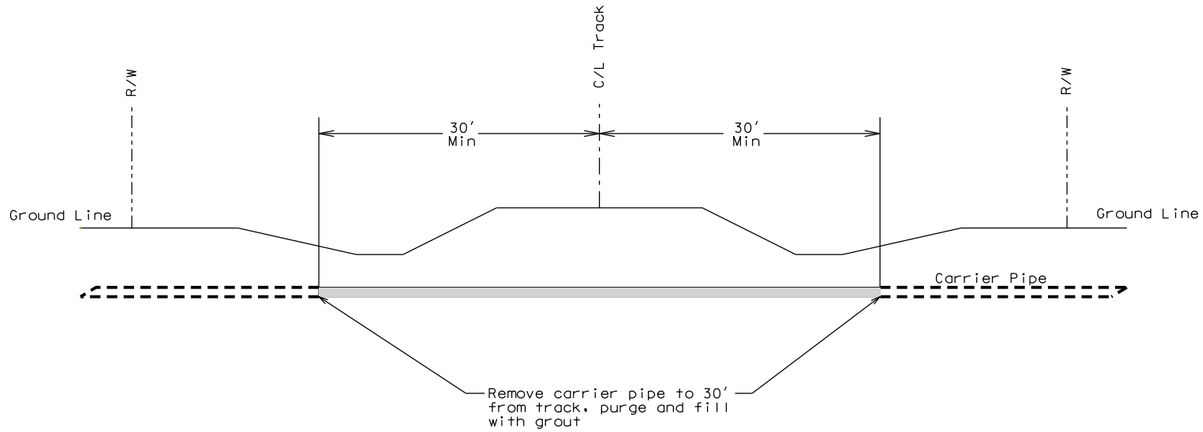
Item No.	Sheet No.	Reviewer Comment Date:	Initial	Designer's Response Date:	Reviewer's Comment Date:	Initial	Designer's Response Date:	Reviewer's Comment Date:	Initial	Designer's Response Date:	Reviewer's Comment Date:	Initial	Status (Open or Closed
1.													
2.													
3.													
4.													
5.													
6.													

*BNSF has reviewed these submittals and no exceptions are taken with regard to BNSF's ability to use or accommodate the project as intended. BNSF has not reviewed the design details or calculations for structural integrity or engineering accuracy. BNSF accepts no responsibility for errors or omissions in the design or execution of the project.

**** Check Submittal Essentials prior to transmittal to Structures Review. If not included, Project Engineer to reject and request resubmittal.**



Pipeline With Casing



Pipeline Without Casing

Upon termination all pipelines and casings will be removed entirely from BNSF property up to the toe of track embankment, but no closer than 30′ from centerline of track.

APPROVALS - (NAME - TITLE)	DATE	APPROVALS - (NAME - TITLE)	DATE

REVISIONS

NO.	DESCRIPTION	DATE	BY

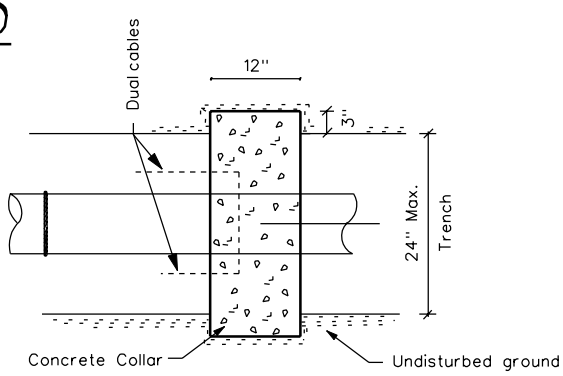
BNSF RAILWAY

RETIREMENT/REMOVAL OF PIPELINES ON BNSF PROPERTY

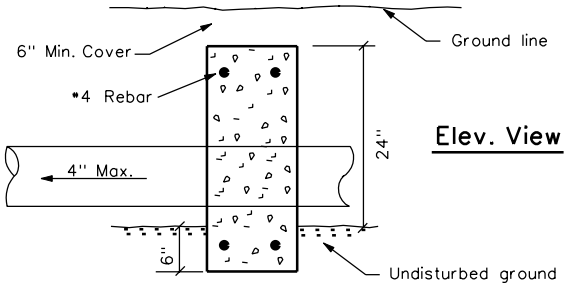
DRAWN	CHECKED	BNSF RAILWAY COMPANY - ENGINEERING SERVICES	PROTRAK SEQ NO		FILE: remove pipeline	SHEET 1 OF 1	DATE: 05/11/2011

DRAINS FOR STEEP SLOPES

Installation of the pipeline will be difficult due to the slope in which the pipe will be laid. Any damage to the slope due to construction must be repaired to its original condition. A large load on the conrete anchor which supports the pipe at the top of the slope will result due to this installation. This anchor should be moved as far away from the face of the slope as possible to maximize its support capability. The pipeline should be designed to withstand the weight of the water within the pipe.
See details below commonly used to support and hold the pipe in place, which should be used for this installation. If the pipeline fails, it will be the owners responsibility to reinstall the pipeline. If damage occurs to railway property due to the failure of the pipeline, the property owner will be responsible for damages. The property owner must not deposit grass clippings, yard waste, trees or other debris on the slope at any time.

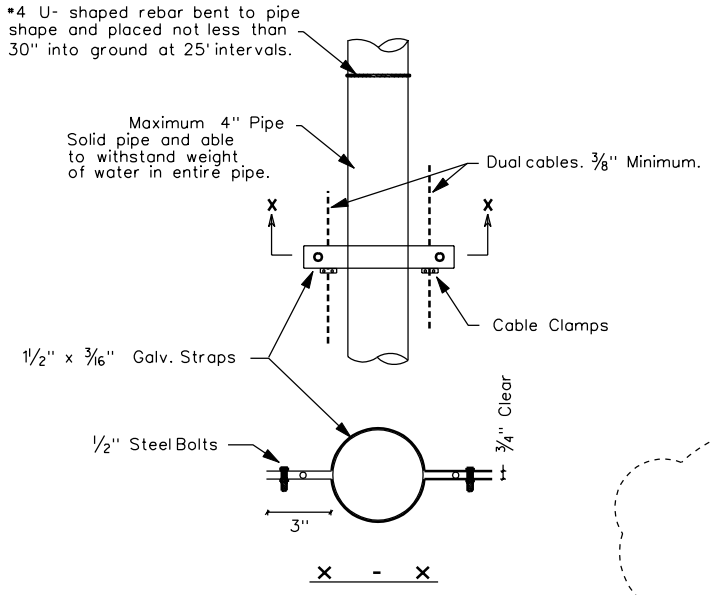


Plan View

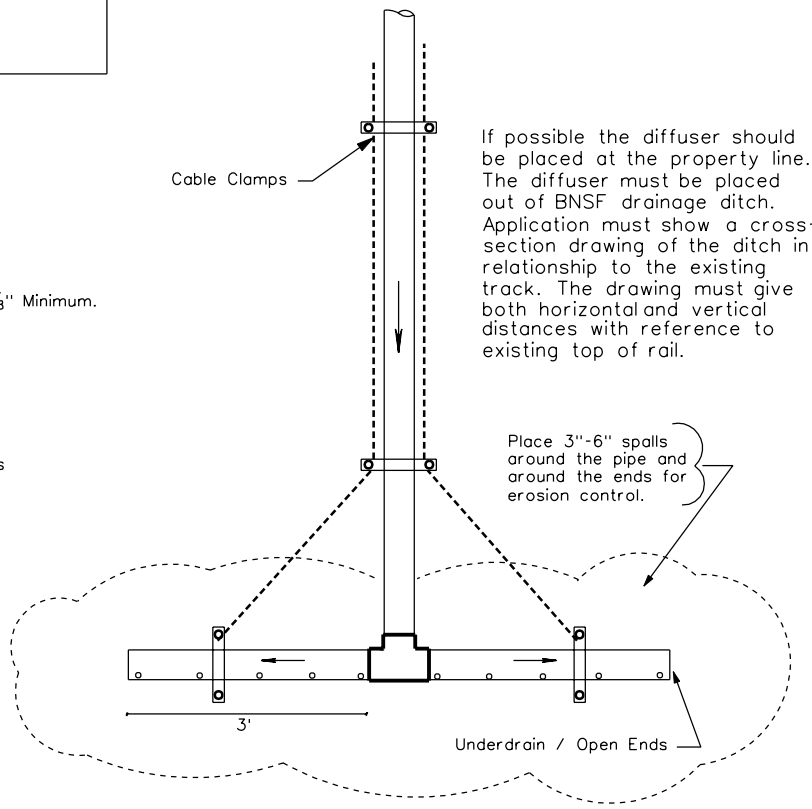


Elev. View

PIPE ANCHOR DETAIL



CLAMP DETAIL



DIFFUSER

NOT TO SCALE

BURLINGTON NORTHERN & SANTA FE RAILWAY CO. OCT 1998

DEFINITION OF TERMS

The terminology used in this Policy strives for conventional meaning and to insure uniform interpretation. To this end, the following definitions apply:

ACCESS CONTROL: Restriction of access to and from abutting lands to railroad property.

AREMA: American Railroad Engineering and Maintenance of Way Association.

ANSI: American National Standard Institute.

ASTM: American Society for Testing and Materials.

BACKFILL: Replacement of soil around and over an underground utility facility.

BORING: Piercing a hole under the surface of the ground without disturbing the earth surrounding the hole. Boring may be accomplished by any approved manner. Water jetting or puddling will not be permitted. Holes may be mechanically bored and cased using a cutting head and continuous auger mounted inside of the casing. Small diameter holes may be augured, and the casing or utility facility pushed in later.

BNSF: Burlington Northern and Santa Fe Railway Company.

BURY: Placement of the utility facility below grade of roadway, ditch or natural ground to a specified depth.

CARRIER: Pipe directly enclosing a transmitted fluid (liquid or gas).

CATHODIC PROTECTION: A means of corrosion control for a metal pipeline with an active induced current, or a passive system that could include sacrificial anodes and/or a coating rated for "cathodic protection." Fusion-bonded epoxy (a powder coating) with an abrasion resistant overlay is one example of rated coatings.

CASING: A larger pipe enclosing a carrier.

CFR: Code of Federal Regulations.

COATING: Material applied to or wrapped around a pipe.

COMMUNICATION LINE: Fiber optic, telephone cable and similar lines, not exceeding four hundred (400) volts to ground or seven hundred fifty (750) volts between any two (2) points of the circuit, the transmittal power of which does not exceed one hundred fifty (150) watts.

CONDUIT OR DUCT: An enclosed tubular runway for protecting wires or cables.

COVER: The depth of material placed over a utility. Depth of cover is measured from top of utility casing or carrier pipe (if no casing is required) to the natural ground line or construction line above the utility.

DIRECT BURIAL: Installing a utility underground without encasement, by plowing or trenching. No rail plows will be permitted.

ELECTRIC SUPPLY: Electric light, power supply, and trolley lines, irrespective of voltage used for transmitting a supply of electrical energy.

ENCASEMENT: Structural element surrounding a pipe or cable.

FLEXIBLE PIPE: A plastic, fiberglass, or metallic pipe having a large ratio of diameter to wall thickness that can be deformed without undue stress. Copper or aluminum pipe shall be considered as flexible pipe.

GROUNDED: Connected to the earth or to some extended conducting bodies which are intentionally or accidentally connected with the earth.

GROUT: A cement mortar or slurry of fine sand or clay as conditions govern.

HANDHOLES: Handholes, also known as service boxes or joint pits, are necessary for a fiber optic network route along its length to access the cables at periodic intervals.

HORIZONTAL DIRECTIONAL DRILLING: A steerable trenchless method of installing underground pipes, conduits, and cables in a shallow arc along a prescribed bore path by using a surface launched drilling rig, with minimal impact on the surrounding area.

JACK-AND-BORE: The installation method whereby the leading edge of the jacked pipe is well ahead of the cutting face of the auger bit. The auger is removing waste from inside the pipe as it is being jacked. This method greatly reduces the likelihood of subsidence of granular material during installation.

JACKING: The installation of rigid pipes using hydraulic jacks or rams to push the pipe under the traveled surface of a road, railroad roadbed, or other facility.

LICENSE:

UTILITY LICENSE AGREEMENTS are executed for all utility facilities located on railroad property.

LOADING DISTRICTS: The US is divided into three ice, wind, and temperature loading districts identified as HEAVY, MEDIUM, and LIGHT. The loading districts determine design of supporting structures, span lengths and supported facilities based on radial thickness of ice, horizontal wind pressure and temperature conditions for a particular loading district.

MANHOLE: An opening to an underground utility system which workmen or other may enter for the purpose of maintaining, inspecting, or making installations.

NATURAL GAS PIPELINES:

DISTRIBUTION SYSTEM - A pipeline other than a gathering or transmission line.

SERVICE LINE - A distribution line that transports gas from a common source of supply to a customer meter.

TRANSMISSION SYSTEM - A pipeline other than a gathering line that transports gas from a gathering line or storage facility to a distribution center or storage facility. It operates at a hoop stress of twenty percent (20%) or more of the Specified Minimum Yield Strength.

NORMAL: Crossing at a right angle.

PERMITS:

PERMIT TO BE ON BNSF PROPERTY FOR UTILITY SURVEY is to be executed prior to all survey work on railroad property.

PIPE: A tubular product made as a production item for sale as such. Cylinders formed from plate during fabrication of auxiliary equipment are not pipes as defined here.

PRESSURE: Relative internal pressure in PSI (pounds per square inch) gauge.

PRIVATE LINES: Any privately owned facilities which convey or transmit the commodities outlined under the definition for Utilities but are devoted exclusively to private use.

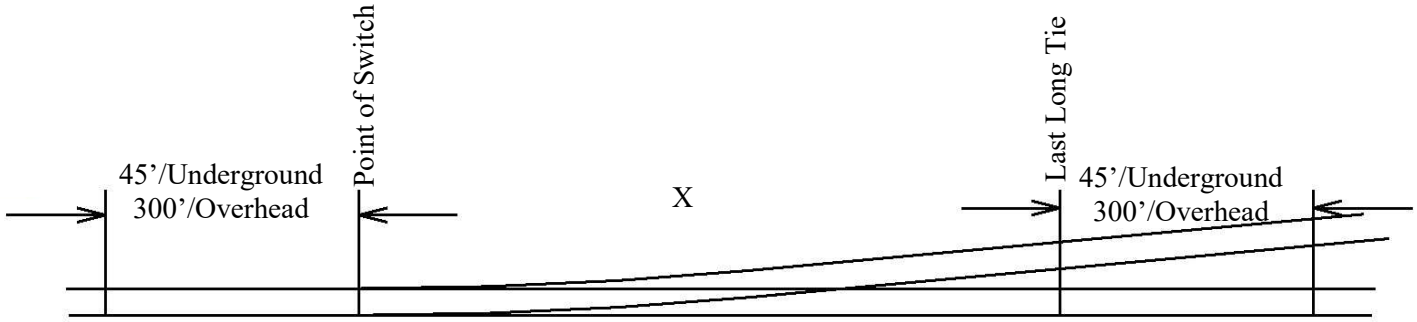
PUBLIC LINES: Those facilities which convey or transmit the commodities outlined under the definition for Utilities and directly or indirectly serve the public or any part thereof.

RIGHT OF WAY: A general term denoting land, property of interest therein, usually in a strip, acquired for or devoted to railroad transportation purposes.

SEAL: A material placed between the carrier pipe and casing to prevent the intrusion of water, where ends of casing are below the ground surface.

SHOULDER: That portion of the roadbed outside the ballast.

SWITCH AREA: Underground = 45'+X'+45' / Overhead = 300'+X'+300', as shown:



TURNOUT SIZE	X		TURNOUT SIZE	X
NO. 7	95'		NO. 14	176'
NO. 8	98'		NO. 15	180'
NO. 9	107'		NO. 20	249'
NO. 10	120'		NO. 24	283'
NO. 11	125'		NO. 30	632'

TRENCHED: Installed in a narrow excavation.

TUNNELING: Excavating the earth ahead of a large diameter pipe by one or more of the following processes: 1) The earth ahead of the pipe will be excavated by men using hand tools while the pipe is pushed through the holes by means of jacks, rams or other mechanical devices, 2) The excavation is carried on simultaneously with the installation of tunnel liner plates, and/or 3) The tunnel liner plates are installed immediately behind the excavation as it progresses and are assembled completely away from the inside.

UTILITY OWNER: All privately, publicly, or cooperatively owned lines, facilities and systems for producing, transmitting or distributing communications, power, electricity, light, heat, gas, oil, crude products, water, steam, waste, storm water and other similar commodities, including fire and police signal systems and street lighting systems which directly or indirectly serve the public.

C-1

DEMOLITION GUIDELINES

BNSF RAILWAY COMPANY

GUIDELINES FOR PREPARATION OF

BRIDGE DEMOLITION & REMOVAL PLAN

OVER THE BNSF RAILWAY

OFFICE OF DIRECTOR BRIDGE ENGINEERING
KANSAS CITY, KANSAS
August 21, 2008

INDEX

I. GENERAL

A. The Contractor's work shall in no way impede the train operations.

1. The words "demolition" and "removal" will be used interchangeably in this Guideline.

2. The term "Railroad" refers to the Railroad's Engineers or designated representative.

B. Safety takes precedence over productivity. The Contractor shall be responsible for planning and executing all procedures necessary to remove the structure in a safe, predictable manner.

1. All employees of the Contractor and Subcontractors must be Safety Trained. Refer to http://www.railroadsafetytraining.com

C. The Contractor shall develop a demolition plan ONLY AFTER CONSULTING WITH THE RAILROAD TO GET AN ESTIMATE OF THE RANGE OF TRACK WINDOWS THAT MIGHT NORMALLY BE AVAILABLE FOR THE JOB SITE.

1. A Track Window is the elapsed time between approaching trains.

2. An estimate of the availability of Track Windows can be used by the Contractor to design a demolition plan. The estimated Track Window is a guideline and not to be considered as a guarantee for available working time.

3. A Track Window is highly variable, depending on the location. Low speed - low train density tracks have predictable Track Windows. The opposite is true for high density- high speed main tracks. The Railroad can furnish a range of Track Windows that might be expected at a specific location under normal train traffic conditions.

4. Plan the demolition procedures based upon the smallest ESTIMATED Track Window. Do not assume the longest Track Window will be available on any given day. Do not assume the same Track Windows will be available from one day to the next.

D. The Railroad's tracks and property shall be protected at all times.

1. Removal procedures shall take into account SEVER WEATHER CONDITIONS, including high winds, heavy rains and snowfall accumulation.

2. The contractor shall ensure that all areas adjacent to active tracks shall remain free from hazards.
   a) Trainmen must have an unobstructed walkway available parallel to all active tracks.
   b) All open excavations shall be protected with fencing.
   c) Do not store materials or equipment within 25 feet of the centerline of an active track.

3. Protect the project area from vandalism.
   a) Do not leave debris where vandals could place it on the tracks to drop it onto the tracks from an overhead structure.

b) Secure all heavy equipment from potential movement by vandals.
c) Do not store flammable materials on railroad right of way. Remove combustible waste materials daily. Do not store fuel or other flammable liquids on railroad right of way.

E. All demolition materials and scrap shall be disposed of outside the Railroad right-of-way at no expense to the railroad. At the conclusion of the project, the area must be left in a clean and graded condition to the exclusive satisfaction of the Railroad.

F. No work is allowed within 25 feet of the nearest track unless protected by a Railroad Flagman. When trains approach the work site, all demolition activity within 50 feet of the track shall stop until the entire length of the train has passed the work site.

G. The staged demolition of any portion of a structure over or adjacent to operational tracks will not jeopardize the stability of other parts of the structure awaiting demolition.

1. Where multiple tracks are involved, the demolition plan should be engineered as much as practical such that no more than one track is rendered impassable at any given moment.

H. No blasting will be permitted on Railroad's right-of-way.

II. BRIDGE REMOVAL PLAN

A. The Contractor shall submit a detailed Bridge Removal Plan to the Railroad. The Bridge Removal Plan shall encompass the following:

1) Provide a scale drawing showing the plan view, elevation and location of the structure and locations of any access roads needed on railroad right of way to access the job site. The as-built drawings may be used for the submittal provided the removal steps are clearly marked and legible.

2) Indicate the position of all railroad tracks below the bridge. Identify each track as mainline, siding, spur, etc. Identify locations where temporary crossings will be installed to cross equipment over each track.

3) List in sequential order, all procedures necessary to remove the bridge in a safe and controlled manner. Include step by step details of each sequence and the elapsed time required to execute the sequence. The removal plan must specify which, if any, sequences will render a track impassable to trains during execution of the sequence. If more than one track is adjacent to the work area, specify which tracks will be impassable during execution of each sequence.

4) Include text, drawings or photos to communicate the types of equipment that will be utilized. Include diagrams showing the position of the equipment in relation to the tracks. Where cranes are to be used, furnish the lifting capacities of the crane at the anticipated radius and the weights of components to be removed.

5) For every sequence, specify the minimum horizontal clearance from centerline of track and the minimum vertical clearance above top of rail for equipment, falsework, rubble shields and temporary supports. If a crane is to be utilized, include clearances for the backswing radius of the crane counterweight and the position of the outriggers. (Refer to the attached frame protection diagram for the minimum allowable vertical and horizontal clearances.)

6) If the removal plan includes concrete demolition, include the details of rubble control such as maximum anticipated size of rubble, drop distance, shield size and shield position.

7) The Bridge Removal Plan will indicate locations and types of temporary supports, shoring, cables or bracing required. Refer to current standard drawing 106613 “General Shoring Requirements” “Guidelines for Design and Construction of Falsework for Structures” and “Guidelines for Design and Construction of Shoring Adjacent to Active Railroad Tracks”, and the appropriate Federal, State and local regulations and building codes.

8) If any temporary supports interfere with the natural drainage along the Railroad right-of-way, a temporary drainage diversion plan shall be included in the Bridge Removal Plan. The drainage plan shall route all surface water away from the railroad tracks.

a) Do not block drainage in side ditches with debris.
b) Do not place footing blocks in drainage ditches.
c) Surface runoff must be diverted away from the footing block excavations to avoid saturation of the underlying supporting soils.

9) The Demolition Plan shall include details, limits, and locations of protective shields or other measures designed to protect the rails, ties and ballast from falling debris. Include details of catchment apparatus necessary to protect the tracks from rolling debris that may fall onto side slopes. Include the design load for the shields for both the maximum static load and the maximum anticipated impact loads from falling debris. Specify the type of equipment that will be utilized to remove the debris and shields from operational tracks.

10) Protection of the track ballast section must be provided to avoid contamination of the rock with fine dust and mud produced during demolition activities. Filter fabric or some other effective means of prevent ballast contamination should be incorporated into the Demolition Plan.

11) All overhead and underground utilities in the area affected by removal of the bridge shall be located on the drawings, including any fiber optic, railroad signal, and communication lines.

11) Indicate the limits of demolition of substructures, including depths and dimensions of excavations that might be necessary to demolish buried footings.

12) The Demolition Plan should include details of planned on-site fire suppression.

B. The Contractor shall submit to the Railroad: three (3) complete sets of the Bridge Removal Plan for review and comments.

1. The Plan shall be sealed by a Civil or Structural Engineer registered in the state where the proposed demolition will take place.

2. A minimum of four (4) weeks shall be expected for the Railroad's review after the complete submittal is received.
3. No removal operations will be permitted over the Railroad right of way until the submitted material has been reviewed and approved.

C. Approval and/or comments furnished by the Railroad in the course of review of the Contractor's Removal Plan will not relieve the Contractor of the ultimate responsibility for the safe and secure demolition of the structure.

III. PROCEDURE

A. The Bridge Removal Plan must be executed such that stability is continuously maintained for the standing portions of the structure over all tracks.

1) All members of the structure being demolished must be continuously supported to resist high winds, including wind buffets and suction forces generated by high speed trains.

B. Prior to proceeding with bridge removal, the sealing Civil or Structural Engineer, or his authorized representative, shall inspect all components of the temporary support shoring, including temporary bracing and protective coverings, insuring conformity with the working drawings.

1) The sealing Engineer shall certify in writing to the Railroad that the work is in conformance with the drawings and that the materials and workmanship are satisfactory.

2) A copy of this certification shall be available at the job site at all times.

C. Well in advance of planned work, coordinate the removal schedule with the Railroad.

1) No work is allowed within 25 feet of the nearest active track unless protected by a Railroad Flagman.

2) All the removal work within 25 feet of the nearest active track shall be performed during the Track Windows granted by the Railroad Flagman.

3) When trains pass the work site, all demolition activity within 50 feet of the track shall stop until the entire length of the train has passed the work site.

D. All substructures shall be removed to at least 3 feet below the final finished grade or at least 3 feet below base of rail whichever is lower, unless otherwise specified by the Railroad.

E. All debris and refuse shall be removed from the railroad right of way by the Contractor. The premises shall be left in a neat and presentable condition to the exclusive satisfaction of the Railroad. Soils contaminated by fuel spills, hydraulic oil leaks, etc. will be removed from railroad right of way and replaced to the exclusive satisfaction of the Railroad.

F. The work progress shall be reviewed and logged by the Contractor's Engineer Should an unplanned event occur, the Contractor shall inform the Railroad and submit a procedure to correct or remedy the occurrence.

G. Beam removal and all other demolition procedures shall take place as much as practicable with equipment positioned above the track. In the rare case that beams require removal from below the structure, the following steps shall be taken before beams are allowed to straddle the tracks:

1) Certain territories with high density train traffic, especially where multiple main tracks are affected, may not grant Track Windows on all tracks simultaneously. Beam removal from the underside of structures may not be possible unless the procedure can be accomplished in very short Track Windows or be engineered such that only one track is affected.

2) The work shall be scheduled well in advance with the Railroad's Service Unit Superintendent subject to the Railroad's operational requirements for continuous train operations. The beam removal plan must be engineered to minimize the Track Window time.

3) The rails, ties and ballast shall be protected. No equipment will be crossed over or placed on the tracks unless pre-approved by the Railroad.

4) The beams shall be blocked to prevent the beams from coming into contact with the rails. Blocking shall not be placed on the rails or ties.

5) Upon approach of a train, the beams and all personnel and equipment will be moved a position to provide a minimum of 15 feet horizontal clearance and 21 ft. vertical clearance from the nearest rail. Care must be exercised to insure that crane booms are rotated to a position parallel with the track.

IV. TRACK PROTECTION

A. The track protective cover shall be constructed before beginning bridge removal work and may be supported by falsework or members of the existing structure. See the attached "Track Shield Detail and Frame Protection Detail" for additional requirements. The following are examples of protective covers that may be acceptable:

1) A decking supported by the bridge or a suspended cover from the bridge above the track clearance envelope.

2) A track shield cover over the tracks per the attached detail.

3) A framed cover outside the track clearance envelope.

4) A catcher box or loader bucket under decking and parapets overhanging the exterior girders.

5) Protection of the track ballast section must be provided to avoid contamination of the rock with fine dust and mud produced during demolition activities. Filter fabric or some other effective means of prevent ballast contamination should be incorporated into the Demolition Plan.

B. Construction equipment shall not be crossed over or placed on the tracks unless the rails, ties and ballast are protected against damage.

1) Track protection is required for all equipment including rubber tired equipment.

2) A list of equipment to be crossed over or positioned on the tracks along with the intended method of protection shall be submitted to the railroad for approval prior to use at the job site.

C. Temporary haul road crossings shall be either Timbers or Precast Concrete Panels. The type of crossing shall be determined by the Railroad.

1) Solid timbers or ballast with timber headers shall be used between multiple tracks.

2) If the job site is accessible to the public, all temporary haul road crossings shall be protected with barricades or locked gates when the Contractor is not actively working at the site.

3) Installation and removal of temporary track crossings for equipment shall be scheduled well in advance with the Railroad.

V. CRANES

A. When cranes are operated over or adjacent to the tracks the following is required:

1) The Contractor shall verify that the foundations and soil conditions under the crane and crane outriggers can support the loads induced by the crane under an assumed maximum capacity lift. The size and material type of crane mats shall be rigid and of sufficient capacity to safely distribute the crane loads.

2) Front end loaders and backhoes cannot be used in place of a crane to lift materials over the tracks. These types of equipment do not have the necessary safety features built into the machines to circumvent overloading and tipping. Only cranes with the rated capacity to handle the loads may be used.

3) Additional track protection may be required for a crane when crossing over the track. The protection methods shall be submitted to the Railroad for review and comment well in advance of intended use.

6) Cranes and other equipment utilizing outriggers shall not place outriggers on the tracks or ballast.

7) Cranes or crane booms shall not be positioned within the track clearance envelope without Railroad Flagman protection. Cranes operating from a position farther than 25 ft. from the nearest track will need a Railroad Flagman present if the boom length is such that it could fall onto a track.

8) During passage of a train, the Crane Operator must stop all movements. Crane Operators shall remain in the cab with motor at idle with the load lines, boom, rotation and travel controls locked and stationary until the full length of the train has passed the job site.

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VI. CUTTING TORCHES

A. When a cutting torch or welding equipment is used in the demolition process, the following steps shall be taken:

1) Fire suppression equipment is required on-site.

2) Do not use a torch over, between, or adjacent to the tracks unless a steel plate protective cover is used to shield against sparks and slag coming into contact with timber ties. Care shall be taken to make certain the use of a steel plate does not come in contact with the rails. See “Track Shield Details” for other requirements. Details of the shield shall be submitted to the Railroad for approval.

3) Wet the ties below the steel plate and wet other timbers and flammable demolition debris located near cutting areas.

4) Monitor the work site for at least three hours after cutting has ceased to detect a smoldering fire.

B. Extensive overhead cutting may require more robust fire suppression equipment and precautions than what would normally be required for routine cuts.

1) On days when extensive torch cutting is planned, the Contractor shall have a larger water supply on hand or take other measures as needed to effectively suppress fires.

2) Overhead torch cutting and welding must cease upon approach and passage of a train.

3) Extensive torch cutting shall not take place during high winds.

4) Contractor will clear vegetation and other combustible debris from the surrounding work areas prior to engaging in extensive torch cutting.

VII. UTILITIES

A. The demolition operations shall be planned such that the utility lines are operating safely at all times. The utility lines shall be protected if affected by demolition operations. All the work associated with utility lines should be coordinated by the contractor with the respective utility companies.

VIII. HAZARDOUS MATERIALS

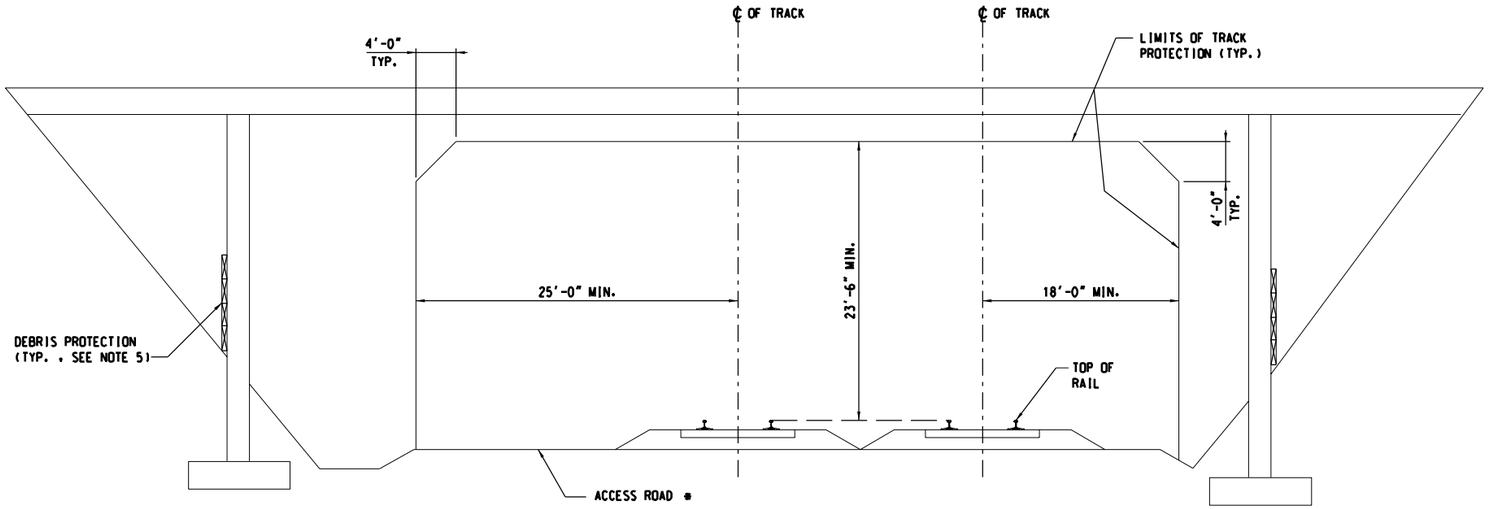
A. If any hazardous materials are discovered, provide material protection as specified in local hazardous material codes and immediately contact the Railroad.

1) If pipelines are attached to the structure, pipes must be purged of flammable or hazardous materials prior to beginning demolition.

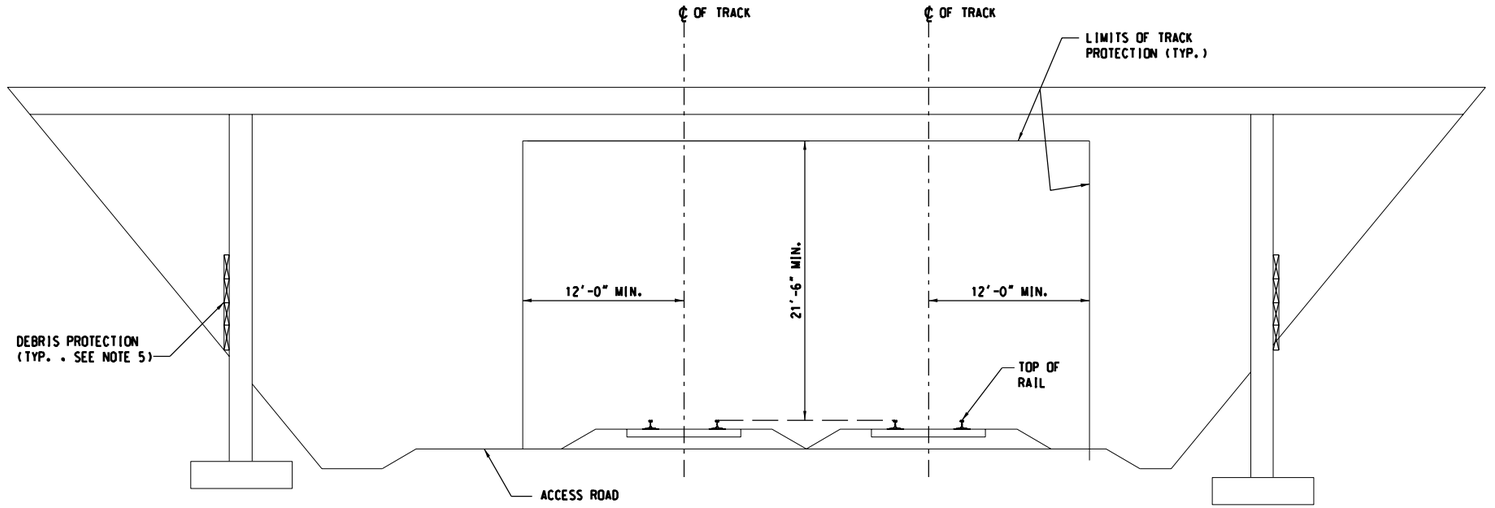
2) Fuel spills, hydraulic fluid releases, equipment oil leaks or any other release of contaminants must be reported to the Railroad. Contaminated soils must be removed and replaced to the satisfaction of the Railroad.

APPENDIX – BNSF-UP Demolition Drawings

- Demolition Frame Protection Details (Sheets 1 of 3 & 2 of 3)
- Demolition Track Shield Details (Sheet 3 of 3)



BRIDGE ELEVATIONS
STANDARD LIMITS OF PROTECTION FOR FRAME PROTECTION



BRIDGE ELEVATION
MINIMUM LIMITS OF PROTECTION FOR FRAME PROTECTION
(SPECIAL PERMISSION REQUIRED, SEE NOTE 1)

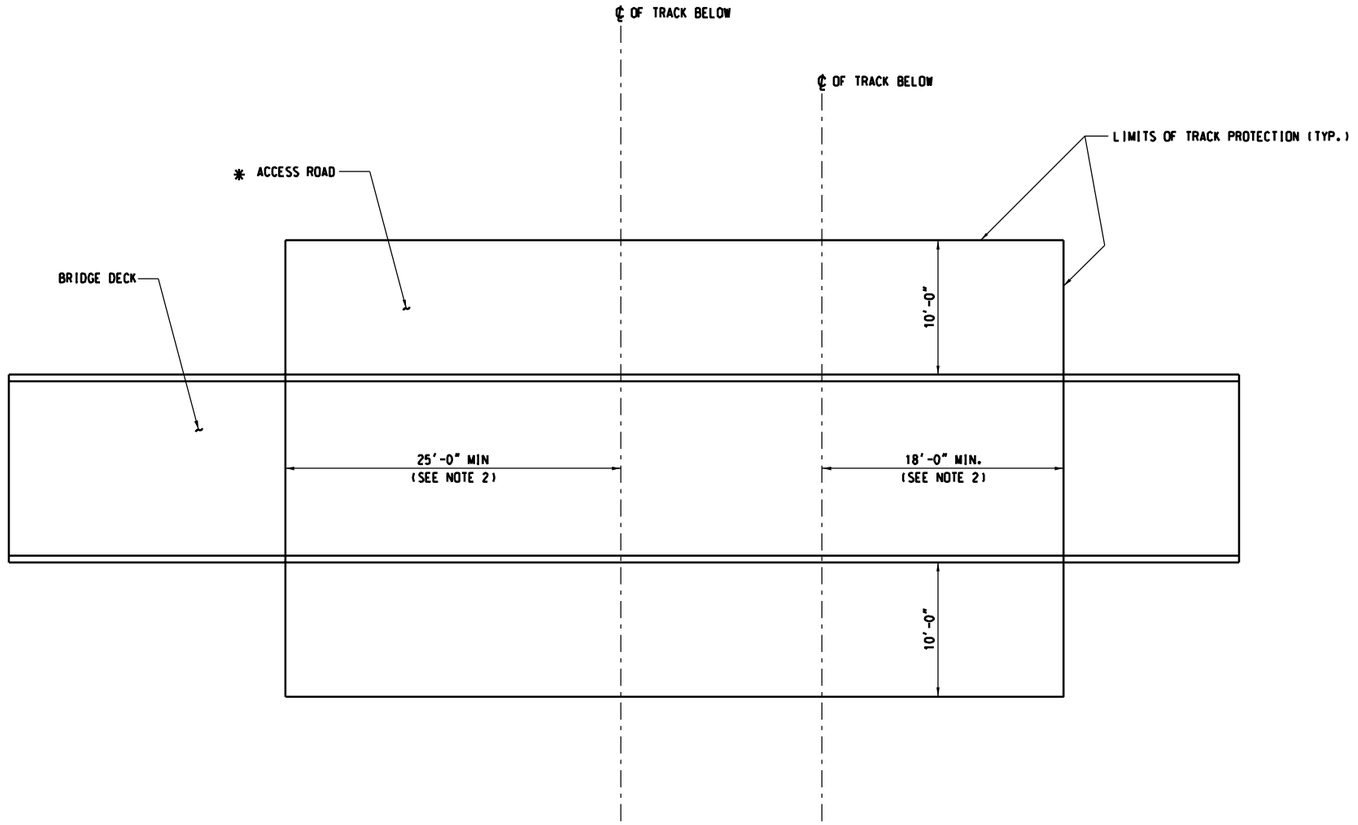
1. THE STANDARD LIMITS OF PROTECTION NOTED ARE THE MIN. CLEARANCES ALLOWED WITHOUT SPECIAL PERMISSION FROM THE RAILROAD. THE REDUCED CLEARANCES NOTED MAY BE ALLOWED BY THE RAILROAD. SPECIAL PERMISSION FOR THE REDUCED CLEARANCES IS REQUIRED FROM THE RAILROAD AND PUBLIC AGENCY.
2. THE PROTECTION FRAME SHALL AS A MINIMUM MATCH THE DEMOLITION LIMITS SHOWN AND EXTEND PAST THE BRIDGE WIDTH AS SHOWN ON THE ATTACHED DEMOLITION PLAN SHEET.
3. FOR ADDITIONAL CLEARANCE AND PROTECTION INFORMATION REFER TO CONTRACT EXHIBITS.
4. THE PROTECTION FRAME SHALL PREVENT DEMOLITION DEBRIS, DUST AND FINE MATERIAL FROM FALLING INTO THE RAILROAD TRACKS, ACCESS ROAD OR TRAINS. THE FRAME SHALL BE DESIGNED BY THE CONTRACTOR TO SUPPORT THE ANTICIPATED DEMOLITION LOADS, AND IN ACCORDANCE WITH CALTRANS FALSEWORK MANUAL FOR STRUCTURES OVER THE RAILROAD.
5. DEBRIS PROTECTION IS REQUIRED NEAR THE BASE OF THE SIDE SLOPES AND ADJACENT TO ROADS USED BY DEMOLITION EQUIPMENT TO PREVENT DEBRIS FROM ROLLING ONTO TRACK, ACCESS ROAD OR DITCH. USE TIMBERS AS REQUIRED TO STOP LARGE PIECES OF ROLLING DEBRIS.
6. ANY ACTIVITY WITHIN 25 FEET OF THE NEAREST RAIL OF A TRACK REQUIRES A FLAGMAN.

* IF NO ACCESS ROAD USE MIN. DIMENSION FROM OTHER SIDE OF DETAIL

BNSF RAILWAY

DEMOLITION FRAME PROTECTION DETAILS

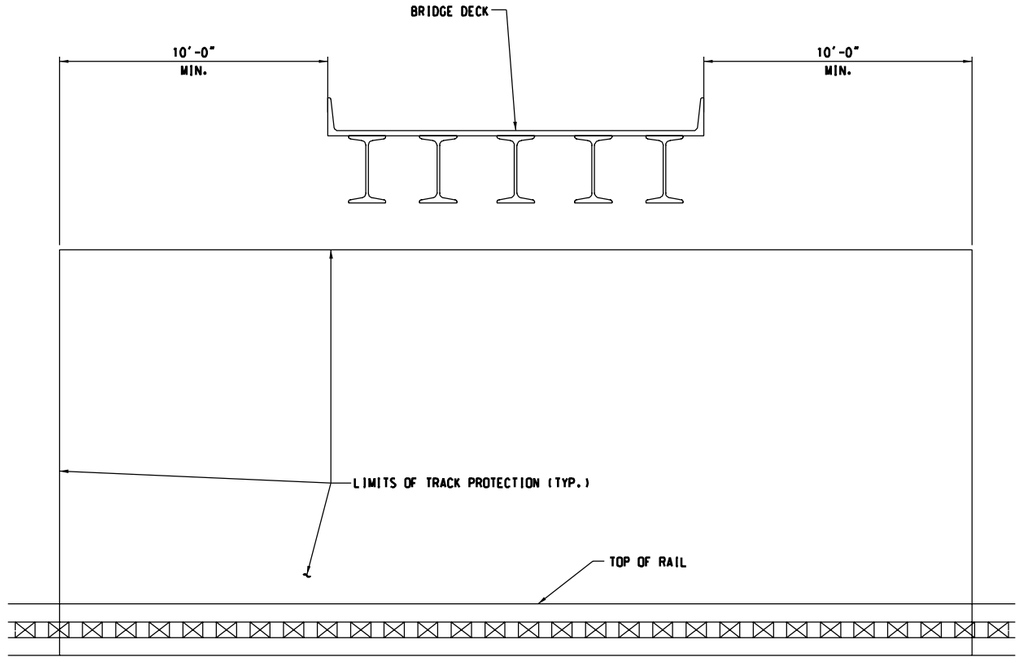
DATE: OCTOBER 17, 2007 SHEET: 1 OF 3



BRIDGE PLAN
STANDARD LIMITS OF PROTECTION FOR FRAME PROTECTION

NOTES:

1. SEE GENERAL NOTES ON BRIDGE ELEVATION SHEET.
2. STANDARD LIMITS OF PROTECTION ARE SHOWN. FOR MIN. LIMITS OF PROTECTION DIMENSIONS. SEE BRIDGE ELEVATION. MINIMUM LIMITS OF PROTECTION.



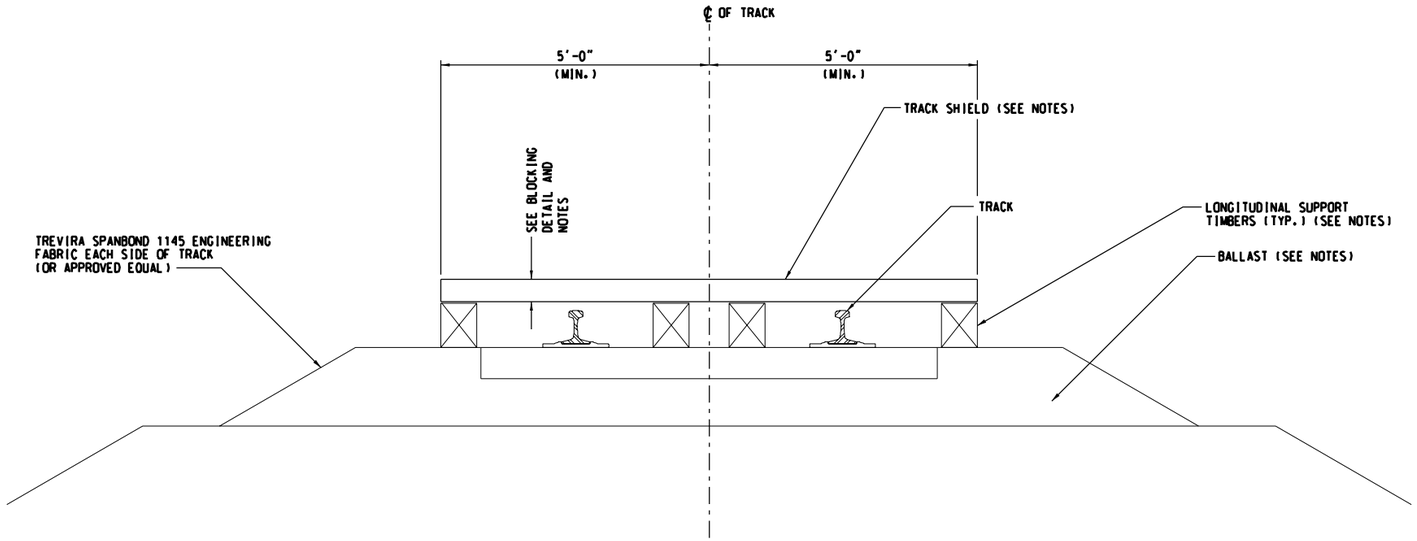
BRIDGE DECK CROSS SECTION
STANDARD LIMITS OF PROTECTION

* IF NO ACCESS ROAD, USE MIN. DIMENSION FROM OTHER SIDE

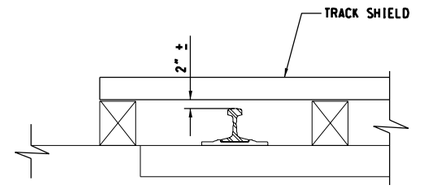
BNSF RAILWAY

DEMOLITION FRAME PROTECTION DETAILS

DATE: OCTOBER 17, 2007 SHEET: 2 OF 3



TRACK SHIELD DETAIL
FOR DEBRIS FALLING FROM BRIDGE DECK REMOVAL
(WHEN TRACK TIME WINDOW IS AVAILABLE)



BLOCKING DETAIL

NOTES:

1. A FLAG MAN IS REQUIRED AT ALL TIMES DURING THE USE OF A TRACK SHIELD.
2. THE TRACK SHIELD SHALL BE DESIGNED BY THE CONTRACTOR AND SHALL BE OF SUFFICIENT STRENGTH TO SUPPORT THE ANTICIPATED LOADS. INCLUDING IMPACT AND PUNCTURE. THE SHIELD SHALL PREVENT MATERIALS AND EQUIPMENT OR DEBRIS FROM FALLING ONTO THE RAILROAD TRACK. ADDITIONAL LAYERS OF MATERIALS SHALL BE FURNISHED AS NECESSARY TO PREVENT FINE MATERIALS OR DEBRIS FROM SIFTING DOWN UPON THE TRACK.
3. THE SHIED SHALL BE PREFABRICATED AND FURNISHED WITH LIFTING HOOKS TO SIMPLIFY REMOVAL.
4. THE SHIELD SHALL BE OF SUFFICIENT STRENGTH TO SPAN BETWEEN IT'S SUPPORTS WITHOUT BEARING UPON THE RAILS AND TO WITHSTAND DROPPING RUBBLE.
5. BEFORE REMOVAL THE SHIELD SHALL BE CLEANED OF ALL DEBRIS AND FINE MATERIAL. GEOFABRIC SHALL LINE THE BALLAST SECTION TO PREVENT CONTAMINATION.
6. THE TRACK SHIELD SHALL EXTEND AT LEAST 20 FEET BEYOND THE LIMITS OF DEMOLITION TRANSVERSE TO THE EDGE OF THE BRIDGE.
7. LONGITUDINAL SUPPORT TIMBERS FOR THE SHIELD SHALL NOT EXTEND ABOVE THE TOP OF RAIL WHEN THE SHIELD IS REMOVED. BLOCKING FROM THE TOP OF RAIL TO THE BOTTOM OF THE SHIELD MAY BE ATTACHED TO THE SHIELD. REMAINING TIMBERS SHALL BE ANCHORED.
8. FOR TRAIN PASSAGE, THE RUBBLE SHALL BE REMOVED TO A MINIMUM OF 8'-6" FROM THE NEAREST RAIL AND TO AN ELEVATION NO HIGHER THAN THE TOP OF RAIL.
9. AT THE END OF THE DAY, THE RUBBLE SHALL BE REMOVED COMPLETELY TO A MINIMUM OF 10'-0" FROM THE NEAREST RAIL AND DOWN TO ORIGINAL GRADE. GEOFABRIC BARRIER SHALL BE USED TO PREVENT BALLAST CONTAMINATION BY FINE MATERIALS.
10. CARE SHALL BE TAKEN TO NOT PLACE METAL ACROSS THE TRACK RAILS. RAILROAD COMMUNICATION ARE SENT THROUGH THE RAILS AND WILL BE DISRUPTED BY A SHORT BETWEEN RAILS.
11. DETAILS SHOWN APPLY FOR TIMBER TIES. SPECIAL DETAILS ARE REQUIRED FOR CONCRETE TIES.

BNSF RAILWAY

DEMOLITION TRACK SHIELD DETAIL

DATE: OCTOBER 17, 2007

C-2

SHORING GUIDELINES

GUIDELINES FOR TEMPORARY SHORING

EMAIL BEFORE YOU DIG
UP.COM/CBUD

EMERGENCIES
1-888-877-7267

CALL BEFORE YOU DIG
1-800-533-2891

EMERGENCIES
1-800-832-5452

Contents

1. INTRODUCTION

1.1 PURPOSE

a. The purpose of these guidelines is to inform public agencies, design engineers, contractors and inspectors of current Railroad standards and requirements concerning design and construction of temporary shoring.

1.2 SCOPE

a. This guideline governs on the Railroad Right-of-Way. This includes the limits of property owned, controlled and/or operated upon by the Railroad.

b. All requirements addressed within this document shall constitute minimum requirements for all projects or works on the Railroad Right-of-Way. The applicability of each requirement for any given project will be subjected to the Railroad's discretion.

c. Where laws or orders of authority prescribe a higher degree of protection or restriction than specified herein, the higher degree so prescribed shall control.

d. These guidelines supplement the current American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering. For items covered within these guidelines and AREMA, the more restrictive shall control.

   i. **It is the requirement for the Contractor and designer developing Railroad shoring systems to have a copy of the AREMA Manual. Visit www.arema.org to obtain the Manual for Railway Engineering.**

e. These guidelines supersede all previous Railroad guidelines for temporary shoring and are subject to revision without notice.

f. In addition to this guideline, all excavations shall also be governed by each individual Railroad requirements, Federal, State and Local laws, rules and regulations concerning construction safety.

g. These guidelines are provided as a reference and cannot be taken as authority to construct without prior review and written approval of the Railroad. See Section 2.9 for review process.

2. GENERAL CRITERIA

2.1 SAFETY & RAILROAD OPERATIONS

a. Projects shall be designed such that construction activities and phasing will not compromise safety nor impact Railroad operations.

b. Emergency Railroad phone numbers are to be obtained from a Railroad representative prior to the start of any work and shall be posted at the job site.

2.2 SHORING REMOVAL

a. The Contractor is responsible for planning and executing all procedures necessary to construct, maintain and remove the temporary shoring system in a safe and controlled manner.

2.3 RAILROAD FLAGGING

a. A flagman is required when any work is performed within 25 feet of track centerline. If the Railroad provides flagging or other services, the Contractor shall not be relieved of any responsibilities or liabilities as set forth in any document authorizing the work. No work is allowed within 50 feet of track centerline when a train passes the work site, and all personnel must clear the area within 25 feet of track centerline and secure all equipment when trains are present.

2.4 CALL BEFORE YOU DIG & EXISTING UTILITIES

a. Call Before You Dig: Appropriate measures for the installation and protection of fiber optic, or other cables, shall be addressed in the plans and contract documents. For specific Railroad requirements and additional information refer to:

   BNSF: www.bnsf.com or call 1-800-533-2891.

   UPRR: www.up.com/cbud

b. Relocation of utilities or communication lines not owned by the Railroad shall be coordinated with the respective utility owners. Utility relocation plans must then be submitted to the Railroad utility representative(s) for review and prior approval must be secured before work can proceed. The Railroad will not be responsible for costs associated with any utility, signal, or communication line relocation or adjustments.

c. Abandonment of utilities must follow the UPRR Guidelines For Abandonment of Subsurface Utility Structures or the BNSF Utility Accommodation Policy.

2.5 APPLICANT & CONTRACTOR RESPONSIBILITIES

a. The Applicant and Contractor must verify with the Railroad's Local Representative their receipt of the latest version of these guidelines prior to developing Construction Documents.

b. Construction shall NOT impact Railroad operations, functions and facilities:

   i. The Applicant and Contractor shall develop design plans, including, without limitation, all procedures necessary to construct and maintain the proposed shoring project, which cause no interruption to Railroad operations during and after construction.

   ii. Work shall also not impede drainage or other functions of the Railroad.

   iii. Any rail traffic outages or curfews thought to be required for the installation or removal of any portions of a shoring system must be requested by submittal to the Railroad for prior consideration long in advance of mobilization and construction. Such requests may not be granted.

   iv. Unapproved and unscheduled interruptions to Railroad operations may result in your removal from Railroad Right-of-Way, and your authorization to re-enter revoked.

c. Railroad approved design and construction plans:

   i. The Contractor shall install the temporary shoring system per the plans approved by the Railroad.

   ii. Any deviation from the Railroad approved plans requires resubmittal and prior approval by the Railroad prior to proceeding with said deviation. Approval from the Railroad may not be granted.

d. The Contractor must monitor the track, ground and shoring for movement. See Section 2.6 for monitoring.

e. The Applicant and Contractor shall be jointly responsible for the design, construction and performance of the temporary structure.

f. The Contractor must review the temporary shoring plans to ensure that the proposed method of construction is compatible with the existing site and soil conditions. Removal of the shoring system must also be addressed.

g. The Contractor must obtain a valid right of entry permit from the Railroad and comply with all Railroad requirements when working on Railroad property.

h. The Contractor is responsible to protect the Railroad ballast and subballast from contamination.

i. The Contractor shall comply with all State and Federal Laws, county or municipal ordinances and regulations which in any manner affect the work.

j. All removed soils will become the responsibility of the Contractor and shall be disposed of outside the Railroad Right-of-Way according to the applicable Federal, State and Local regulations.

k. The project engineer and the Contractor shall evaluate the quality of materials furnished and work performed.

l. The Applicant, at its expense, shall be solely responsible for all costs, design, construction, future replacement, maintenance, and serviceability of the proposed shoring project, except as noted otherwise in the Construction & Maintenance (C & M) Agreement with the Railroad.

m. The Applicant shall be responsible for obtaining all Federal, State, Local and other permits for construction of the shoring project.

   i. 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.

n. 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 shoring.

o. 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).

p. The Applicant and Contractor 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 shoring 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 Track Maintenance Representative.

q. 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.

2.6 TRACK, GROUND & SHORING MONITORING:

The Contractor must monitor the track, ground and shoring for movement to ensure proper performance of the shoring system and the safe operation of trains. Record top of rail elevations and track alignment for the duration of the project. After the project is complete additional track and ground monitoring may be required as deemed necessary by the Railroad.

a. Track & Ground Monitoring requirements: In addition to Table 2:
   - For UPRR, see the Union Pacific Railroad Guidelines for Track & Ground Monitoring.
   - For BNSF, subject to direction of the BNSF project engineer for the project

   ii. Deflection Limits (Table 2), Section 3.8k, for both track and shoring deflection limits.
   - Displacements exceeding the limits defined in Table 2 must be immediately reported to the Railroad. All work on the project must stop and the Railroad may take any action necessary to ensure safe passage of trains. The Contractor must immediately submit a corrective action plan to the Railroad for review and approval. The Railroad must review and approve the proposed repair procedure. The repair must be inspected by the Railroad before any work on the project can proceed.

b. Any damage to Railroad property such as track, signal equipment or structure could result in a train derailment. All damage must be reported immediately to the Railroad representative in charge of the project and to the Railroad Track Maintenance Representative.

2.7 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 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.

2.8 CONSTRUCTION AND MAINTENANCE AGREEMENT

a. Prior to construction on Railroad Right-of-Way, Applicants must have an executed a C & M Agreement with the Railroad.

b. The C & M agreement shall, at a minimum, 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 project 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(s) 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.

2.9 RAILROAD REVIEW PROCESS

a. <u>How to Communicate with the Railroad</u>

   i. All design and construction submittals shall be sent to the Railroad Representative who will pass them along for Railroad review.

b. <u>Railroad Compensation Agreement</u>:

   i. 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. This is often referred to as the Preliminary Engineering Agreement (PE Agreement).

   ii. The estimated costs of such PE Agreement 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 submittals shall be fully recoverable from the Applicant.

c. <u>Railroad Review Duration</u>

   i. Review of design submittals and resubmittals by the Railroad (or its consultants) will require a minimum of 4 weeks each individual submission to the Railroad.

   ii. To expedite the review process of the temporary shoring plans, drawings submitted to the Railroad shall be in accordance with these Guidelines. Otherwise, longer review times shall be expected.

   iii. To avoid impacting the construction schedule, the Contractor should schedule submittals at least 4 to 6 months in advance.

   iv. Partial, incomplete or inadequate designs will be rejected, thus delaying the approval.

   v. Revised submittals will follow the same procedure as the initial submittal until all issues are resolved.

d. Applicant and Engineer of Record Review

i. Before providing submittals for the Railroad to review, the applicant and or Engineer of Record must first review and approve the submittal for compliance with the project specifications, AREMA Manual, these Guidelines and structural capacity. Exceptions or proposed alternatives, if any, must be clearly communicated and identified for all submittals involved.

ii. Drawings and calculations must be signed and stamped by a licensed professional engineer familiar with railway loadings and is licensed in the state where the shoring system is intended for use.

e. Construction May Commence Only When:

i. The Contractor must not begin construction of any component of the shoring system affecting the Railroad Right-of-Way until written Railroad approval has been received.

2.10 APPROVAL EXPIRATION

a. 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. DESIGN

3.1 GENERAL DESIGN REQUIREMENTS

a. Shoring Zones (see Figure 1 below):

i. All dimensions are measured perpendicular to the centerline of track.

ii. For ALL excavations within Zone A, shoring plans shall be accompanied by design calculations.

iii. All shoring within the limits of Zone A must be placed prior to the start of excavation.

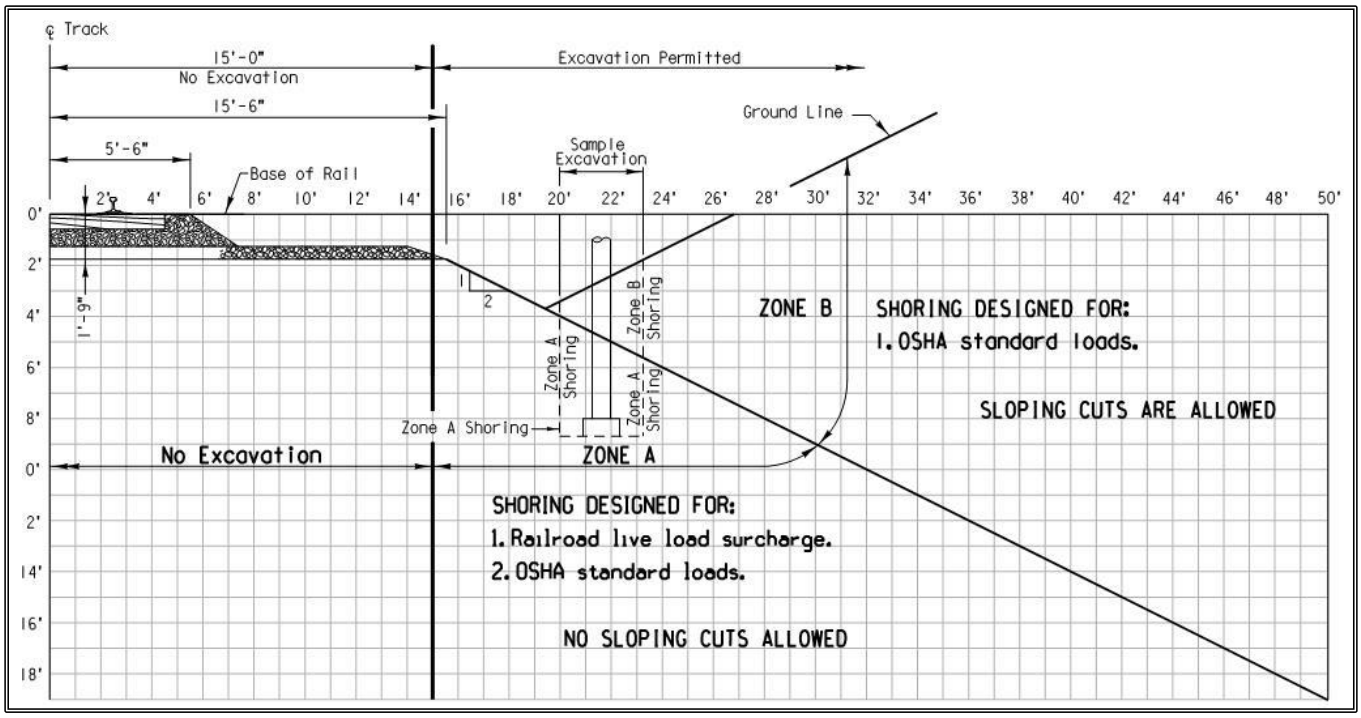


FIGURE 1

b. Excavation Limits: No excavation shall be permitted closer than 15'-0" measured at a right angle from the centerline of track to the trackside of shoring system.

c. Evaluate slope and stability conditions to ensure the Railroad embankment will not be adversely affected. Local and global stability conditions must also be evaluated.

d. Lateral clearances must provide sufficient space for construction of the required Railroad ditches parallel to the standard Railroad roadbed section. The size of ditches will vary depending upon the flow and terrain and should be designed accordingly.

e. Protect Open Excavations:

   i. Any excavation, holes or trenches on the Railroad property shall be covered, guarded and/or protected. Handrails, fence, or other barrier methods must meet OSHA and FRA requirements. Temporary lighting may also be required by the Railroad to identify tripping hazards to train crewmen and other Railroad personnel.

f. The most stringent project specifications shall be used of the Public Utilities Commission Orders, Department of Industrial Safety, OSHA, FRA, AREMA, BNSF, UPRR or other governmental agencies.

g. Secondhand material is not acceptable unless the Engineer of Record submits a full inspection report which verifies the material properties and condition of the secondhand material. The report must be signed and sealed by the Engineer of Record.

h. Shoring Removal:

   i. All components of the shoring system are to be removed when the shoring is no longer needed to the extent that there is no impact to Railroad operations. All voids must be filled and compacted properly, and drainage facilities restored. See compaction requirements in Section 3.5c.

   ii. If the shoring cannot be completely removed, it shall be removed at least 3.0 feet below the final finished grade or at least 3.0 feet below the base of rail, whichever is lower, unless otherwise specified by the Railroad and only if approved by the Railroad.

   iii. No traffic during unsupported excavations resulting from shoring removal.

i. Soldier piles may be installed in predrilled holes if the requirements of AREMA, Vol. 2, Ch. 8, Article 28.5.4.3 and the following are met:

   i. Slurry and drilling fluid type materials are not acceptable as backfill for soldier piles in drilled holes.

   ii. Concrete and flowable backfill may be used but might prevent removal of the embedded piles. If width of the drilled hole will be relied on for passive resistance, the concrete backfill shall have a minimum compressive strength of 3,000 psi, and a minimum coverage of at least 3.0 inches between the edge of the pile and drilled hole.

   iii. Compacted pea gravel material is allowed as backfill if the groundwater level is below the bottom of the drilled hole, the diameter of the hole is at least 12 inches greater than the diagonal width of the pile, and the pea gravel is placed in successive lifts of 8 inches or less in thickness and either consolidated by vibrating the pile or being dry rodded between each lift. The design passive resistance shall be based on the lessor of that derived from either the surrounding subsurface soils or the pea gravel. The pea gravel shall be assumed to have a friction angle no greater than 34 degrees.

   iv. Temporary or permanent casing is used to support the sides of the drilled hole for holes drilled within 25 feet from centerline of track, or 2 times the hole diameter plus 15 feet from centerline of track, whichever is greater. The thickness and strength of the steel casing shall be sufficient to support the loads described in Section 3.7, and shall be specified on the plans.

j. Tieback & Soil Nail Anchor Rods

   i. Soil Nails are defined as drilled-in ground anchors that require ground and wall movement to occur before fully utilized, and Tiebacks are defined as tie rods and drilled-in ground anchors that are prestressed after installation.

ii. Tiebacks & Soil Nails are not approved to permanently retain Railroad embankment supporting tracks.

iii. Tiebacks & Soil Nails installed below active tracks shall be cased during anchor installation.

iv. Tiebacks & Soil Nails shall be installed a minimum of 6 feet below base of rail, unless comprised of fiberglass or fully removed after the shoring is no longer needed. Additionally, the upper surface of the grouted tieback or soil nail shall be no less than 3.5 feet below base of rail.

v. Tiebacks & Soil Nails shall be designed for gravity placement of grout unless pressure grouting can be proven to not cause an unacceptable risk of track heave.

vi. For shoring that will extend above existing grade, which will result in the shoring being backfilled with compacted fill, settlement of the backfill, and associated impacts to shoring and adjacent structures, shall be evaluated. If tieback tie rods will be installed within the compacted backfill, the tie rods shall be placed in the bottom of pipe sleeves that have sufficient diameter to prevent vertical loading on the tie rods from backfill settlement. The pipe sleeves shall also have sufficient strength to support overburden backfill and surcharge loads.

vii. The contractor is responsible for providing an approved test method to verify the capacity of anchored or tieback systems. The manufacturers recommendations for testing must be satisfied. Systems which support the Railroad embankment will be considered high risk in determining the percentage of elements to be proof tested.

viii. Cement-grouted anchors tiebacks shall be installed, tested and stressed in accordance with the project specifications, AREMA requirements, FHWA-IF-99-015, Geotechnical Engineering Circular 4, Ground Anchors and Anchored Systems.

k. The proximity of existing structures shall be evaluated when determining shoring installation methods. Installation of shoring by vibratory or impact hammers has the potential to cause dynamically induced subsidence of existing structures and track. The Railroad may dictate shoring installation methods as required on a case by case basis.

3.2 INFORMATION REQUIRED

a. Plans and calculations shall be submitted, signed and stamped by a Licensed Professional Engineer familiar with Railroad loadings and who is licensed in the state where the shoring system is intended for use. See Section 3.9 for requirements on plan submittals. In addition to plans and calculations, the following information is also required.

b. Field Survey

i. The field survey shall be referenced to the centerline of track(s) and top of rail elevations. Existing grades and alignment of tracks and roads shall be surveyed. The location of existing utilities shall also be determined.

c. Drainage

i. The drainage pattern of the site before and after construction should be analyzed and adequate drainage provisions should be incorporated into the plans and specifications. Consideration should be given to groundwater seepage as well as surface drainage.

ii. Drainage provisions for backfill should be compatible with the assumed water conditions in design.

d. Geotechnical Report – See Section 3.5, Subsurface Characterization.

e. Assumed Loading – See Section 3.7, Applied Loads and Calculations.

f. Structural Design Calculations – See Section 3.8, Structural Design Calculations.

3.3 DESIGN PROCEDURE

a. Shoring design should generally adhere to the following procedure:

Step 1) Determine proposed excavation location and depth.

Step 2) Establish subsurface and surface conditions at proposed shoring location. See Section 3.5 for requirements.

Step 3) Select shoring type (see Section 3.6)

Step 4) Determine Applied Loads

- Lateral Driving Pressures on back side of shoring, which would consist of the following:
  - Earth pressure (Active, At-Rest, Apparent) (see Sections 3.7c.i, 3.7c.ii, and 3.7c.iii)
  - Surcharge pressures (see Section 3.7c.iv)
  - Hydrostatic pressure (see Section 3.7c.v)
- Lateral Resisting Pressures on the front side of shoring, which would consist of the following:
  - Passive earth pressure (see Section 3.7d.i).
  - Passive earth pressure reductions (e.g., seepage uplift) (see Section 3.7d.ii)
  - Resisting loads from braces and tiebacks

Step 5) Perform Structural Design Calculations

- Perform stability analysis to establish the minimum embedment depth of shoring and anchor/brace loads (see Section 3.8j).
  - For complex shoring designs, perform global and basal heave stability analyses (see Section 3.8j).
- Verify deflection is within that allowable (see Section 3.8k).
- Verify strength of structural elements are not exceeded (see Section 3.8i)

3.4 (Step 1) EXCAVATION LOCATION

a. See Figure 1, Section 3.1b for excavation limits.

b. Shoring systems should be located as far from the Railroad track and structures as possible.

3.5 (Step 2) SUBSURFACE CHARACTERIZATION

a. Subsurface exploration.

i. Sufficient borings shall be made along the length of the structure to determine, with a reasonable degree of certainty, the subsurface conditions. Irregularities found during the initial soil boring program may dictate that additional borings be performed.

ii. In general, borings should be performed within 50 feet of the planned location of shoring, or closer as necessary. If the planned shoring is longer than 250 feet in length, additional borings shall be performed along the length of the shoring on an average spacing of 250 feet.

iii. Borings shall be performed to a depth sufficient to fully characterize the soils adjacent to and below the proposed shoring.

iv. Unless otherwise stated in these guidelines, subsurface investigation shall also be made in accordance with the provisions of AREMA, Vol. 2, Ch. 8, Part 22, Geotechnical Subsurface Investigation.

b. Type of backfill and backfill properties.

i. Backfill is defined as material behind the wall, whether undisturbed ground or compacted fill, that contributes to the pressure against the wall.

ii. The compacted fill may be classified with reference to the soil types described in AREMA Vol. 2, Ch. 8, Articles 5.2.5 and 5.3.2. However, the unit weight used in design shall be representative of the actual unit weight of the material as measured by laboratory testing.

c. Backfill placement and compaction.
   i. The compacted fill shall meet the latest version requirements of Section 31 23 26 of the UPRR General Conditions and Specifications (UPRR) or BNSF Standard Construction Specifications (BNSF).
   ii. No dumping of backfill material shall be permitted in such a way that the successive layers slope downward toward the wall. The layers shall be horizontal or shall slope downward away from the wall.
   iii. If the wall is not free to rotate (i.e., is anchored or braced) and achieve an active condition during compaction of the backfill, the induced earth pressure due to compaction shall be evaluated. The assumed earth pressure shall be no less than the at-rest earth pressure (see Section 3.7c.ii).

d. Stress states and corresponding soil strength properties.
   i. Saturated cohesive soils (clays and some silts) can reside in two different stress states while shoring is in service:
      - Undrained / Total Stress: A short-term condition where the undrained shear strength (S_u) of the soil should be used for analysis.
      - Drained / Effective Stress: A long-term condition where drained effective friction angle (ϕ') and effective cohesion (c') of the soil should be used for analysis.
   ii. It is impossible to accurately predict how long saturated cohesive soils will remain in an undrained / total stress state before pore pressures dissipate and the soil achieves a drained / effective stress state. For this reason, the Undrained Cohesive soil state shall only control for design when it results in a higher factor of safety for the shoring design than that estimated for the Drained Cohesive soil state. This will generally only be the case when the cohesive soils are relatively soft.
   iii. It is noted that cohesive soils can also reside in an "unsaturated" state, where the soil can be characterized by an unsaturated shear strength. The unsaturated shear strength of a cohesive soil can vary drastically as it's moisture content increases or decreases. Given the impossibility of predicting moisture content changes for soils exposed to weather and groundwater fluctuations, the unsaturated shear strength of the soil shall not be used for design.
   iv. Saturated and unsaturated cohesionless soils (some silts, sands, and gravels) should be assumed to always reside in a drained / effective stress state.

e. A Geotechnical Report summarizing the existing and proposed subsurface conditions shall be provided by a Licensed Professional Engineer. The Geotechnical Report shall include:
   i. Boring location plan showing the location of each boring in relation to tracks and the proposed shoring.
   ii. Boring logs that indicate the elevation and depth of each layer of soil encountered, USCS classification of each layer of soil, an indication of whether the soil is fill or natural soil, the depth/elevation of groundwater, results of in-situ testing, index properties of the soil layers as determined by laboratory testing (e.g., moisture, density, sand content, plasticity, unconfined strength, etc.)
   iii. Results of all laboratory testing. Laboratory testing shall include at a minimum: moisture content, density, unconfined compression tests on clay/rock, and direct shear or triaxial compression testing on soils to determine the effective cohesion and internal angle of friction.

iv. Recommended soil properties for the design of shoring for each layer of soil as follows:
    - Top/bottom elevation of soil layer
    - Moist (γ) and effective (γ') unit weight
    - Undrained shear strength (S_u) of cohesive soils
    - Effective cohesion (c') and friction angle (ϕ')
    - Active and passive earth pressure coefficients
    - Parameters for p-y curve generation, if necessary.

v. If required, allowable bearing capacity for spread footings.

vi. Compaction recommendations for backfill, optimum moisture content and maximum density of fill material, and design parameters for the compacted fill. See Sections 3.5b and 3.5c.

vii. Water table elevation to be assumed on both sides of the shoring system.

viii. Dewatering recommendations, as needed, and proposed flownets or zones of groundwater influence.

3.6 (Step 3) SHORING TYPES

a. Shoring/Trench Box is a prefabricated shoring system which is installed as the excavation progresses. This system is allowed in special applications only, typically where Railroad live load surcharge is not present unless it can be shown that the over excavation outside the box will be filled and compacted before the presence of Railroad live load.

b. Anchored systems with tiebacks are discouraged, as the tiebacks will be an obstruction to future utility installations and may also damage existing utilities. If used, see Section 3.1.j for design requirements for tiebacks and soil nails.

c. Sheet Pile Wall (Anchored) is a structure designed to provide lateral support for a soil mass and derives stability from passive resistance of the soil in which the sheet pile is embedded and the tensile resistance of tiebacks.

d. Sheet Pile Wall (Cantilevered) is a structure designed to provide lateral support for a soil mass and derives stability from passive resistance of the soil in which the sheet pile is embedded. Cantilever sheet pile walls shall be used only in granular soils or stiff clays. The maximum height of wall above the excavation line shall be 10 feet in Zone A (see Figure 1) and 12 feet in Zone B.

e. Soldier Pile with Lagging Wall (Anchored) is a structure designed to provide lateral support for a soil mass and derives stability from passive resistance of the soil/rock in which the soldier beam is embedded and from the tensile resistance of tiebacks. Soldier beams include steel H-piles, wide flange sections or other fabricated sections that are driven or set in drilled holes. Lagging refers to the members spanning between soldier beams.

f. Soldier Pile with Lagging Wall (Cantilever) is a structure designed to provide lateral support for a soil mass and derives stability from passive resistance of the soil/rock in which the soldier beam is embedded. The maximum height of the wall above the excavation line shall be 8 feet for Zone A (see Figure 1) and 12 feet for Zone B.

g. Braced Excavation is a structure designed to provide lateral support for a soil mass and derives stability from passive resistance of the soil in which the vertical members are embedded and from the structural capacity of the bracing members. For purposes of these guidelines, the vertical members of the braced excavation system include steel sheet piling or soldier beams comprised of steel H-piles, wide flange sections, or other fabricated sections that are driven or installed in drilled holes. Wales are horizontal structural members designed to transfer lateral loads from the vertical members to struts or rakers. Struts and rakers are structural compression members that support the lateral loads from the wales and transfer the load to either another side of a shored excavation (struts) or to a reaction pile/thrust block (raker).

h. Cofferdam is an enclosed temporary structure used to keep water and soil out of an excavation for a permanent structure such as a bridge pier or abutment or similar structure. Cofferdams may be

constructed of timber, steel, concrete or a combination of these. These guidelines consider cofferdams primarily constructed with steel sheet piles.

3.7 (Step 4) APPLIED LOADS AND CALCULATIONS

a. For shoring design submittal, all design criteria, temporary and permanent loading must be clearly stated in the design calculations and on the contract and record plans.

b. Applied loading will consist of driving pressures/forces on the back of the shoring and resisting pressures/forces on the front of the shoring.

- Driving pressure will generally consist of:
  - Active, At-Rest & Apparent pressures. (Sections 3.7c.i, 3.7c.ii, 3.7c.iii)
  - Surcharge (Section 3.7c.iv)
  - Hydrostatic pressures (Section 3.7c.v).
- Resisting pressure will generally consist of:
  - Passive earth pressure (3.7d.i) and brace/tieback loading.

c. **Driving Pressures/Loads**:

i. **Active Earth Pressure**

- Use for cantilever walls and flexible walls with only one row of tiebacks/braces (i.e., flexible anchored bulkheads), if the minimum deflection criteria per AREMA Vol. 2, Ch. 8, Article 20.1.2.d is met. If the minimum deflection criteria for flexible anchored bulkheads is not met, use Apparent Earth Pressure for top-down shoring construction (Section 3.7c.iii), and At-Rest Earth Pressure for walls that are backfilled (Section 3.7c.ii).
- The active earth pressure may be computed by the Rankine, Coulomb or Log-Spiral theories. The active earth pressure may also be based on general soil type per AREMA Vol. 2, Ch. 8, Part 20, Table 8-20-3 as provided in the Appendix.
- For interface friction angles used for Coulomb and Log-Spiral theories, the interface friction angle shall not be greater than one-half of the effective friction angle of the soil, or that consistent with published values for specific types of soil in contact with either steel or concrete (e.g., **NAVFAC DM7.02, Chapter 3, Table 1**).
- The backslope of the retained soil shall be considered when calculating the active earth pressure.
- See Section 3.5b. Subsurface Characterization, for further requirements for computing earth pressure from compacted backfill.

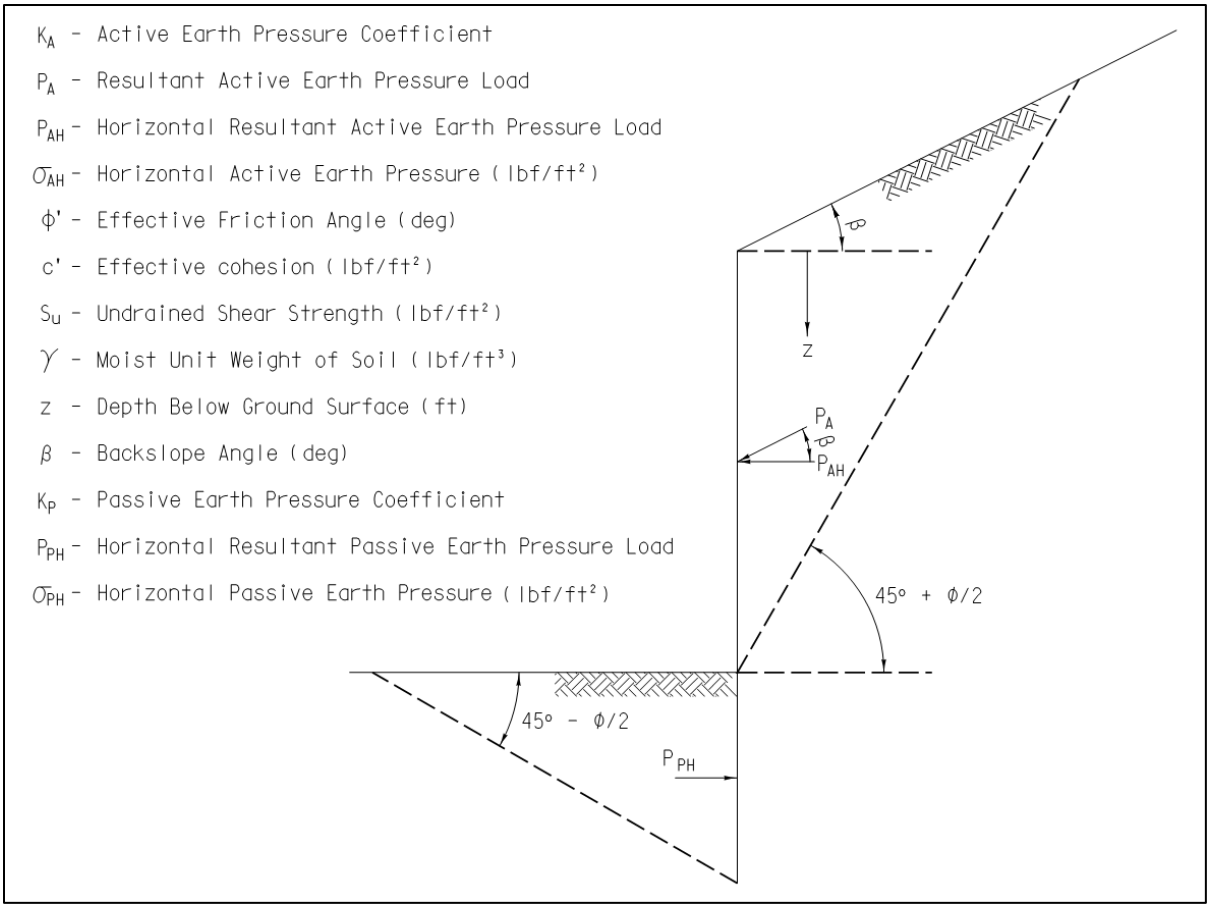


FIGURE 2

- NON-COHESIVE SOILS

  Level Backslope (Rankine)

$$\sigma_{AH} = K_A \gamma z \ \ , where \ \ K_A = tan^2\left(45 - \frac{\phi'}{2}\right)$$

  Sloping Backslope (Rankine)

$$\sigma_{AH} = K_A \gamma z \cos\beta \ \ , where \ \ K_A = \cos\beta\left(\frac{cos\beta - \sqrt{cos^2\beta - cos^2\phi'}}{cos\beta + \sqrt{cos^2\beta - cos^2\phi'}}\right)$$

- COHESIVE SOILS & FRACTURED ROCK

  Drained Cohesive & Fractured Rock - Level & Sloping Backslope (Rankine/Bell)

  - Use these drained equations unless the undrained equations below result in greater earth pressures in the shoring design.

$$\sigma_{AH} = K_A \gamma z - 2c'\sqrt{K_A}$$

$$K_A = tan^2\left(45 - \frac{\phi'}{2}\right), For\ Level\ Backslope$$

$$K_A = \cos\beta\left(\frac{cos\beta - \sqrt{cos^2\beta - cos^2\phi'}}{cos\beta + \sqrt{cos^2\beta - cos^2\phi'}}\right), For\ Sloping\ Backslope$$

- Effective Cohesion Note: Effective cohesion shall be assumed to be zero, unless local experience by a Licensed Geotechnical Engineer indicates the fully softened strength of the clay will have an effective cohesion greater than zero.
- Fractured Rock Note: The active earth pressure for fractured rock and intermediate geomaterials (e.g., weak shales, sandstone, etc.) shall be based on either the rock mass effective cohesion and friction angle, or mass shear strength. The mass strength parameters shall be determine using a methodology that accounts for rock type, intact strength, spacing and conditions of joints, rock quality designation (RQD), geological strength index (GSI), and/or rock mass rating (RMR).

Undrained Cohesive – Level Ground (Rankine/Bell)

- Only use undrained when it results in a higher earth pressure in the shoring design. Otherwise use the Drained equations above.
- Assumes ϕ=0 and c'=S_u

$$\sigma_{AH} = \gamma z - 2S_u$$

or

$$\sigma_{AH} = K_A \gamma z \quad ,where \quad K_A = 1 - \frac{2S_u}{\gamma z}$$

Very Soft to Medium Clays/Silts

- Where the Stability Number $N_s = \gamma * H/S_{ub}$ is greater than 4, active earth pressure shall be estimated as the greater of that determined using the equations above for drained (effective) and undrained (total stress) conditions, or the equations directly below. The factor of safety against basal heave shall also be analyzed per Section 3.8j.ii3.8. For N_s > 6, the global stability of the shoring shall also be evaluated by a limit-equilibrium method of slices per Section 3.8j.ii.

  - For 4 < N_s < 5.14, $K_A = 0.22$
  - For N_s > 5.14 (Henkel, 1971), $K_A = 1 - \frac{4S_u}{\gamma H} + 2\sqrt{2}\frac{d}{H}\left(1 - \frac{5.14S_{ub}}{\gamma H}\right) \geq 0.22$

  Where:

  S_u = Undrained strength of retained soil (lbf/ft^2)
  S_{ub} = Undrained strength of soil below excavation base (lbf/ft^2)
  γ = Total unit weight of retained soil (lbf/ft^3)
  H = Total excavation depth (ft)
  d = Depth of potential base failure surface below base of excavation (ft)
  (The lessor of either the thickness of soft to medium stiff clay below the bottom of excavation, or the width of the excavation divided by the square root of 2. See Figure 3 below.)

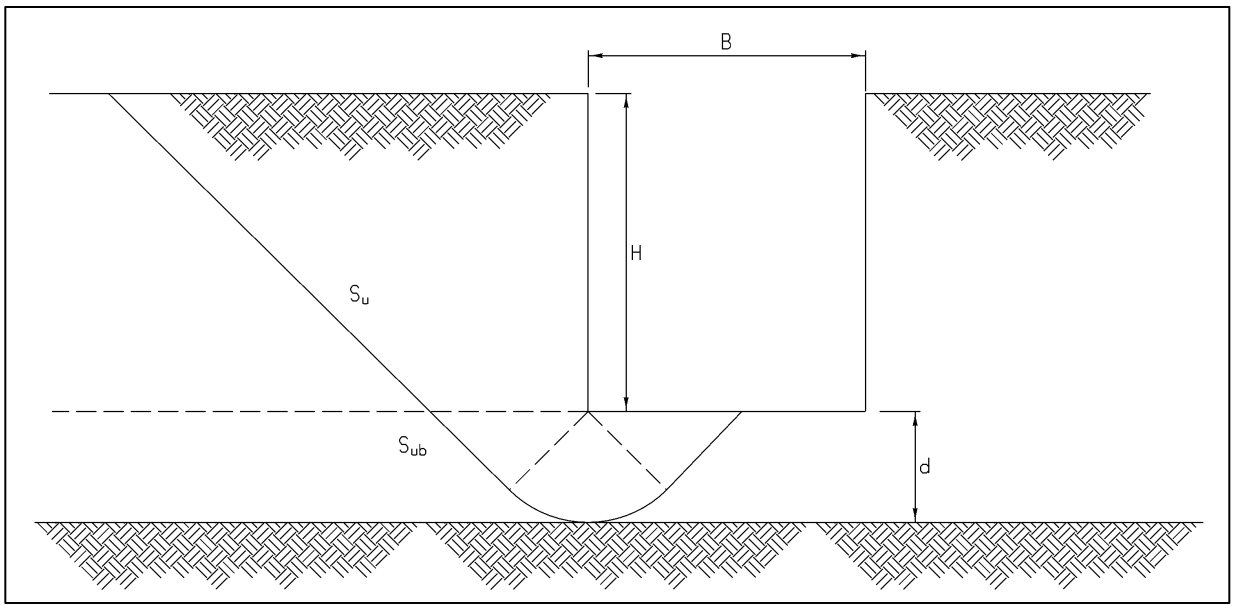


FIGURE 3

ii. **At-Rest Earth Pressure.**

- Used for rigid walls (e.g., reinforced concrete walls) that deflect less than that indicated in Table 1.

Table 1 - When to Use At-Rest Earth Pressure

Type of Backfill	Wall Deflection / Wall Height
Dense sand	0.001
Medium dense sand	0.002
Loose sand	0.004
Compacted Silt	0.002
Compacted lean clay	0.010
Compacted fat clay	0.010

(Clough & Duncan, 1991)

- At-Rest earth pressure shall also be used for walls that are restrained above the dredge line by braces/tiebacks and are backfilled with compacted fill. See also Section 3.8j.ii.
- At-Rest earth pressure shall be calculated as follows:

Level Ground

$$\sigma_{0H} = K_0 \gamma z \ , \ where \ \ K_0 = (1 - sin\phi')OCR^{(sin\phi')}$$

Sloping Backslope

$$\sigma_{0H} = K_0 \gamma z (1 + sin \beta)$$

Where:

σ_{0H} – Horizontal At-Rest Earth Pressure (lbf/ft^2)
K_0 – At-Rest Earth Pressure Coefficient
ϕ' – Effective Friction Angle (deg)
OCR – Over-Consolidation Ratio
β – Backslope Angle (deg)

iii. **Apparent Earth Pressure**

- Use for braced excavations with single or multiple levels of braces/tiebacks.
- Use equations determined per AREMA Vol. 2, Ch. 8, Article 28.5.4.1 or **FHWA-IF-99-015, Sections 5.2.4** (sands), **5.2.5** (stiff to hard clays) and **5.2.6** (soft to medium clays).
- For braced excavations that bottom out in very soft to medium stiff clays/silts, where the Stability Number $N_s = \gamma * H/S_{ub}$ is greater than 4, the requirements of Section 3.7c.i for very soft to medium clays shall also apply if they control for design.

iv. **Surcharge Loads**

- Loads include but are not limited to: Railroad vertical and centrifugal loading, railroad service vehicles (HS-20 truck), roadway loading, fills placed above the top of shoring, construction equipment, crane pads, future grading and paving, structures, material storage piles, and snow.
- Dead load assumptions to be used for design:
  - Spoil pile: must be included assuming a minimum height of two feet of soil adjacent to the excavation.
  - Track: use 200 lbs/linear-ft for rails, inside guardrails and fasteners.
  - Roadbed: ballast, including track ties, use 120 lbs per cubic foot.
- For specific applications of the Cooper E80 live load, refer to in Appendix 5.1, which illustrates Live Load Pressure Due to Cooper E80.
- Additional analysis for centrifugal force calculations as described in AREMA Vol. 2, Ch. 15, Article 1.3.6. Centrifugal Loads are required where shoring is located along the outer side of curved track and track curvature exceeds three degrees.
- Lateral pressure from to infinite and uniform surcharge load.
  - The surcharge can effectively be treated as another soil layer, whereby the vertical surcharge pressure is multiplied by the active or at-rest earth pressure coefficient as shown below:

$$\sigma_{UA} = K_A q \quad or \quad \sigma_{U0} = K_0 q$$

Where:

σ_{UA} – Uniform lateral surcharge pressure for active condition (lbf/ft^2)

σ_{U0} – Uniform lateral surcharge pressure for at-rest condition (lbf/ft^2)

K_A - Active earth pressure coefficient

K_0 – At-rest earth pressure coefficient

q - Uniform surcharge load (lbf/ft^2)

- Lateral pressure from to point, line, uniform strip, and rectangular-area surcharge loads.
  - Equations shall be based on Boussinesq theory (i.e., elastic theory) and a rigid wall condition.
  - For point loads, see **AREMA, Vol. 2 , Ch. 8, Article 20.3.2.4**.
  - For line loads, see **AREMA, Vol. 2 , Ch. 8, Article 20.3.2.3**.
  - For rectangular loads, see **NAVFAC DM7.02, Figure 11**.
  - For uniform strip loads, see Case I (Cooper E80 loading parallel to walls) in Appendix 5.1, or **AREMA, Vol. 2 , Ch. 8, Article 20.3.2.2.**
- Trial Wedge method per AREMA, Vol. 2 , Ch. 8, Article C5.3.2.II may also be used.

v. **Hydrostatic Pressure Due to Unbalanced Groundwater Levels.**

- Hydrostatic pressure shall be assumed on secant/tangent pile and sheet pile shoring if the base of the excavation extends below the water table and no drainage system is installed behind the shoring.
- Weep holes are not considered an effective drainage system, unless the soil behind the shoring above the dredge line is uniformly free-draining granular material.

d. **Resisting Pressures/Loads:**

i. Passive earth pressure

- The passive earth pressure, P_p, below the excavation line may be computed by Rankine or Log-Spiral theories, but not the Coulomb theory.
- For Log-Spiral theory, the interface friction angle shall not be greater than one-half of the effective friction angle of the soil, or that consistent with published values for specific types of soil in contact with either steel or concrete.
- The passive earth pressure for cohesionless soils (sands, gravels and some silts), uncontrolled fill, and mixed layers of cohesive and cohesionless soil shall be calculated based on the effective friction angle of the soil.
- The passive earth pressure for cohesive (clay and some silts) soils and controlled backfill shall be calculated for the effective stress condition (see Section 3.5d.i for definition), unless the resulting earth pressure for the total stress condition (i.e., S_u) is less.
- For conditions where the slope in front of the shoring slopes down and away from the wall, the slope in front of the wall shall be considered when calculating passive pressure. If the ground in front of the shoring slopes upwards away from the wall, the ground level shall be assumed to be level for analysis.
- For reference, Rankine equations are provided below:

K_P – Passive Earth Pressure Coefficient

σ_{PH} – Horizontal Passive Earth Pressure (lbf/ft^2)

ϕ' – Effective Friction Angle (deg)

c' – Effective cohesion (lbf/ft^2)

S_u – Undrained Shear Strength (lbf/ft^2)

γ – Moist Unit Weight of Soil (lbf/ft^3)

z – Depth Below Ground Surface (ft)

β – Front Slope Angle (deg)

NON-COHESIVE SOILS

Level Frontslope (Rankine)

$$\sigma_{PH} = K_P \gamma z \quad , where \quad K_P = tan^2\left(45 + \frac{\phi'}{2}\right)$$

Sloping Frontslope (Rankine)

- Use only if ground is sloping down and away from shoring (i.e., β is negative)

$$\sigma_{PH} = K_P \gamma z \cos\beta \quad , where \quad K_P = \cos\beta\left(\frac{cos\beta + \sqrt{cos^2\beta - cos^2\phi'}}{cos\beta - \sqrt{cos^2\beta - cos^2\phi'}}\right)$$

COHESIVE SOILS & FRACTURED ROCK

Drained Cohesive & Fractured Rock - Level & Sloping Backslope (Bell's)

$$\sigma_{PH} = K_P \gamma z + 2c'\sqrt{K_P}$$

$$K_P = tan^2\left(45 + \frac{\phi'}{2}\right), For\ Level\ Frontslope$$

$$K_P = \cos\beta\left(\frac{cos\beta + \sqrt{cos^2\beta - cos^2\phi'}}{cos\beta - \sqrt{cos^2\beta - cos^2\phi'}}\right), For\ Sloping\ Frontslope$$

- Effective cohesion shall be assumed to be zero unless local experience by a Licensed Geotechnical Engineer indicates the fully softened strength of the clay will have an effective cohesion greater than zero.
- The passive resistance for fractured rock and intermediate geomaterials (e.g., weak shales, sandstone, etc.) shall be based on either the rock mass effective cohesion and friction angle, or mass shear strength. The mass strength parameters shall be determine using a methodology that accounts for rock type, intact strength, spacing and conditions of joints, rock quality designation (RQD), geological strength index (GSI), and/or rock mass rating (RMR).

Undrained Cohesive – Level Ground (Rankine/Bell)

- Only use undrained when it results in a lower earth pressure in the shoring design. Otherwise use Drained equations above.
- Assumes ϕ=0 and c'=S_u

$$\sigma_{PH} = \gamma z + 2S_u$$

or

$$\sigma_{PH} = K_P \gamma z \quad where \quad K_P = 1 + \frac{2S_u}{\gamma z}$$

- For soldier pile walls, the upper 1.5 pile/shaft diameters of passive resistance in soil below the excavation line shall be ignored per AREMA, Vol. 2, Ch. 8, Article 28.5.3.2.a.
- Allowable arching factors for soldier pile walls shall comply with AREMA, Vol. 2, Ch. 8, Article 28.5.3.2.a.
- As noted in Section 3.1i.ii above, the width of the drilled hole for a soldier pile shall not be assumed to provide passive resistance unless the concrete backfill has a minimum compressive strength of 3,000 psi, and a minimum coverage of at least 3.0 inches between the edge of the pile and drilled hole.
- P-y curve methods shall use a P-multiplier less than 1 to account for group effects on sheet and soldier pile walls when piles are spaced less than 3.5D apart on center, and for slopes in front of the wall.

ii. Seepage pressures on bulkheads and cofferdams.

- Where the imbalance of water levels results in water seeping under the bottom of shoring and upward into the excavation, the seepage pressures on the wall and base of excavation shall be based on flownet or equivalent analyses, and the passive resistance reduced accordingly. See AREMA, Vol. 2, Ch. 8, Article 20.3.5 or FHWA-IF-99-015 Section 5.2.9 for further detail.

3.8 (Step 5) STRUCTURAL DESIGN CALCULATIONS

a. Temporary shoring is defined by AREMA, Vol. 2, Ch. 8, Article 28.1.1, and is anticipated to be in service for not more than an 18-month period. Earth retention structures that are anticipated to be in service for more than 18 months shall be designed per AREMA as permanent structures.

b. Calculations shall be performed for each stage of construction, when one or more rows of braces/tiebacks are being implemented. The calculations shall be performed for each stage of excavation before the braces/tiebacks are installed for that stage.

c. Calculations shall be performed by one of two methods:

   1. Classical Method: A sum of forces and moments analysis whereby driving and resisting pressures are balanced. Driving pressures are applied from the top to the bottom of the back side of the shoring. For braced excavations, Apparent earth pressure will be applied from the top down to the excavation line, and below the excavation line, Active earth pressure will be applied down to the bottom of the shoring on the back side of the shoring. Resisting pressures/forces are applied from the excavation line to the bottom of the front side of the shoring. To achieve an acceptable factor of safety for embedment, the passive resistance will be reduced as required in Section 3.8j.i. It is noted that all AREMA requirements are based on an assumption that the Classical Method will be used for design.
   2. P-y Method: A force-deflection analysis (i.e., Winkler beam analysis) whereby the soil below the excavation line on both sides of the shoring is characterized as springs. Driving earth pressures are generally only applied above the excavation line. However, surcharge loads are generally applied to the bottom of the shoring elements. Minimum embedment is based on the base of the shoring reaching fixity as required in Section 3.8j.i.

d. Calculations shall be in English units. If Metric units are used, all controlling dimensions, elevations, design criteria assumptions, and material stresses shall be expressed in dual units, with English units to be in parentheses.

e. List all assumptions used to design the temporary shoring system, and provide references for equations, tables, figures, and design criteria obtained from design manuals and guidelines.

f. Computerized calculations and programs must clearly indicate the input and output data. List all equations used in determining the output.

g. Example calculations with values must be provided to support computerized output and match the calculated computer result.

h. Provide a simple free body diagram showing all controlling dimensions and applied loads on the temporary shoring system.

i. Documents and manufacturer's recommendations which support the design assumptions must be included with the calculations.

j. **Embedment depth and stability.**

   i. The minimum depth of embedment is that required to balance driving and resisting pressures/loads.

      - The minimum factor of safety for balancing active and passive pressures shall be 1.5 (See AREMA, Vol. 2, Ch. 8, Article 20.5.1.a). The factor of safety is achieved by reducing the passive earth pressure resistance by a factor of 0.67. A calculated factor of safety based on shallow penetration into strong soil layer is not acceptable.
      - Note, some commercially available software packages add ~ 30% length to the embedment computed for moment equilibrium in order to achieve force equilibrium. This additional length added by the software is not the required factor of safety noted above. Additional embedment, beyond the 30% added by the software package, is required to achieve the specified factor of safety.

- The minimum embedment for p-y methods shall be based on both the shoring meeting the deflection limit criteria in Table 2 over the full height of the shoring, and a moment reversal (i.e., moment diagram passes through zero twice) being achieve below the excavation line.

ii. In special circumstances, as indicated in these guidelines, minimum embedment might also be controlled by basal heave or global stability.

- The minimum factor of safety against basal heave shall be 1.5 for temporary structures. See FHWA-IF-99-015, Section 5.8.2 for further details on methodology.
- The minimum factor of safety for global stability shall be 1.3 when using a limit-equilibrium method of slices. (See AREMA, Vol. 2, Ch. 8, Article 20.4.1.c). The global stability analyses shall consider failure surfaces that pass both below and through non-continuous shoring (e.g., soldier piles) located below the dredge line, as well as both through and behind wall anchors. See FHWA IF-99-015, Section 5.7.3 for further details on methodology.
- Global stability shall also be analyzed for slopes steeper than 2(H):1(V) that are above, adjacent or below shoring.

iii. Multiple tiers of shoring should not be used if the active wedge of the lower wall overlies the passive wedge of the upper wall.

- If there is active/passive overlap between tiers of shoring, or the shoring will be supporting an existing retaining wall, the effect of loading of the upper wall/shoring on the lower wall shall be evaluated. This will require estimating the bearing, sliding and/or passive resistance demand of the upper wall, and applying those demands in part or fully to the lower wall. In addition, any loading in front of or behind the upper wall that is not fully supported by the wall, would also need to be applied to the shoring. Lastly, a global stability analysis per Section 3.8j.ii shall be performed to determine the external stability of the multi-tiered wall/shoring system.

k. **Deflection limits**.

i. Calculated total deflections of any part of the temporary shoring system and top of rail elevation shall not exceed the criteria outlined in Table 2 Deflection Criteria. Include the accumulated elastic deflection of all of the wall elements (piles, anchors, lagging, walers, strut/raker restraints, etc.), as well as the deflection due to the passive deflection of the resisting soil mass.

Table 2 - Deflection Criteria

Horizontal distance from shoring to track C/L measured at a right angle from track	Maximum horizontal movement of shoring system	Maximum acceptable horizontal or vertical movement of rail
15’ < S < 18’	3/8”	1/4”
18’ < S < 25’	1/2”	1/4”
S > 25’	1% of shoring height above excavation line	-

ii. Braced excavations should be designed for conditions in which the ground surface on all sides is relatively uniform in elevation. If the ground surface elevation varies significantly from one side of the excavation to the other, the deflection of the higher braced shoring towards the side with lower braced shoring shall be evaluated. This analysis would approximate that required for shoring supported by rakers, where the lower shoring acts as the raker thrust block, such that the passive deflection of the lower shoring is added to the higher shoring deflection and the resulting sum is verified to not exceed the deflection criteria in Table 2.

l. **Strength design.**

i. Shall be performed using the Service Load Design method. Allowable Stresses based on AREMA requirements are as follows:

- Structural Steel Allowable Stress: See AREMA, Vol. 2, Ch. 15, Section 1.4, Table 15-1-11 For common shoring components, generally 0.55 of the yield strength of the steel.
- Sheet Pile Sections: 2/3 of yield strength for steel. (AREMA, Vol. 2, Ch. 8, Article 20.5.7)
- Concrete: 1/3 of Compressive strength. (AREMA, Vol. 2, Ch. 8, Article 20.5.7)
- Anchor Rods: 1/2 of yield strength for steel. (AREMA, Vol. 2, Ch. 8, Article 20.5.7)

ii. AISC allowances for increasing allowable stress due to temporary loading conditions are not acceptable.

iii. Structures and structural members shall be designed to have design strengths at all sections at least equal to the required strengths calculated for the loads and forces in such combinations as stipulated in AREMA, Vol. 2, Ch. 8, Article 2.2.4b, which represents various combinations of loads and forces to which a structure may be subjected. Each part of the structure shall be proportioned for the group loads that are applicable, and the maximum design required shall be used.

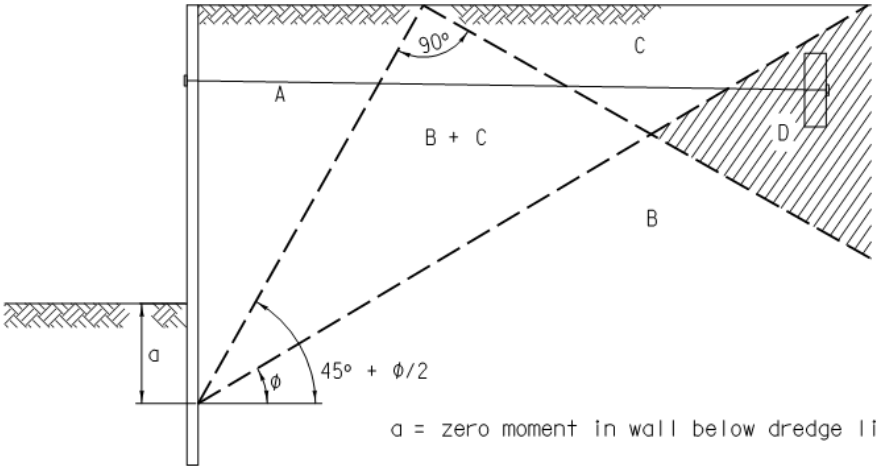
iv. In braced excavations, the connections between struts and wales shall be designed to resist both axial demands as well as the vertical demands from the self-weight of the members and any incidental vertical loads applied during construction.

v. Stiffeners shall be provided at points of bearing concentrated load. (See AREMA Vol. 2, Ch.15, Article 1.7.7).

m. Gravity type temporary shoring systems must also be analyzed for settlement, overturning, sliding, bearing capacity per AREMA, Vol. 2, Ch. 8, Part 5**,** and global stability per the requirements in Section 3.8j.ii.

n. Anchor blocks and deadman for tiebacks shall be designed for a safety factor of 2.0, where safety factor is derived as the ratio of the net passive resistance (passive earth pressure minus active earth pressure) on the anchor block to the load on tie rod. To utilize the full allowable anchor capacity, the minimum length of the tie rod shall be as shown in Figure 4. If site constraints prevent the minimum length of tie rods from being implemented, the anchor capacity shall be reduced as Indicated in Figure 4. For deriving anchor block capacity where minimum tie rod length is achieved, NAVFAC DM7.02 or CalTrans 2011 may be referenced.

i. For sheet and soldier pile deadman, p-y methods may be used. The sum of the estimated deflection of the deadman pile and shoring shall be less than that indicated in Section 3.8k.

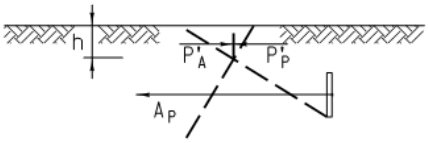


Cohesionless Soil

For Cohesionless soils, anchor resistance in each zone is as follows:

A - No Anchor resistance available

B - Anchor block resistance is reduced by $P'_P - P'_A$



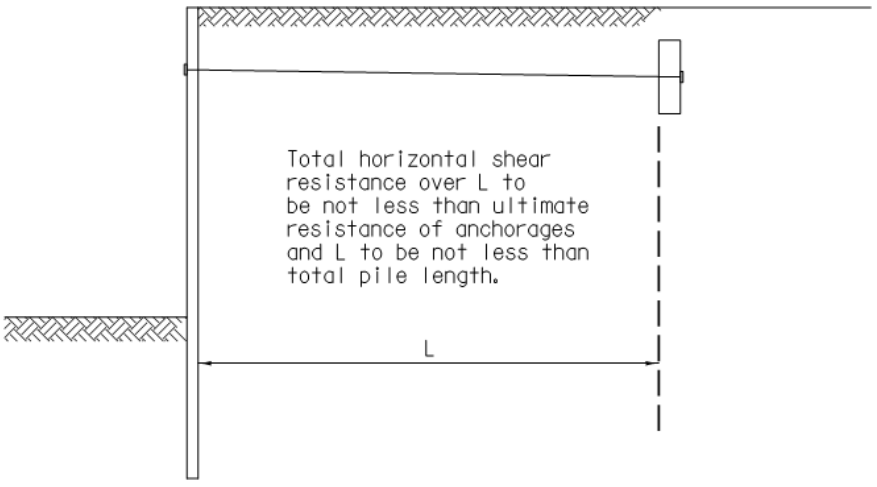
$$P'_P = \frac{1}{2} h^2 \gamma \tan^2\left(45° + \frac{\Phi}{2}\right)$$

$$P'_A = \frac{1}{2} h^2 \gamma \tan^2\left(45° - \frac{\Phi}{2}\right)$$

C - Anchor block achieves full resistance but pressure is increased on the wall by ΔP_P.
(See ΔP_P force diagram in Theoretical Soil Mechanics, pgs. 232-233 or NAVFAC DM7.02, Figure 20)

B + C - Anchor block resistance is reduced by $P'_P - P'_A$ and pressure is increased on the wall by ΔP_P.

D - Anchor block achieves full resistance without adding additional load to the wall



Cohesive Soil or Stratum of Cohesive Extending Below Anchor to Wall (Dismuke, 1991)

FIGURE 4

3.9 DESIGN PLAN REQUIREMENTS

a. Shoring design plans shall be in English units. If Metric units are used, all controlling dimensions, elevations, design criteria assumptions, and material stresses shall be expressed in dual units, with English units to be in parentheses. The shoring plans must completely identify the site constraints and the shoring system, and must be signed and stamped by a Licensed Professional Engineer, registered in the state where the work will be performed. Use the design templates provided in the appendix as an example to show the required information, specifications and drawings. The specific requirements of the plan submittals are as follows:

i. **General plan view should show:**

- Railroad Right-of-Way and North arrow.
- Position of all railroad tracks and identify each track as mainline, siding, spur, etc.
- Spacing between all existing tracks.
- Location of all access roadways, drainage ditches and direction of flow.
- Contours of existing grade elevations.
- Footprint of proposed structure, proposed shoring system and any existing structures if applicable.
- Proposed horizontal construction clearances. The minimum allowable is 15 feet measured at a right angle from centerline of track. 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, per Section 4.4.1.2 of the BNSF-UPRR Guidelines for Railroad Grade Separation Projects.
- Location of existing and proposed utilities.
- Location of soil borings used for design.
- Specifications for all elements of the proposed shoring.
- Detailed view of shoring along with controlling elevations and dimensions.

ii. **Typical sections and elevations perpendicular to adjacent track alignment should show:**

- Top of rail and/or top of tie elevations for all tracks.
- Offset from the outside face of shoring system to the centerline of all tracks at all changes in horizontal alignment.
- All structural components, controlling elevations and dimensions of shoring system.
- All drainage ditches and controlling dimensions.
- All slopes, existing structures and other facilities which may surcharge the shoring system.
- Location of all existing and proposed utilities.
- Total depth of shoring system.
- For shoring with tiebacks/bracing, elevations for each temporary stage of shoring construction.
- The assumed groundwater elevation.
- The extent of the Zone A envelope as it overlies the proposed shoring.

iii. **General notes**

- Design loads to be based on the AREMA manual and Cooper E80 loading.
- Pressure due to embankment surcharges.
- ASTM designation and yield strength for each material.
- Maximum allowable bending stress for structural steel is 0.55Fy.
- Temporary overstress allowances are not acceptable.
- All timber members shall be Douglas Fir grade 2 or better.
- In-situ soil classification.
- Backfill soil classification.
- Soil properties used for design.
- Active and passive soil coefficients.
- Fill and backfill compaction criteria.
- Slopes without shoring shall not be steeper than 2 horizontal to 1 vertical.
- Dredge line elevation.
- Shoring deflection to be calculated and meet Railroad requirements.
- Rail, ground and shoring movement monitoring requirements.

iv. **Miscellaneous:**

- Project name, location, GPS coordinates, track owner, railroad line segment, milepost and subdivision in the title block.
- A detailed construction sequence outlining the installation and removal of the temporary shoring system.
- A description of the tieback installation including

drilling, casing, grouting, stressing information and testing procedures, anchor capacity, type of tendon, anchorage hardware, minimum unbonded lengths, minimum anchor lengths, angle of installation, tieback locations, spacing, and distance below bottom of tie.

- All details for construction of drainage facilities associated with the shoring system shall be clearly indicated.
- Details and descriptions of all shoring system members and connection details.
- Handrail and protective fence details along the excavation.
- Railroad and other “CALL BEFORE YOU DIG” numbers and web sites
- Construction clearance diagram.

4. DEFINITIONS

Access Road:

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

Applicant:

Any party proposing a temporary retaining structure project on Railroad Right-of-Way or other Railroad operating location, regardless of track being active or out of service. Includes all agents working on behalf of the Applicant.

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 licensed 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 / Railroad 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 Track Maintenance Representative (UPRR=MTM, BNSF=RDM):

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 limits of property owned, controlled and/or operated upon 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:

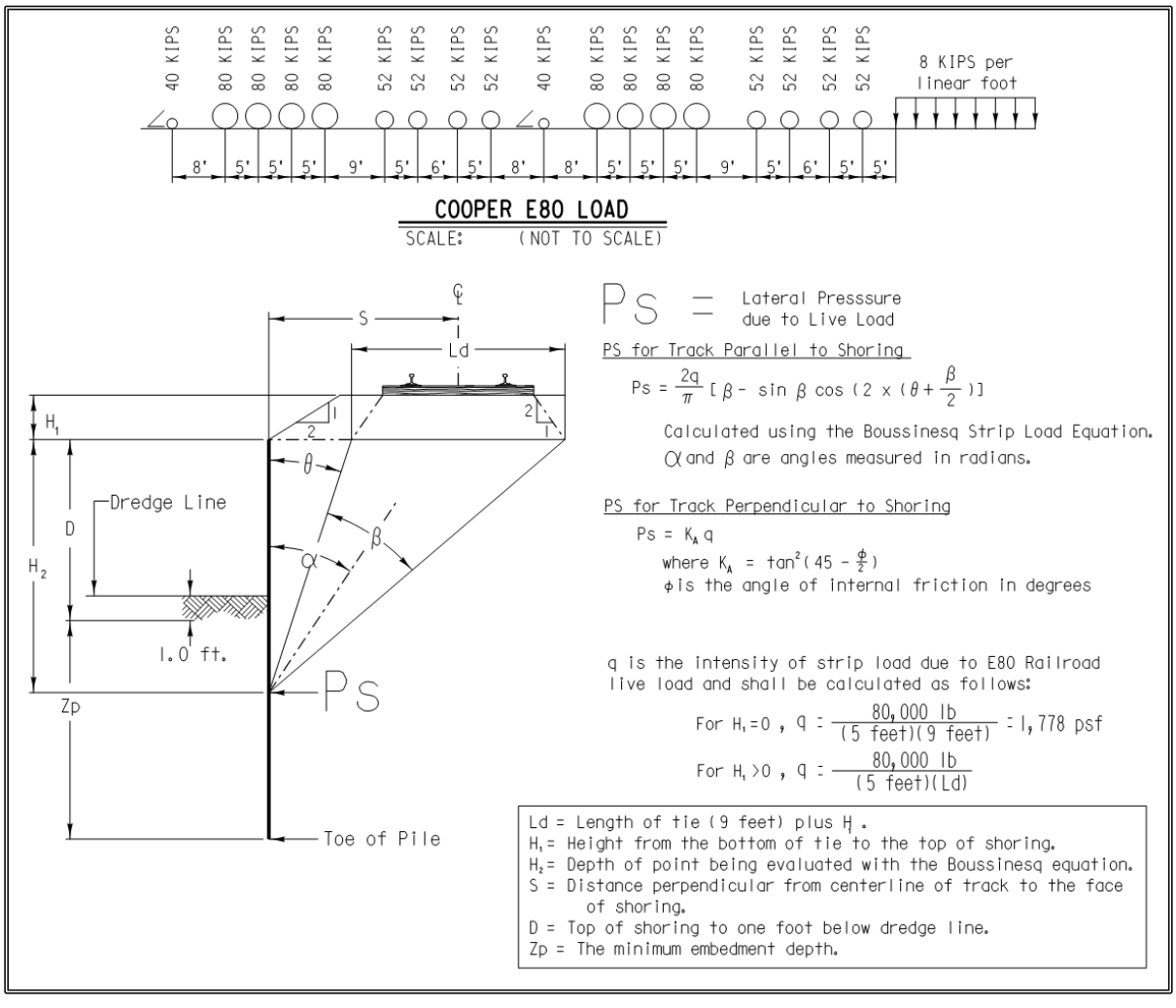
A system of tracks of defined limits, other than main tracks and sidings, for storing and sorting cars and other purposes.

Yard Limits:

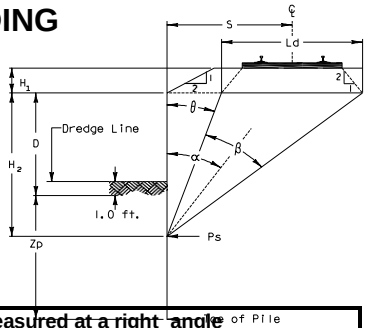
A portion of main track designated by “yard limit” signs and included in the timetable special instructions or a track bulletin.

5. APPENDIX

5.1 LIVE LOAD PRESSURE DUE TO COOPER E80 LOADING



5.2 CHART – LIVE LOAD PRESSURE DUE TO E80 LOADING



This chart identifies the active pressure and resulting forces due to E80 liveload.

1. Select distance S from track centerline to face of shoring.
2. Select depth H_2 below base of tie.
3. Read Ps, M, R and $\bar{Z}$ from the table.
4. Use the procedure outlined in the sample problem to determine values at non-tabulated points.

$$Ps = \frac{2q}{\pi}[\beta - \sin\beta\cos(2\alpha)] \quad \textbf{where q = 1778 psf}$$

Boussinesq surcharge pressure E80 live load for H_1=0

Depth below top of shoring H_2 (ft)	Variables		Horizontal distance (S) from shoring to track CL measured at a right angle									
			12	14	16	18	20	22	24	26	28	30
2	**Ps**	(psf)	**305**	**220**	**166**	**130**	**105**	**86**	**72**	**61**	**53**	**46**
	α	(radians)	1.38	1.41	1.44	1.45	1.47	1.48	1.48	1.49	1.50	1.50
	β	(radians)	0.14	0.10	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02
	z	(ft)	1.32	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33
	M	(ft-lbs/ft)	215	152	114	89	71	58	49	41	36	31
	R	(lbs/ft)	317	226	170	132	106	87	73	62	53	46
4	**Ps**	(psf)	**496**	**381**	**299**	**240**	**197**	**164**	**138**	**118**	**102**	**89**
	α	(radians)	1.21	1.27	1.31	1.34	1.36	1.38	1.40	1.41	1.43	1.44
	β	(radians)	0.25	0.19	0.14	0.11	0.09	0.07	0.06	0.05	0.05	0.04
	z	(ft)	2.59	2.61	2.63	2.64	2.64	2.65	2.65	2.65	2.65	2.66
	M	(ft-lbs/ft)	1,609	1,165	882	692	557	459	384	327	281	244
	R	(lbs/ft)	1,141	840	643	508	411	339	285	242	209	182
6	**Ps**	(psf)	**558**	**461**	**381**	**317**	**266**	**225**	**193**	**167**	**146**	**128**
	α	(radians)	1.06	1.13	1.19	1.23	1.27	1.29	1.32	1.34	1.35	1.37
	β	(radians)	0.33	0.25	0.20	0.16	0.13	0.11	0.09	0.08	0.07	0.06
	z	(ft)	3.77	3.83	3.88	3.90	3.92	3.94	3.95	3.96	3.96	3.97
	M	(ft-lbs/ft)	4,944	3,674	2,830	2,244	1,822	1,508	1,269	1,082	933	813
	R	(lbs/ft)	2,214	1,696	1,332	1,070	877	731	618	529	458	400
8	**Ps**	(psf)	**535**	**476**	**414**	**358**	**309**	**268**	**234**	**205**	**181**	**160**
	α	(radians)	0.94	1.02	1.08	1.13	1.17	1.21	1.24	1.26	1.29	1.30
	β	(radians)	0.37	0.29	0.24	0.19	0.16	0.14	0.12	0.10	0.09	0.08
	z	(ft)	4.84	4.97	5.06	5.11	5.16	5.19	5.21	5.23	5.24	5.26
	M	(ft-lbs/ft)	10,481	8,006	6,286	5,051	4,141	3,452	2,920	2,501	2,165	1,892
	R	(lbs/ft)	3,316	2,641	2,134	1,751	1,456	1,228	1,047	903	786	689
10	**Ps**	(psf)	**474**	**449**	**411**	**370**	**329**	**293**	**260**	**232**	**207**	**186**
	α	(radians)	0.83	0.92	0.99	1.04	1.09	1.13	1.17	1.19	1.22	1.24
	β	(radians)	0.38	0.32	0.26	0.22	0.19	0.16	0.14	0.12	0.10	0.09
	z	(ft)	5.81	6.02	6.16	6.26	6.34	6.39	6.44	6.47	6.50	6.52
	M	(ft-lbs/ft)	18,145	14,227	11,385	9,280	7,689	6,463	5,502	4,736	4,117	3,610
	R	(lbs/ft)	4,328	3,571	2,964	2,482	2,099	1,792	1,544	1,341	1,175	1,037
12	**Ps**	(psf)	**404**	**403**	**386**	**360**	**331**	**302**	**274**	**248**	**225**	**204**
	α	(radians)	0.75	0.83	0.90	0.96	1.01	1.06	1.10	1.13	1.16	1.18
	β	(radians)	0.38	0.33	0.28	0.24	0.20	0.18	0.15	0.13	0.12	0.11
	z	(ft)	6.68	6.97	7.18	7.34	7.46	7.55	7.61	7.67	7.71	7.75
	M	(ft-lbs/ft)	27,703	22,237	18,121	14,980	12,550	10,641	9,121	7,895	6,894	6,068
	R	(lbs/ft)	5,207	4,424	3,763	3,214	2,762	2,389	2,080	1,823	1,608	1,427
14	**Ps**	(psf)	**338**	**351**	**349**	**337**	**319**	**298**	**276**	**255**	**234**	**215**
	α	(radians)	0.68	0.76	0.83	0.89	0.94	0.99	1.03	1.07	1.10	1.13
	β	(radians)	0.38	0.33	0.28	0.25	0.22	0.19	0.17	0.15	0.13	0.12
	z	(ft)	7.46	7.85	8.13	8.35	8.51	8.64	8.74	8.82	8.89	8.94
	M	(ft-lbs/ft)	38,880	31,856	26,395	22,116	18,729	16,021	13,831	12,043	10,568	9,339
	R	(lbs/ft)	5,948	5,178	4,499	3,913	3,414	2,990	2,631	2,327	2,068	1,847
16	**Ps**	(psf)	**280**	**301**	**310**	**308**	**300**	**286**	**271**	**254**	**237**	**220**
	α	(radians)	0.62	0.70	0.77	0.83	0.88	0.93	0.97	1.01	1.04	1.07
	β	(radians)	0.36	0.32	0.28	0.25	0.22	0.20	0.18	0.16	0.14	0.13
	z	(ft)	8.17	8.64	9.01	9.29	9.51	9.68	9.82	9.93	10.03	10.10
	M	(ft-lbs/ft)	51,411	42,880	36,066	30,598	26,183	22,590	19,644	17,207	15,175	13,468
	R	(lbs/ft)	6,563	5,829	5,158	4,560	4,034	3,576	3,179	2,837	2,540	2,284

Continued

Depth below top of shoring H_2 (ft)	Variables		Horizontal distance (S) from shoring to track CL measured at a right angle									
			12	14	16	18	20	22	24	26	28	30
18	**Ps**	(psf)	**231**	**256**	**271**	**277**	**276**	**269**	**259**	**247**	**234**	**220**
	α	(radians)	0.57	0.64	0.71	0.77	0.82	0.87	0.92	0.96	0.99	1.02
	β	(radians)	0.35	0.31	0.28	0.25	0.23	0.20	0.18	0.16	0.15	0.13
	z	(ft)	8.80	9.37	9.81	10.16	10.44	10.67	10.85	11.00	11.12	11.22
	M	(ft-lbs/ft)	65,062	55,110	46,976	40,313	34,834	30,304	26,536	23,384	20,728	18,477
	R	(lbs/ft)	7,072	6,386	5,739	5,145	4,609	4,132	3,710	3,338	3,012	2,725
20	**Ps**	(psf)	**191**	**217**	**236**	**246**	**250**	**249**	**244**	**237**	**227**	**217**
	α	(radians)	0.52	0.59	0.66	0.72	0.77	0.82	0.87	0.91	0.94	0.98
	β	(radians)	0.33	0.30	0.28	0.25	0.23	0.21	0.19	0.17	0.15	0.14
	z	(ft)	9.37	10.03	10.56	10.98	11.32	11.59	11.82	12.01	12.16	12.30
	M	(ft-lbs/ft)	79,641	68,368	58,973	51,137	44,586	39,093	34,465	30,548	27,216	24,367
	R	(lbs/ft)	7,493	6,859	6,245	5,668	5,135	4,651	4,214	3,822	3,474	3,163
22	**Ps**	(psf)	**159**	**184**	**204**	**217**	**225**	**228**	**227**	**223**	**217**	**210**
	α	(radians)	0.49	0.55	0.62	0.67	0.73	0.77	0.82	0.86	0.90	0.93
	β	(radians)	0.31	0.29	0.27	0.25	0.23	0.21	0.19	0.17	0.16	0.14
	z	(ft)	9.89	10.64	11.24	11.73	12.14	12.47	12.74	12.97	13.17	13.33
	M	(ft-lbs/ft)	94,986	82,497	71,913	62,945	55,341	48,878	43,370	38,658	34,611	31,122
	R	(lbs/ft)	7,842	7,260	6,684	6,131	5,611	5,128	4,685	4,283	3,918	3,590
24	**Ps**	(psf)	**133**	**157**	**176**	**191**	**202**	**207**	**210**	**209**	**206**	**201**
	α	(radians)	0.45	0.52	0.58	0.63	0.68	0.73	0.78	0.82	0.85	0.89
	β	(radians)	0.30	0.28	0.26	0.24	0.22	0.20	0.19	0.17	0.16	0.15
	z	(ft)	10.35	11.19	11.87	12.44	12.90	13.29	13.62	13.89	14.13	14.32
	M	(ft-lbs/ft)	110,969	97,366	85,670	75,625	66,997	59,577	53,183	47,661	42,875	38,716
	R	(lbs/ft)	8,132	7,600	7,064	6,540	6,037	5,564	5,122	4,715	4,342	4,001
26	**Ps**	(psf)	**112**	**134**	**153**	**168**	**180**	**188**	**192**	**194**	**193**	**191**
	α	(radians)	0.42	0.48	0.54	0.60	0.65	0.69	0.74	0.78	0.82	0.85
	β	(radians)	0.28	0.27	0.25	0.23	0.22	0.20	0.19	0.17	0.16	0.15
	z	(ft)	10.78	11.69	12.45	13.09	13.62	14.07	14.44	14.77	15.04	15.28
	M	(ft-lbs/ft)	127,485	112,863	100,135	89,071	79,460	71,105	63,836	57,499	51,963	47,113
	R	(lbs/ft)	8,376	7,890	7,393	6,899	6,418	5,959	5,524	5,118	4,741	4,393
28	**Ps**	(psf)	**94**	**114**	**132**	**148**	**160**	**169**	**175**	**179**	**180**	**180**
	α	(radians)	0.40	0.46	0.51	0.56	0.61	0.66	0.70	0.74	0.78	0.81
	β	(radians)	0.27	0.26	0.24	0.23	0.21	0.20	0.19	0.17	0.16	0.15
	z	(ft)	11.17	12.16	12.99	13.70	14.29	14.80	15.23	15.60	15.91	16.19
	M	(ft-lbs/ft)	144,448	128,896	115,211	103,191	92,642	83,385	75,258	68,113	61,823	56,274
	R	(lbs/ft)	8,581	8,137	7,677	7,214	6,758	6,315	5,892	5,491	5,115	4,764
30	**Ps**	(psf)	**80**	**98**	**115**	**130**	**142**	**152**	**160**	**165**	**167**	**168**
	α	(radians)	0.37	0.43	0.48	0.53	0.58	0.63	0.67	0.71	0.74	0.78
	β	(radians)	0.26	0.25	0.23	0.22	0.21	0.20	0.18	0.17	0.16	0.15
	z	(ft)	11.52	12.59	13.49	14.26	14.92	15.48	15.97	16.38	16.75	17.06
	M	(ft-lbs/ft)	161,789	145,388	130,819	117,903	106,466	96,343	87,381	79,443	72,404	66,153
	R	(lbs/ft)	8,755	8,349	7,925	7,492	7,060	6,636	6,227	5,834	5,462	5,112
32	**Ps**	(psf)	**69**	**85**	**101**	**115**	**127**	**137**	**145**	**151**	**155**	**157**
	α	(radians)	0.35	0.41	0.46	0.51	0.55	0.60	0.64	0.68	0.71	0.75
	β	(radians)	0.25	0.24	0.22	0.21	0.20	0.19	0.18	0.17	0.16	0.15
	z	(ft)	11.85	12.98	13.95	14.79	15.51	16.13	16.67	17.13	17.54	17.89
	M	(ft-lbs/ft)	179,452	162,274	146,888	133,136	120,859	109,909	100,144	91,432	83,655	76,706
	R	(lbs/ft)	8,904	8,532	8,140	7,736	7,329	6,925	6,531	6,150	5,785	5,438

5.3 TABLES FOR SOIL SPECIFICATIONS

Table 8-20-1. Granular Soils

Descriptive Term for Relative Density	Standard Penetration Test Blows per Foot "N"
Very Loose	0 – 4
Loose	4 – 10
Medium	10 – 30
Dense	30 – 50
Very Dense	Over 50

Table 8-20-2. Silt and Clay Soils

Descriptive Term for Consistency	Unconfined Compressive Strength Tons per Square Foot
Very Soft	Less than 0.25
Soft	0.25 – 0.50
Medium	0.50 – 1.00
Stiff	1.00 – 2.00
Very Stiff	2.00 – 4.00
Hard	Over 4.00

Table 8-20-3. Unit Weights of Soils, and Coefficients of Earth Pressure

Type of Soil	Unit Weight of Moist Soil, γ (Note 1)		Unit Weight of Submerged Soil, γ' (Note 1)		Coefficient of Active Earth Pressure, K_a				Coefficient of Passive Earth Pressure, K_p		
					For Backfill	For Soils in Place	Friction Angles (Note 2)		For Soils in Place	Friction Angles (Note 2)	
	Minimum	Maximum	Minimum	Maximum			ϕ	δ		ϕ	δ
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Clean Sand:											
Dense	110	140	65	78		0.20	38	20	9.0	38	25
Medium	110	130	60	68		0.25	34	17	7.0	34	23
Loose	90	125	56	63	0.35	0.30	30	15	5.0	30	20
Silty Sand:											
Dense	110	150	70	88		0.25			7.0		
Medium	95	130	60	68		0.30			5.0		
Loose	80	125	50	63	0.50	0.35			3.0		
Silt and Clay (Note 3)	$\frac{165(1+w)}{1+2.65w}$		$\frac{103}{1+2.65w}$		1.00	$1-\frac{q_u}{\bar{p}+\gamma z}$			$1+\frac{q_u}{\bar{p}+\gamma z}$		

Note 1: In pounds per cubic foot.

Note 2: These angles, expressed in degrees, are ϕ, the angle of internal friction, and δ, the angle of wall friction, and are used in estimating the coefficients under which they are listed.

Note 3: The symbol γ represents γ or γ', whichever is applicable; $\bar{p}$ is the effective unit pressure on the top surface of the stratum; q_u is the unconfined compressive strength; w is the natural water content, in percentage of dry weight; and z is the depth below the top surface of the stratum.

6. REFERENCES

a. The following list of references used in these guidelines are placed here in alphabetical order for your convenience.

i. AREMA Manual for Railway Engineering, 2019, American Railway Engineering and Maintenance-of-Way Association.

ii. Clough and Duncan, 1991, “Earth Pressures,” Foundation Engineering Handbook, 2nd Edition, Fang, Chapter 6.

iii. CalTrans Trenching and Shoring Manual, 2011, Revision 1, State of California Department of Transportation, Office of Structures Construction.

iv. Dismuke, T.D., 1991, “Retaining Structures and Excavations,” Foundation Engineering Handbook, 2nd Edition, Fang, Chapter 12.

v. FHWA-IF-99-015, Geotechnical Engineering Circular 4, Ground Anchors and Anchored Systems, June 1999, Federal Highway Administration, Office of Bridge Technology.

vi. Henkel, D. J., 1971, "The Calculation of Earth Pressures in Open Cuts in Soft Clays.” The Arup Journal, Vol. 6, No. 4, pp. 14-15.

vii. NAVFAC DM7.02, Foundations and Earth Structures, September 1986, Department of the Navy, Naval Facilities Engineering Command.

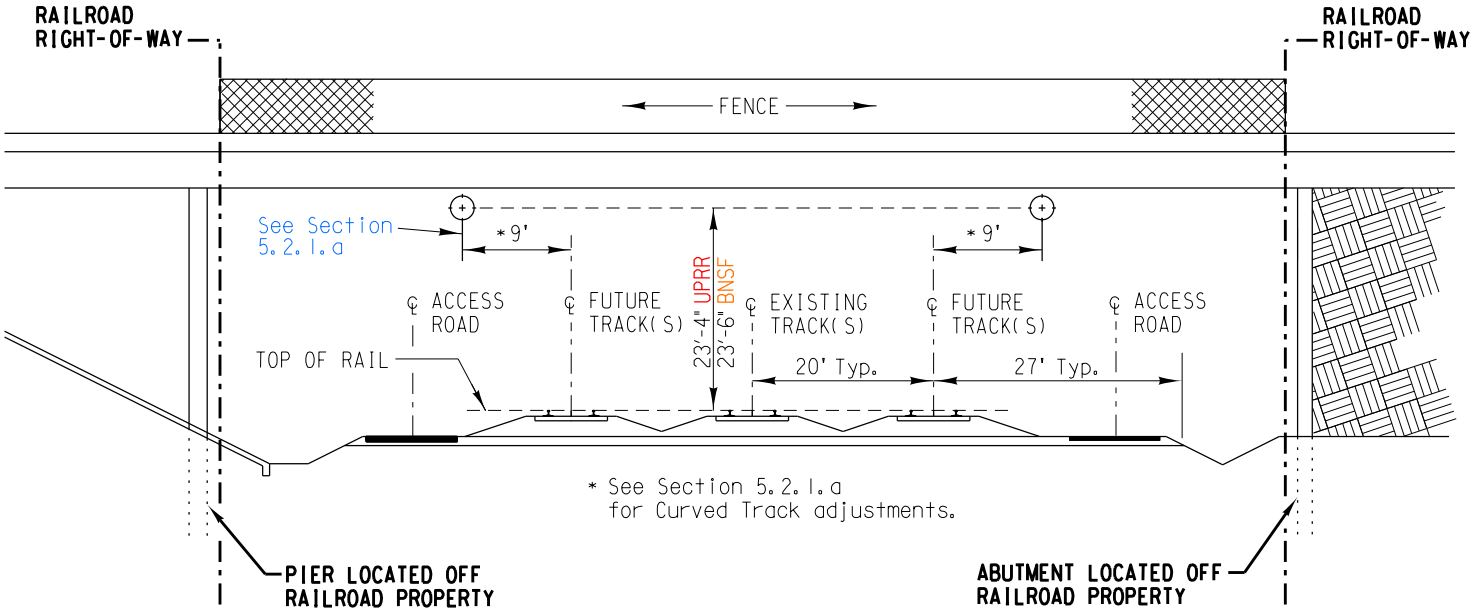
viii. Terzaghi, K., 1943, Theoretical Soil Mechanics, John Wiley & Sons, Inc., New York, NY.

C-3

BNSF – UPRR JOINT GUIDELINES FOR RAILROAD GRADE SEPARATION PROJECTS

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

FILE OWNER: UPRR	DATE: 1/05/16
AUTHORED BY: R. FRIESEN	CHECKED BY: A. HURST

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APPENDIX

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 it's 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 ± ½".
m. The area around all lifting loops shall be recessed so that the loops can be removed to a depth of ¾" 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

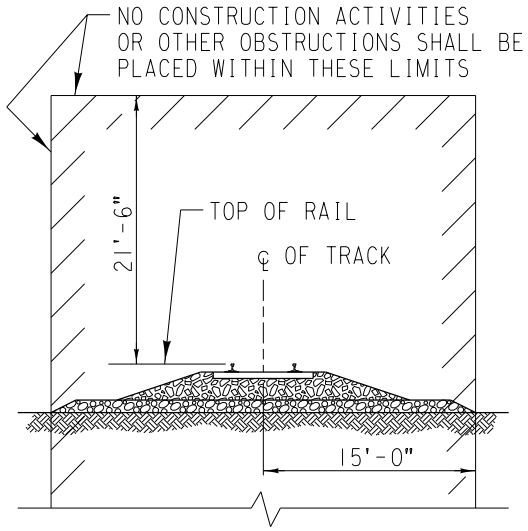
a. The Applicant shall specify the appropriate fencing to contain the Trail traffic within the Trail, crossing the Railroad right-of-way. Fence limits are subject to each project site and must be determined on a case by case basis. Refer to Section 4.7 for fence requirements.
b. Fencing shall be located 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)

DESIGN BY: RAF	CHECKED BY: AMH

APPROVED:

Rick Friesen

UPRR - SENIOR MANAGER STRUCTURES DESIGN

Austin M Hurst

BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN

BRIDGE STANDARDS

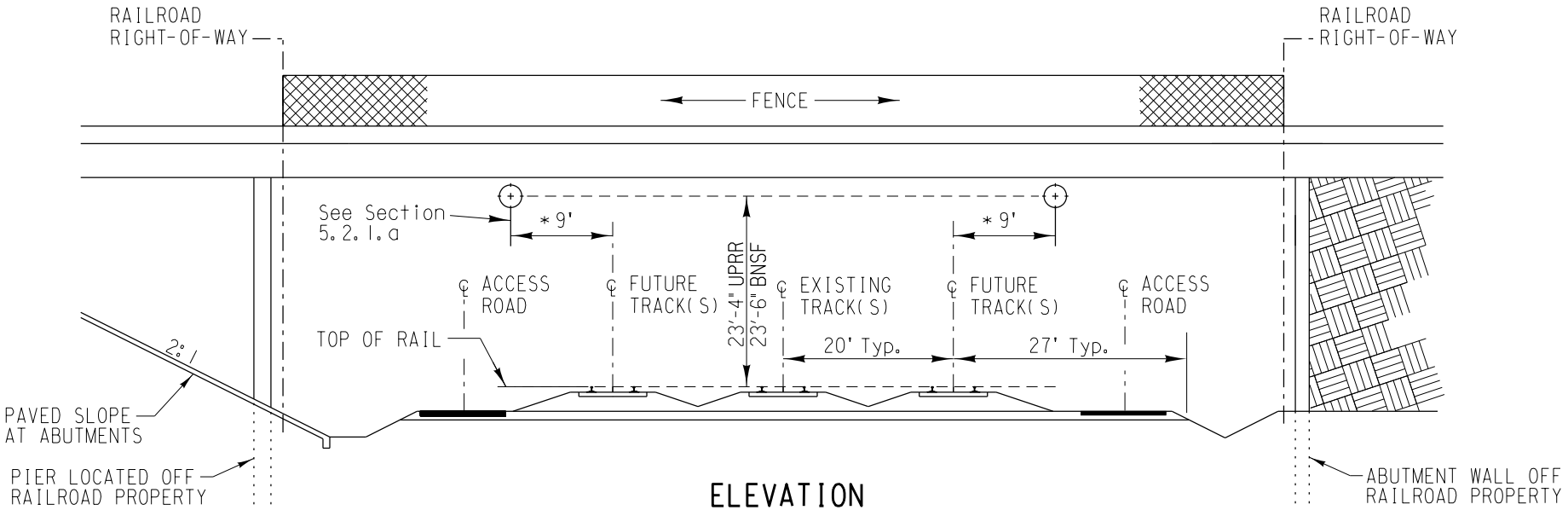
GRADE SEPARATION GUIDELINES

TEMPORARY CLEARANCE ENVELOPE

FILE OWNER: UPRR	DATE: 1/05/16
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.

DESIGN BY: RAF	CHECKED BY: AMH

APPROVED:

Rick Friesen
UPRR - SENIOR MANAGER STRUCTURES DESIGN

Austin M Hurst
BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN

UNION PACIFIC

BNSF RAILWAY

BRIDGE STANDARDS

GRADE SEPARATION GUIDELINES

GENERAL OVERHEAD STRUCTURE DRAWING

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

PLOTTED: 5/12/2016 9:14:06 AM

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 minumum 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 goundline & 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.

DESIGN BY: RAF	CHECKED BY: AMH

APPROVED:

Rick Friesen

UPRR - SENIOR MANAGER STRUCTURES DESIGN

Austin M Hurst

BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN

UNION PACIFIC

BNSF RAILWAY

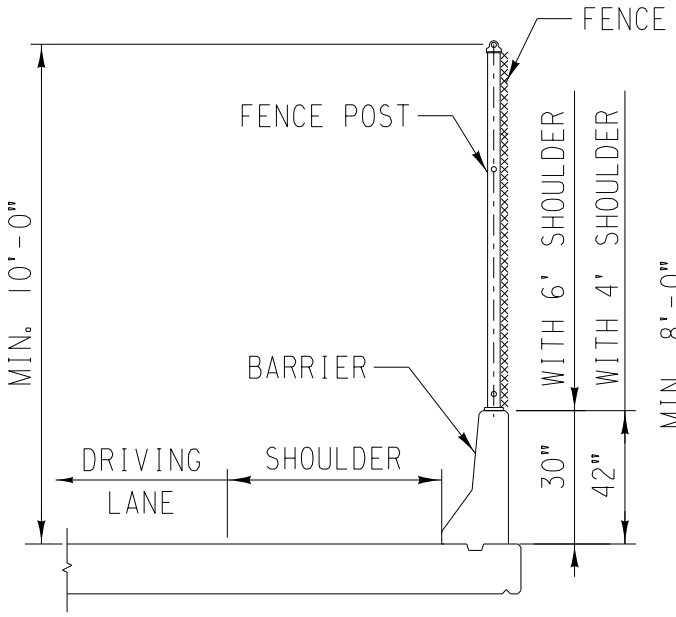
BRIDGE STANDARDS

GRADE SEPARATION GUIDELINES

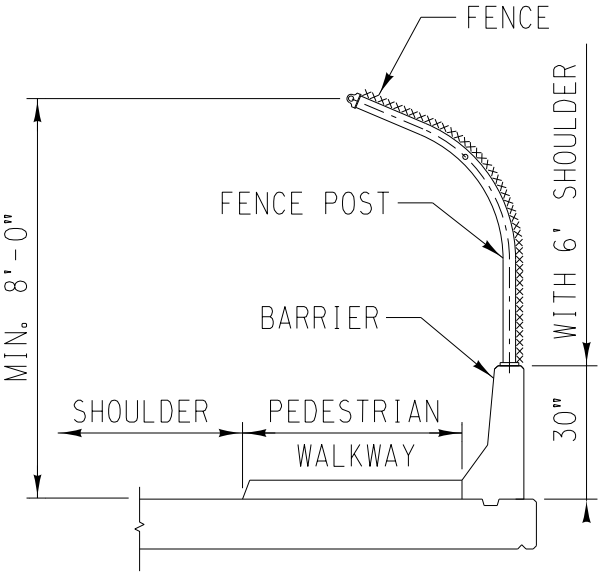
MINIMUM LAYOUT REQUIREMENTS FOR OVERHEAD STRUCTURES

FILE OWNER: UPRR	DATE: 1/05/16
PLAN NO.: 711100	SHEET: 2

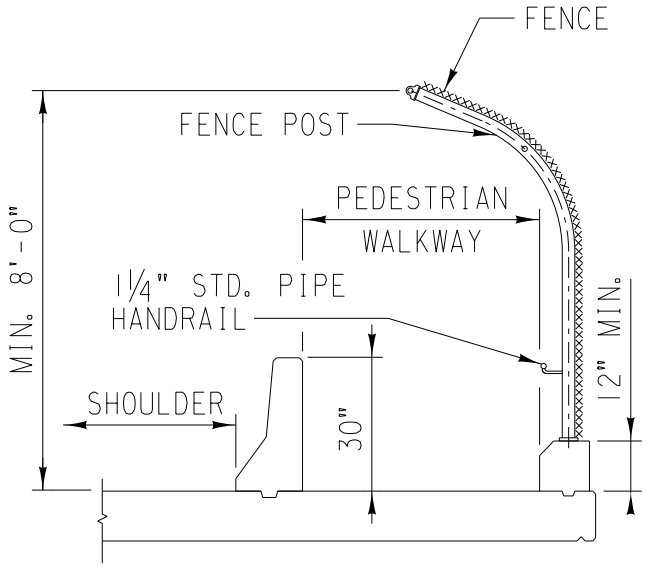
PLOTTED: 5/12/2016 9:14:06 AM



FENCE ON BARRIER



WALKWAY FENCE ON BARRIER



WALKWAY FENCE ON CURB WITH BARRIER

DESIGN BY: RAF	CHECKED BY: AMH

APPROVED:

Rick Friesen
UPRR - SENIOR MANAGER STRUCTURES DESIGN

Austin M Hurst
BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN

BRIDGE STANDARDS

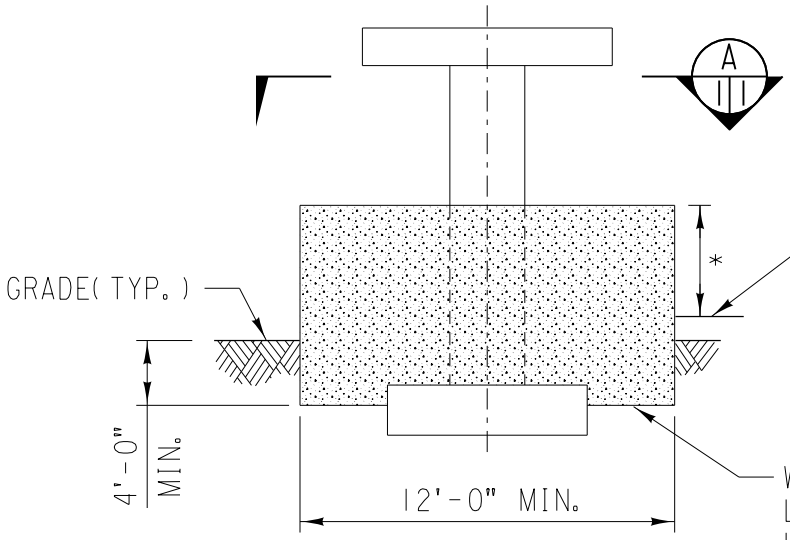
GRADE SEPARATION GUIDELINES

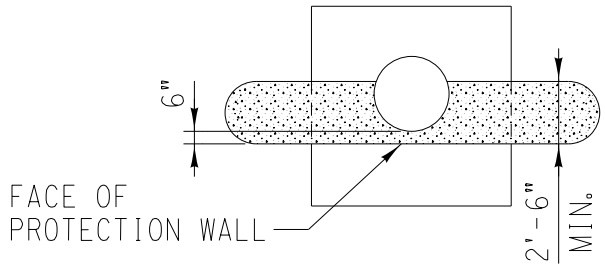
OVERHEAD STRUCTURE BARRIERS AND FENCES

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

PLOTTED: 5/12/2016 9:14:06 AM

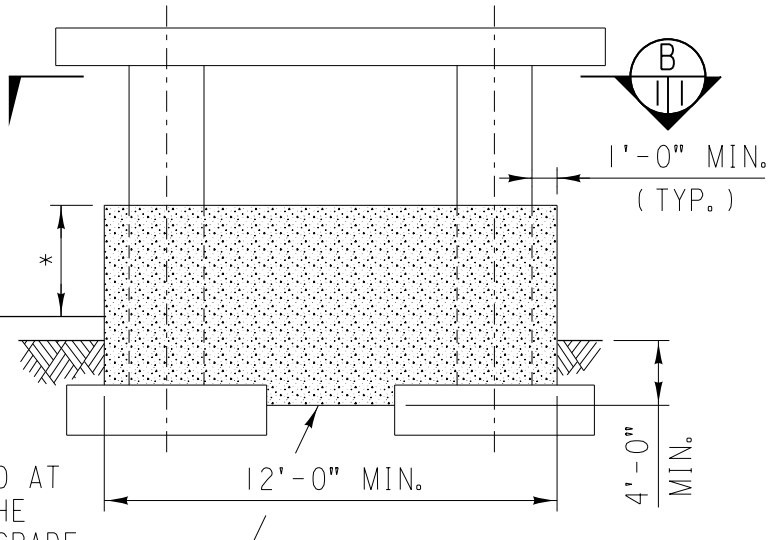
SINGLE COLUMN DESIGN

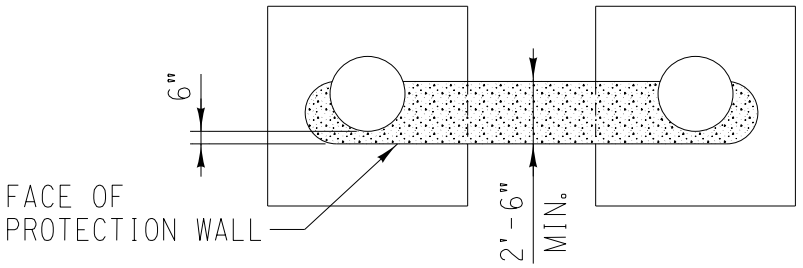




SECTION A
SCALE: 1/8"=1'-0"

MULTI-COLUMN DESIGN





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。

DESIGN BY: RAF	CHECKED BY: AMH

APPROVED:

Rick Friesen
UPRR - SENIOR MANAGER STRUCTURES DESIGN

Austin M Hurst
BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN

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BNSF RAILWAY

BRIDGE STANDARDS

GRADE SEPARATION GUIDELINES

STANDARDS FOR PIER PROTECTION WALLS

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

PLOTTED: 5/12/2016 9:14:07 AM

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.

DESIGN BY: RAF	CHECKED BY: AMH

APPROVED:

Rick Friesen

UPRR - SENIOR MANAGER STRUCTURES DESIGN

Austin M Hurst

BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN

UNION PACIFIC

BNSF RAILWAY

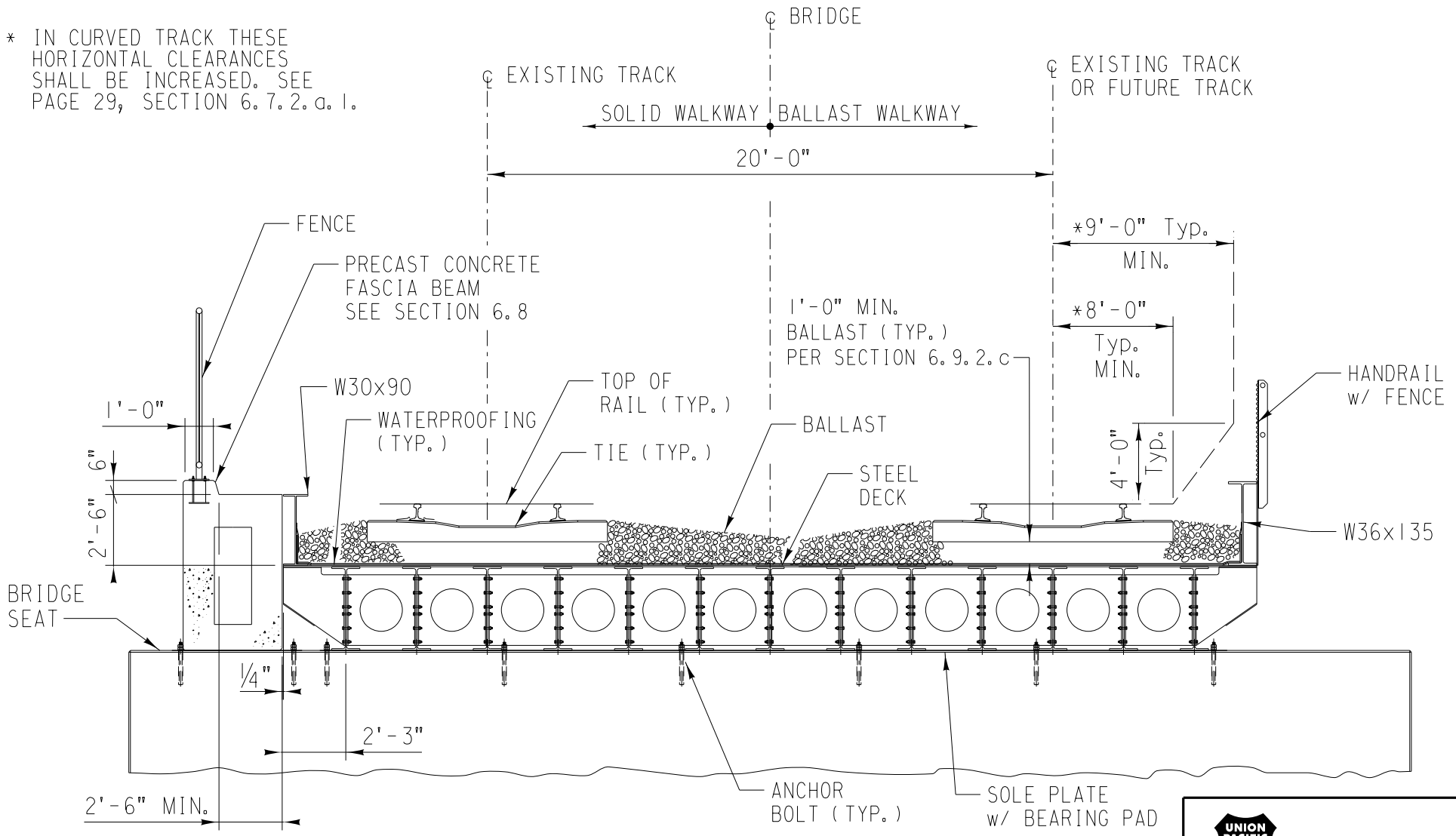
BRIDGE STANDARDS

GRADE SEPARATION GUIDELINES

MINIMUM LAYOUT REQUIREMENTS FOR UNDERPASS STRUCTURES

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

PLOTTED: 5/12/2016 9:14:07 AM



DESIGN BY: RAF	CHECKED BY: AMH

APPROVED:

Rick Friesen
UPRR - SENIOR MANAGER STRUCTURES DESIGN

Austin M Hurst
BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN

UNION PACIFIC

BNSF RAILWAY

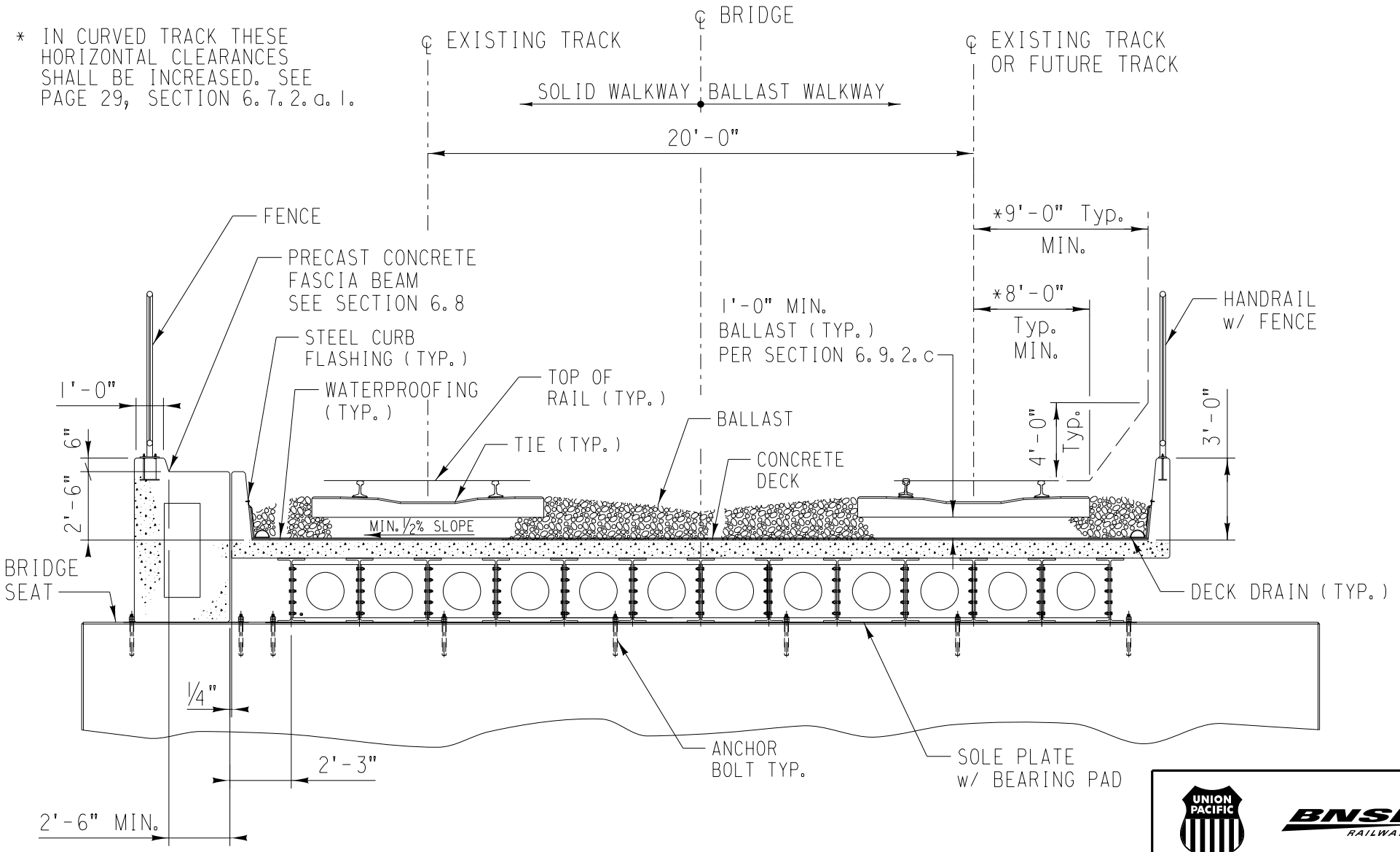
BRIDGE STANDARDS

GRADE SEPARATION GUIDELINES

ROLLED BEAMS w/ STEEL PLATE DECK

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

PLOTTED: 5/12/2016 9:14:08 AM



DESIGN BY: RAF	CHECKED BY: AMH

APPROVED:

Rick Friesen
UPRR - SENIOR MANAGER STRUCTURES DESIGN

Austin M Hurst
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UNION PACIFIC

BNSF RAILWAY

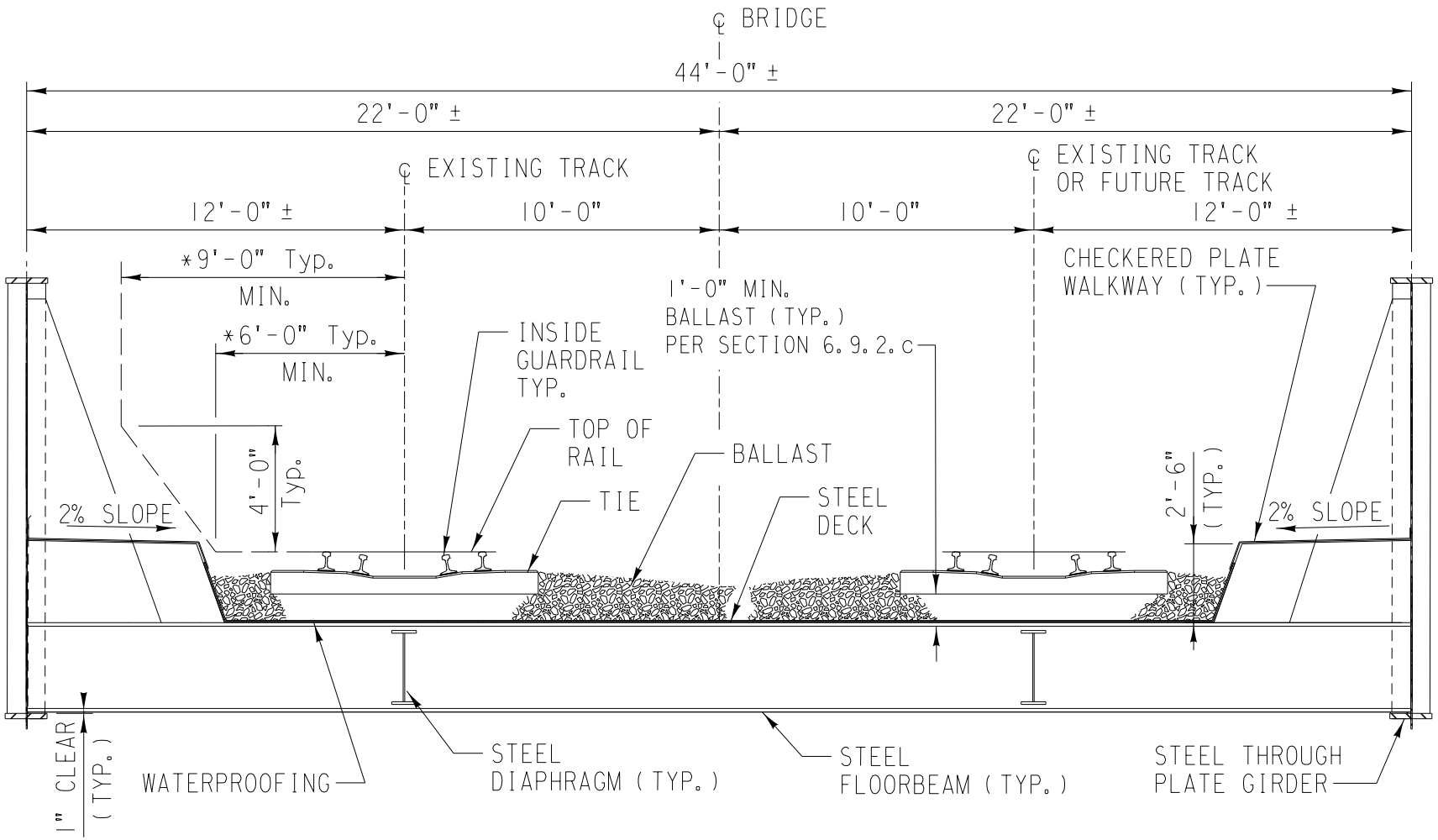
BRIDGE STANDARDS

GRADE SEPARATION GUIDELINES

ROLLED BEAMS w/ CONCRETE DECK

FILE OWNER: UPRR	DATE: 1/05/16
PLAN NO.: 711200	SHEET: 3

PLOTTED: 5/12/2016 9:14:08 AM



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

DESIGN BY: RAF	CHECKED BY: AMH

APPROVED:

Rick Friesen
UPRR - SENIOR MANAGER STRUCTURES DESIGN

Austin M Hurst
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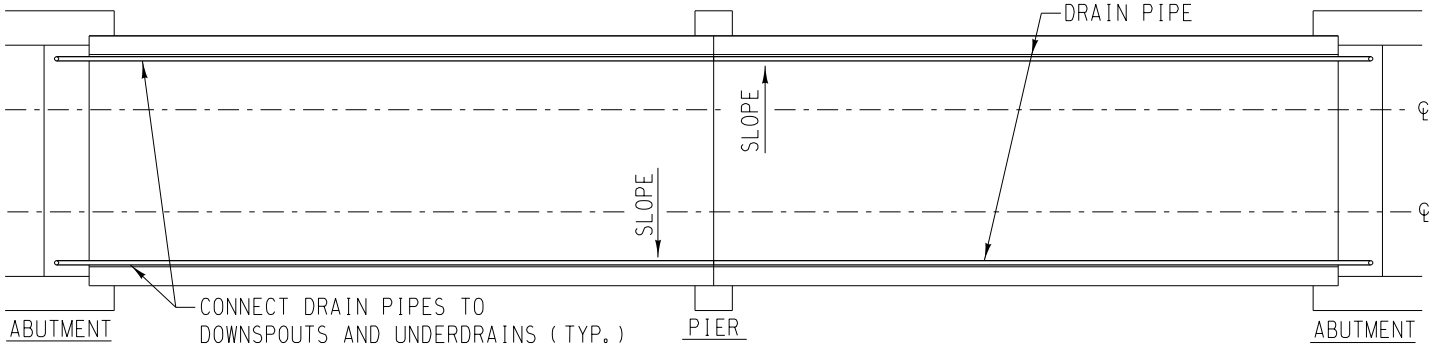
BRIDGE STANDARDS

GRADE SEPARATION GUIDELINES

STEEL THROUGH PLATE GIRDERS w/ STEEL PLATE DECK

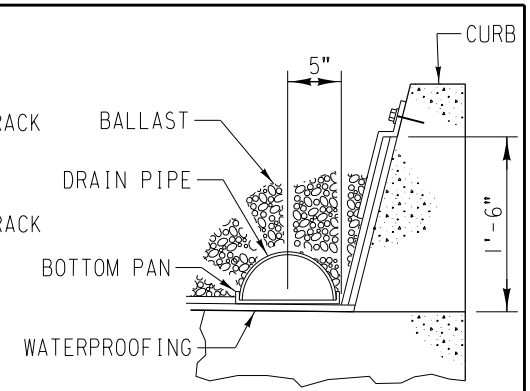
FILE OWNER: UPRR	DATE: 1/05/16
PLAN NO.: 711200	SHEET: 4

PLOTTED: 5/12/2016 9:14:08 AM



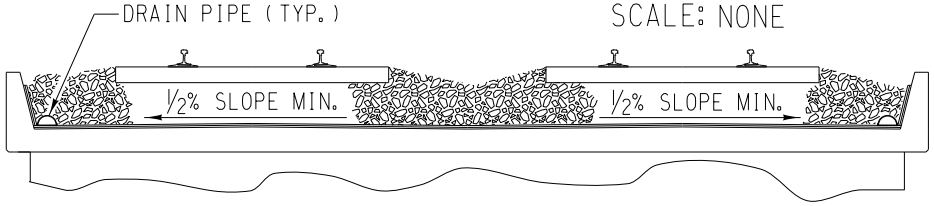
DECK PLAN

SCALE: NONE



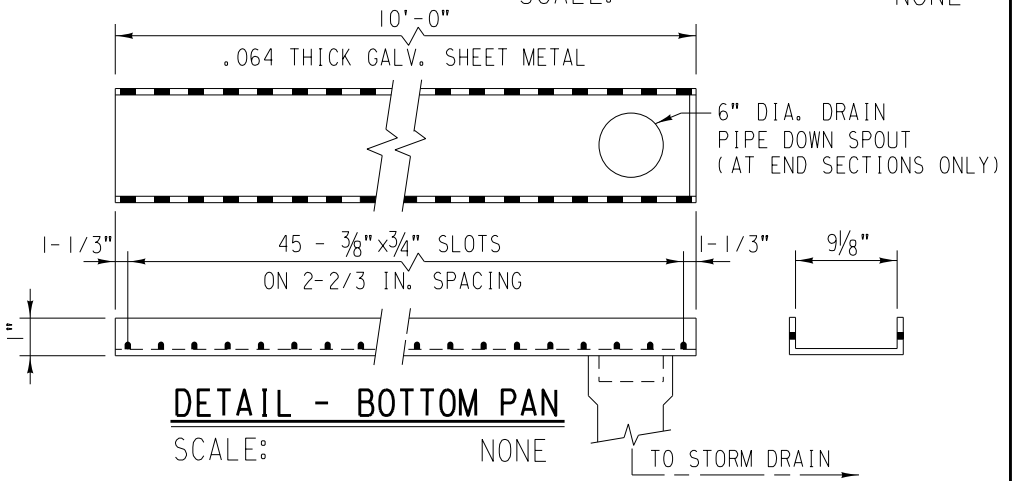
LOCATION OF DRAIN PIPE

SCALE: NONE



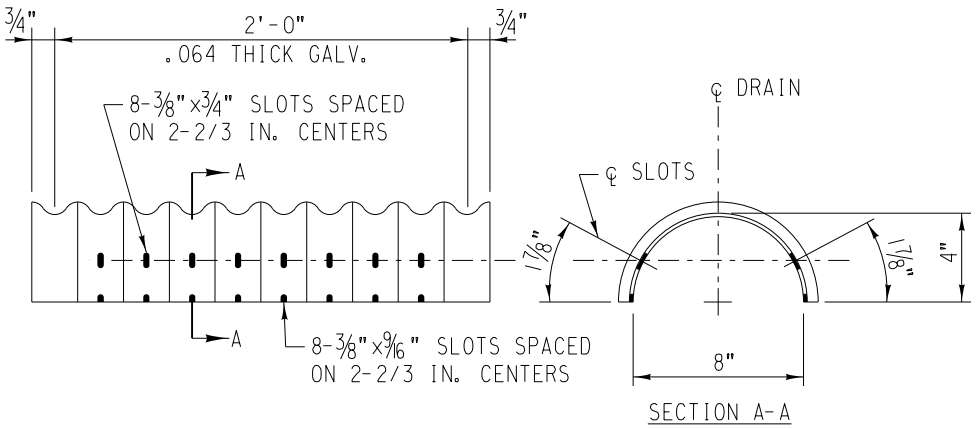
TYPICAL DECK SECTION

SCALE: NONE



DETAIL - BOTTOM PAN

SCALE: NONE



DETAIL - DRAIN PIPE

SCALE: NONE

NOTE: LAP DRAIN PIPE ONE CORRUGATION AT EACH END.

DESIGN BY: RAF	CHECKED BY: AMH

APPROVED:

Rick Friesen

UPRR - SENIOR MANAGER STRUCTURES DESIGN

Austin M Hurst

BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN

UNION PACIFIC

BNSF RAILWAY

BRIDGE STANDARDS

GRADE SEPARATION GUIDELINES

CAST-IN-PLACE CONCRETE DECK DRAIN DETAILS

FILE OWNER: UPRR	DATE: 1/05/16
PLAN NO.: 711200	SHEET: 5

PLOTTED: 5/12/2016 9:14:08 AM

D-1

BNSF REVIEW COMMENT SHEET EXAMPLE

Version Dated 2017-11-06

No Comment / All Items CLOSED* ☐

Submittal Essentials in RED **

MPP Review Items; KC Structures Review Items

BNSF Engineering Services-Structures Review Comments

Grade Separation (OH Design) Review Comments Sheet

Check for compliance with current AREMA and Union Pacific - BNSF Guidelines for Railroad Grade Separation Projects

Project Name:		BNSF Point of Contact:	
Submittal Name:		Project CM Contact:	
Plan File Name:		Asset MP Name:	
Plan File Date:		Plan %:	

Horizontal Clearance
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Clearance for Future Track(s) (Input from Cap Planning; Left / Right?)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

BNSF MP & Direction of Increasing MP on Plan View
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Track Geometry (Curves, run off, grades, track spacing, etc.)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Vertical Clearance
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Fence / Barrier Rail (Shoulder width, height, limits w/ respect to tracks)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Temporary Horizontal Clearance (Includes Falsework)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Temporary Vertical Clearance (Includes Falsework)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

TOR Elevations at All Tracks
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Clearance for Access Road (Input from Division on Need)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

RR Track Profile (1000' Either direction on all Existing and Future Tracks)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

ROW Limits Shown (all piers should be off of BNSF ROW if possible)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Drainage – Diverted away from BNSF ROW & Drain Locations
☐No Exceptions Taken ☐ Comments Below ☐ N/A

2:1 Slopes w/ Type / limits of Paving
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Depth of Foundations from TOT Dimensioned
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Ditches Shown and Drainage Path Indicated
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Impacts to signal, telecom, etc.
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Width of Superstructure & Depth Dimensioned on Section View
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Piers on BNSF ROW (Check Pier Protection Requirements)
☐ > 25' to CL ☐ ≤ 25' to CL ☐ ≤ 12' to CL

Splice Locations Shown w/ respect to tracks
☐No Exceptions Taken ☐ Comments Below ☐ N/A

MSE Walls
☐None Proposed ☐ Off BNSF ROW ☐ Crash-Protected

Item No.	Sheet No.	Reviewer Comment Date:	Initial	Designer's Response Date:	Reviewer's Comment Date:	Initial	Designer's Response Date:	Reviewer's Comment Date:	Initial	Designer's Response Date:	Reviewer's Comment Date:	Initial	Status (Open or Closed
1.													
2.													
3.													
4.													
5.													
6.													
7.													

*BNSF has reviewed these submittals and no exceptions are taken with regard to BNSF's ability to use or accommodate the project as intended. BNSF has not reviewed the design details or calculations for structural integrity or engineering accuracy. BNSF accepts no responsibility for errors or omissions in the design or execution of the project.

**** Check Submittal Essentials prior to transmittal to Structures Review. If not included, Project Engineer to reject and request resubmittal.**

Version Dated 2017-11-06

No Comment / All Items CLOSED* ☐

Submittal Essentials in RED **

MPP Review Items; KC Structures Review Items

BNSF Engineering Services-Structures Review Comments

Grade Separation (Underpass Design) Review Comments Sheet

Check for compliance with current AREMA and Union Pacific - BNSF Guidelines for Railroad Grade Separation Projects

Project Name:		BNSF Point of Contact:	
Submittal Name:		Project CM Contact:	
Plan File Name:		Asset MP Name:	
Plan File Date:		Plan %:	

Spans, abutments & Piers Numbered low to high MP
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Geotechnical Report Provided and Boring Location(s) Near Bridge on GP&E
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Individual Span Types/Lengths & Total BR Length face to face backwalls
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Distance from CL tracks to Handrail / Fence (Section View) & AREMA Clearance
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Track Geometry & Spacing (Curves, run off, grades, track spacing, etc.) - labels
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Skew Angles (Substructure & Bridge w/ respect to CL Roadway)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Vertical Clearance from Roadway to Bridge
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Foundation Depth Below Roadway (Elevation View)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Timetable direction arrows, nearest and ending stations, increasing MP shown
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Profile Grade of Bridge – Include TOR Elevations at Ends
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Show BNSF ROW & Fence Limits & Include Access Road / Turnarounds
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Rail, Tie, Ballast system w/ Distance TOT to TOD Shown (Section View)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Depth of Superstructure & Girder Spacing (Section View)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Show Limits of Handrail/Fence (Elevation View)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Drainage Direction of Flow for all Drainage Systems
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Calculations Provided w/ PE Seal for Non-Standard Bridge Components
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Indicate Fixed or Exp Bearings (Elevation) & Dimension Bearing Plate Assembly
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Substructure Locations & Type w/ Elevations and Stick Log shown
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Depth of Superstructure w/ Deck Waterproofing Detail (Section View)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Temporary Shoring Limits Shown w/ Min Dist. To CL Tracks (See Temp Shoring)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

If water crossing, show ordinary high water (OHW), 50 yr, 100 yr Energy Grade Line (EGL) Elevations
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Item No.	Sheet No.	Reviewer Comment Date:	Initial	Designer's Response Date:	Reviewer's Comment Date:	Initial	Designer's Response Date:	Reviewer's Comment Date:	Initial	Designer's Response Date:	Reviewer's Comment Date:	Initial	Status (Open or Closed
1.													
2.													
3.													
4.													
5.													
6.													
7.													

*BNSF has reviewed these submittals and no exceptions are taken with regard to BNSF's ability to use or accommodate the project as intended. BNSF has not reviewed the design details or calculations for structural integrity or engineering accuracy. BNSF accepts no responsibility for errors or omissions in the design or execution of the project.

**** Check Submittal Essentials prior to transmittal to Structures Review. If not included, Project Engineer to reject and request resubmittal.**

BNSF RAILWAY

https://www.bnsf.com/