

# ***BNSF RAILWAY COMPANY***

## **DESIGN GUIDELINES FOR INDUSTRIAL TRACK PROJECTS**



**Engineering Services**

**4515 Kansas Avenue  
Kansas City, KS 66106**

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# **BNSF RAILWAY COMPANY**

## **DESIGN GUIDELINES FOR INDUSTRIAL TRACK PROJECTS**

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## GENERAL PROCEDURE FOR DEVELOPMENT OF TRACK PLANS AND

### ESTIMATES FOR INDUSTRIAL TRACK PROJECTS

These guidelines are intended for the development of industry tracks and facilities. Build-ins and tracks other than industrial need to follow BNSF's Main Line Design Guidelines for Track Projects.

1. Customer will contact BNSF's Economic Development (ED) representative. A questionnaire will be completed that will be used in preparing the New Business Review (NBR) to be reviewed by various BNSF groups, including Service Design & Performance (SDP).
2. Customer will be required to furnish a track plan for the project. Prior to preparing the track plan, it is recommended a site meeting be held to review the proposal. BNSF's ED, Engineering, Division Maintenance, Signal Engineering and Division Operating personnel should attend as appropriate to meet with the Customer.

The feasibility of constructing the project at the location will be discussed along with operating issues and recommendations from the NBR. Track layout concepts and constraints will be identified with the Customer, the intent being to guide the track design to an efficient layout given specific site conditions. The Customer's track designer can attend this meeting. Following meeting, BNSF Engineering will prepare a project schematic (see appendix, page A-9, for example) and forward to Division Operating, Division Maintenance, Signal Engineering and ED for review and approval. Approvals and comments are returned to BNSF Engineering and the sketch is edited as necessary. ED will furnish a copy to the Customer upon BNSF internal approval.

3. The Customer may use a designer or contractor of its choice to prepare the track plans. The project schematic is to be used as a guide for preparation of the track plans. Plans should be complete and follow the example outlined herein. Questions concerning these guidelines should be directed to the BNSF Engineering representative. Customers are encouraged to reference this document, including standard plan drawings, in the construction specifications.
4. The Customer will develop an industrial track plan (in electronic format), including plan/profile and drainage plan, which is to be submitted to ED for further handling by BNSF. Design plans shall include all information contained in "Industrial Track Survey and Plan Requirements" section, pages 10 and 11. BNSF Engineering will review and approve the track design, and if there are significant changes from the project schematic, the plan may need to be reviewed by other BNSF departments.
5. BNSF Engineering will communicate directly with the Customer regarding any plan revisions. Any revisions will be documented on the prints and communicated in writing to the Customer. BNSF Engineering will notify ED when the industrial track plan has been approved.
6. BNSF Engineering will prepare a cost estimate, chargeable to the Customer, for *the BNSF portion of track construction*, and revise the project schematic if necessary. In general, BNSF will construct from point of switch to the 14-ft clearance point. When a power turnout is required, BNSF will construct from the point of switch to just beyond the power derail.
7. Upon receiving the Firm Bid Cost Estimate, ED will present the formal industrial track package, including all agreements and cost proposal, to the Customer for consideration.
8. Upon Customer's acceptance of the proposal (check, fully executed agreements, and submittal of the final plans) ED will notify all concerned the project has been approved and funded. The final plans must be approved by BNSF Engineering prior to start of work on BNSF property. Materials for BNSF's portion of the project are ordered, work scheduled and construction completed.

# BNSF RAILWAY COMPANY

## STANDARDS FOR INDUSTRIAL TRACKAGE (NON-UNIT)

### 1. **Roadbed:**

Roadbed and ballast section for industrial trackage shall conform to the special roadbed section (see appendix, page A-10), and to the ballast material requirements on page 16.

### 2. **Curvature:**

Maximum degree of curve shall not exceed 9°30' (603.80' radius). All curves are defined using the chord definition method. A minimum tangent length of 50 feet must be placed between reversing curves. No turnouts (switches) can be placed in a curve. Mainline turnouts must be placed at least 200 feet from the end of a mainline curve.

### 3. **Profile Grade:**

Track profile grades shall be limited to a maximum of 1.5%.

### 4. **Vertical Curves:**

Vertical curves must be provided at break points in profile grade. The rate of change shall not exceed 2.0 in summits or sags. Vertical curves shall not extend into limits of turnout switch ties. See appendix, pages A-41 and A-42 for BNSF's standard for vertical curves.

### 5. **Track:**

Recommended rail section is 112-lb. or greater. Hardwood ties shall be new 7" X 8" (No. 4) or 7" X 9" (No. 5), 8'-6" long, placed on 21.5" centers with a 6" ballast section. Rail anchorage shall be provided at a minimum rate of 16 anchors per 39' panel. Continuous welded rail (CWR) shall be box-anchored every other tie. Concrete ties can be spaced at 28" center to center with an 8" ballast section. CWR is recommended when using concrete ties. Steel ties are spaced at 24" centers with 8" ballast section.

### 6. **Turnouts:**

All main line, controlled siding and passing track turnouts will be a minimum new No. 11-141 lb. and include either a spring-rail frog or a rigid, railbound manganese frog, as specified by BNSF Engineering. For other turnouts maintained by BNSF, the size and weight will be determined dependent upon the transportation commodity, with a No. 11-141 lb. recommended, and a No. 9 - 112 lb. as the minimum (see appendix, pages A-15 to A-32). Main line turnout switch ties shall be new and hardwood. All mainline, controlled siding and passing track turnouts and trackage are to be placed by BNSF personnel out to the 14' clearance point.

Mainline, controlled siding and passing track turnouts will require the placement of a construction berm alongside the track to allow assembly of the turnout, with no disruption to traffic. After the turnout is assembled, a track window is obtained to remove the trackage and insert the turnout. An example of a construction berm is shown in the appendix on page A-13.

For turnouts placed off of BNSF property and/or maintained by the Customer, and operated by BNSF, the recommended minimum is a No. 9 - 112 lb. All switch stands need to include a "30 Degree" handle (see appendix, page A-34).

Switch heaters are required for mainline turnouts where snow and ice present operational challenges. If a power turnout requires a switch heater, the power derail will require one also. The cost estimate will include installation of the switch heaters when required.

## 7. Derails:

A derail shall be placed on all tracks connecting with a main line, siding, or industrial lead. Derails protecting mainline tracks and controlled sidings shall be double switch point (see appendix, page A-33) and installed so that the derailed car is directed away from BNSF trackage. A power derail is required when the mainline turnout is powered, and BNSF will install track and signal from the point of switch to the insulated joints just beyond the power derail. Derails protecting mainline tracks shall be placed a minimum of 100 feet behind the 14' clearance point, and placed on tangent track where possible. Derails protecting other-than-mainline tracks shall be placed a minimum of 50 feet behind the 14' clearance point, and placed on tangent track where possible. The type of derail and actual location may be determined by BNSF Operating Department requirements. A "Derail" sign needs to be placed next to the derail.

## 8. Structures:

Bridges, drainage structures, track hoppers, retaining walls, etc. shall be designed to carry Cooper E-80 live load with diesel impact. Structures shall be designed per American Railway Engineering and Maintenance of Way Association (AREMA) Manual chapters 1, 7, 8, or 15 as applicable, and designed by a licensed engineer. See AREMA standards for unloading pits. All structural plans will need to be reviewed and accepted by BNSF Engineering. Gratings covering open pits must be bolted in place.

## 9. Road Crossings

The standard for a road crossing surface installed and maintained by the BNSF is concrete plank (for 141-lb. rail) placed on 10-ft. switch ties. Also, ten each 10-ft. switch ties are placed on both ends of the crossing, replacing any standard cross-ties. For crossings installed and maintained by the Customer, a concrete plank is recommended, with a wood plank surface as acceptable (see appendix, pages A-35 to A-37).

## 10. Clearances:

BNSF will adhere to the "Clearance Requirements By State," BNSF Dwg. No. 2509, Sheet No. 2 (see appendix, page A-38) for each state. If a state does not have its own clearances, the "BNSF Minimum Clearances Diagram," BNSF Dwg. No. 2509, Sheet No. 1 (see appendix, page A-39) will apply. Side clearances for curves should have an additional 1-1/2" per degree of curvature. All effort should be made to provide adequate clearances. In the event clearances cannot be provided for as prescribed, warning signs will be installed and they must be illuminated at night (see appendix, page A-40).

All loading/unloading equipment that fouls the clearance envelope during operation must positively lock in a non-fouling position when not in use.

All new tracks constructed will maintain a minimum distance of 25 feet for track centers from any main track, controlled siding or passing track. New tracks adjacent to other tracks will maintain a minimum distance of 14 feet for track centers.

At road crossings the set-back distance for storing rail cars on multiple adjacent tracks (track centers less than 25') is 250 feet from the edge of roadway. For single tracks, the setback distance varies for each state and is regulated by the states' appropriate agencies, **but 150 feet from the edge of roadway is the minimum.** However, operating conditions may require greater distances.

## 11. Walkways:

Walkways on bridges and adjacent to switches and trackage are governed by the appropriate State Public Service Commission, Railway Commission or other State and/or Federal agencies. However, the example on page A-11 depicts requirements for most states. Walkway ballast shall be Class 2 and no larger than 1" in size (ballast gradation shown on page 16).

## 12. Signals and Electrical Service

**Customer shall provide electrical service to BNSF property should the proposed trackwork require power for the signal facilities.** The requirement and locations will be identified at the initial on-site meeting. If the service is for an electric switch heater, a 200 Amp, Single Phase, 120/240 volt service, with meter socket and service disconnect is required. The service disconnect shall be a 200 amp, 2 pole breaker by either Cutler Hammer or Square D (QO style), with the meter socket requirement as per the power company specifications. No additional electrical panels are necessary as BNSF will take a feeder from the load side of the 200 amp service disconnect switch. The service may be either overhead or underground. All electrical installations will be made in accordance with the prevailing State/local electrical code(s), or if there is none, the current edition of the National Electrical Code will govern the installation. If an electric switch heater is not involved, 100 Amp service will be sufficient.

## 13. Inspection of Materials and Track:

BNSF's Division Engineer representative should inspect all track materials prior to placement to avoid subsequent removal of sub-standard material. BNSF personnel will inspect the completed track before placing it into service.

## 14. General:

- a. Loading and unloading tracks must be designed so that they are completely independent of railroad operating lines and passing tracks such that loading and unloading operations in no way interfere with train operations. Design of trackage must be approved by BNSF Engineering.
- b. Utility installations may require a permit. Pipelines under track are to be encased per BNSF requirements. Wirelines are to be installed per BNSF requirements. Refer to "BNSF Utility Accommodation Policy" booklet. Utilities within 50 feet beyond the end of track must be underground, and protected as if they were under the track.
- c. The effect on sight distance must be considered when planning construction of trackage in the vicinity of any grade crossings. The required sight distance should be determined and preserved when performing and designing for construction near any grade crossing. Less than the required sight distance will be the liability of the Customer.

### Maintenance of Way Operating Rule No. 6.32.4:

"Leave cars, engines, or equipment clear of road crossings and crossing signal circuits. If possible, avoid leaving cars, engines, or equipment standing closer than 250 feet from the road crossing when there is an adjacent track (<25' track centers)."

- d. An earthen berm (see appendix, page A-14) or suitable bumping post shall be installed at the end of track. Also, a red retro-reflective marker shall be placed at the end of track.
- e. **Customer is responsible for all grading including placing all subballast up to BNSF ballast and the placement of a construction berm.**
- f. Customer is to acquire any additional property required to construct grade and drainage. If the proposed trackage or facility will increase runoff onto BNSF property, a detailed drainage plan needs to be submitted for review prior to construction. Drainage should be handled in a manner as not to overload current drainage structures on BNSF property.
- g. **Contractor must not at any time foul the main line tracks.** A BNSF flagman will be required, at the Contractor's expense, when working within 25 feet from centerline of the track.

Billing for the flagman is separate from the cost for BNSF portion of the track work. Current cost for BNSF flagging is approximately \$1,000 per day with billing based on actual charges.

- h. Adequate lighting must be provided for train crews working at night. Work areas near switches, gates, doors, pits and buildings should be illuminated to prevent walking/tripping hazards and allow crewmen riding rail cars to see without reliance upon a flashlight.

# BNSF RAILWAY COMPANY

## STANDARDS FOR UNIT TRAIN/LOOP FACILITIES

### 1. **Roadbed:**

Roadbed and ballast section for industrial trackage shall conform to the special roadbed section (see appendix, page A-10), and to the ballast material requirements on page 16.

### 2. **Curvature:**

Maximum degree of curve shall not exceed  $7^{\circ}30'$  (764.49' radius). All curves are defined using the chord definition method. A minimum tangent length of 200 feet must be placed between reversing curves. No turnouts (switches) can be placed in a curve. Mainline turnouts must be placed at least 200 feet from the end of a mainline curve.

### 3. **Profile Grade:**

Track profile grades shall be limited to a maximum of 1.5%. For loop tracks, the maximum grade will be 0.5%. Other restrictions may be defined for individual projects.

### 4. **Vertical Curves:**

Vertical curves must be provided at break points in profile grade. The rate of change shall not exceed 1.0 in summits or 0.5 in sags. Vertical curves shall not extend into limits of turnout switch ties. See appendix, pages A-41 and A-42 for BNSF's standard for vertical curves.

### 5. **Track:**

For New Unit Train Facilities minimum rail section is 112-lb and continuous welded rail (CWR) is recommended. Hardwood ties shall be new 7" X 8" (No. 4) or 7" X 9" (No. 5), 8'-6" long, placed on 21.5" centers with a 6" ballast section. Rail anchorage shall be provided at a minimum rate of 16 anchors per 39' panel. Continuous welded rail (CWR) shall be box-anchored every other tie. Concrete ties can be spaced at 28" center to center with an 8" ballast section. CWR is recommended when using concrete ties. Steel ties are spaced at 24" centers with 8" ballast section.

### 6. **Turnouts:**

All main line, controlled siding and passing track turnouts will be a minimum new No. 11-141 lb. and include either a spring-rail frog or a rigid, railbound manganese frog, as specified by BNSF Engineering. For other turnouts maintained by BNSF, a No. 11-115 lb. is the minimum (see appendix, pages A-21 to A-32). Main line turnout switch ties shall be new and hardwood. All mainline, controlled siding and passing track turnouts and trackage are to be placed by BNSF personnel out to the 14' clearance point. All joints in the side of turnout receiving majority of traffic will be thermite welded.

Mainline, controlled siding and passing track turnouts will require the placement of a construction berm alongside the track to allow assembly of the turnout, with no disruption to traffic. After the turnout is assembled, a track window is obtained to remove the trackage and insert the turnout. An example of a construction berm is shown in the appendix on page A-13.

For turnouts placed off of BNSF property and/or maintained by the Customer, and operated by BNSF, a No. 11 - 112 lb. turnout will be the minimum. All switch stands need to include a "30 Degree" handle (see appendix, page A-34).



Switch heaters are required for mainline turnouts where snow and ice present operational challenges. If a power turnout requires a switch heater, the power derail will require one also. The cost estimate will include installation of the switch heaters when required.

#### 7. **Derails:**

A derail shall be placed on all tracks connecting with a main line, siding, or industrial lead. Derails protecting mainline tracks and controlled sidings shall be double switch point (see appendix, page A-33) and installed so that the derailed car is directed away from BNSF trackage. A power derail is required when the mainline turnout is powered, and BNSF will install track and signal from the point of switch to the insulated joints just beyond the power derail. Derails protecting mainline tracks shall be placed a minimum of 100 feet behind the 14' clearance point, and placed on tangent track where possible. Derails protecting other-than-mainline tracks shall be placed a minimum of 50 feet behind the 14' clearance point, and placed on tangent track where possible. The type of derail and actual location may be determined by BNSF Operating Department requirements. A "Derail" sign needs to be placed next to the derail.

#### 8. **Structures:**

Bridges, drainage structures, track hoppers, retaining walls, etc. shall be designed to carry Cooper E-80 live load with diesel impact. Structures shall be designed per American Railway Engineering and Maintenance of Way Association (AREMA) Manual chapters 1, 7, 8, or 15 as applicable, and designed by a licensed engineer. See AREMA standards for unloading pits. All structural plans will need to be reviewed and accepted by BNSF Engineering. Gratings covering open pits must be bolted in place.

#### 9. **Road Crossings**

The standard for a road crossing surface installed and maintained by the BNSF is concrete plank (for 141-lb. rail) placed on 10-ft. switch ties. Also, ten each 10-ft. switch ties are placed on both ends of the crossing, replacing any standard cross-ties. For crossings installed and maintained by the Customer, a concrete plank is recommended, with a wood plank surface as acceptable (see appendix, pages A-35 to A-37).

#### 10. **Clearances:**

BNSF will adhere to the "Clearance Requirements By State," BNSF Dwg. No. 2509, Sheet No. 2 (see appendix, page A-38) for each state. If a state does not have its own clearances, the "BNSF Minimum Clearances Diagram," BNSF Dwg. No. 2509, Sheet No. 1 (see appendix, page A-39) will apply. Side clearances for curves should have an additional 1-1/2" per degree of curvature. All effort should be made to provide adequate clearances. In the event clearances cannot be provided for as prescribed, warning signs will be installed and they must be illuminated at night (see appendix, page A-40).

All loading/unloading equipment that fouls the clearance envelope during operation must positively lock in a non-fouling position when not in use.

All new tracks constructed will maintain a minimum distance of 25 feet for track centers from any main track, controlled siding or passing track. New tracks adjacent to other tracks will maintain a minimum distance of 14 feet for track centers.

At road crossings the set-back distance for storing rail cars on multiple adjacent tracks (track centers less than 25') is 250 feet from the edge of roadway. For single tracks, the setback distance varies for each state and is regulated by the states' appropriate agencies, **but 150 feet from the edge of roadway is the minimum.** However, operating conditions may require greater distances.

## 11. Walkways:

Walkways on bridges and adjacent to switches and trackage are governed by the appropriate State Public Service Commission, Railway Commission or other State and/or Federal agencies. Due to revised FRA Airbrake and Train Handling Rules, outbound trains are required to have an airbrake inspection on both sides of the train. New shuttle projects will be required to have a minimum 13' inspection road on one side and a minimum 8.5' walkway on the other. See appendix pages A-11 and A-12 for typical sections of roads and walkways. Walkway ballast shall be Class 2 and no larger than 1" in size (ballast gradation shown on page 16).

## 12. Signals and Electrical Service

**Customer shall provide electrical service to BNSF property should the proposed trackwork require power for the signal facilities.** The requirement and locations will be identified at the initial on-site meeting. If the service is for an electric switch heater, a 200 Amp, Single Phase, 120/240 volt service, with meter socket and service disconnect is required. The service disconnect shall be a 200 amp, 2 pole breaker by either Cutler Hammer or Square D (QO style), with the meter socket requirement as per the power company specifications. No additional electrical panels are necessary as BNSF will take a feeder from the load side of the 200 amp service disconnect switch. The service may be either overhead or underground. All electrical installations will be made in accordance with the prevailing State/local electrical code(s), or if there is none, the current edition of the National Electrical Code will govern the installation. If an electric switch heater is not involved, 100 Amp service will be sufficient.

## 13. Access Road:

Unless otherwise directed a road will be required that will provide access to inspect the entire train prior to movement from the facility. Due to revised FRA Airbrake and Train Handling Rules, outbound trains are required to have an airbrake inspection on both sides of the train. New shuttle projects will be required to have a minimum 13' inspection road on one side and a minimum 8.5' walkway on the other. See appendix pages A-11 and A-12 for typical sections of roads and walkways. A standard section with a 13-ft wide roadway is shown in the appendix, page A-12. The roadway can be constructed using subballast materials as specified in the Grading & Embankment section of this document, page 12.

## 14. Inspection of Materials and Track:

BNSF's Division Engineer representative should inspect all track materials prior to placement to avoid subsequent removal of sub-standard material. BNSF personnel will inspect the completed track before placing it into service.

## 15. General:

- a. Loading and unloading tracks should be designed so that they are completely independent of railroad operating lines and passing tracks such that loading and unloading operations in no way interfere with train operations. Design of trackage must be approved by BNSF Engineering.
- b. Utility installations may require a permit. Pipelines under track are to be encased per BNSF requirements. Wirelines are to be installed per BNSF requirements. Refer to "BNSF Utility Accommodation Policy" booklet. Utilities within 50 feet beyond the end of track must be underground, and protected as if they were under the track.

- c. The effect on sight distance must be considered when planning construction of trackage in the vicinity of any grade crossings. The required sight distance should be determined and preserved when performing and designing for construction near any grade crossing. Less than the required sight distance will be the liability of the Customer.

Maintenance of Way Operating Rule No. 6.32.4:

"Leave cars, engines, or equipment clear of road crossings and crossing signal circuits. If possible, avoid leaving cars, engines, or equipment standing closer than 250 feet from the road crossing when there is an adjacent track (<25' track centers)."

- d. An earthen berm (see appendix, page A-14) or suitable bumping post shall be installed at the end of track. Also, a red retro-reflective marker shall be placed at the end of track.
- e. **Customer is responsible for all grading including placing all subballast up to BNSF ballast and the placement of a construction berm, if required.**
- f. Customer is to acquire any additional property required to construct grade and drainage. If the proposed trackage or facility will increase runoff onto BNSF property, a detailed drainage plan needs to be submitted for review prior to construction. Drainage should be handled in a manner as not to overload current drainage structures on BNSF property.
- g. **Contractor must not at any time foul the main line tracks.** A BNSF flagman will be required, at the Contractor's expense, when working within 25 feet from centerline of the track. Billing for the flagman is separate from the cost for BNSF portion of the track work. Current cost for BNSF flagging is approximately \$1,000 per day with billing based on actual charges.
- h. Adequate lighting must be provided for train crews working at night. Work areas near switches, gates, doors, pits and buildings should be illuminated to prevent walking/tripping hazards and allow crewmen riding rail cars to see without reliance upon a flashlight.
- i. A track to set out bad order cars unsuitable for loading or unloading needs to be added to the overall design. Set out track should be long enough to place at least 5 rail cars and be accessible to a repair crew. A locomotive tie-up track may also need to be incorporated into the design. This need will be determined at the on-site meeting.

## **INDUSTRIAL TRACK SURVEY AND PLAN REQUIREMENTS**

### Provide a Plan View of new track(s):

Show complete description of all proposed trackage, including mainline or lead track stationing, curvature, milepost location and size (#9, #11, #15) of proposed or future turnouts, car capacities, and location of bumpers or wheel stops and derails. Include at least one existing fixed object (road xing, point of switch) to assist with staking the new trackage.

With track stationing show location of 14' clearance point, railroad property line and pertinent property corners, and any previously dedicated railroad easements. Ex: "Sta 1+85.0 Clear Pt". Note length of storage capacity of each track (clear length).

Show the location of present or proposed buildings including locations of unloading doors, ramps or docks. Show clearance from centerline of track to these facilities.

Show all existing trackage using railroad stationing, and locate all obstructions such as poles, pole lines, utilities, ditches and road crossings. Note the type of signal protection at grade crossings and location of insulated joints where applicable, and whether modifications to any of these facilities are required.

Note weight of rail in existing and proposed tracks, and list materials to be used for proposed tracks.

Furnish Milepost and Line Segment (if known) in the Title Block, along with name of Industry and date of plan preparation. Contact information for engineering firm should also be included on plans.

Suggested plan scale: 1" = 50'. **All plans and drawings need to be prepared electronically in MicroStation format (AutoCad acceptable).** This allows for updates to BNSF's maps and records to be done electronically. All information is to be in English units. Plan submittals should be in Adobe's Acrobat pdf format, with 11" x 17" sheet size. Upon approval, BNSF Engineering will revise the project schematic, if necessary.

Establish and document one local benchmark near industrial track site.

### Provide a Profile View of new track(s):

Include profile of top/rail of new track and ground line at centerline of track.

Include profile of existing track at location of switch and switch ties.

Include cross-sections for proposed tracks and existing affected tracks.

Show drainage structures, if required, with invert elevations and ditch profiles.

Suggested scales for drawings:

Profiles: 1" = 50' horizontal and 1" = 5' vertical

Cross Sections: 1"=10' horizontal and vertical

### Include a description of work to be performed by the railroad:

Example: "Construct 185 track feet including a #11-141 lb turnout from point of switch to clearance point, raise railroad pole line, adjust signals."

Include a description of work to be performed by the contractor:

Example: “Construct remaining trackage from clearance point to end, place wheel stops, install plank crossing and signs, perform all grading, install all drainage structures, install double switch point derail, provide electrical service to a point opposite the proposed switch locations.”

Include a list of track materials to be used by the contractor:

Example: “115-lb continuous welded rail (CWR) on #4 new cross-ties, #11-115lb BNSF standard turnouts, 32-ft full depth timber crossing planks to be placed in new construction.”

Provide an Operating Plan

Prepare a sketch (does not have to be to-scale) showing in-bound and out-bound switching plans and lengths of tracks to be used. Accompany sketch with a brief narrative of a typical move to switch facility.

Customers are encouraged to reference this document, including standard plan drawings, in the construction specifications.

## BNSF RAILWAY COMPANY

### SPECIFICATIONS FOR CONSTRUCTION OF INDUSTRIAL TRACKAGE BY PRIVATE CONTRACTOR

#### CONTRACTOR'S RESPONSIBILITY

By acceptance of the contract the contractor assumes complete responsibility for construction of the work. The Contractor should understand that any work not specifically mentioned in the written specifications, but which is necessary, either directly or indirectly, for the proper carrying out of the intent thereof, shall be required and applied, and will perform all such work just as though it were particularly delineated or described. Contractor should also understand that final approval of the track for service is the prerogative of BNSF and close contact with BNSF's Engineering and Division Engineer (if applicable) is required. No work is to be performed on BNSF's right-of-way, or in such proximity as to interfere with BNSF's tracks or roadbed, without advance permission by BNSF, including insurance and if necessary, flagging protection.

#### INSURANCE REQUIREMENTS

Contained within the Contract for Industrial Track Agreement to be signed prior to construction.

#### GRADING & EMBANKMENT

The work covered by this section of the specifications consists of furnishing all plant, labor, material and equipment and performing all operations in connection with construction of track roadbed, including clearing and grubbing, excavation, construction of embankments and incidental items, all in accordance with the contract drawings and specifications.

The Contractor shall load, haul, spread, place and compact suitable materials in embankments and shall finish the embankments to the grade, slope and alignment as shown in the plans. Suitable materials shall consist of mineral soils free from organics, debris, and frozen materials. Embankment slopes shall be compacted and dressed to provide a uniform and dense slope. Embankments shall be built with approved materials from excavation of cuts or from borrow unless otherwise shown on the plans.

If materials unsuitable for embankments (organics, debris, brush and trees, etc.) are encountered within the areas to be excavated, or material existing below the designated subgrade in cuts or within areas on which embankments are to be placed are of such nature that stability of the roadbed will be impaired, such materials shall be removed and wasted or stockpiled for other use. Topsoil removed from embankment areas shall be spread uniformly over the embankment slopes.

Unsuitable material removed from embankment foundations or below subgrade elevation in excavation areas shall be replaced to grade with suitable material compacted as specified for embankments in these specifications.

Wherever an embankment is to be placed on or against an existing slope steeper than four horizontal to one vertical, such slope shall be cut into steps as the construction of the new embankment progresses. Such steps shall each have a horizontal dimension of not less than three feet and a vertical rise of one foot.

At all times, the Contractor shall operate sufficient equipment to compact the embankment at the rate at which it is being placed. Compaction shall be accomplished by sheep's foot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Use construction procedures and drainage design that will provide a stable roadbed.

Each layer in embankments made up primarily of materials other than rock shall not exceed 6" in loose depth and shall be compacted to the dry density as specified hereinafter before additional layers are placed. All embankments shall be compacted to a density of not less than 95% of the maximum standard laboratory density, and not more than +4 percentage points above the optimum moisture content, unless otherwise specified on the drawings. The standard laboratory density and optimum moisture content shall be the maximum density and optimum moisture as determined in accordance with ASTM Designation: D 698 (Standard Proctor Test). Copies of soil test results shall be furnished to owner.

On top of the embankment fill, the Contractor shall place a minimum of 6 inches of granular sub-ballast which meets the above criteria and contains no material larger than that which will pass through a (3) inch square sieve. Sub-ballast shall be crushed gravel or crushed stone with a minimum 75% of the material having two fractured faces. Sub-ballast must meet the quality requirements of ASTM Designation: D 1241 and be approved by the Engineer. Additional sub-ballast may be required as determined from an engineering soil analysis.

### CORRUGATED METAL CULVERTS

These instructions cover the selection, installation, and fabrication of circular type zinc coated (galvanized) corrugated steel culverts for nominal diameters of 36-inch to 96-inch, inclusive. Additional protective coatings may be specified or allowed by BNSF Engineering. The minimum diameter for all culverts installed under main tracks or tracks maintained by BNSF is 36 inches. This diameter will allow for inspection and cleaning. For culverts maintained by the Customer, 24 inches is the minimum diameter.

Galvanized corrugated steel pipe shall be manufactured in accordance with ASSHTO Specifications M 36 and M 218. All areas of surface rust on re-corrugated ends or lockseams shall be painted using the hot-dip or metallizing process.

Design, installation, and fabrication shall be in accordance with current American Railway Engineering and Maintenance of Way Association (AREMA) Specifications Chapter 1, Part 4, Culverts. Additionally, all culvert pipes shall meet the requirements shown in Table 1.

TABLE 1

<u>Nominal Diameter (Inches)</u>	<u>Nominal* Corrugation (Inches)</u>	<u>Minimum** Width of Lap (Inches)</u>	<u>Nominal Thickness (Inches)</u>	<u>Thickness U.S. Std. Gage</u>	<u>Rivet** Diameter (Inches)</u>	<u>Max. Cover</u>	<u>Min. Cover</u>
36	2-2/3 x 1/2	2	0.109	12	3/8	40'	***
42	2-2/3 X 1/2	3	0.138	10	3/8	70'	***
42	3 x 1 & 5 x 1	3	0.109	12	7/16	70'	***
48	2-2/3 x 1/2	3	0.138	10	3/8	65'	***
48	3 x 1 & 5 x 1	3	0.109	12	7/16	70'	***
54	2-2/3 x 1/2	3	0.168	8	3/8	60'	***
54	3 x 1 & 5 x 1	3	0.138	10	7/16	75'	***
60	2-2/3 x 1/2	3	0.168	8	3/8	55'	***
60	3 x 1 & 5 x 1	3	0.138	10	7/16	70'	***
66	3 X 1 & 5 X 1	3	0.138	10	7/16	60'	***
72	3 X 1 & 5 X 1	3	0.168	10	7/16	65'	***
84	3 X 1 & 5 X 1	3	0.168	8	7/16	55'	***
96	3 X 1 & 5 X 1	3	0.168	8	7/16	45'	***

\* Where two types of corrugation are acceptable, the use of standard 2-2/3" x 1/2" material is preferred, if available. 5 x 1 corrugations to be used only on helical pipe.

\*\* For riveted pipe.

Pipes 48 inches or greater in diameter shall be shop-elongated 5 percent of their diameter in a vertical direction and have lifting lugs.

\*\*\*Minimum cover to be one-half diameter of culvert pipe from top of subgrade to top of pipe.

Due to settlement of culvert pipes, cambering longitudinally is recommended to improve the flow line profile after settlement. This is accomplished by laying the upstream half of the pipe on a flatter grade than the downstream half. Riveted pipe shall be placed with the inside circumferential laps pointing downstream and with the longitudinal laps at the side. Pipes shall be installed with a camber suitable to the height of the cover over the pipe and bearing capacity of the supporting soil.

Firm support must be provided to obtain a satisfactory installation. The filling material adjacent to pipes shall be loose granular material, free from large stones, frozen lumps, cinders, or rubbish. The filling shall be deposited alternately on opposite sides of the pipe in layers not exceeding 6 inches in depth, and each layer shall be thoroughly tamped before placing the next layer. Special care shall be taken in tamping under the lower part of the pipe. For a trench installation, the backfill shall be tamped the entire width of the trench, and for surface installation it shall be tamped not less than one half the pipe diameter out from the sides of the pipe. The density of the backfill after tamping must be at least 95% of its maximum density, as determined by ASTM D 698.

Any other type or size drainage structure shall have approval of BNSF Engineering prior to installation under track locations.

UTILITY CROSSINGS

Utility crossings and relocations shall conform to BNSF standards as outlined in the "BNSF Utility Accommodation Policy." Applications for utility crossings and relocations are handled by Jones, Lang, LaSalle, phone number 1- 866-498-6647. Any questions regarding utilities can be directed to the BNSF Engineering representative.



## CURVATURE AND GRADES

Tracks will be staked by the customer's surveyor (under flag protection if necessary) and constructed as shown on the approved plans. Any changes to the approved design need to be reviewed by BNSF Engineering or appointed representative.

## CLEARANCES

BNSF will adhere to the "Clearance Requirements By State," BNSF Dwg. No. 2509, Sheet No. 2 (see appendix, page A-38) for each state. If a state does not have its own clearances, the "BNSF Minimum Clearances Diagram," BNSF Dwg. No. 2509, Sheet No. 1 (see appendix, page A-39) will apply. Side clearances for curves should have an additional 1-1/2" per degree of curvature. Warning signs will be installed for all close clearances less than standard (see appendix, page A-40). All loading/unloading equipment that fouls the clearance envelope during operation must positively lock in a non-fouling position when not in use.

## MATERIAL

BNSF's Division Engineer representative should inspect all track materials prior to placement to avoid removal of sub-standard material. BNSF personnel will also inspect the track before placing it into service.

### Rail:

For trackage maintained by the Customer the minimum acceptable rail shall be 112# section (5-1/2" base) and shall be compatible with BNSF standard rail section. For locations where trackage will be maintained by BNSF rail and fastenings shall conform to the BNSF standard rail section in use in that area. Contractor shall contact BNSF Engineering for approved section. Transition rails or compromise joints at the BNSF-Customer interface are the responsibility of the customer. Minimum length shall not be less than 39 feet except in turnouts and shall be free from defects. Rail should be minimum full ball relay rail, not exceeding 3/16 inch wear on any surface. Continuous welded rail (CWR) will need to be de-stressed as soon as possible after laying (see "Procedures for the Installation, Adjustment, Maintenance, and Inspection of CWR in Industry Tracks" appendix, page A-1 thru A-8). CWR is recommended when using concrete ties. Thermite and flash-butt welds must be placed in crib area between ties. An abrasive rail saw will be used to cut rail—no torch-cutting.

### Anchors:

Rail anchors shall be new or reconditioned, sized to fit the rail section, and shall be provided per industrial track design criteria on pages 3 and 6. High traffic volumes or unusual grade or alignment problems may require additional anchors as determined by BNSF Engineering. Turnouts shall also be anchored.

### Ties:

Hardwood ties shall be new 7" X 8" (AREMA No. 4) or 7" X 9" (No. 5), 8'-6" long, placed on 21.5" centers. Switch ties shall have a minimum cross section of 7" x 9" and minimum lengths shall conform to applicable BNSF Standard plans.

Concrete ties shall be pre-stressed, measure 11" wide at the bottom and 9" high with a length of 8' 3" and weight of 630 pounds. Concrete ties can be placed on 28" centers provided there is a minimum ballast section of 8" below the tie. Second-hand, or "3/4" concrete ties can be used after inspection and approval from the BNSF Roadmaster. When placing 3/4 ties, the damaged shoulders should be alternated from left to right sides so that they are not on the same side.

Steel ties are spaced at 24" centers with 8" ballast section and can be used with timber or concrete ties. Steel ties should not be used within 200 feet of a signal circuit identified by insulated joints.

### Turnouts (Switches, Frogs & Guardrails):

All parts shall be new or good secondhand, with secondhand parts being free of injurious defects.

**Tie Plates:**

Tie plates may be new or secondhand, free of injurious defects and foreign material, conforming to AREMA Specifications, and shall fit rail being used. For rail 110# section and greater, all plates will be double-shouldered.

**Joints:**

New or secondhand joints, free of foreign material and without injurious defects, and with 4 or 6 bolt holes, conforming to AREMA requirements, may be furnished to fit rail section for which they are designed. Bolt holes must be drilled with proper equipment. Torch-cutting of bolt holes is not allowed. New or secondhand compromise joints of manufactured type (welded or homemade are not acceptable), free of foreign material and without injurious defects, shall be furnished and used where rail section (weight or design) changes. Rail section by weight shall not be compromised where difference in weight is in excess of 25 lbs. When this becomes necessary, a rail of some weight between the two different rail sections, in excess of 25 lbs., shall be used and the compromise made in two steps. The length of the medium-weight rail should be 39 feet where practical.

**Spikes:**

5/8" x 6" cut track spikes shall be installed. All spikes shall conform to AREMA requirements.

**Track Bolts & Nuts:**

Track bolts and nuts shall be installed conforming to AREMA Specifications. Bolts will be correct size and length to fit rail.

**Lock Washers:**

One lock washer conforming to AREMA Specifications shall be installed on each track bolt.

**Ballast:**

Track ballast shall be Class 2 (1" - 3/8"). Ballast shall be free from loam, dust, and other foreign particles and shall not have less than 75% crushed particles with two or more fractured faces, unless otherwise approved by BNSF.

Processed ballast shall be hard, dense, of angular particle structure, providing sharp corners and cubicle fragments and free of deleterious materials. Ballast materials shall provide high resistance to temperature changes, chemical attack, have high electrical resistance, low absorption properties and free of cementing characteristics. Materials shall have sufficient unit weight (measured in pounds per cubic foot) and have a limited amount of flat and elongated particles.

Unless it meets or exceeds BNSF requirements, slag is not an approved ballast material.

Walkway ballast shall be Class 2 (1" - 3/8").

NOMINAL BALLAST SIZE		PERCENT PASSING (BY WEIGHT)										
SIZE NO.	SQ. OPENING	2 1/2"	2"	1 3/4"	1 1/2"	1 1/4"	1"	3/4"	1/2"	3/8"	No. 4	
Class 2	1" - 3/8"				100		90-100	40-75	15-35	0-15	0-5	

**Bumping Post:**

An earthen berm (see appendix, page A-14) or suitable bumping post, approved by the Railroad, shall be installed at the ends of tracks. Also, a red retro-reflective marker shall be placed at the end of track.

**Derails:**

A derail shall be placed on all tracks connecting with a main line, siding, or industrial lead. Derails protecting mainline tracks and controlled sidings shall be double switch point (see appendix, page A-33) and installed so that the derailed car is directed away from BNSF trackage. A power derail is

required when the mainline turnout is powered, and BNSF will install track and signal from the point of switch to the insulated joints just beyond the power derail. Derails protecting mainline tracks shall be placed a minimum of 100 feet behind the 14' clearance point, and placed on tangent track where possible. Derails protecting other-than-mainline tracks shall be placed a minimum of 50 feet behind the 14' clearance point, and placed on tangent track where possible. The type of derail and actual location may be determined by BNSF Operating Department requirements. A "Derail" sign needs to be placed next to the derail.

A second derail may be required where BNSF locomotives are parked during unit train loading operations. BNSF's Operating department will determine the necessity and type. If required, placement will be 275 feet from first derail. A "Derail" sign needs to be placed next to the derail.

Timber ties are recommended within 50 feet of a derail.

#### Highway Crossings:

All crossings shall be approved by BNSF Engineering and local governments as to type and design, in advance of placing order. Effect on sight distance of crossings must be considered when planning construction of trackage in vicinity of public grade crossings not equipped with automatic signals.

#### Under Track Hoppers or Pits:

Plans shall be approved by BNSF Engineering or authorized representative. Specifications for unloading pits are covered in the "AREMA Manual for Railway Engineering," Section 8.4. Gratings covering open pits must be bolted in place.

### TRACK CONSTRUCTION

#### General:

All work shall be of good quality in materials, equipment and workmanship and shall conform in every respect with the specifications and instructions.

#### Ties:

Ties will be unloaded and handled in such a manner as not to damage ties, using approved handling equipment.

Ties to be placed at design spacing of 21.5-inch center to center (22 ties/39 feet) for wood, and 28-inch centers for concrete, on the finished subgrade, perpendicular to center line of track with the right hand ends of ties being parallel. Exception: On curves, align the ties to the inside of the curve. All joints are to be suspended between ties.

Top surface of ties shall be clean and smooth to provide full bearing for tie plates.

Lay wood ties with heartwood face down, and if not possible to determine position of the heartwood, lay the widest surface of the tie down.

If spikes are pulled from any tie, hole shall be filled by driving in a treated wood tie plug the full depth of the hole.

Boring or adzing of ties shall be kept to a minimum.

#### Tie Plates:

Double-shouldered tie plates will be used on all ties and set in position with cant surface sloping inward, making sure they are firmly seated and have full bearing. After rails are in place, shoulder of plates shall be in full contact with outside edge of rail base.

#### Rails:

Assemble joints before fastening rails to ties, using joint bars with full number of track bolts and spring washer for each bolt, first removing loose mill scale and rust from contact surfaces or joint bars and rails.

In laying secondhand rail, care must be taken to rail end mismatch at the joints.

Under no circumstances must rail be struck in web with tool or any metal object.

The right-hand rail facing in direction of increasing construction shall be spiked to ties, and the opposite rail shall be brought to gage of 4' 8-1/2", measured at right angles between the rails, in a place 5/8" below top of rail. A track gauge manufactured for the purpose of measuring gage should be used rather than a tape measure. Gage is to be checked at every third tie. Do not strike rail directly with a maul, either on top when driving spikes, or on side to obtain track gage.

Rail shall be laid with staggered joints. Joints shall be located as nearly as possible to the middle of the opposite rails with the following variation: (a) except through turnouts, the staggering of the joints on one side shall not vary more than 6' in either direction from the center of the opposite rail.

Continuous welded rail (CWR) will need to be de-stressed as soon as possible after laying (see "Procedures for the Installation, Adjustment, Maintenance, and Inspection of CWR in Industry Tracks" appendix, pages A-1 thru A-8). The completed "Record of Neutral Temperature of Welded Rail as Laid" form will be completed and presented to the BNSF Roadmaster at time of final track inspection.

**Joints:**

If necessary to force joint bar into position, strike lower edge of bar lightly with 4-lb. maul. Do not drive bolts in place. Tighten bolts in sequence, beginning at joint center and working out to ends. Bolts are to be tightened to a range of 20,000 to 30,000 ft-lbs. tension. If a bolt tightening machine is not used, a standard track wrench with a 42" long handle may be used.

At the time of installation, rail expansion shims of softwood not over 1" width shall be placed between the ends of adjacent rails to insure proper space allowance for expansion required by the rail temperatures in the following table, and shall be left in place:

39-ft Rail	
Temperature	
<u>Deg. F</u>	<u>Expansion</u>
Over 85	None
66 to 85	1/16
46 to 65	1/8
26 to 45	3/16
6 to 25	1/4
Below 6	5/16

**Bending Stock Rails:**

Use approved rail bending equipment. Make bends uniform and accurate for all stock rails.

**Spiking to Wood Ties:**

Rails shall be spiked to every tie, using not less than 2 spikes for each rail at each tie. Drive spikes through tie plate holes into ties, located diagonally opposite each other but not less than 2" from edge of tie. Start and drive spikes vertically and square with rail. Take care to avoid slanting, bending, or causing sideways movement of spike.

Each rail will be spiked with two spikes per tie plate on tangent track staggered with inside spikes to the east or north and outside spikes to the west or south. On curves a third spike is required on the gage side of the rail. Spikes should not be placed in the slots on skirted joint bars when such practice can be avoided by providing other plates with a hole pattern that will clear the skirts.

When spikes are driven by machine, work shall be closely supervised to see that they are driven with hammer centered exactly over each spike head and drive spike vertically. Set stop bolt on the machine to prevent over-driving.

Withdraw spikes that are incorrectly driven and fill hole by driving a tie plug to full depth of hole. Locate replacement spike at another hole in tie plate and tie.

**Ballast and Surfacing:**

Raise track by means of jacks placed close enough together to prevent excessive bending of rails or

strain on joint. Lift both rails simultaneously and as uniformly as possible. Power jack may also be used. Each track raise shall not exceed 4" with ties tamped prior to additional raise.

#### Unloading and Tamping Ballast:

Unload and level down ballast by most practical means, taking care not to disturb grade stakes. Perform tamping, using power tamping machines wherever possible, or manually, using approved AREMA tamping tools appropriate for type of ballast being placed. Tamp each layer of ballast from a line 15" inside each rail, on both sides of and to the ends of ties. Center area between these limits shall be filled lightly with ballast but not tamped. At turnouts and crossovers, tamp ballast uniformly for full length of ties. Tamping shall proceed simultaneously at both ends of same tie, making sure ballast is forced directly under the ties and against sides and ends of ties.

#### Finishing and Dressing:

Dress ballast in conformance with dimensions shown on drawings, placing additional ballast material as necessary. When placing pavement up to the track and flush with top of rail it is important to make sure water drains away from the track. This will prevent pooling and freezing which create hazardous walking conditions. Lines should be painted 10 feet parallel to the centerline of track on both sides to serve as visual reminder of the track's foul zone. Crushed rock or fabric should be placed over the ties to keep the pavement from adhering to them. Flange ways need to be kept clean to allow wheels to contact top of rail at all times.

#### Final Inspection:

After ballasting and surfacing are completed, inspect track to see that joints are tight and rail attachments to ties are secure.

Customer will notify the BNSF Economic Development Manager that the trackwork is complete and ready for inspection. The ED Mgr will arrange an on-site inspection with the BNSF Roadmaster, or designate, who will inspect the finished trackwork and complete the checklist on page 20, or similar document. The Contractor will provide a copy of the "Record of Neutral Temp of Welded Rail as Laid" form to the Roadmaster prior to or during inspection. After the Roadmaster's approval the track will be placed in service by the Division's General Manager and can then accept rail cars. Rail cars delivered to site before the track is in service will be stored at another location at an additional cost to the customer, or returned to origination point.

#### MISCELLANEOUS

#### Fencing and Gates:

Gates and fences must be grounded in accordance with National Electric Safety Code requirements to prevent an injury resulting from an electrical charge. Gates crossing tracks must have the ability to lock in the open position during train operations. If a fence parallel to a track has an angled piece at the top with security wire it must not foul the clearance envelope of the track.

**ACCEPTANCE**

Final acceptance of the work will be subject to the inspection by BNSF, and any portion of the work not accepted will have its faults corrected before the track is put into service.

Customer \_\_\_\_\_ Contractor \_\_\_\_\_

Location \_\_\_\_\_

Roadmaster's Check List:      Indicate OK, NO, N/A or other comments

Before traffic is permitted on trackage constructed by private contractor, Roadmaster shall make an inspection for compliance with the attached specifications and submit form to Division Engineer and Manager Economic Development:

Subgrade \_\_\_\_\_ Drainage \_\_\_\_\_

Ballast \_\_\_\_\_ Curvature & Alignment \_\_\_\_\_

Surface \_\_\_\_\_ Any Clearance Problems? \_\_\_\_\_

Rail/Gage \_\_\_\_\_ Anchors \_\_\_\_\_

Record of Neutral Temp of Welded Rail as Laid (from Contractor) \_\_\_\_\_

Tie \_\_\_\_\_ Switches, Frogs & Guard Rails \_\_\_\_\_

Tie Plates \_\_\_\_\_ Joint Bars \_\_\_\_\_

Spikes \_\_\_\_\_ Bolts, Nuts & Washers \_\_\_\_\_

Earthen Berm or Bumping Post \_\_\_\_\_ Derails, Derail Signs \_\_\_\_\_

Walkways \_\_\_\_\_

Track or Highway Crossings \_\_\_\_\_

\_\_\_\_\_

Comments \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
Roadmaster

\_\_\_\_\_  
Date

## **REQUIREMENTS FOR CONTRACTORS WORKING**

### **ON BNSF RIGHT-OF-WAY**

In order to protect BNSF's investment in its right-of-way and for the safety of persons coming onto BNSF property, BNSF has established certain requirements. The following 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. A web site has been set up to assist in preparation of a safety plan—[www.contractororientation.com](http://www.contractororientation.com). Contractors will not be allowed to occupy or work on BNSF right-of-way prior to registering on the web site and completing the course.

1. All permits and agreements must be in effect, required payments made, and insurance certificates received and approved prior to Contractor entering BNSF right-of-way. All of these documents are included in the packet containing the cost proposal. Prior to performing the preliminary survey, the consultant will obtain a "Temporary Occupancy Permit". To obtain a permit, contact Jones, Lang, LaSalle, phone number 1-866-498-6647. The permit requires a preparation fee and some lead time. Copies of all documents should be kept on the job site.
2. Any de-watering utilizing drains or ditches on BNSF property must be approved by BNSF Engineering.
3. Contractor must have BNSF approved "Final Construction Plans" prior to commencing work on a project. No change will be made to "Final Construction Plans" without approval by all parties involved. Approved revised plan will be furnished to all parties prior to implementation of changes.
4. Road Authority or Contractor will incur all costs for track work, including flagging, etc., made necessary due to their construction operation.
5. Pursuant to BNSF safety rules, flagging protection is always required when equipment crosses or is working within 25 feet of center of any track. When deemed necessary by BNSF, a flagman may be required at all times while working on BNSF right-of-way.
6. Crossing of any railroad tracks must be done at approved locations and must be over full depth timbers, rubber, etc. Any equipment with steel wheels, lugs, or tracks must not cross steel rails without aid of rubber tires or other approved protection and proper flagging will be required.
7. All temporary construction crossings must be covered by a "Private Roadway & Crossing Agreement," and must be barricaded when not in use.
8. Contractor must furnish details on how work will be performed that may affect existing drainage and/or possible fouling of track ballast as well as removal of overhead bridges/structures. (Structures and bridge spans over tracks must be removed intact.)
9. Absolutely no piling of construction materials or any other material, including dirt, sand, etc., within 25 feet of any track or on property of BNSF not covered by construction easement, permit, lease or agreement, or within 250 feet of a public grade crossing. A 10-foot clear area on both sides of a main track must remain unobstructed at all times to allow for stopped train inspection.
10. No construction will be allowed within 25 feet of center of any track unless authorized by BNSF's Division Engineer and as shown on Final Plan approved by the Railroad. This includes any excavation, slope encroachment and driving of sheet piles.

11. No vehicles or machines shall remain unattended within 25 feet of any track. All machines will be disabled when not in use to prevent unauthorized operation.
12. **IMPORTANT:** Disregard of any of these items will result in Contractor being shut down and prohibited from working on BNSF right-of-way while infraction is investigated. Based on findings of the investigation, it will be determined if the Contractor will be allowed to work on BNSF right-of-way in the future.
13. Contractor safety rules, including rules regarding Personal Safety Equipment, must not conflict with BNSF safety policies. Contractor's personnel will obtain BNSF's safety 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 proper personal protective equipment (PPE) 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 should be directed to the BNSF project representative.
14. Articles included in Agreement should compliment this document or exceed its contents.





# Procedures for the Installation, Adjustment, Maintenance, and Inspection of CWR in Industry Tracks

October 13, 2010

## Table of Contents

Materials contained within this document are excerpts from BNSF's Engineering Instructions, and the EI chapter numbers and references are retained. Sections unrelated to construction of industry tracks have been removed.

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# Procedures for the Installation, Adjustment, Maintenance, and Inspection of CWR in Industry Tracks

This document details the Railroad's policy on installing, adjusting, maintaining, and inspecting Continuous Welded Rail (CWR) track. Each chapter details how the Railroad applies its standards and procedures to comply with FRA standards. The procedures listed in this document apply to CWR on all tracks.

## Chapter 1 CWR Installation Procedures

Rail length that exceeds 400 feet is considered CWR. Rail installed as CWR remains CWR, regardless of whether a joint or plug is installed into the rail at a later time. Temperature variations affect rail length. Rail expands (lengthens) when heated and contracts (shortens) when cooled.

### 1.1 Neutral Temperature

The neutral temperature is the temperature at which a rail is neither in tension nor compression. Target neutral temperatures have been established to provide a specific desired neutral temperature to prevent track buckling. When laying or adjusting CWR, use Figure 6-1, *Target Rail Laying Temperatures*, located in Engineering Instruction 6.2.3 A, reproduced below (page 3).

### 1.2 Temperature Differential

The difference between the target neutral temperature and the actual rail temperature taken at the time of installation is called the temperature differential. CWR laying and adjusting procedures have been established to compensate for this temperature difference.

### 1.3 Installing CWR

Follow these general requirements when laying CWR:

- Refer to Figure 6-1 (page 3) for the target rail laying temperature for your area.
- Take the rail temperature and calculate the expansion required before making adjustments.
- Record the rail laying temperature, location, and date on approved forms.
- Rail does not need to be adjusted when the actual rail temperature exceeds the target neutral temperature.
- Use rail heaters or rail expanders to adjust the rail to the correct length when the actual rail temperature is less than the target neutral temperature. Heat the rail evenly and uniformly so that the rail expansion occurs evenly and uniformly throughout its length.

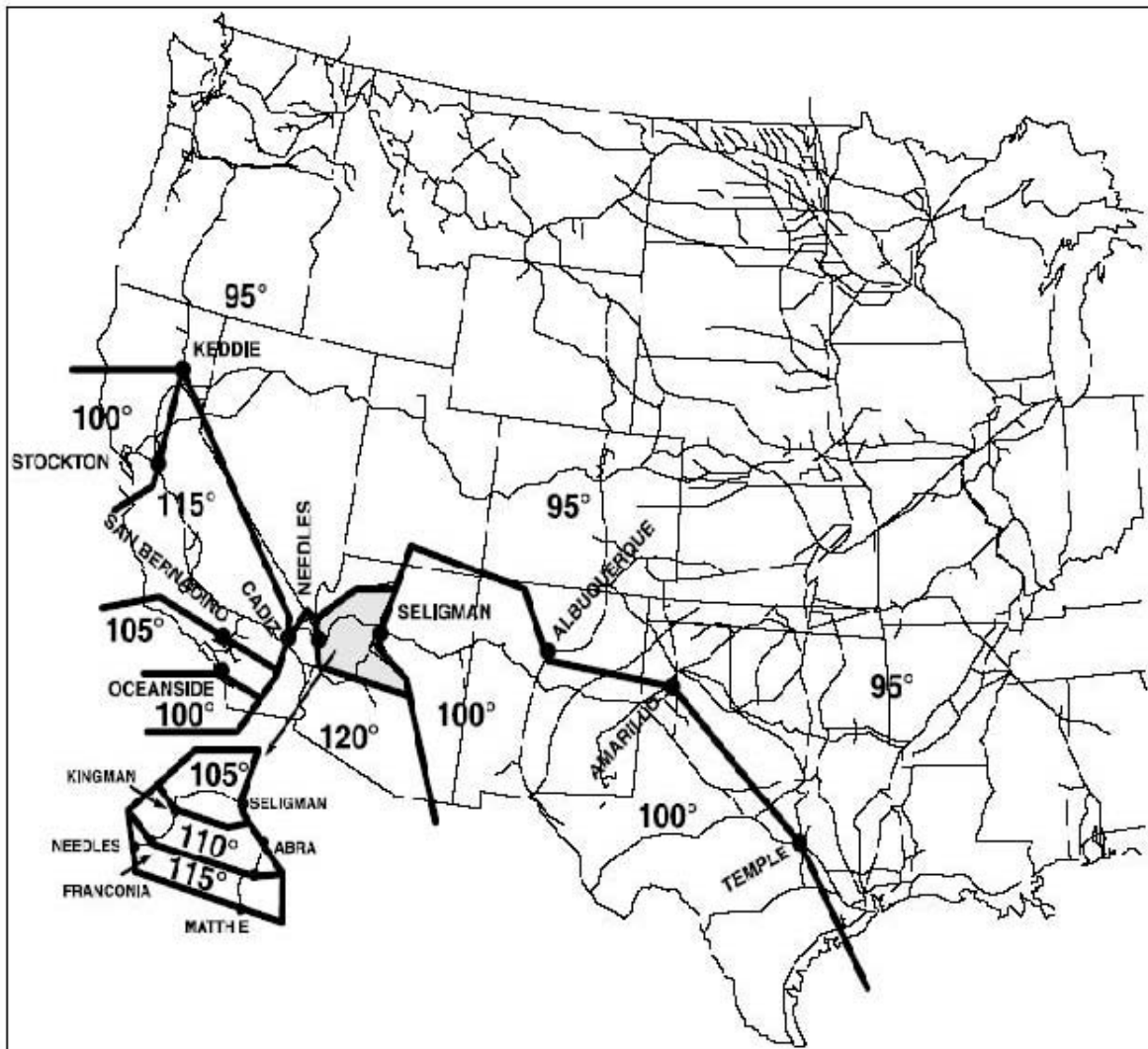


Figure 6-1. Target Rail Laying Temperatures

## Chapter 2 Rail Anchoring Requirements

Where the anchoring function is otherwise provided, rail anchors may be omitted. Anchors may not be applied where they will interfere with signal or other track appliances, where they are inaccessible for adjustment or inspection, or on rail opposite a joint. Anchor pattern may be varied as reasonable to avoid placing anchors against deteriorated ties.

### Installation

The following anchoring requirements apply to CWR installations on all main tracks, sidings, and other tracks over which trains operate at speeds above Class 1.

#### 2.1 Standard Box Pattern

When installing CWR, box anchor every other tie except as outlined in Section 2.2.

#### 2.2 Solid Box Pattern

When installing CWR, box anchor every sound (effective) tie at specific locations listed below to provide additional restraint against rail movement.

Condition	Action
Turnouts Crossing Frogs Joint where CWR abuts bolted rail	Anchor every tie for 195 feet in each direction
Bolted joint created during CWR installation/construction when using heater, rail expander, or at or above Target Neutral Temperature	<b>Within 60 days from date of creation:</b> Weld Joint, <b>OR</b> Install joint with 6 bolts, <b>OR</b> Anchor every tie for 195' in both directions

#### 2.3 Bridge Pattern

When installing CWR, follow these bridge anchoring requirements:

1. Ballast deck bridges should be anchored with the same pattern as in section 2.1 and 2.2.
2. Open deck bridges should be anchored according to Engineering Instruction 6.4.5:
  - On open-deck timber bridges, apply anchors to all ties fastened to the stringers.
  - On open-deck steel bridges 150 feet long or less, apply anchors to all ties fastened to the steel structure.

## Maintenance or Rail Repair

### 2.5 Anchor Requirements after Rail Repair

When rail repairs result in a joint added to CWR, the anchor pattern shall match the existing pattern in track. At least every other tie will be box anchored for a distance of 195 feet in each direction unless anchoring is otherwise provided. When repairs are made to a stripped joint or failed joint bar, the adjustment or addition of anchors will be as prescribed in the following table.

Condition	Action
Bolted joint in CWR experiencing service failure (stripped joint) or failed bar(s) with gap* present.  *gap exists if it cannot be closed by drift pin	1. Weld joint, <b>OR</b> 2. Remediate joint conditions (per Chapter 6.5) <b>and</b> replace bolts (new, in-kind or stronger), <b>and</b> weld joint within 30 days, <b>OR</b> 3. Replace failed bar(s), install 2 additional bolts <b>and</b> adjust anchors <b>OR</b> 4. Replace bars, bolts (if failed or missing) <b>and</b> anchor every tie for 195' in both directions <b>OR</b> 5. Add rail (with provisions for adjusting later, if necessary)

## Chapter 3 Preventive Maintenance on Existing CWR Track

Performing track buckling preventive maintenance can reduce the risk of buckles. When tight rail conditions exist, be governed by Chapter 7.1.

### 3.2 De-Stressing Rail

Rail can be de-stressed by cutting rail out or by re-aligning a curve. When cutting rail out, use this procedure:

#### Procedure

1. Cut rail to be de-stressed.
2. Remove or reposition anchors or clips for a minimum of 200 feet in both directions from the cut or up to a restriction that prevents rail movement.
3. Wait until the rails stop moving. The rail ends may need to be trimmed more than one time to allow for expansion.
4. Take the rail temperature (far enough away from the cut so that the reading is not affected by the cutting procedure).
5. Use Figure 6-1 (page 3) to compare the rail temperature with the target neutral temperature for the territory. This is known as the temperature differential.
6. If the actual rail temperature is lower than the target neutral temperature for the territory, use Table 6-3, *Change in Length of Welded Rail to Change Neutral Temperature* (page 8), to determine the rail length to be removed based on the total distance the anchors or clips have been removed.
7. If the rail temperature is at or above the Target Neutral Temperature, no additional adjustments are needed.
8. Weld the joint or apply joint bars.
9. Replace the rail anchors or clips.

## Chapter 9 Recordkeeping

### 9.1 Report of CWR Installations

Rail temperature, location, and date of CWR installations should be recorded on the prescribed form, "Record of Neutral Temperature of Welded Rail as Laid", as shown below in Figure 6-2.

Record of Neutral Temperature of Welded Rail as Laid											
Division _____			Subdivn _____			Line Segment _____					
Relay Between _____				and _____		Recorded by _____					
Target Neutral Temperature = _____ ° F (see Figure 6-1)											
Date Rail Laid	Curve No and/or MP Loc	Position		Trk No	Actual Rail Temp	Temp Diff	Distance to Match Mark	Expansion at Matchmark		Length of String	Remarks
		N/W Rail	S/E Rail					Required	Actual		

Figure 6-2. Record of Neutral Temperature of Welded Rail as Laid

### 9.2 Report Maintenance Work in CWR

Because track maintenance can disturb the lateral and longitudinal resistance of the track, records of the following must be kept until corrections or adjustments are made:

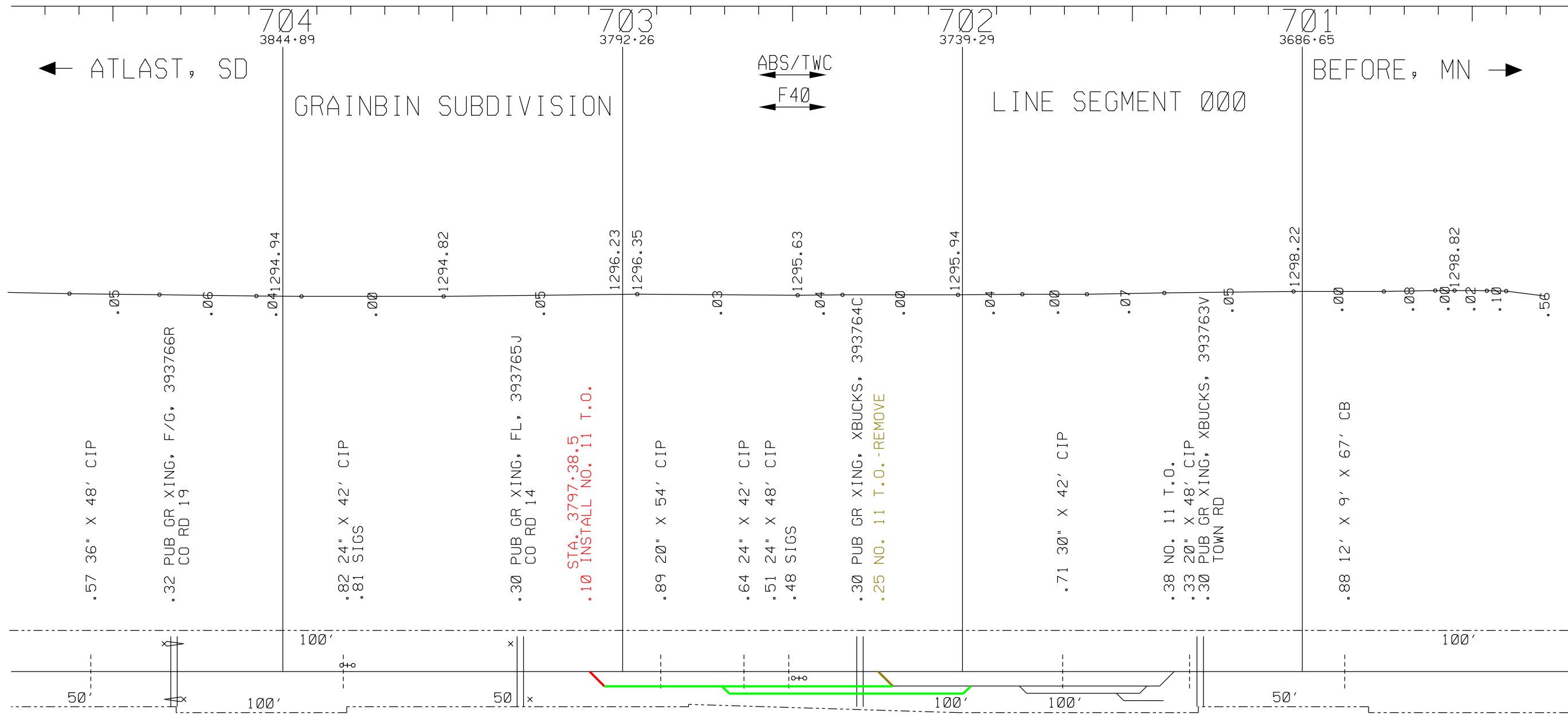
- Rail that is added for any reason, including repair of broken or defective rail, pullaparts, and welding of rail joints
- Where a curve has been staked and inward lateral curve movement exceeds 3"
- CWR installation or maintenance work that does not conform to these written procedures. A record of rail neutral temperature will be maintained where rail has pulled apart, broken or been cut for defect removal.

The Division Engineer and Roadmaster will review these records during initial and periodic track inspections.

**Table 6-3. Change in Length of Welded Rail to Change Neutral Temperature.**

Temp. Diff. in Deg. F	Length of Unrestrained Rail							
	200'	400'	600'	800'	1,000'	1,200'	1,400'	1,600'
5°	1/8"	1/4"	1/4"	1/4"	1/2"	1/2"	1/2"	1/2"
10°	1/8"	1/4"	1/2"	1/2"	3/4"	1"	1"	1-1/4"
16°	1/4"	1/2"	3/4"	1"	1 1/4"	1 1/2"	1 3/4"	1 3/4"
20°	1/4"	1/2"	1"	1-1/4"	1-1/2"	1-3/4"	2-1/4"	2-1/2"
25°	3/8"	3/4"	1-1/4"	1-1/2"	2"	2-1/4"	2-3/4"	3"
30°	1/2"	1"	1-1/2"	1-3/4"	2-1/4"	2-3/4"	3-1/4"	3-3/4"
35°	1/2"	1"	1-3/4"	2-1/4"	2-3/4"	3-1/4"	3-3/4"	4-1/4"
40°	5/8"	1-1/4"	1-3/4"	2-1/2"	3"	3-3/4"	4-1/4"	5"
45°	3/4"	1-1/2"	2"	2-3/4"	3-1/2"	4-1/4"	5"	5-1/2"
50°	3/4"	1-1/2"	2-1/4"	3"	4"	4-3/4"	5-1/2"	6-1/4"
55°	7/8"	1-3/4"	2-1/2"	3-1/2"	4-1/4"	5-1/4"	6"	6-3/4"
60°	7/8"	1-3/4"	2-3/4"	3-3/4"	4-3/4"	5-1/2"	6-1/2"	7-1/2"
65°	1"	2"	3"	4"	5"	6"	7"	8"
70°	1-1/8"	2-1/4"	3-1/4"	4-1/4"	5-1/2"	6-1/2"	7-3/4"	8-3/4"
75°	1-1/8"	2-1/4"	3-1/2"	4-3/4"	5-3/4"	7"	8-1/4"	9-1/4"
80°	1-1/4"	2-1/2"	3-3/4"	5"	6-1/4"	7-1/2"	8-3/4"	10"
85°	1-3/8"	2-3/4"	4"	5-1/4"	6-3/4"	8"	9-1/4"	10-1/2"
90°	1-3/8"	2-3/4"	4-1/4"	5-1/2"	7"	8-1/2"	9-3/4"	11-1/4"
95°	1-1/2"	3"	4-1/2"	6"	7-1/2"	9"	10-1/4"	11-3/4"
100°	1-1/2"	3"	4-3/4"	6-1/4"	7-3/4"	9-1/4"	11"	12-1/2"





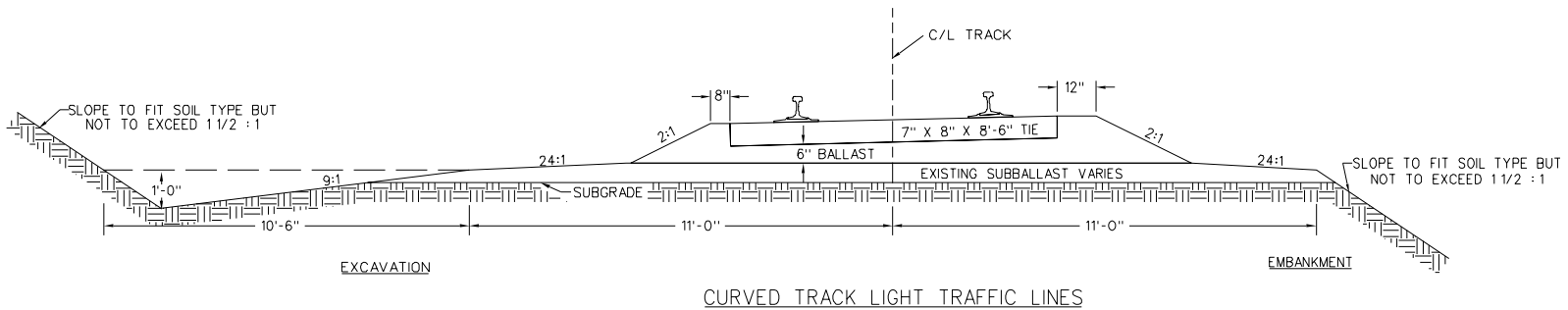
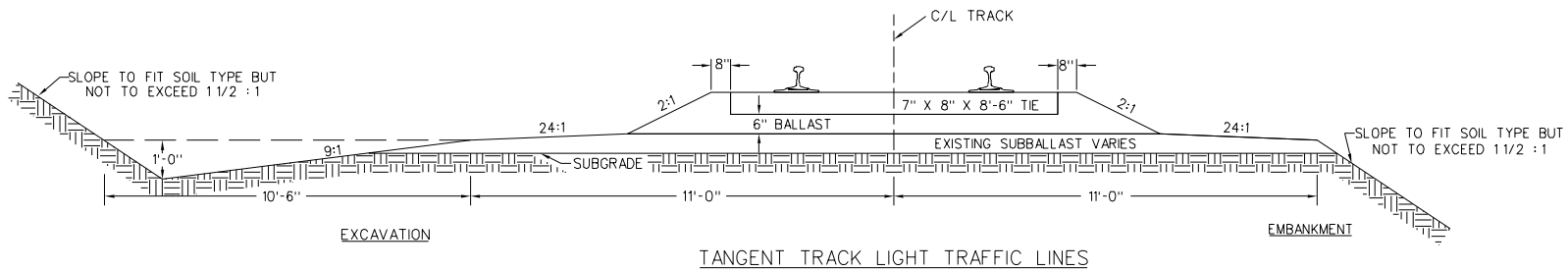
**BNSF WORK**  
 INSTALL #11-115LB RHTO  
 AT MP 703.10  
 REMOVE #11-112LB RHTO  
 AT MP 702.25

CUSTOMER TO CONSTRUCT  
 REMAINING TRACKAGE

.71 #9 TO  
 GRAIN BELT  
 MP 702.3  
 .98 #9 TO

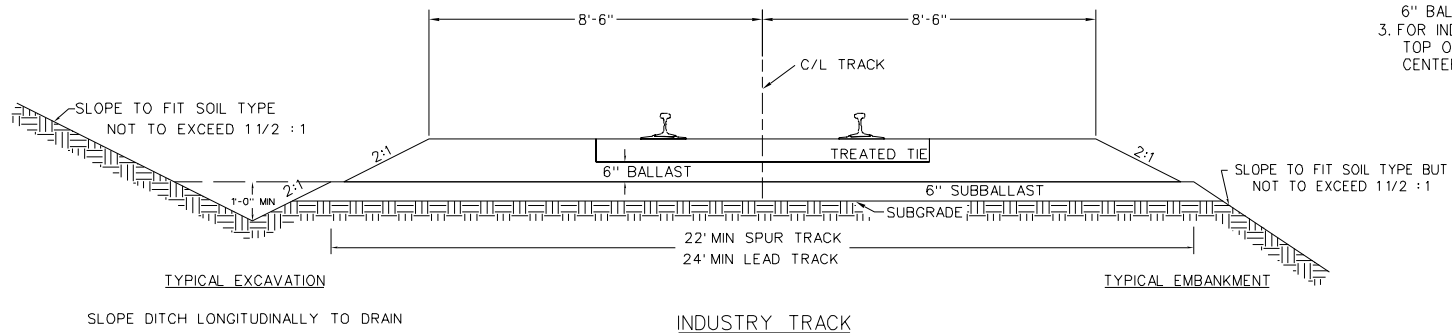
**CONCEPTUAL DRAWING ONLY!**  
 THIS LAYOUT HAS NOT BEEN  
 ENGINEERED AND NEEDS TO BE  
 VERIFIED BY FIELD SURVEY

APPROVALS - (NAME - TITLE)		DATE	APPROVALS - (NAME - TITLE)		DATE	<b>DAKOTA DIVISION</b> <b>GRAINBIN SUBDIVISION</b> <b>LINE SEGMENT 000</b>			
							<b>NW GRAIN GROWERS</b> <b>GRAIN BELT, SD</b>		
REVISIONS						FILE: grainbelt.dgn			
DRAWN JRG    CHECKED JRG <b>BNSF RAILWAY COMPANY - ENGINEERING SERVICES</b>						SHEET 1 OF 1    DATE: 04/28/2011			
PROTRAK SEQ NO    STATUS PRELIMINARY						A-9			

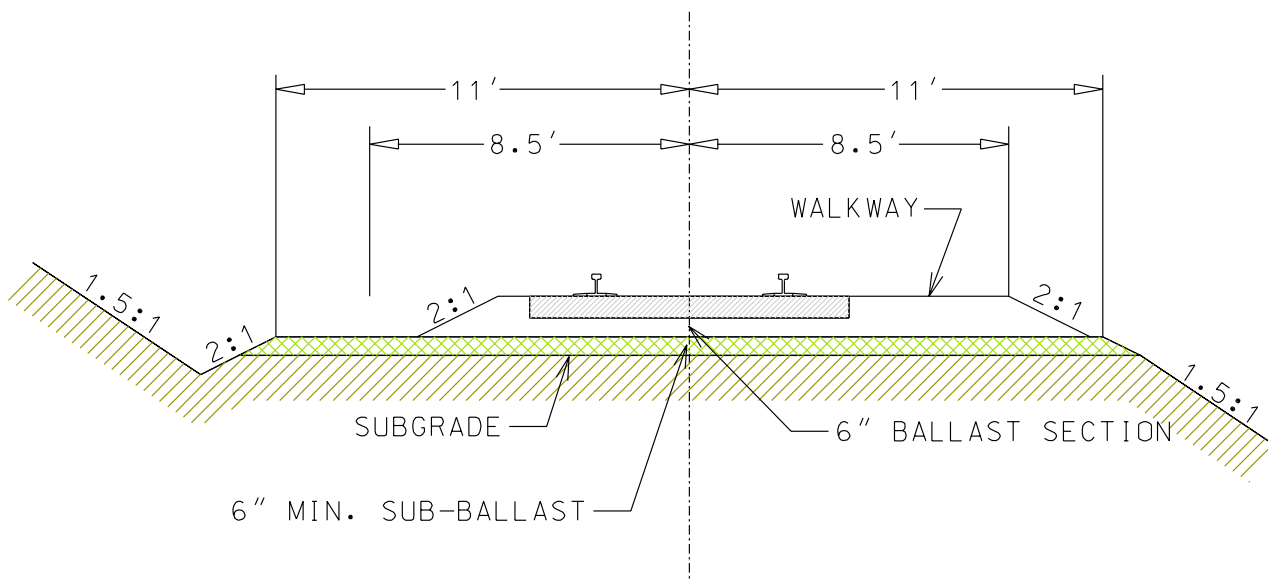
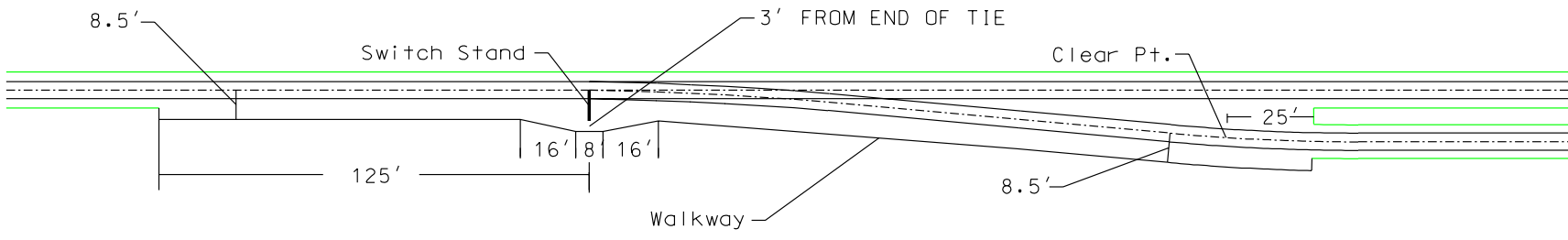


**NOTE:**

1. 6" MIN. GRANULAR SUBBALLAST OR AS REQUIRED PER LOCAL SUBGRADE CONDITION.
2. BALLAST PER MILE OF TRACK:  
6" BALLAST 2,435 CU. YARDS TANGENT
3. FOR INDUSTRY TRACK BALLAST SECTION TO BE LEVEL WITH TOP OF TIE WHERE WALKING REQUIRED, 8'-6" MIN FROM CENTER LINE.

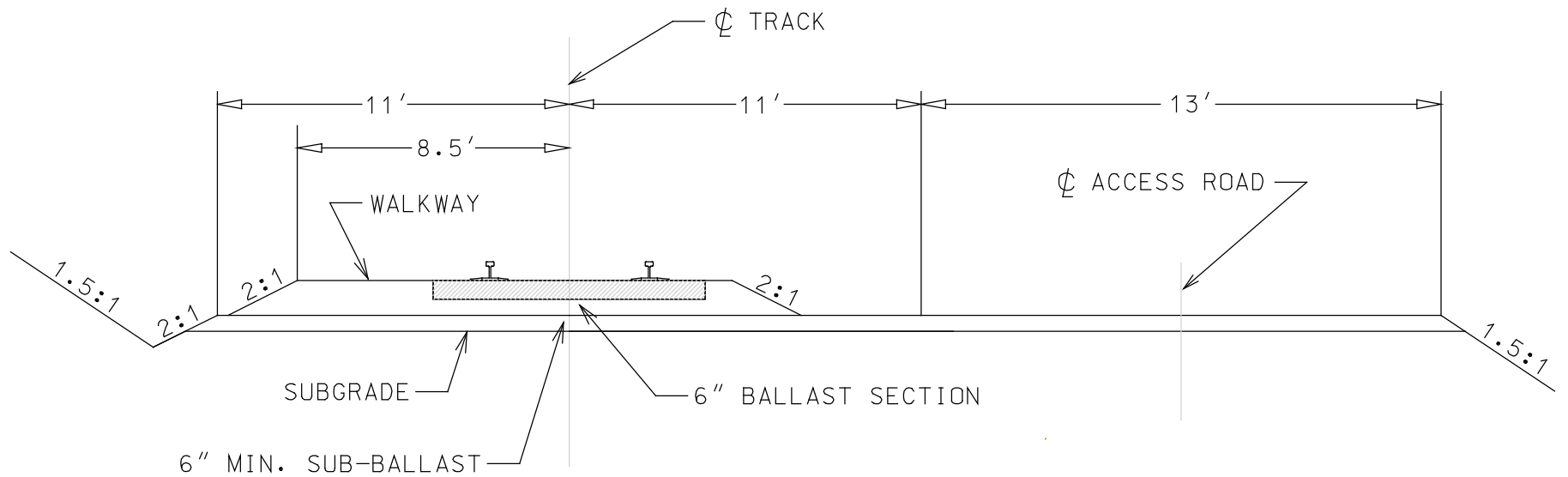
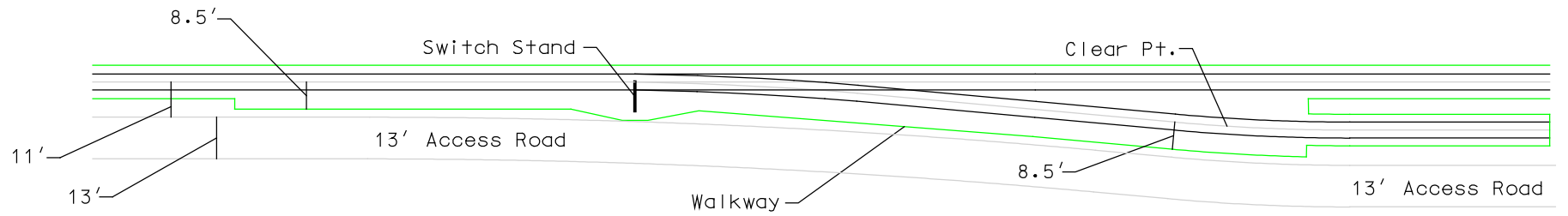


<b>BURLINGTON NORTHERN SANTA FE STANDARD PLAN</b> <small>ENGINEERING DEPT., FORT WORTH, TEXAS</small>		
LIGHT TRAFFIC LINES AND INDUSTRY TRACK		
RAIL:		
DATE: 10/29/97	SCALE: NONE	
DWG. NO. 1000	SHEET NO. 03	REV. NO. 01
USE OF THIS DRAWING IS LIMITED TO BURLINGTON NORTHERN SANTA FE AND THE PARTY DESIGNATED ON THE ATTACHED EXHIBIT. NO OTHER USE MAY BE MADE BY ANY THIRD PARTY WITHOUT THE WRITTEN CONSENT OF BURLINGTON NORTHERN SANTA FE.		



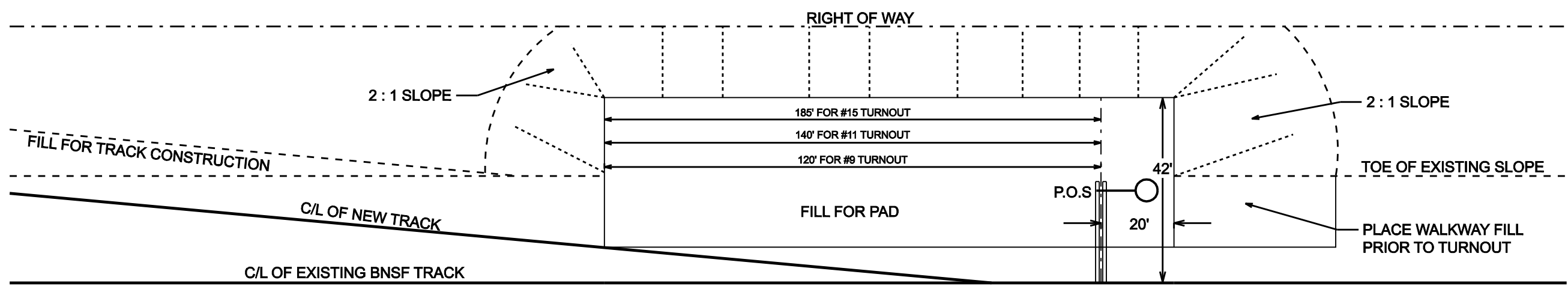
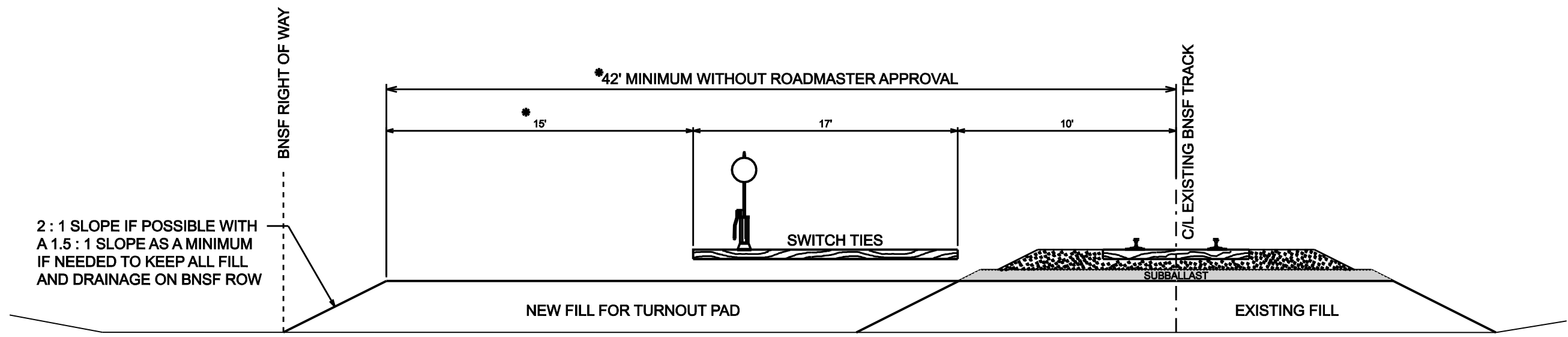
INDUSTRY TRACK STD SECTION  
WITH 8.5' WALKWAY

BNSF ENG SVCS - 10/12/01



INDUSTRY TRACK STD SECTION  
WITH 13' ACCESS ROAD

BNSF ENG SVCS - 04/02/04



NOTE: CONSTRUCTION OF INDUSTRY TURNOUT PAD IS FOR THE PLACEMENT OF THE PROPOSED PACKAGE TURNOUT FOR ASSEMBLY AND INSTALLATION. TURNOUT PAD IS ALSO TO PROVIDE FOUNDATION FOR ANY REQUIRED SIGNAL EQUIPMENT

TURNOUT PAD FILL MATERIAL SHALL BE PLACED BY THE INDUSTRY AS PART OF THE GRADING FOR THE NEW INDUSTRY SPUR. PAD IS TO BE CONSTRUCTED USING STANDARD COMPACTION AND FILL PLACEMENT PROCESSES AS PER THE BNSF INDUSTRY TRACK GUIDELINES. TOP OF PAD IS TO BE 2' BELOW THE EXISTING TOP OF RAIL.

CONTRACTOR SHALL COORDINATE WITH THE ROADMASTER AND ASSOCIATED PROJECT ENGINEER FOR ANY DEVIATION OF FILL AND FOR FLAGMAN PROTECTION.

\* NOTE: IF RIGHT OF WAY IS OVER 50' FROM C/L OF EXISTING BNSF TRACK THIS DISTANCE SHALL BE INCREASED TO 25' AND 50' RESPECTIVELY

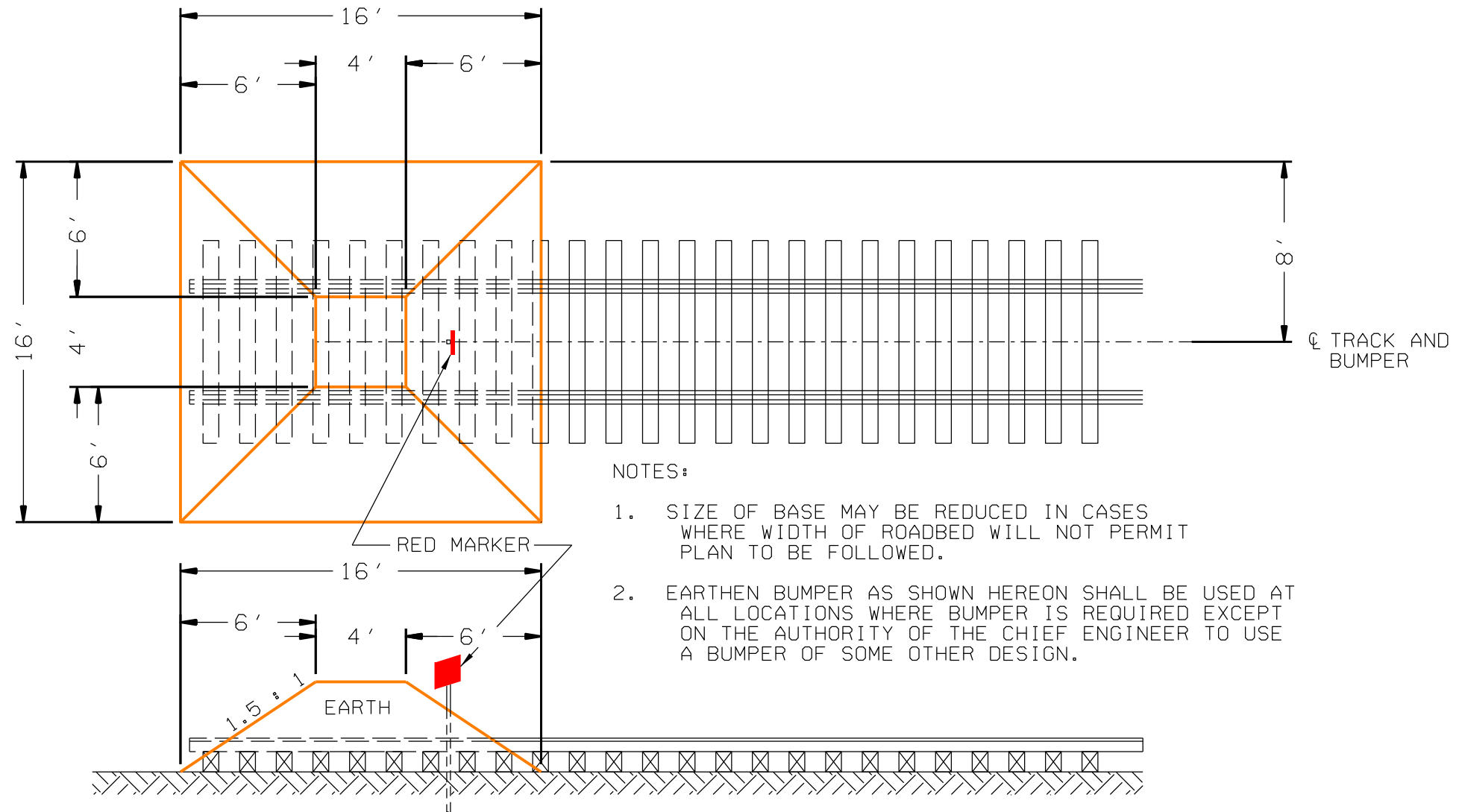
APPROVALS - (NAME - TITLE)	DATE	APPROVALS - (NAME - TITLE)	DATE

**BNSF STANDARD TURNOUT PAD  
#9, #11 AND #15**

REVISIONS			
NO.	DESCRIPTION	DATE	BY

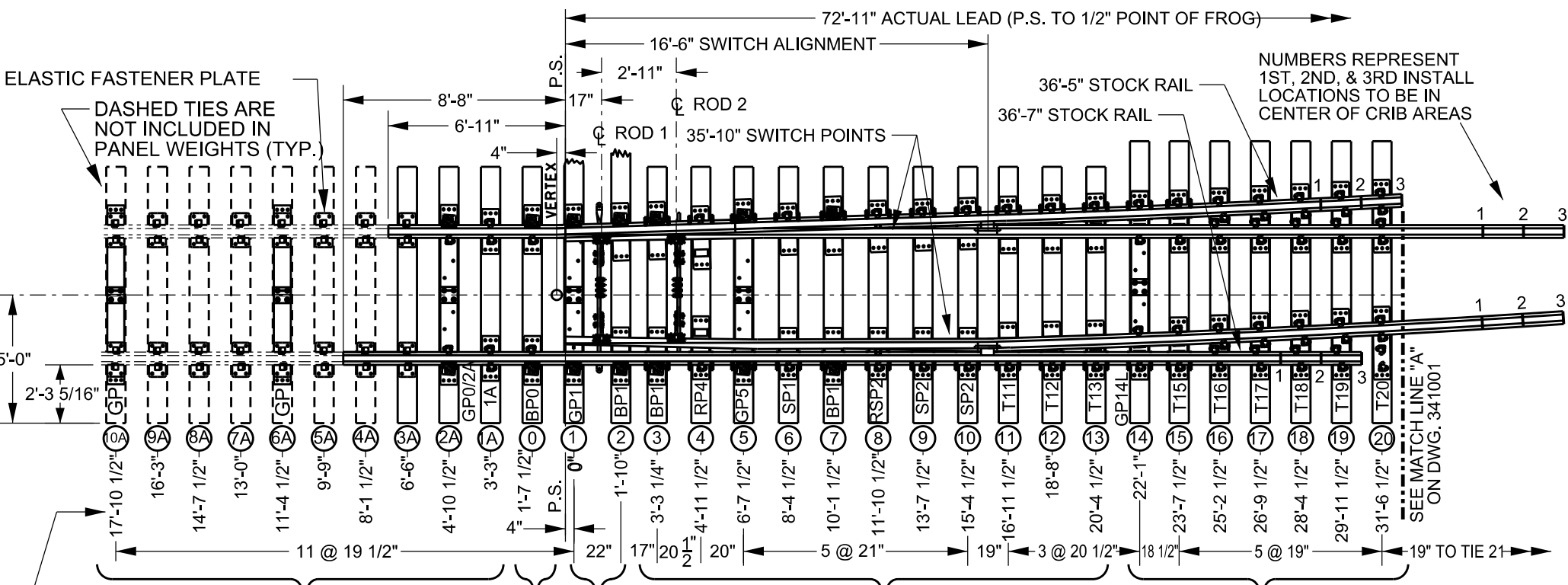


SYSTEM WIDE  
NOT TO SCALE  
REFERENCE ONLY



TYPICAL PLAN & SECTION FOR  
 EARTHEN BUMPER FOR END OF TRACK  
 SCALE: N.T.S.

APPROVALS - (NAME - TITLE)		DATE	APPROVALS - (NAME - TITLE)		DATE				
						REVISIONS NO. DESCRIPTION DATE BY			
						EARTHEN BUMPER FOR END OF TRACK			
DRAWN	CHECKED	BNSF RAILWAY COMPANY - ENGINEERING SERVICES			PROTRAK SEQ NO	STATUS PRELIMINARY	FILE: EARTHEN BUMPER.DGN	SHEET 1 OF 1	DATE: 05/05/2011



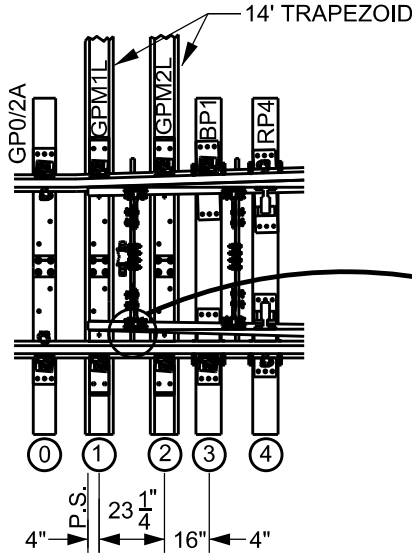
NUMBERS REPRESENT 1ST, 2ND, & 3RD INSTALL LOCATIONS TO BE IN CENTER OF CRIB AREAS

SEE MATCH LINE "A" ON DWG. 341001

WOOD TIE QUANTITIES BY LENGTH  
ACCUMULATIVE TIE SPACING FROM C TIE 1

(10) 10'-0"    8" X 10" X 10'    (2) 17'-0"    (11) 10'-0"    (7) 11'-0"

**MANUAL OPERATED**  
PANEL WEIGHT: 20,000 LBS.



THROW DETAIL    4 3/4" THROW AT C OF ROD

- NOTES:
1. SEE DWGS 341001, 341002, 341003, AND 341004 FOR THE BALANCE OF LAYOUT PLANS.
  2. ALL TIES 7" X 9" BODY UNLESS OTHERWISE SHOWN.
  3. SEE DWG 341100 FOR TURNOUT GEOMETRY.
  4. SEE DWG 341200 FOR TURNOUT BILL OF MATERIAL.
  5. FULLY BOX ANCHOR STOCK RAILS, TIES 3-15 FOR SHIPPING OF PANELS ONLY.
  6. APPLY 5" SAFE BOND WIRES ONE CRIB AHEAD OF HEEL OF SWITCH ON STOCK AND SWITCH POINT RAILS.



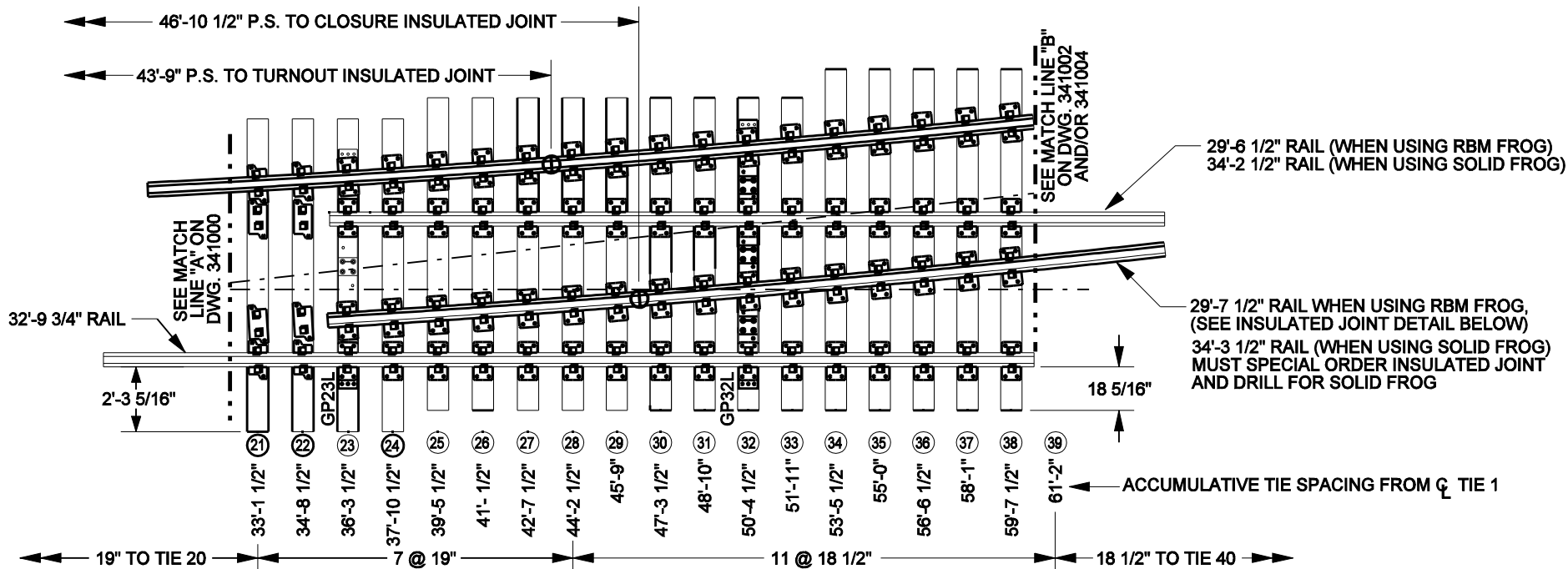
**COMMON STANDARDS**

**NO. 9 TURNOUT 136 LB PANEL NO. 1**

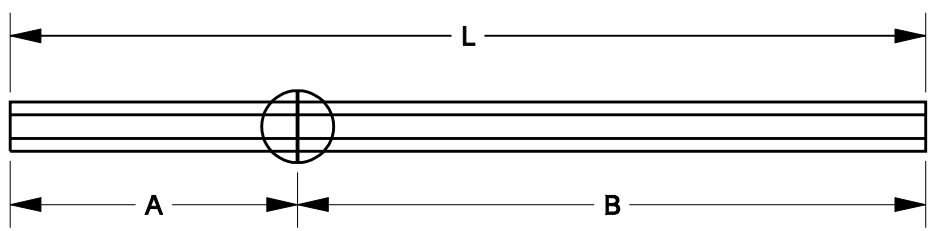
	UPRR	BNSF RH	BNSF LH
POWER	N/A	518030061	518030073
MANUAL	N/A	518030074	518030075

 UPRR VP ENGINEERING BNSF VP ENGINEERING	FILE OWNER: BNSF	DATE: OCT. 5, 2010
	REV. NO.: 4	DWG NO: 341000

22-1



- NOTES:
1. WHEN INSULATED JOINTS ARE REQUIRED, THE LOCATION OF THE JOINTS SHOULD BE STAGGERED NO CLOSER THAN 6" AND NOT MORE THAN 4'-6" APART, MEASURED ALONG THE TURNOUT.
  2. SEE DWGS 341000, 341002, 341003, AND 341004 FOR THE BALANCE OF LAYOUT PLANS.
  3. ALL TIES 7" X 9" BODY UNLESS OTHERWISE SHOWN.
  4. SEE DWG 341100 FOR TURNOUT GEOMETRY.
  5. SEE DWG 341200 FOR TURNOUT BILL OF MATERIAL.
  6. PANEL WEIGHT = 14,500 LBS.



	A	B	L	BNSF ITEM NO.
TURNOUT INSULATED JOINT RAIL	14'-3 1/4"	17'-0 3/4"	31'-4"	524400027
CLOSURE INSULATED JOINT RAIL	11'-0 1/2"	18'-7"	29'-7 1/2"	524400030

**INSULATED JOINT DETAIL**  
(FOR USE WITH RBM FROG ONLY)

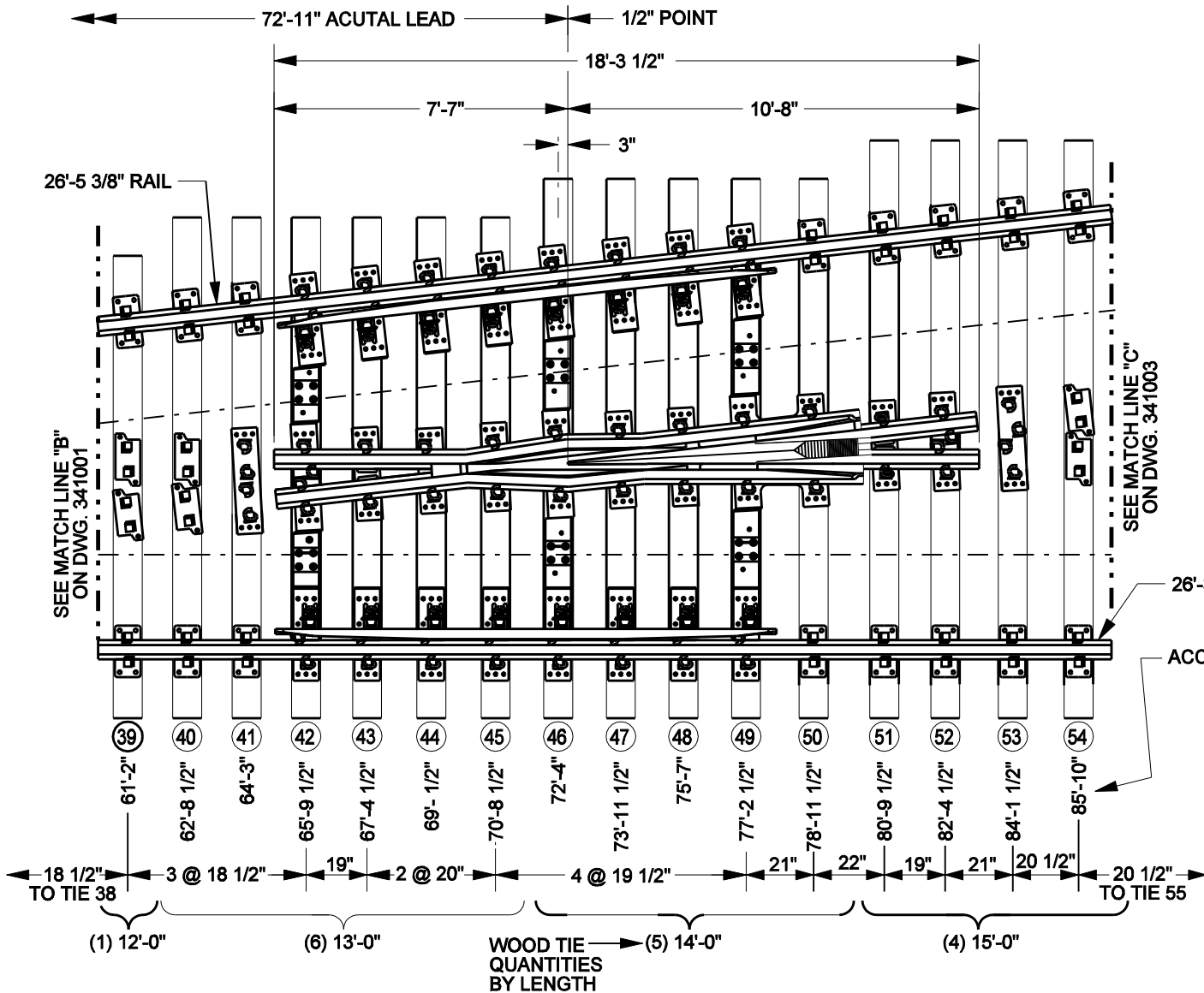


**COMMON STANDARDS**

**NO. 9 TURNOUT 136 LB. PANEL NO. 2**

FILE OWNER: BNSF	DATE: MAR. 1, 2007
REV. NO.: 4	DWG NO: 341001





- NOTES:
1. SEE DWGS 341000, 341001, 341003, AND 341004 FOR THE BALANCE OF LAYOUT PLANS.
  2. ALL TIES 7" X 9" BODY UNLESS OTHERWISE SHOWN.
  3. SEE DWG 341100 FOR TURNOUT GEOMETRY.
  4. SEE DWG 341200 FOR TURNOUT BILL OF MATERIAL.
  5. PANEL WEIGHT = 18,000 LBS.
  6. SEE DWG 3413004 FOR SOLID MANGANESE FROG PANEL.

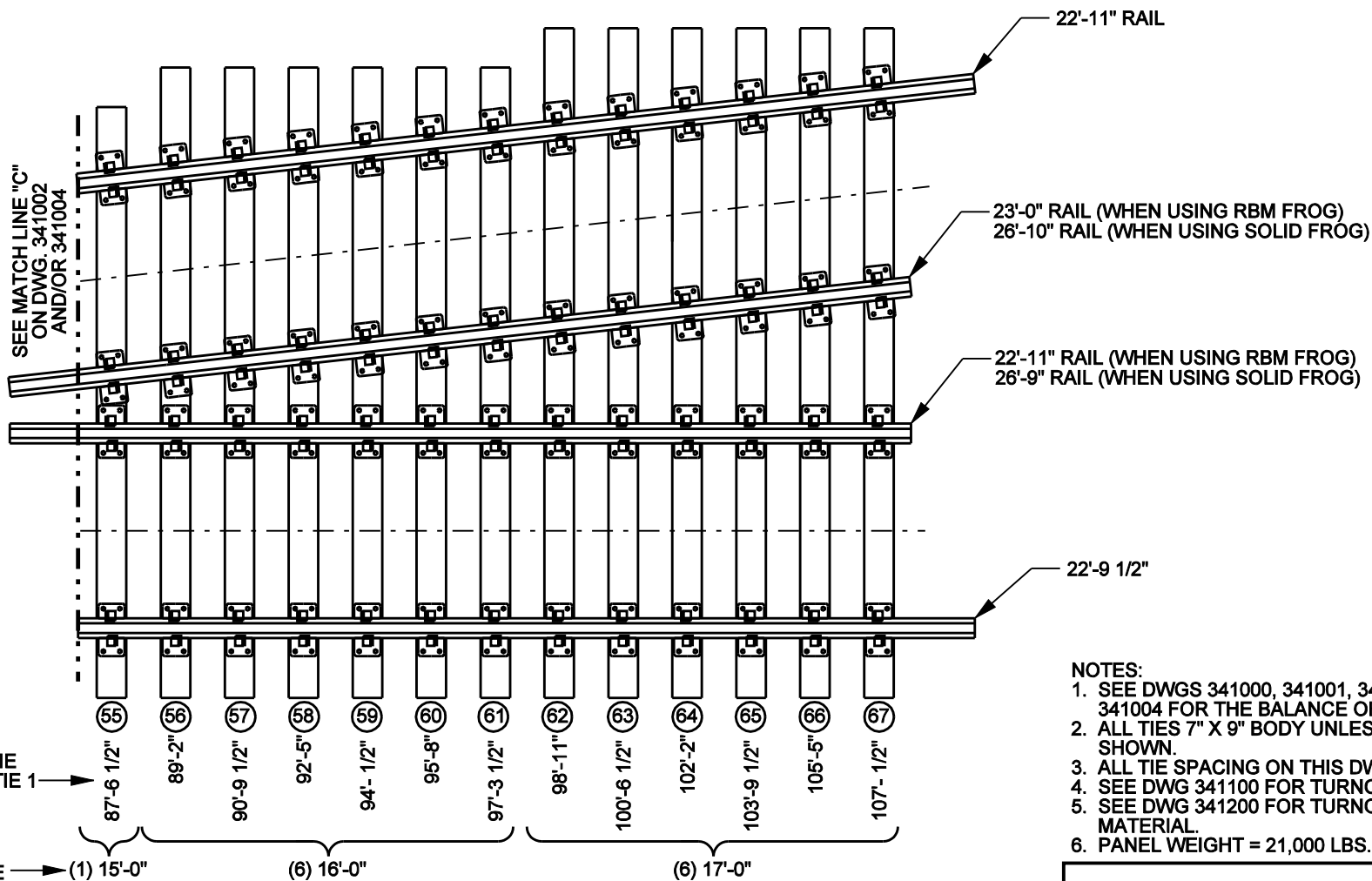


**COMMON STANDARDS**  
**NO. 9 TURNOUT 136 LB.**  
**PANEL NO. 3 WITH**  
**OPTIONAL RBM FROG**

	UPRR	BNSF RH	BNSF LH
RBM	N/A	513450048	513450049
SOLID	N/A	513450050	513450051

FILE OWNER: BNSF	DATE: MAY 19, 2008
REV. NO.: 5	DWG NO: 341002

22-3



NOTES:

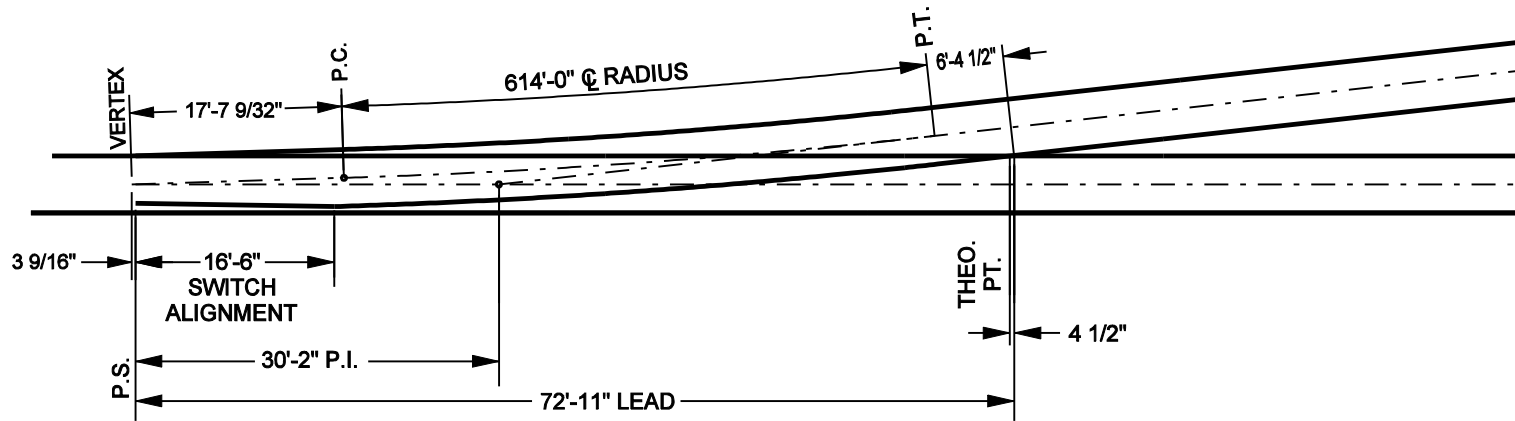
1. SEE DWGS 341000, 341001, 341002, AND 341004 FOR THE BALANCE OF LAYOUT PLANS.
2. ALL TIES 7" X 9" BODY UNLESS OTHERWISE SHOWN.
3. ALL TIE SPACING ON THIS DWG IS 19 1/2".
4. SEE DWG 341100 FOR TURNOUT GEOMETRY.
5. SEE DWG 341200 FOR TURNOUT BILL OF MATERIAL.
6. PANEL WEIGHT = 21,000 LBS.



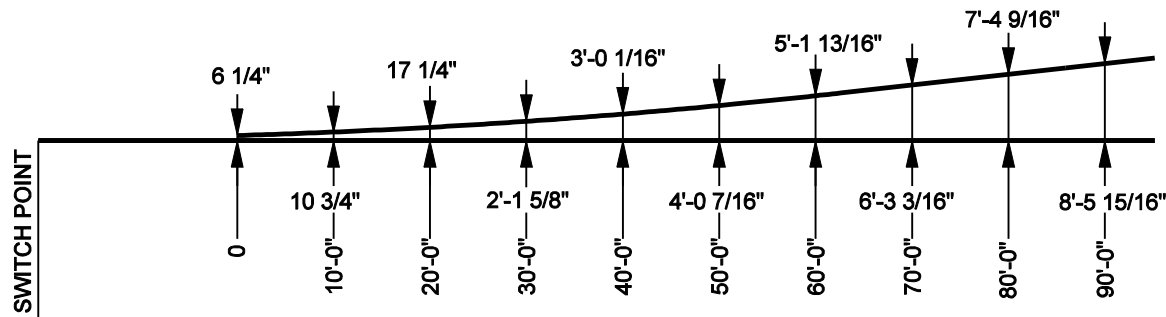
COMMON STANDARDS

**NO. 9 TURNOUT 136 LB.  
PANEL NO. 4**

FILE OWNER: BNSF	DATE: FEB 28, 2007
REV. NO.: 2	DWG NO: 341003



**GENERAL LAYOUT**



**SPREAD LAYOUT**

SWITCH DATA	
SWITCH LENGTH	16'-6"
HEEL SPREAD	6 1/4"
HEEL ANGLE	1°-46'-22"
SWITCH ANGLE	1°-46'-22"
THROW AT ROD #1	4 3/4"
THICKNESS AT POINT	0"
RADIUS (CLOSURE CURVE)	616.3542'
VERTEX DISTANCE	7 1/16"

FROG DATA	
ANGLE	6°-21'-35"
LENGTH	VARIES

TURNOUT DATA	
RADIUS OF CENTER LINE	614'
T =	24.59'
CENTRAL ANGLE - CLOSURE CURVE	4°35'13"
DEGREE OF CURVE	9°20'31"



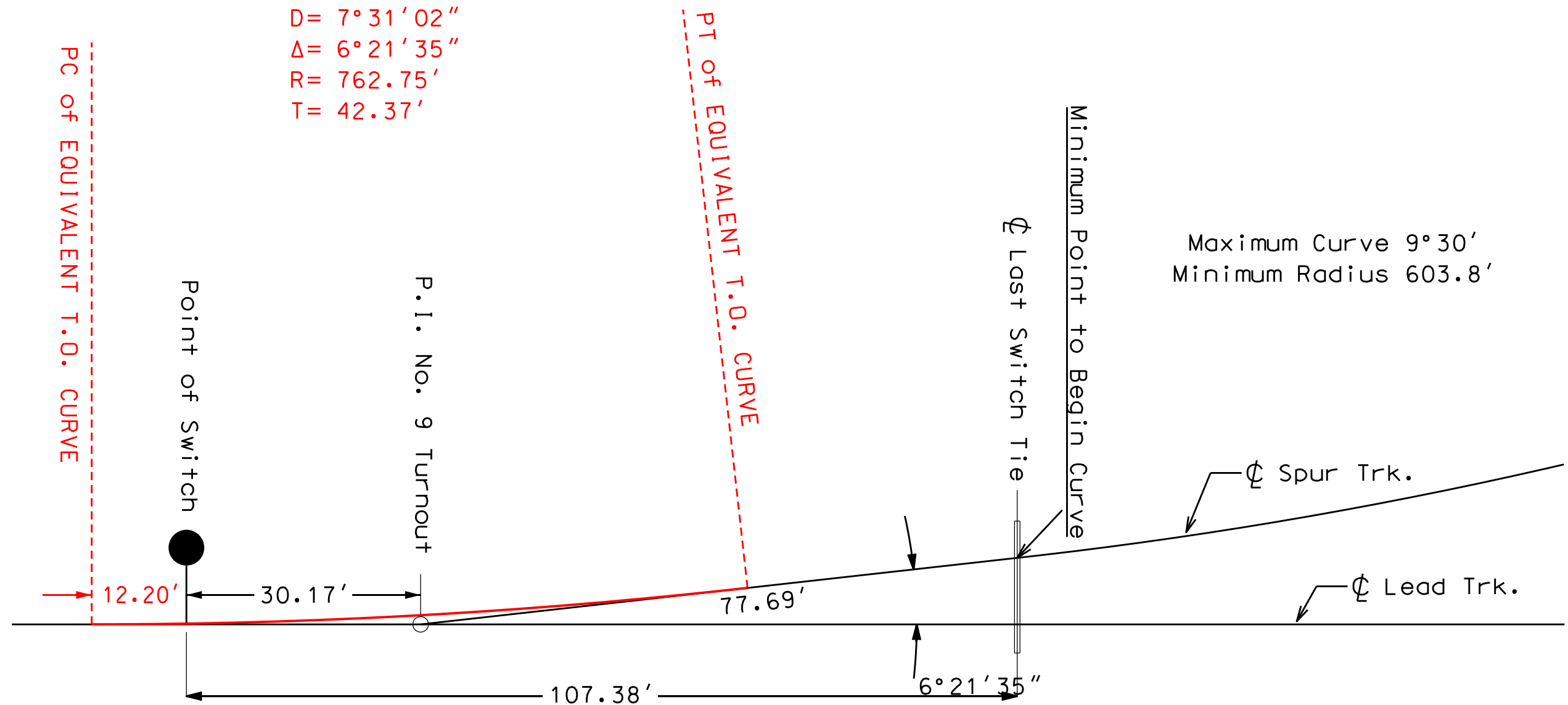
**COMMON STANDARDS**

**NO. 9 TURNOUT 16-6" STRAIGHT SWITCH TURNOUT GEOMETRY**

FILE OWNER: BNSF      DATE: JAN. 8, 2003  
 REV. NO.: 0      DWG NO: 341100

EQUIVALENT  
TURNOUT CURVE

D= 7° 31' 02"  
 Δ= 6° 21' 35"  
 R= 762.75'  
 T= 42.37'

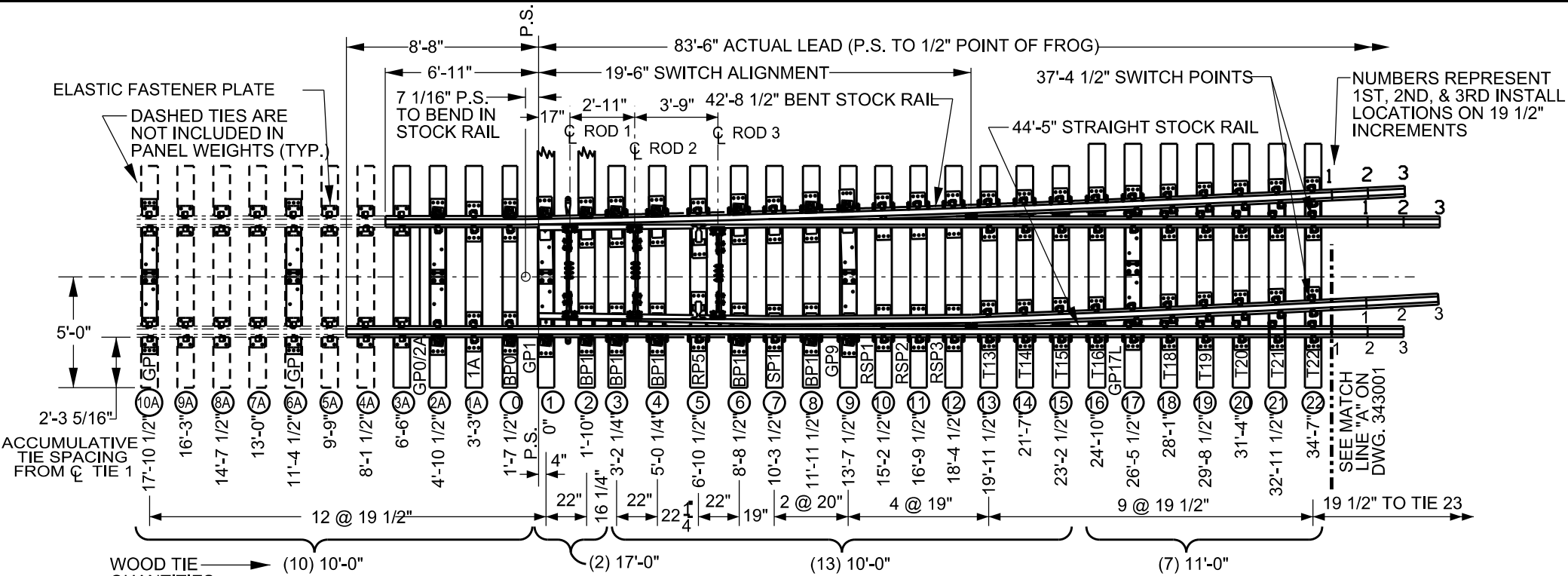


APPROVALS - (NAME - TITLE)	DATE	APPROVALS - (NAME - TITLE)	DATE



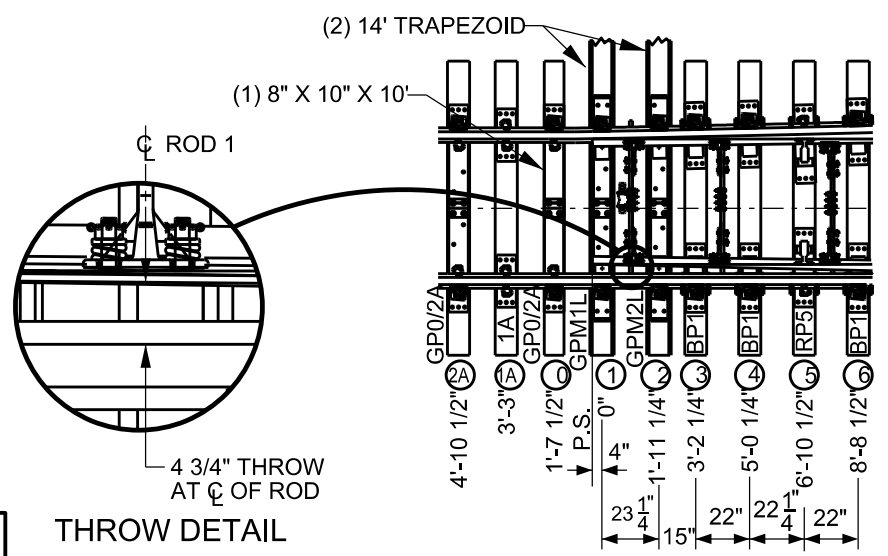
NUMBER 9 TURNOUT  
 TRACK ALIGNMENT GEOMETRY

REVISIONS			
NO.	DESCRIPTION	DATE	BY



**MANUAL OPERATED**  
PANEL WEIGHT: 20,000 LBS.

- NOTES:
1. SEE DWGS 343001 THRU 343005 FOR THE BALANCE OF LAYOUT PLANS.
  2. ALL TIES 7" X 9" BODY UNLESS OTHERWISE SHOWN.
  3. SEE DWG 343100 FOR TURNOUT GEOMETRY.
  4. SEE DWG 343200 FOR TURNOUT BILL OF MATERIAL.
  5. FULLY BOX ANCHOR STOCK RAILS, TIES 3-15 FOR SHIPPING OF PANELS ONLY.
  6. APPLY 5" SAFE BOND WIRES ONE CRIB AHEAD OF HEEL OF SWITCH ON STOCK AND SWITCH POINT RAILS
  7. ALL SWITCH POINT AND STOCKRAIL DIMENSIONS ARE TO FIRST INSTALL, SEE PLAN 241500 FOR FULL LENGTH.



**POWER OPERATED**  
PANEL WEIGHT: 20,000 LBS.

	UPRR	BNSF RH	BNSF LH
136LB. POWER	N/A	004734653	004734810
136LB. MANUAL	N/A	004734828	004734836
136LB. MAN. SPR. SW.	N/A	004734869	004734877
141LB. POWER	N/A	005253505	005253497
141LB. MANUAL	N/A	005253521	005253513
141LB. MAN. SPR. SW.	N/A	005253547	005253539

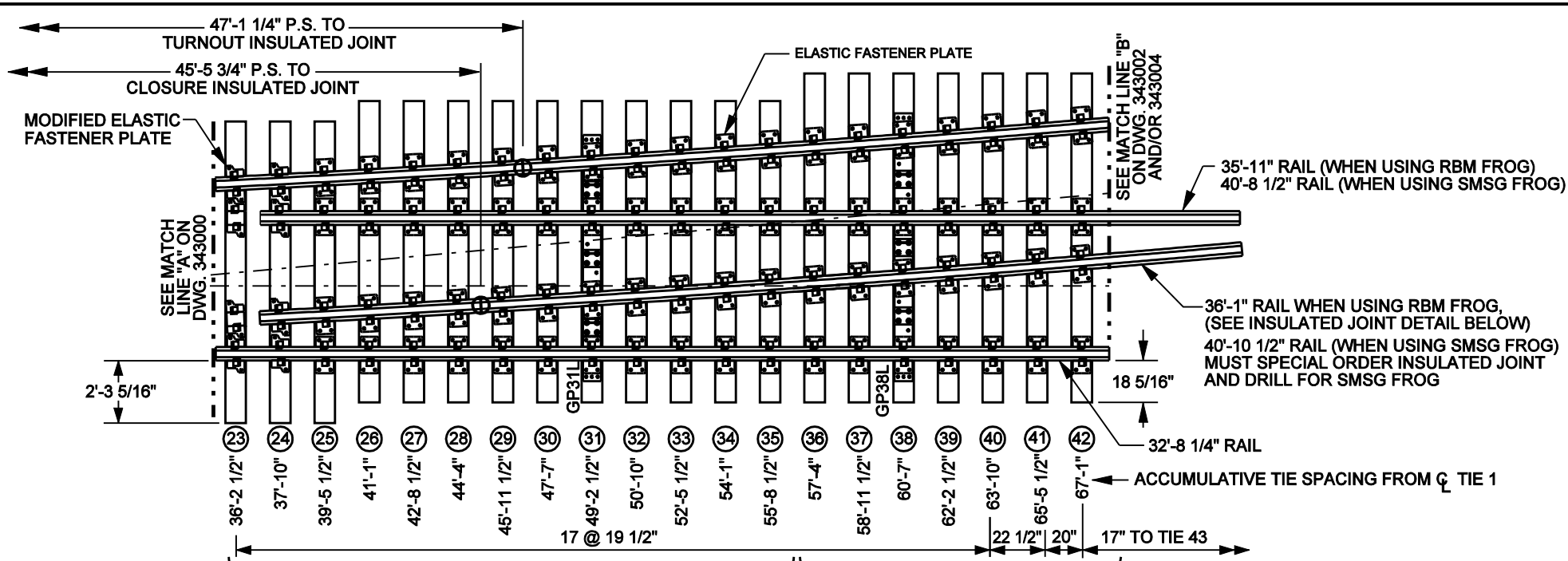
**BNSF RAILWAY**

**COMMON STANDARDS**

**NO. 11 TURNOUT 136/141 LB. PANEL NO. 1**

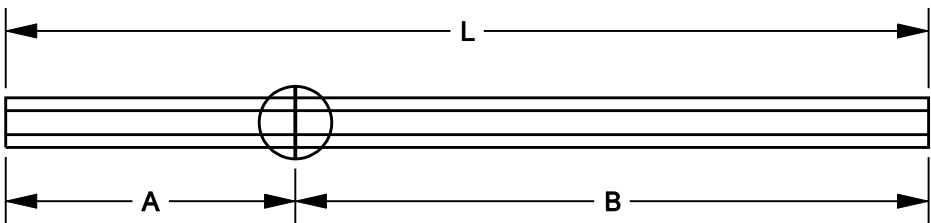
FILE OWNER: BNSF DATE: OCT. 5, 2010

REV. NO.: 6 DWG NO: 343000



WOOD TIE QUANTITIES BY LENGTH

(7) 12'-0"



**INSULATED JOINT DETAIL**  
(FOR USE WITH RBM FROG ONLY)

- NOTES:
1. WHEN INSULATED JOINTS ARE REQUIRED, THE LOCATION OF THE JOINTS SHOULD BE STAGGERED NO CLOSER THAN 6" AND NOT MORE THAN 4'-6" APART, MEASURED ALONG THE TURNOUT.
  2. SEE DWGS 343000, 343002, 343003, 343004, AND 343005 FOR THE BALANCE OF LAYOUT PLANS.
  3. ALL TIES 7" X 9" BODY UNLESS OTHERWISE SHOWN.
  4. SEE DWG 343100 FOR TURNOUT GEOMETRY.
  5. SEE DWG 343200 FOR TURNOUT BILL OF MATERIAL.
  6. PANEL WEIGHT = 17,000 LBS.



**COMMON STANDARDS**

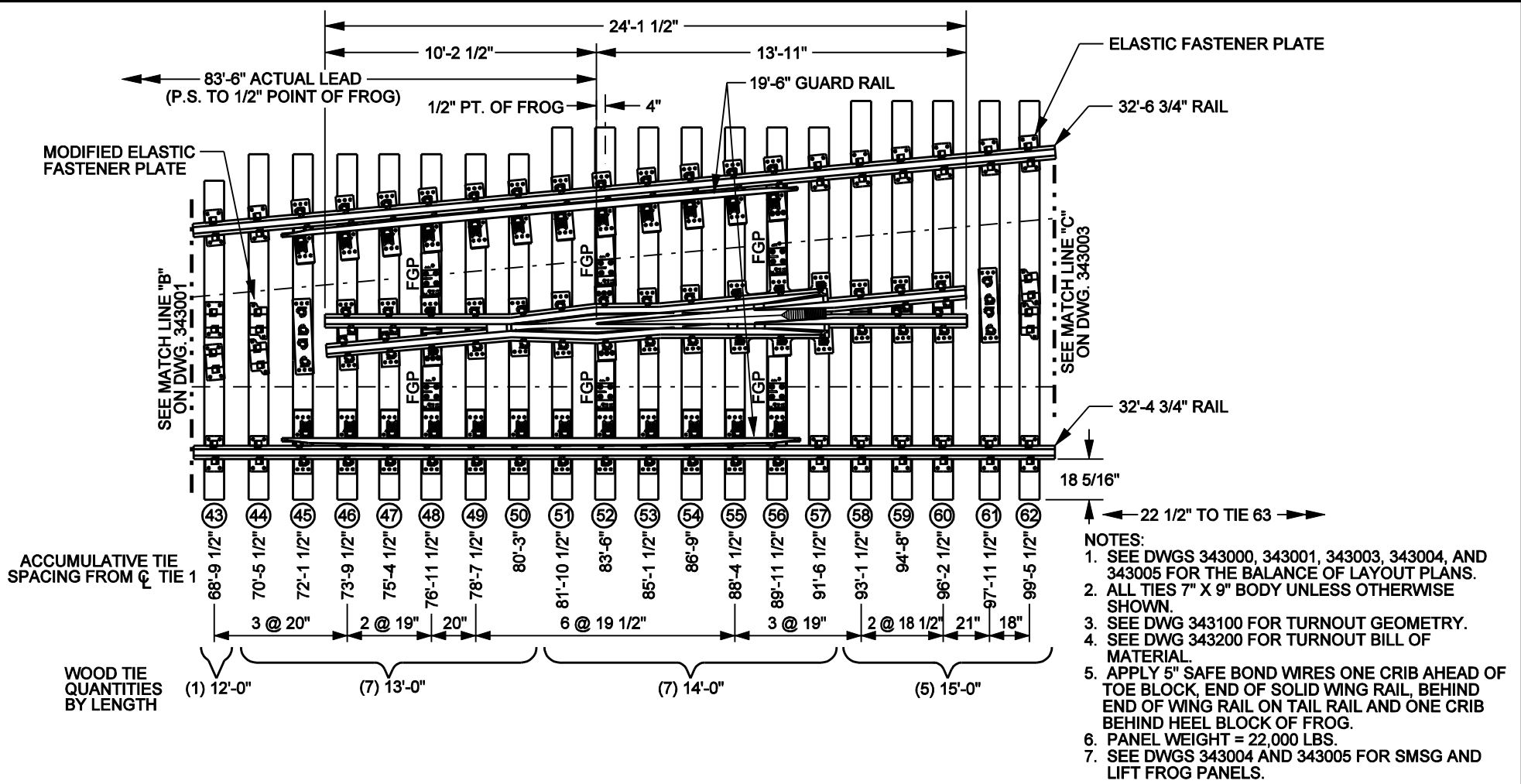
**NO. 11 TURNOUT 136/141 LB. PANEL NO. 2**

FILE OWNER: BNSF	DATE: AUG. 26, 2009
REV. NO.: 5	DWG NO: 343001

	BNSF STOCK CODE	
	136LB.	141LB.
LH TURNOUT INSULATED JOINT RAIL	005253760	005253554
LH CLOSURE INSULATED JOINT RAIL	005253778	005253562
RH TURNOUT INSULATED JOINT RAIL	005253786	005253570
RH CLOSURE INSULATED JOINT RAIL	005253794	005253588

	A	B	L
TURNOUT INSULATED JOINT RAIL	11'-4"	21'-5"	32'-9"
CLOSURE INSULATED JOINT RAIL	8'-2"	27'-11"	36'-1"

22-8



- NOTES:
1. SEE DWGS 343000, 343001, 343003, 343004, AND 343005 FOR THE BALANCE OF LAYOUT PLANS.
  2. ALL TIES 7" X 9" BODY UNLESS OTHERWISE SHOWN.
  3. SEE DWG 343100 FOR TURNOUT GEOMETRY.
  4. SEE DWG 343200 FOR TURNOUT BILL OF MATERIAL.
  5. APPLY 5" SAFE BOND WIRES ONE CRIB AHEAD OF TOE BLOCK, END OF SOLID WING RAIL, BEHIND END OF WING RAIL ON TAIL RAIL AND ONE CRIB BEHIND HEEL BLOCK OF FROG.
  6. PANEL WEIGHT = 22,000 LBS.
  7. SEE DWGS 343004 AND 343005 FOR SMSG AND LIFT FROG PANELS.



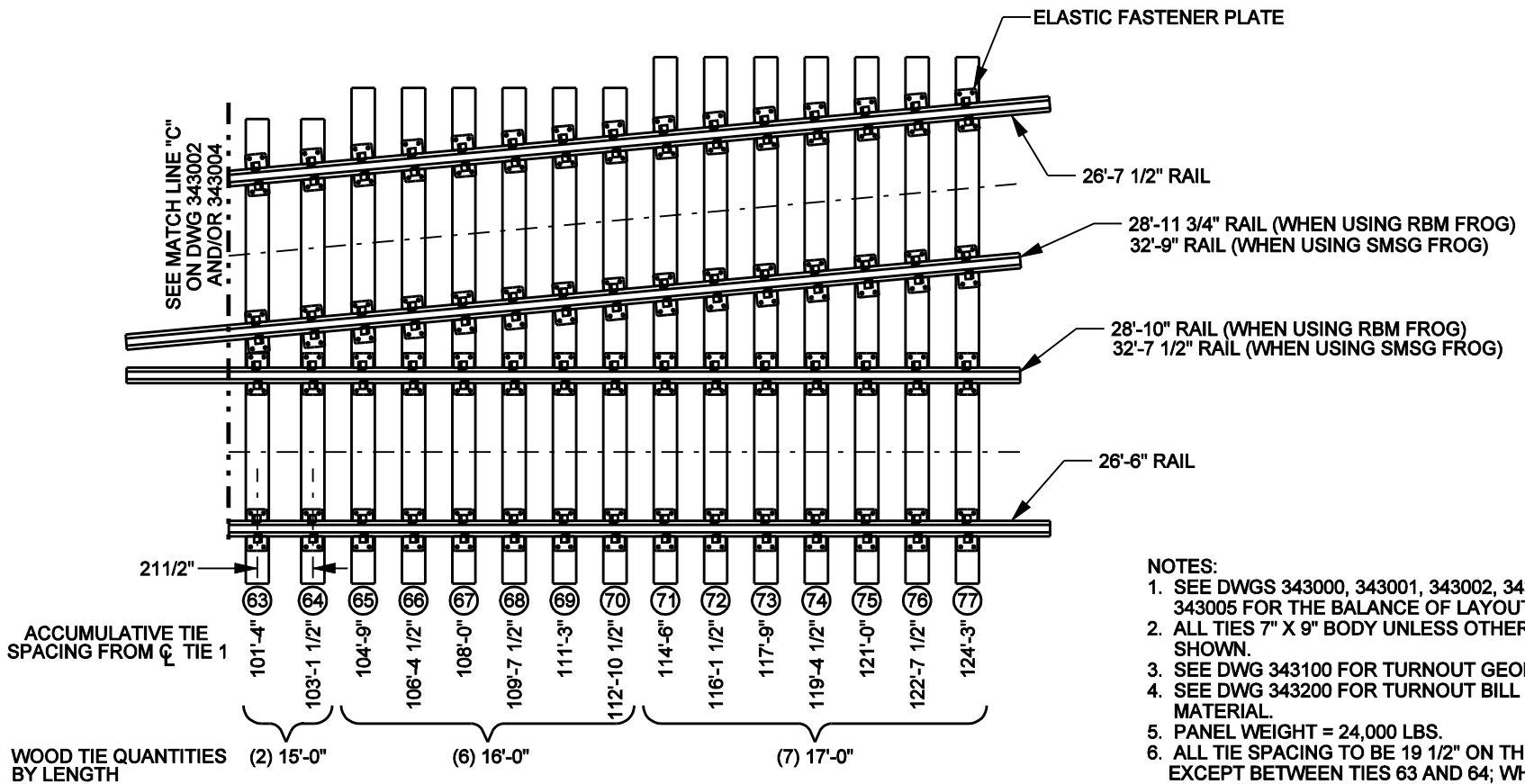
**COMMON STANDARDS**

**NO. 11 TURNOUT 136/141 LB. PANEL NO. 3 WITH OPTIONAL RBM FROG**

	UPRR	BNSF RH	BNSF LH
136LB. RBM	N/A	004710299	004710307
136LB. SPR	N/A	004710315	004710323
136LB. SOLID	N/A	004710331	004710349
141LB. RBM	N/A	005252739	005252721
141LB. SPR	N/A	005252754	005252747
141LB. SOLID	N/A	N/A	N/A

FILE OWNER: BNSF	DATE: AUG. 26, 2009
REV. NO.: 5	DWG NO: 343002

22-9



NOTES:

1. SEE DWGS 343000, 343001, 343002, 343004, AND 343005 FOR THE BALANCE OF LAYOUT PLANS.
2. ALL TIES 7" X 9" BODY UNLESS OTHERWISE SHOWN.
3. SEE DWG 343100 FOR TURNOUT GEOMETRY.
4. SEE DWG 343200 FOR TURNOUT BILL OF MATERIAL.
5. PANEL WEIGHT = 24,000 LBS.
6. ALL TIE SPACING TO BE 19 1/2" ON THIS DWG. EXCEPT BETWEEN TIES 63 AND 64; WHICH ARE SHOWN AT 21 1/2".

**BNSF**  
RAILWAY



COMMON STANDARDS

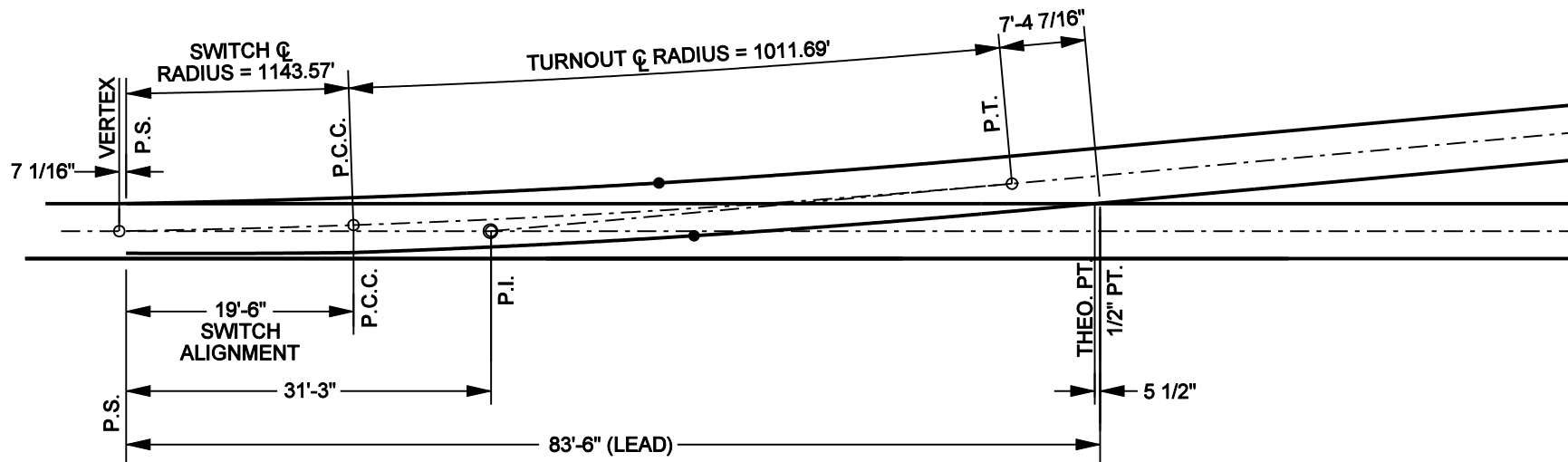
**NO. 11 TURNOUT 136/141 LB.  
PANEL NO. 4**

FILE OWNER: BNSF DATE: AUG. 26, 2009

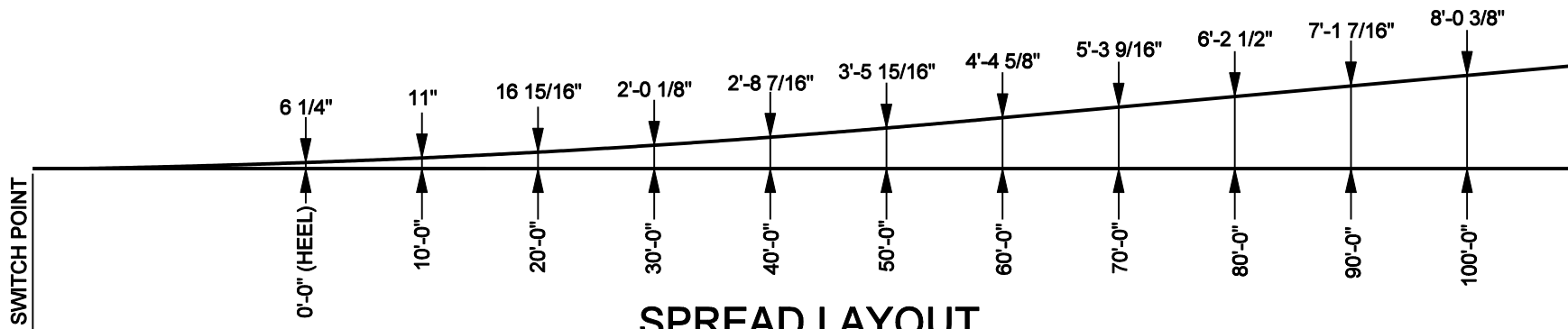
REV. NO.: 3 DWG NO: 343003

21-10





### GENERAL LAYOUT





### SPREAD LAYOUT

SWITCH DATA	
SWITCH LENGTH	19'-6"
HEEL SPREAD	6 1/4"
HEEL ANGLE	1°-59'-16"
SWITCH ANGLE	1°-00'-40"
THROW AT ROD #1	4 3/4"
RADIUS (CENTER LINE)	1143.57'
T =	9.69'
CENTRAL ANGLE - CLOSURE CURVE	0°58'16"
DEGREE OF CURVE	5°00'06"
THICKNESS AT POINT	1/8"
RADIUS (CLOSURE CURVE)	1145.92'
VERTEX DISTANCE	7 1/16"

FROG DATA	
ANGLE	5°-12'-18"
LENGTH	VARIES

TURNOUT DATA	
RADIUS OF CENTER LINE	1011.69'
T =	28.35'
CENTRAL ANGLE - CLOSURE CURVE	3°13'02"
DEGREE OF CURVE	5°40'44"

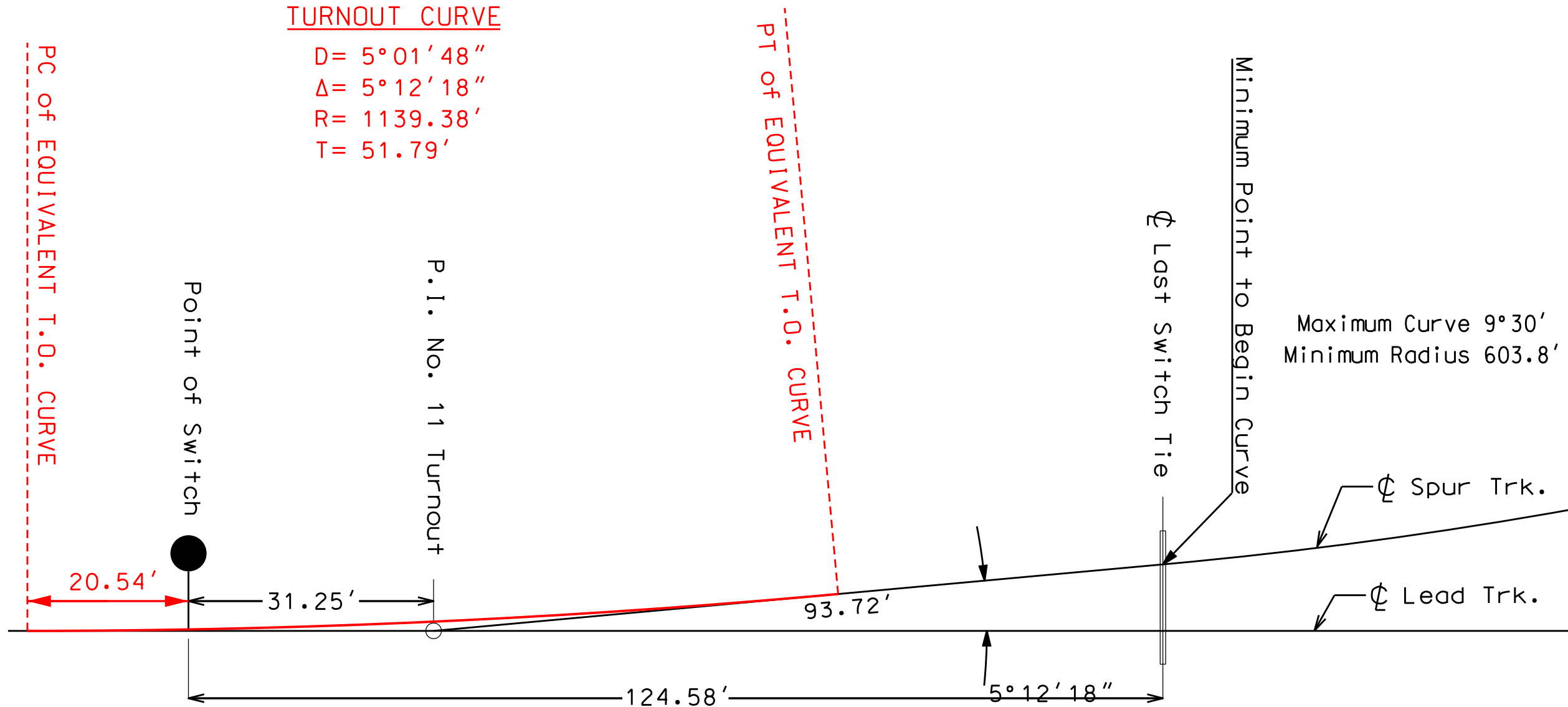
NOTES:

 <b>COMMON STANDARDS</b> 	<b>NO. 11 TURNOUT 19'-6" CURVED SWITCH TURNOUT GEOMETRY</b>	
	FILE OWNER: BNSF	DATE: JAN. 9, 2003
REV. NO.: 0	DWG NO: 343100	

22-11

EQUIVALENT  
TURNOUT CURVE

D= 5° 01' 48"  
 Δ= 5° 12' 18"  
 R= 1139.38'  
 T= 51.79'

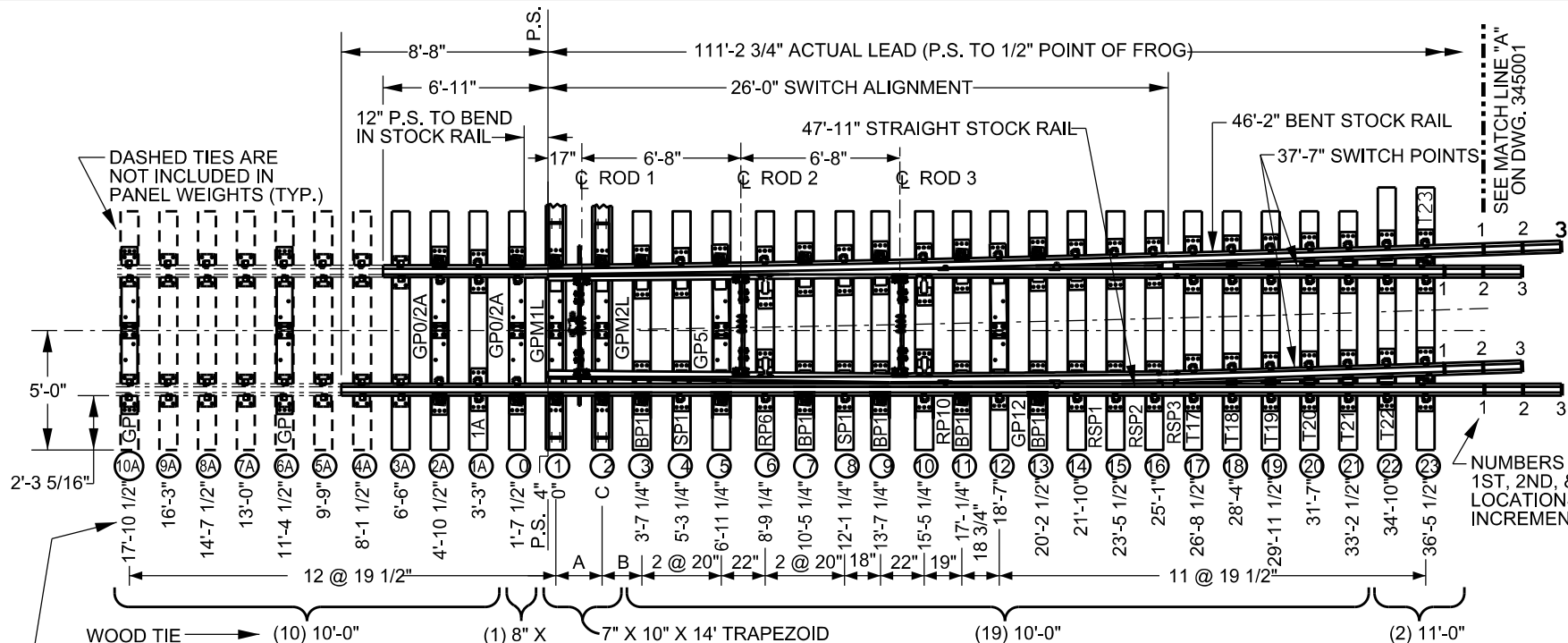


APPROVALS - (NAME - TITLE)	DATE	APPROVALS - (NAME - TITLE)	DATE



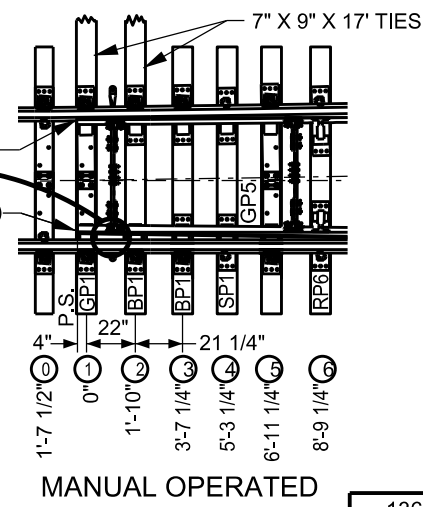
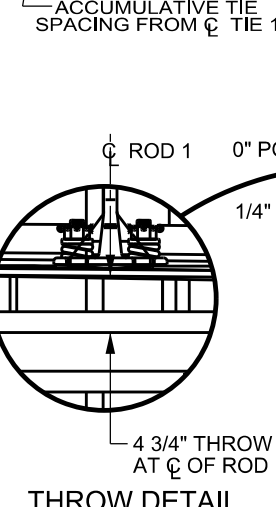
NUMBER 11 TURNOUT  
TRACK ALIGNMENT GEOMETRY

REVISIONS			
NO.	DESCRIPTION	DATE	BY



WOOD TIE QUANTITIES BY LENGTH  
 ACCUMULATIVE TIE SPACING FROM C TIE 1

POWER OPERATED



VARIABLE TIE SPACING		
VARIABLE	UPRR	BNSF
A	23 1/4"	22"
B	20"	21 1/4"
C	23 1/4"	22"

	UPRR	BNSF LH	BNSF RH
136LB. POWER	N/A	518030091	518030065
136LB. MANUAL	N/A	518030093	518030092
136LB. MAN. SPRG.	N/A	518030095	518030094
141LB. POWER	N/A	518030134	518030135
141LB. MANUAL	N/A	518030136	518030137
141LB. MAN. SPRG.	N/A	518030138	518030139

- NOTES:
- SEE DWGS 345001, 345002, AND 345003 FOR THE BALANCE OF LAYOUT PLANS.
  - ALL TIE SPACING 19 1/2" EXCEPT WHERE NOTED.
  - ALL TIES 7" X 9" BODY UNLESS OTHERWISE SHOWN.
  - SEE DWG 345100 FOR TURNOUT GEOMETRY.
  - SEE DWG 345200 FOR TURNOUT BILL OF MATERIAL.
  - APPLY 5" SAFE BOND WIRES ONE CRIB AHEAD OF HEEL OF SWITCH ON STOCK AND SWITCH POINT RAILS.
  - BNSF MANUAL AND MANUAL SPRING SWITCHES WILL BE SUPPLIED WITH UHMWPE PADS ON TIES 1 THROUGH 14.
  - PANEL WEIGHT = APPROXIMATELY 20,900 LBS.

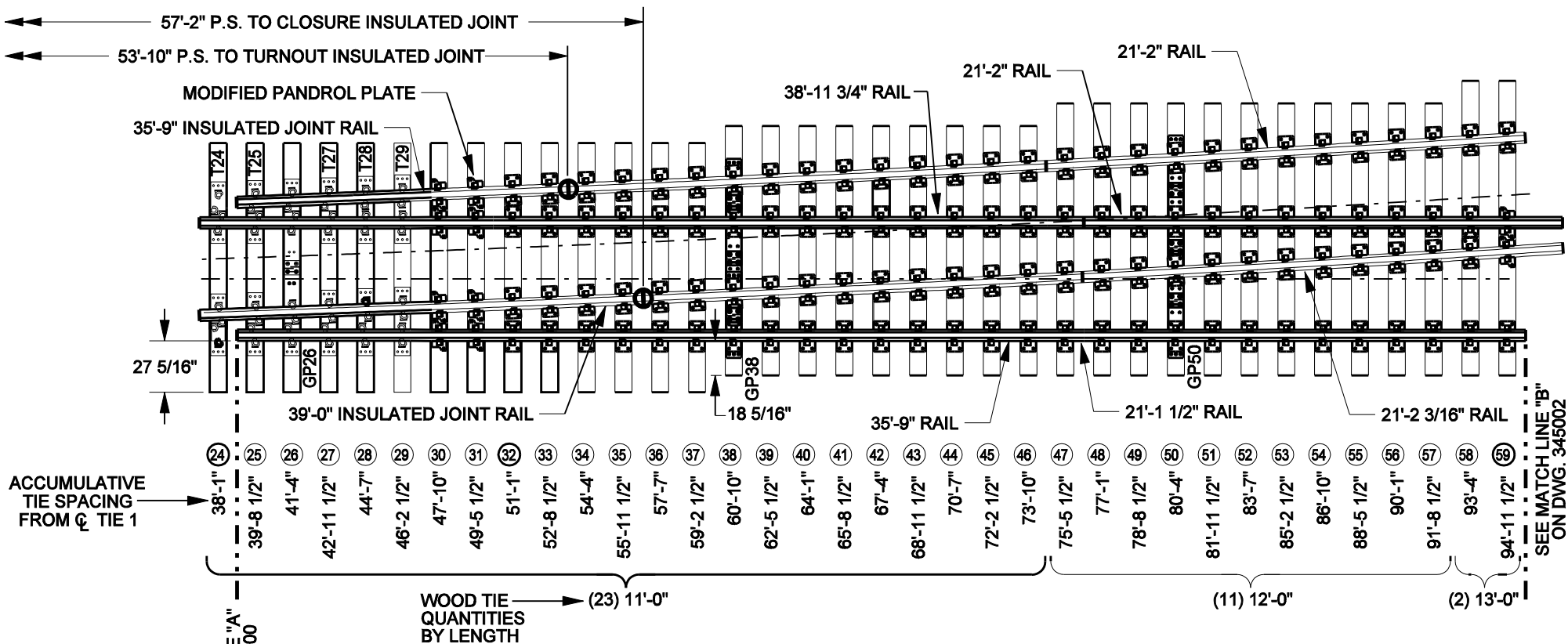



## COMMON STANDARDS

# NO. 15 TURNOUT 136/141 LB. PANEL NO. 1

UPRR VP ENGINEERING	FILE OWNER: UPRR	DATE: OCT. 5, 2010
BNSF VP ENGINEERING	REV. NO.: 5	DWG NO: 345000

22-13

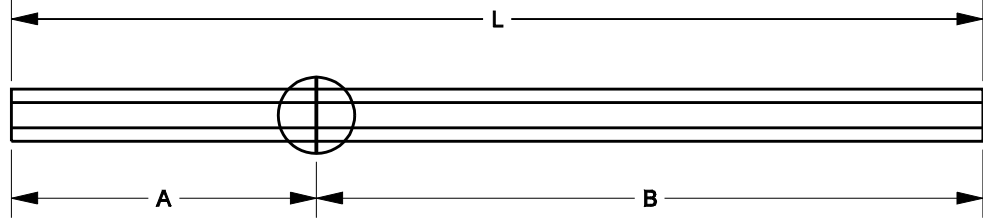


ACCUMULATIVE TIE SPACING FROM  $\phi$  TIE 1

SEE MATCH LINE "A" ON DWG. 345000

SEE MATCH LINE "B" ON DWG. 345002

WOOD TIE QUANTITIES BY LENGTH



**NOTES:**

1. SEE DWGS 345000, 345002, AND 345003 FOR THE BALANCE OF LAYOUT PLANS.
2. ALL TIE SPACING IS 19 1/2" ON THIS PANEL.
3. ALL TIES 7" X 9" BODY UNLESS OTHERWISE SHOWN.
4. SEE DWG 345100 FOR TURNOUT GEOMETRY.
5. SEE DWG 345200 FOR TURNOUT BILL OF MATERIAL.
6. PANEL WEIGHTS = APPROXIMATELY 19,500 LBS. AND 11,800 LBS.



**COMMON STANDARDS**

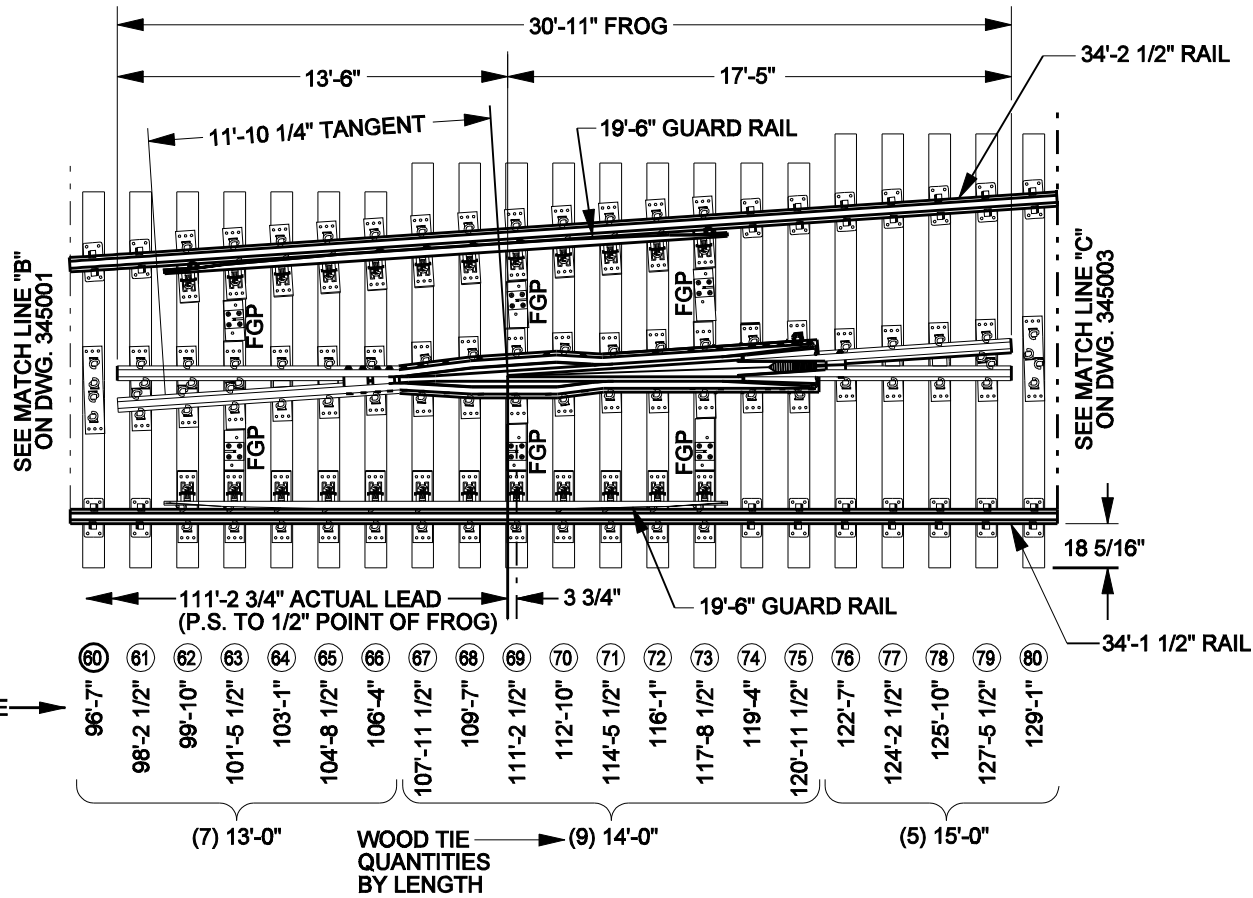
**NO. 15 TURNOUT 136/141 LB. PANELS NO. 2 AND NO. 3**

	A	B	L
TURNOUT INSULATED JOINT RAIL	14'-8"	21'-1"	35'-9"
CLOSURE INSULATED JOINT RAIL	19'-7"	19'-5"	39'-0"

	BNSF ITEM NUMBER	
	136LB.	141LB.
LH TURNOUT INSULATED JOINT RAIL	518030155	518030140
LH CLOSURE INSULATED JOINT RAIL	518030156	518030141
RH TURNOUT INSULATED JOINT RAIL	518030157	518030142
RH CLOSURE INSULATED JOINT RAIL	518030158	518030143

FILE OWNER: UPRR	DATE: MAY 19, 2008
REV. NO.: 3	DWG NO: 345001

22-14



ACCUMULATIVE TIE SPACING FROM Q TIE 1

⑧0	⑧1	⑧2	⑧3	⑧4	⑧5	⑧6	⑧7	⑧8	⑧9	⑧0	⑧1	⑧2	⑧3	⑧4	⑧5	⑧6	⑧7	⑧8	⑧9	⑧0
96'-7"	98'-2 1/2"	99'-10"	101'-5 1/2"	103'-1"	104'-8 1/2"	106'-4"	107'-11 1/2"	109'-7"	111'-2 1/2"	112'-10"	114'-5 1/2"	116'-1"	117'-8 1/2"	119'-4"	120'-11 1/2"	122'-7"	124'-2 1/2"	125'-10"	127'-5 1/2"	129'-1"
(7) 13'-0"							WOOD TIE QUANTITIES BY LENGTH						(9) 14'-0"							

- NOTES:
1. SEE DWGS 345000, 345001, AND 345003 FOR THE BALANCE OF LAYOUT PLANS.
  2. ALL TIE SPACING IS 19 1/2" ON THIS PANEL.
  3. ALL TIES 7" X 9" BODY UNLESS OTHERWISE SHOWN.
  4. SEE DWG 345100 FOR TURNOUT GEOMETRY.
  5. SEE DWG 345200 FOR TURNOUT BILL OF MATERIAL.
  6. PANEL WEIGHT = APPROXIMATELY 28,800 LBS.



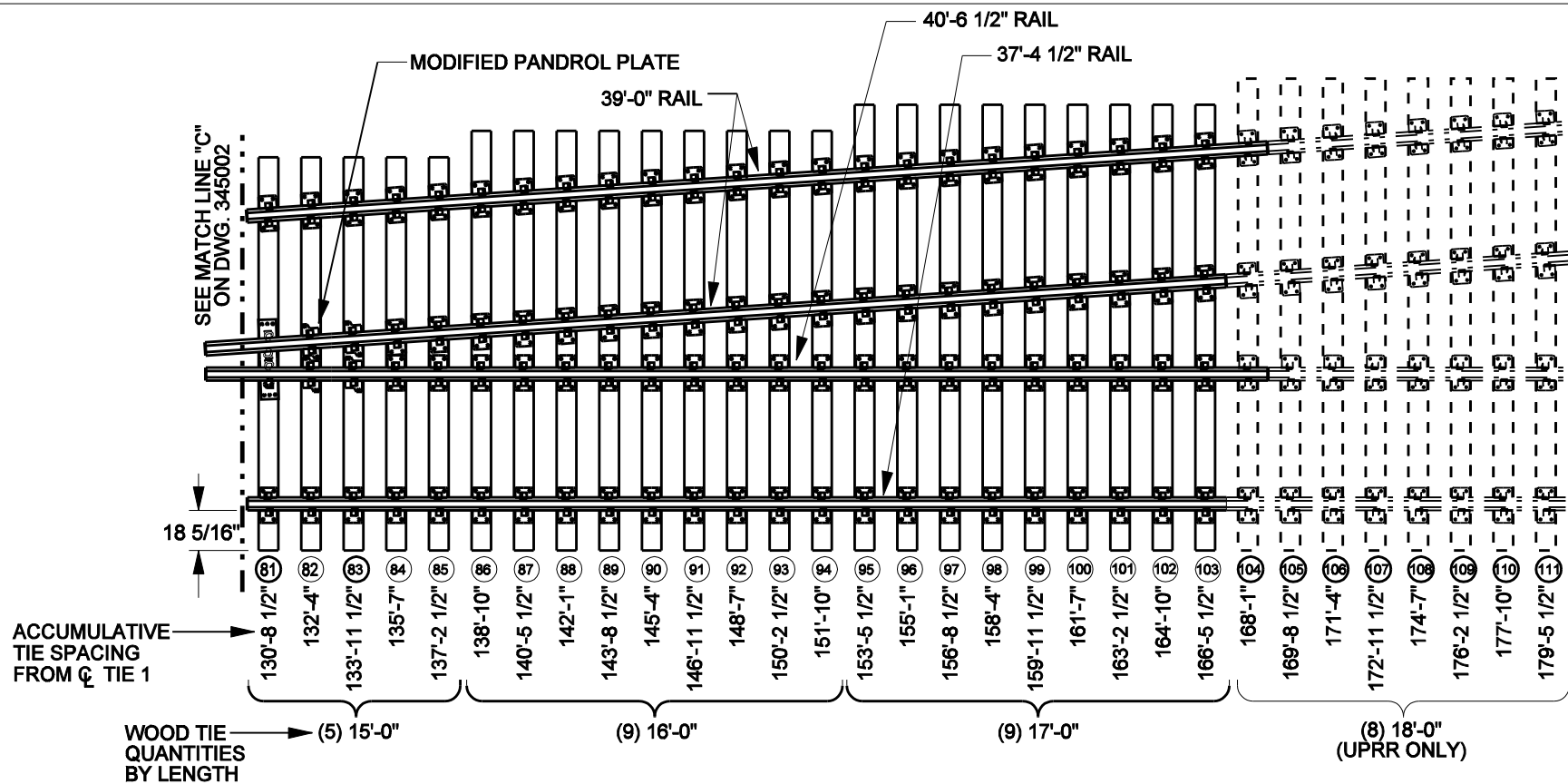
COMMON STANDARDS

**NO. 15 TURNOUT 136/141 LB. PANEL NO. 4**

	UPRR	BNSF LH	BNSF RH
136LB. RBM	N/A	513450060	513450059
136 LB. SPRING	N/A	513450063	513450061
141 LB. RBM	N/A	513450232	513450233
141 LB. SPRING	N/A	513450234	513450235

FILE OWNER: UPRR	DATE: MAY 16, 2008
REV. NO.: 3	DWG NO: 345002

22-15



**NOTES:**

1. SEE DWGS 345000, 345001, AND 345002 FOR THE BALANCE OF LAYOUT PLANS.
2. ALL TIE SPACING IS 19 1/2" ON THIS PANEL.
3. ALL TIES 7" X 9" BODY UNLESS OTHERWISE SHOWN.
4. SEE DWG 345100 FOR TURNOUT GEOMETRY.
5. SEE DWG 345200 FOR TURNOUT BILL OF MATERIAL.
6. PANEL WEIGHT = APPROXIMATELY 23,650 LBS.

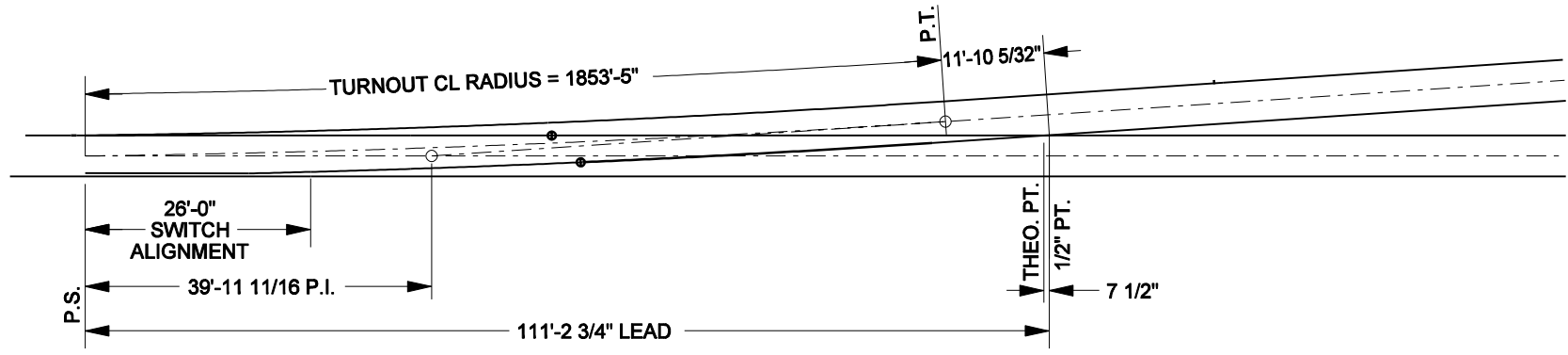


**COMMON STANDARDS**

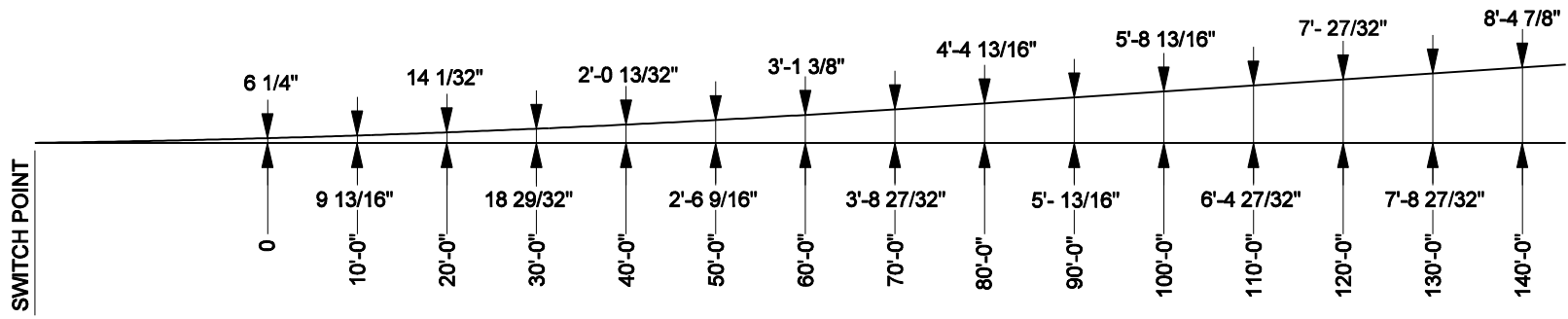
**NO. 15 TURNOUT 136/141 LB. PANEL NO. 5**

FILE OWNER: UPRR	DATE: MAY 2, 2008
REV. NO.: 1	DWG NO: 345003

22-16



### GENERAL LAYOUT



### SPREAD LAYOUT

SWITCH DATA	
SWITCH LENGTH	26'-0"
HEEL SPREAD	6 1/4"
HEEL ANGLE	1°-33'-2"
SWITCH ANGLE	0°-44'-47"
THROW AT ROD #1	4 3/4"
RADIUS (CENTER LINE)	1853.42'
T =	49.68'
CENTRAL ANGLE - CLOSURE CURVE	3°-04'-16"
DEGREE OF CURVE	3°-05'-30"
THICKNESS AT POINT	1/4"
RADIUS (CLOSURE CURVE)	1855.77'
VERTEX DISTANCE	0"

FROG DATA	
ANGLE	3°-49'-06"
LENGTH	VARIES

TURNOUT DATA	
RADIUS OF CENTER LINE	1853.42'
T =	49.68'
CENTRAL ANGLE - CLOSURE CURVE	3°-04'-16"
DEGREE OF CURVE	3°-05'-30"

NOTES:



COMMON STANDARDS



## NO. 15 TURNOUT 26'-0" CURVED SWITCH, TURNOUT GEOMETRY

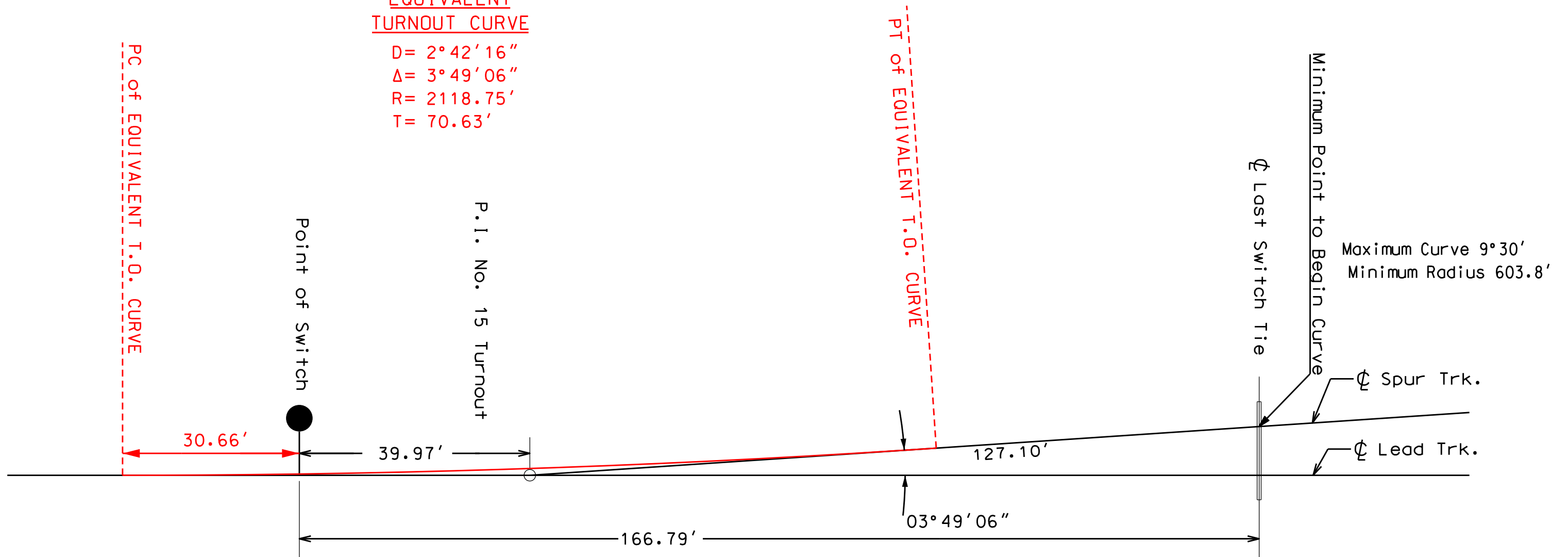
FILE OWNER: UPRR	DATE: JAN. 14, 2003
REV. NO.: 0	DWG NO: 345100

345100

TURNOUT POINT

EQUIVALENT  
TURNOUT CURVE

D= 2° 42' 16"  
 Δ= 3° 49' 06"  
 R= 2118.75'  
 T= 70.63'



Maximum Curve 9° 30'  
 Minimum Radius 603.8'

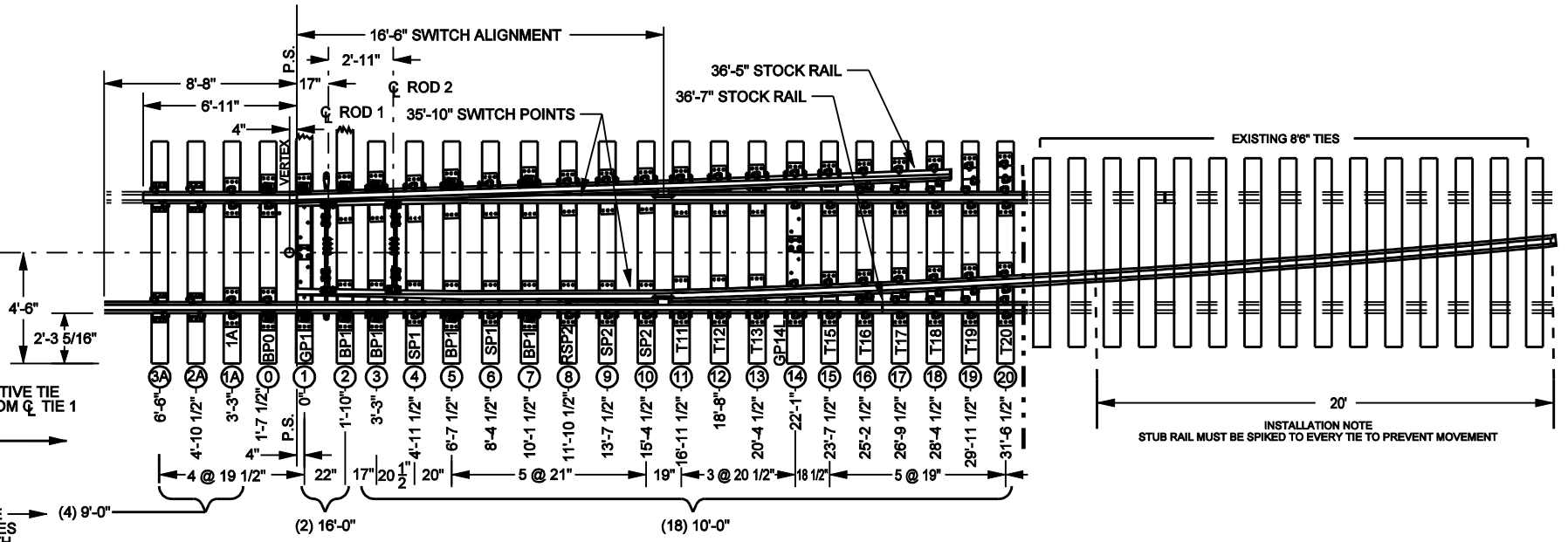
APPROVALS - (NAME - TITLE)	DATE	APPROVALS - (NAME - TITLE)	DATE



NUMBER 15 TURNOUT  
 TRACK ALIGNMENT GEOMETRY

REVISIONS			
NO.	DESCRIPTION	DATE	BY

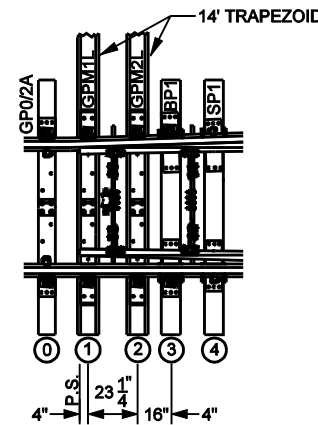




ACCUMULATIVE TIE SPACING FROM  $\phi$  TIE 1

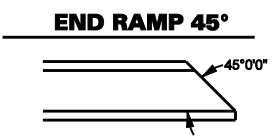
WOOD TIE QUANTITIES BY LENGTH

INSTALLATION NOTE  
STUB RAIL MUST BE SPIKED TO EVERY TIE TO PREVENT MOVEMENT



**POWER OPERATED**  
PANEL WEIGHT: 20,000 LBS.

**MANUAL OPERATED**  
PANEL WEIGHT: 20,000 LBS.  
Panel Length 44' 6"



- NOTES:
1. ALL TIES 7" X 9" BODY UNLESS OTHERWISE SHOWN ABOVE.
  2. SEE DWG 341100 FOR TRACK GEOMETRY.
  3. FULLY BOX ANCHOR STOCK RAILS, TIES 3-15 FOR SHIPPING OF PANELS ONLY.
  4. SWITCH POINT DERAIL FURNISHED AS A COMPLETE PANEL.
  5. WHEN ORDERING SPECIFY LEFT OR RIGHT HAND AND POWER OR MANUAL OPERATION. SUPPLIER TO PROVIDE CORRECT PLATING AND TIES FOR POWER APPLICATIONS..
  6. FOR OPERATING STANDS SEE STANDARD PLANS 2501.02 & 2153.01. FOR ROD PLAN SEE DRAWING 2156.01 AND DERAIL SIGN ON PLAN 3020.01.
  7. SEE STANDARD PLAN 24000202 FOR DOUBLE SWITCH POINT DERAIL REQUIREMENTS.
  8. SEE LATEST REVISED ENGINEERING INSTRUCTIONS 9.3.3 FOR INSTALLATION AND USE.
  9. MANUFACTURER WILL PROVIDE A DRILLED 20' STUB RAIL, A DRILLED TURNOUT SWITCH POINT AND ANGLE BARS FOR HOOK UP.
  10. END RAMPs REQUIRED ON STUB RAIL AND TURNOUT STOCK RAIL.

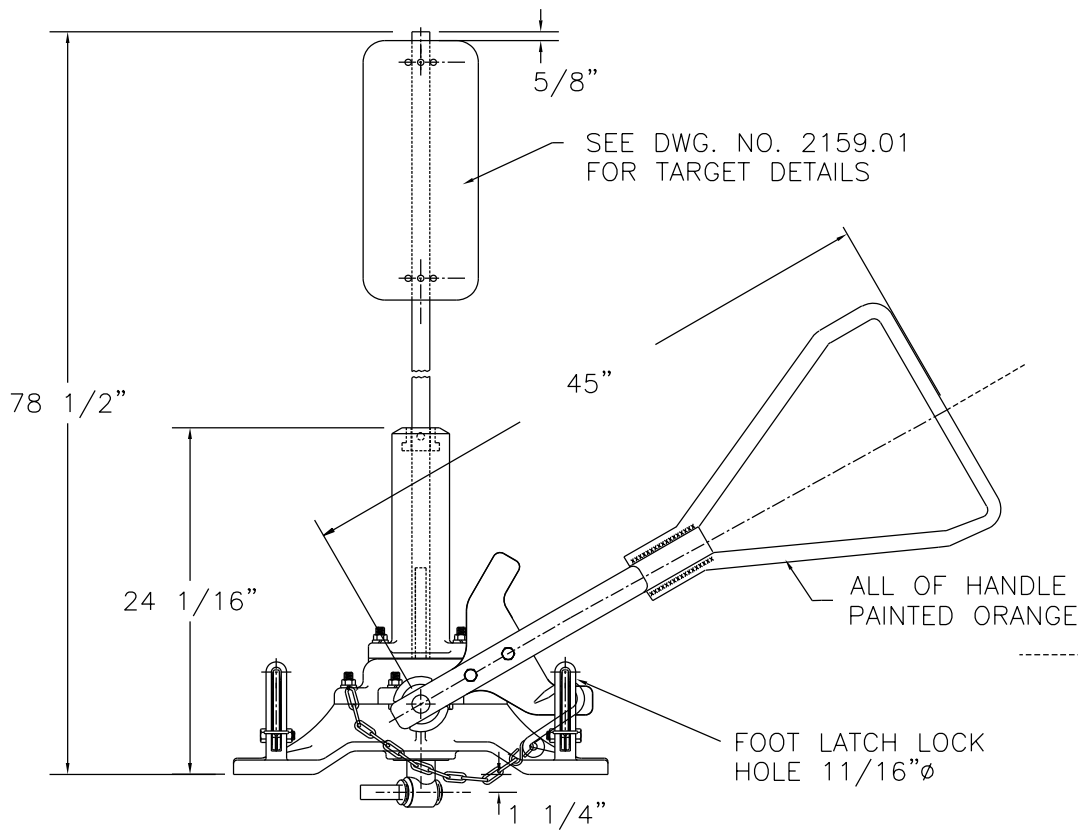
	LH	RH
POWER 141	054333703	054333711
POWER 136	054333646	054333653
POWER 115	054333687	054333695
MANUAL 141	054333661	054333679
MANUAL 115	054333638	-

**BNSF**  
RAILWAY

**STANDARD PLAN**

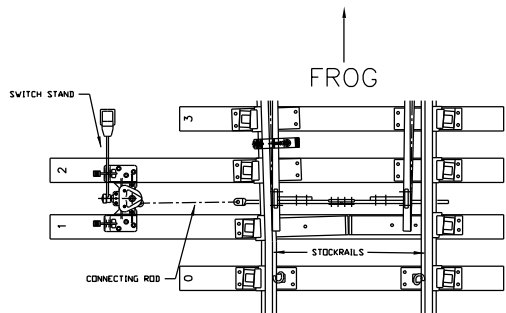
**DOUBLE SWITCH POINT DERAIL**  
**16' 6" POINTS 136 LB**

DATE: MAY 22, 2009	FILE OWNER: BNSF
DWG NO: 240003	REV NO 04

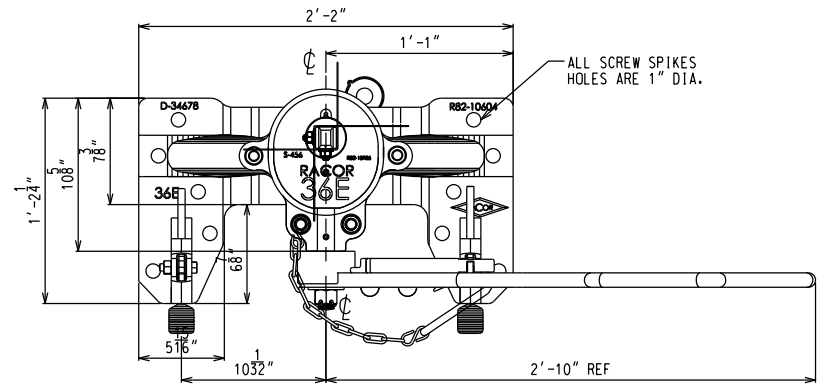


ELEVATION VIEW

36 EH STANDS,  
SHOWN WITH HIGH STAFF  
AND TRI-HANDLE.



INSTALLATION VIEW



PLAN VIEW

PLAN VIEW  
36 E STANDS,  
SHOWN WITH LOW STAFF  
AND TRI-HANDLE.

BILL OF MATERIALS

QUANTITY SWITCH STAND DESCRIPTION

1 EA.	36E LOW TARGET WITH TRI-HANDLE @ 30'	ITEM NO. 517740985N
1 EA.	36EH HIGH TARGET WITH TRI-HANDLE @ 30'	ITEM NO. 517740995N
1 EA.	36D RETRO-FIT KIT WITH TRI-HANDLE @ 30'	ITEM NO. 513960006N

NOTES:

1. SEE DWG. 2156 & 2160 FOR SPINDLE AND CRANK EYE DETAILS.
2. HANDLE KITS (STRAIGHT OR TRI-HANDLE) ARE AVAILABLE FOR FIELD RETRO FIT OF EXISTING 36 STYLE SWITCH STANDS.
3. STAND 36EH IS FOR MAIN LINE USE ONLY. FURNISHED WITH NO. 1.2 STAFF, SEE DWG. 2160.01.
4. STAND 36E IS FOR MAIN LINE OR YARD USE, FURNISHED WITH NO. 2 STAFF, SEE DWG. 2160.01.
5. 16:1 MECHANICAL ADVANTAGE.
6. SWITCH STANDS ARE TO BE INSTALLED WITH HANDLE DIRECTED TOWARDS FROG WHEN LINED TO THE STRAIGHT SIDE OF SWITCH.
6. STAND INCLUDES 1/2" DIAMETER HOOK ON 19" CHAIN

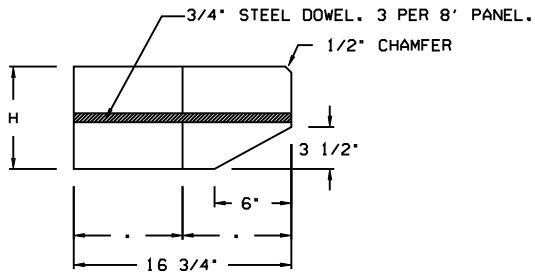
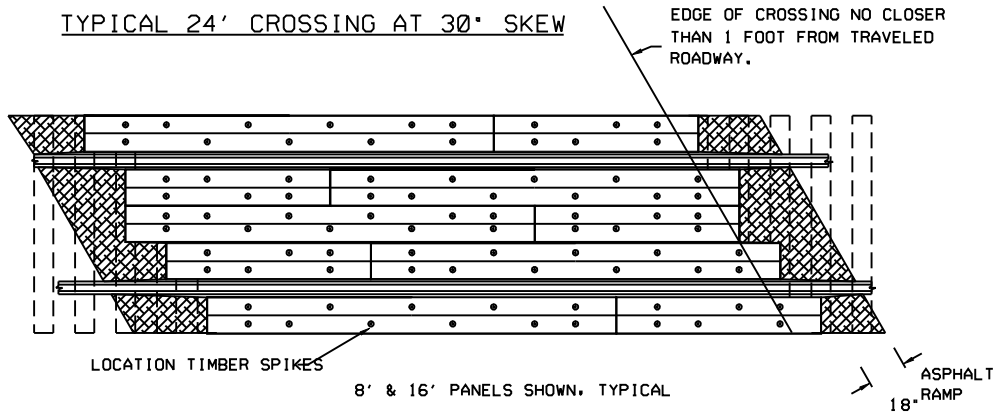


**STANDARD PLAN**

**RACOR STYLE 36E & 36EH  
SWITCH STAND  
WITH 45" TRI-HANDLE**

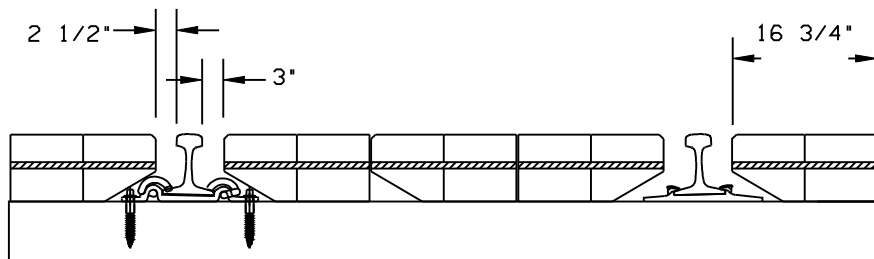
FILE OWNER BNSF	DATE: DECEMBER 10, 2010
REV. NO.: 13	DWG NO: 215301

**TYPICAL 24' CROSSING AT 30° SKEW**



**TWO PIECE PANEL**

H • 7" FOR 100 LB RAIL  
 H • 7 1/2" FOR 115 LB RAIL  
 H • 8" FOR 136 LB. RAIL



**8' 6" CROSS TIE**

**MATERIAL & FABRICATION**

1. HARDWOOD PANELS TO BE TREATED (BNSF SPECIFICATIONS) MIXED HARDWOOD, FREE OF WANE.
2. BRANDING: EACH CROSSING PANEL SHALL BE IDENTIFIED ON THE END WITH MANUFACTURER ID, MO/YR MANUFACTURED, WEIGHT RAIL.

**INSTALLATION**

1. BALLAST THROUGH CROSSING AREA SHALL BE CLEAN CRUSHED ROCK BALLAST, 12" BELOW BOTTOM OF TIES, TOP OF BALLAST TO BE 2" BELOW TOP OF TIES. TIES THROUGH CROSSING SHALL BE NO. 5 TREATED HARDWOOD 19 3/16" ON CENTERS, IN GOOD CONDITION.
2. IF REQUIRED BY GDLM, PERFORATED DRAINAGE PIPE RECOMMENDED FOR PROPER DRAINAGE PER BNSF DWG. 2259.01.
3. ENDS OF CROSSING PANELS SHOULD BE CENTERED ON TIE.
4. THERMITE WELDS OR RAIL JOINTS SHOULD BE LOCATED OUTSIDE THE CROSSING. WHEREVER POSSIBLE, WELDED RAIL SHOULD BE RELAYED THROUGH CROSSING (MINIMUM RAIL WEIGHT, 112 LB.) BEFORE NEW TIES AND CROSSING PANELS ARE INSTALLED.
5. PANELS SHALL BE HANDLED CAREFULLY, SLATTED AND STACKED ON LEVEL GROUND TO PREVENT WORPAGE.
6. PUBLIC CROSSINGS SHALL BE OF SUCH WIDTH AS PRESCRIBED BY LAW, BUT IN NO CASE SHALL THE WIDTH BE LESS THAN THAT OF THE ADJACENT TRAVELED ROADWAY PLUS 2 FEET.
7. TWIN LEAD TIMBER SPIKES FURNISHED SEPARATELY.
8. 3/8" DIA. HOLES SHOULD BE BORED IN FIELD, TO PATTERN SHOWN.
9. GAGE SIDE AND FIELD SIDE PANELS ARE INTERCHANGEABLE.
10. ALL CROSSING PANELS HAVE CLEARANCE FOR PANDROL PLATES AND CLIPS.
11. USE OF 10' TIES IS REQUIRED IN HEAVILY RAIL TRAFFIC CROSSINGS SEE DWG. 2253.03.
12. PANELS ARE FURNISHED FOR ANY LENGTH CROSSING IN INCREMENTS OF 8 AND 16 FEET. THE ITEM NUMBERS LISTED BELOW COVERS THE REQUIRED PANELS BY THE TRACK FOOT.

BILL OF MATERIAL		
WT. RAIL	DESCRIPTION	STOCK CODE
100 LB	8' FULL DEPTH PANEL (2 PCS. DOWELED)	004938916
115 LB	8' FULL DEPTH PANEL (2 PCS. DOWELED)	004938940
115 LB	16' FULL DEPTH PANEL (2 PCS. DOWELED)	004938932
136 LB	8' FULL DEPTH PANEL (2 PCS. DOWELED)	004938866
136 LB	16' FULL DEPTH PANEL (2 PCS. DOWELED)	004938957
	3/4" X 12" TWIN LEAD TIMBER SPIKE	004744074
	3/4" X 13" TWIN LEAD TIMBER SPIKE	004743985



**STANDARD PLAN**

**TIMBER CROSSING PANELS FOR LOW DENSITY RAIL TRAFFIC ON 8'6" WOOD TIES**

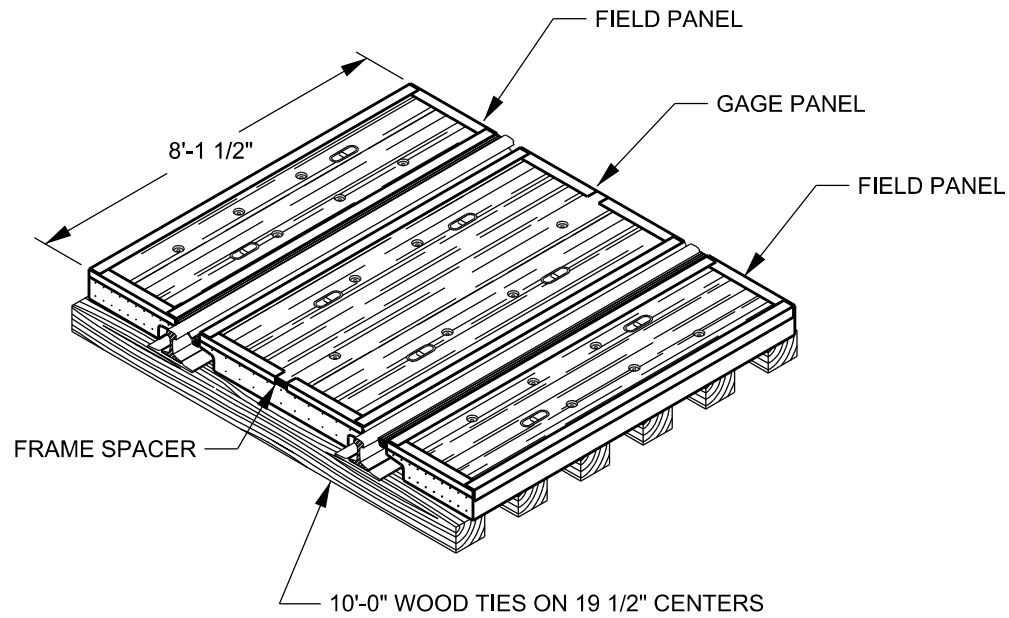
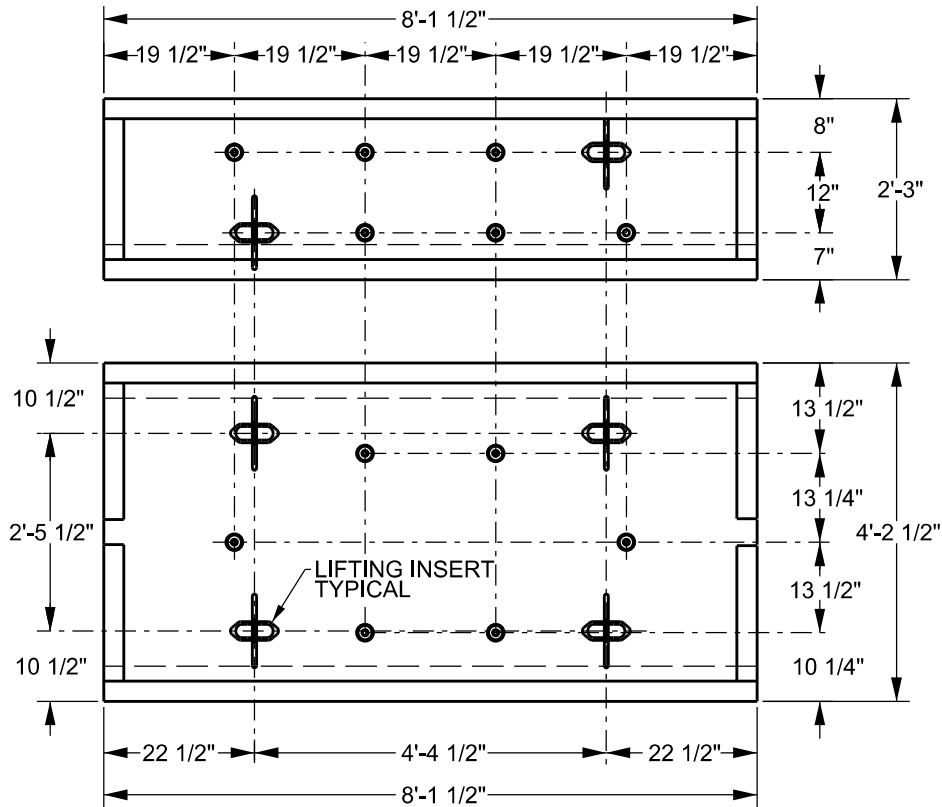
SCALE: NONE

FILE OWNER BNSF

DATE: MAY 11, 2010

REV. NO.: 07

DWG NO: 225302



NOTES:  
 1/4" RUBBER INTERFACE PAD TO BE PLACED BETWEEN PANEL AND TIES FOR 141 LB. RAIL SECTION. PAD TO BE NAILED TO TIES,

CROSSING TYPE - 10W

RAIL SIZE	PANEL HEIGHT	GAGE PANEL WEIGHT	FIELD PANEL WEIGHT
115	7 1/8"	2850 LBS.	1550 LBS.
132-141	7 7/8"	3125 LBS.	1675 LBS.

**COMMON STANDARDS**

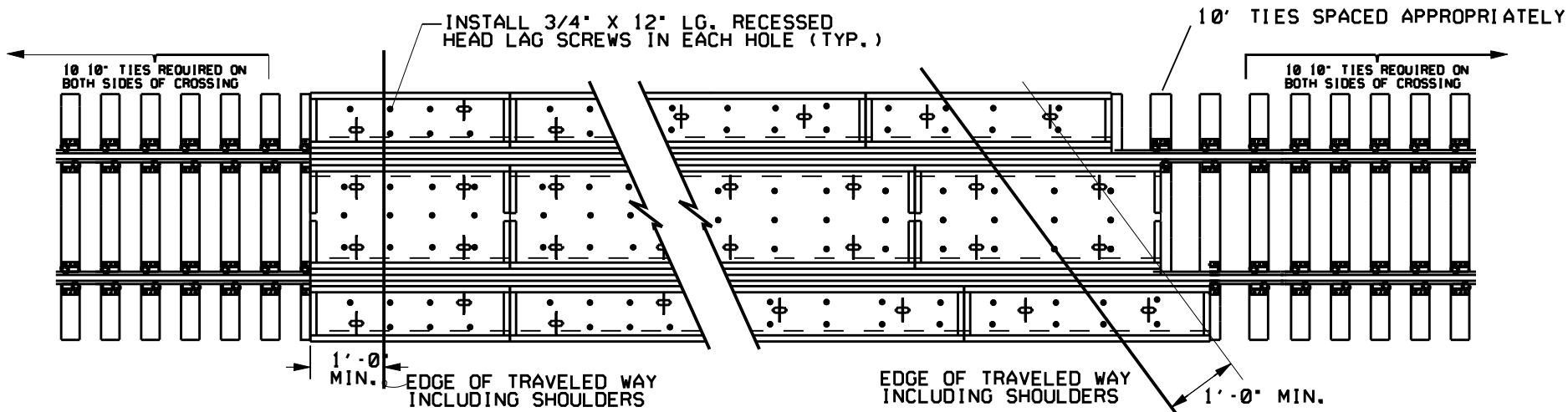
**LAYOUT FOR CONCRETE PANELS ON 10'-0" LONG WOOD TIES (10W)**

FILE OWNER: UPRR
DATE: DEC. 6, 2010

REV. NO.: 2
DWG NO: 200100

ITEM NUMBERS				
141 LB. BNSF	133-141 LB. UPRR	132-136 LB. BNSF	115 LB. UPRR	115 LB. BNSF
054374616	540-1301	004935722	540-0202	004935706

15-1

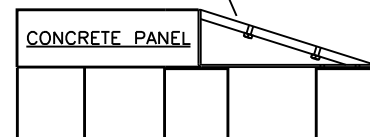


**PLAN VIEW OF PANEL ON TIMBER TIES WITH ELASTIC FASTENERS**

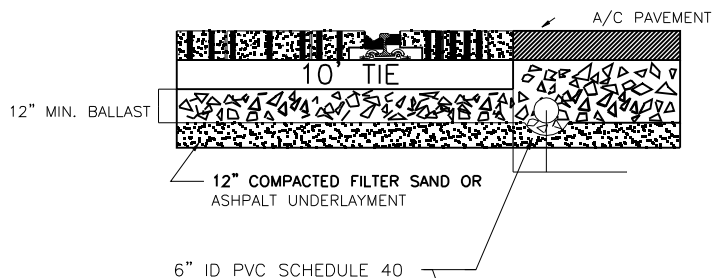


ENDS OF CONCRETE PANELS MUST BE SUPPORTED BY TIES AS SHOWN.

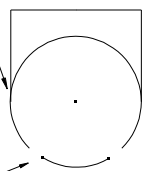
MANUFACTURED OR ASPHALT END RAMP REQUIRED.



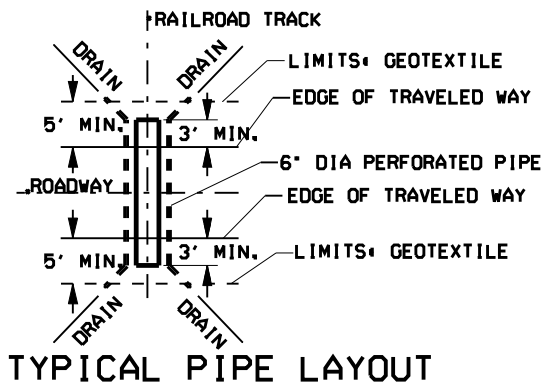
SIDE VIEW  
FIELD RAMP BASE REFER TO PLAN 22580301 FOR END RAMP RESTRAINT SYSTEM



6" ID PVC SCHEDULE 40



INSTALL PIPE SO THAT WEEP HOLES ARE TOWARDS BOTTOM



**TYPICAL PIPE LAYOUT**

NOTE: GEOTEXTILE & PIPE TO BE INSTALLED ONLY AT LOCATIONS WHERE REQUIRED BY STATE OR LOCAL AGENCIES OR WHERE DESIGNATED BY CHIEF ENGINEER.

SEE ENGINEERING INSTRUCTIONS SECTION 10 FOR INSTALLATION AND MAINTENANCE DETAILS.



**STANDARD PLAN**

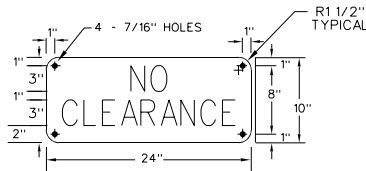
**MINIMUM INSTALLATION REQUIREMENTS FOR STANDARD ROAD CROSSINGS AT GRADE**

SHEET NO. 01	FILE OWNER BNSF	DATE: MAR 07, 2007
	REV. NO.: 05	DWG NO: 2259

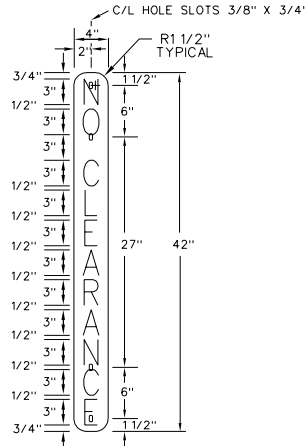




# EXAMPLE 1



# EXAMPLE 2



## SIGNS:

NO. 44 - "NO CLEARANCE"

PLACE NO CLEARANCE SIGN ON BUILDING STRUCTURE OVER C/L TRACK WHERE VERTICAL CLEARANCE IS LESS THAN REQUIRED. LETTERED AND MOUNTED AS SHOWN IN EXAMPLE 1.

NO. 44A - "NO CLEARANCE"

PLACE NO CLEARANCE SIGN ON BUILDING STRUCTURE OR POST WHERE HORIZONTAL CLEARANCE IS LESS THAN REQUIRED. LETTERED AND MOUNTED AS SHOWN IN EXAMPLE 2.

## NOTES:

1. THE SIGNS LISTED IN THIS PLAN ARE 10" X 24" AND 4" X 42" SIZED WITH WHITE BACKGROUND AND BLACK LETTERS, ONE SIDE ONLY, AS SHOWN IN EXAMPLES 1 AND 2.
2. SEE PLAN 3000.01 FOR ADDITIONAL SPECIFICATIONS AND INFORMATION CONCERNING THE REFLECTIVE AND PANEL MATERIAL.
3. FOR USE IN THE STATE OF MINNESOTA AS ORDERED BY THE PUB. SERV. COMM. AT POINTS WHERE CLEARANCE IS LESS THAN THE LEGAL REQUIREMENT.

## BILL OF MATERIALS

QUANTITY	SIGN PANEL
1 EA.	SIGN NO. 44-NO CLEARANCE ITEM NO. 047220983
1 EA.	SIGN NO. 44A-NO CLEARANCE ITEM NO. 047220984
	OPTIONAL HARDWARE
1 EA.	2 LB. PER LIN. FT. GALVANIZED FLANGED CHANNEL STEEL POST, 8'-0" LONG WITH 3/8"Ø MONTING HOLES, 1" CENTERS, WITH POINTED END.
2 EA.	5/16" DIA. X 2" GALVANIZED ROUND HEAD SQUARE NECK MACHINE BOLT, ALL THREAD, WITH LOCK NUT AND WASHER.

BURLINGTON NORTHERN SANTA FE STANDARD PLAN <small>ENGINEERING DEPT., FORT WORTH, TEXAS</small>	
CLEARANCE SIGNS	
RAIL:	
DATE: 06/10/96	SCALE:
DWG. NO. 3044	SHEET NO. 01
REV. NO. 04	
<small>USE OF THIS DRAWING IS LIMITED TO BURLINGTON NORTHERN SANTA FE AND THE PARTY DESIGNATED ON THE ATTACHED SHEET. NO USE MAY BE MADE BY ANY THIRD PARTY WITHOUT THE WRITTEN CONSENT OF BURLINGTON NORTHERN SANTA FE.</small>	



## Vertical Curves

- a. Vertical curves should be used to round off all intersecting grades.
- b. The length of a vertical curve is determined by the grades to be connected and the speed of the traffic.
- c. The rate of change for tracks with a vertical curve concave upwards (sag) should be one-half the rate of change of a vertical curve concave downward (summit).
- d. The rate of change for high-speed main tracks (> 50 MPH) should not be more than 0.05 feet per station (of 100 feet) in sags, and not more than 0.10 feet per station on summits.
- e. For secondary main tracks (speed < 50 MPH), the rate of change should not be more than 0.10 feet per station in sags, and not more than 0.20 feet per station on summits.
- f. For industry tracks and non-main tracks with speeds not greater than 20 MPH, the rate of change should not be more than 2.0 feet per station for both sags and summits.
- g. The rate of change per station is calculated as follows:  $R = D/L$                       Where:

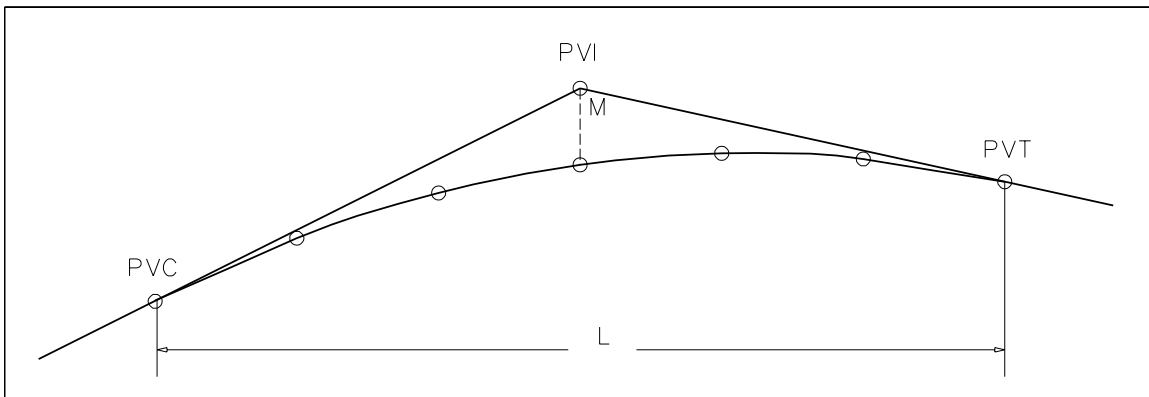
R = Rate of change per station

D = Algebraic difference of the two intercepting grades

L = Length of vertical curve in 100-ft. stations

M = Correction from the straight grade to the vertical curve

A parabola is used for the vertical curve in which the correction from the straight grade for the first station is one half the rate of change, and the others vary as the square of the distance from the point of tangency. Where points fall on full stations, it will be necessary to figure these for only one half the vertical curve, as they are the same for corresponding points each side of the vertex. Corrections are (-) when the vertical curve is concave downwards (summit), and (+) when the vertical curve is concave upwards (sag). The rate of change may be assumed and the length of vertical curve computed, or preferable the length assumed and the rate computed.

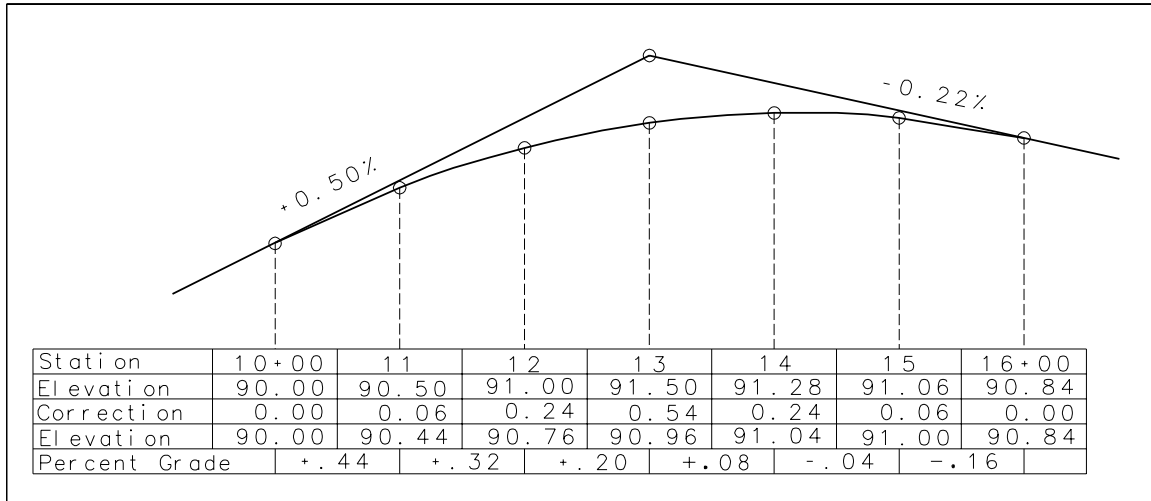


For example:

Assume length = 600 feet (6 stations)

$D = 0.50 \text{ minus } -0.22 = 0.72$

$R = 0.72/6 = 0.12$



Calculate the straight-grade elevations for each station.

The correction for the first station is one-half the rate of change (R). So, the correction for station 11 is 0.06 (minus since it concaves downwards).

The correction for the Station 12 is  $4(0.06) = 0.24$ . This is the correction to the first station (one-half the rate of change) multiplied by the square of the length, in stations, from the PVC. At Station 13 (the PVI), the correction is  $9(0.06) = 0.54$ . Notice the corrections for Stations 11 and 15 are the same. Likewise for 12 and 14, since they are the same distance from the PVC and PVT. So, only one-half of the curve's corrections need to be calculated.

Next, apply the correction at each station to the straight-grade elevation to obtain the elevation on the vertical curve.

A simpler method of computing this and one that furnishes a check throughout is the following:

Sta. 10	90.00	
	<u>+0.44</u>	(% grade sta. 9 to 10) minus one half rate = $0.50 - 0.06$
Sta. 11	90.44	
	<u>+0.32</u>	(% grade sta. 10 to 11) minus rate = $0.44 - 0.12$
Sta. 12	90.76	
	<u>+0.20</u>	(% grade sta. 11 to 12) minus rate = $0.32 - 0.12$
Sta. 13	90.96	
	<u>+0.08</u>	(% grade sta. 12 to 13) minus rate = $0.20 - 0.12$
Sta. 14	91.04	
	<u>-0.04</u>	(% grade sta. 13 to 14) minus rate = $0.08 - 0.12$
Sta. 15	91.00	
	<u>-0.16</u>	(% grade sta. 14 to 15) minus rate = $-0.04 - 0.12$
Sta. 16	90.84	

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(PROJECT NAME – STATION, ST)

I acknowledge that I have received the internet link and/or hard copy of BNSF's "Design Guidelines for Industrial Track Projects" dated May 2011. I understand that the design and construction of this facility will follow the Guidelines. Questions concerning the Guidelines are to be directed to the BNSF Project Engineer listed below.

[http://www.bnsf.com/customers/pdf/IndyTrkStds\\_1007a.pdf](http://www.bnsf.com/customers/pdf/IndyTrkStds_1007a.pdf)

Owner Representative

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Signature

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Date

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Printed

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Company Name

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BNSF Project Engineer