Burlington Northern Santa Fe

DESIGN GUIDELINES
FOR
INDUSTRIAL TRACK PROJECTS

Engineering Services

4515 Kansas Avenue
Kansas City, KS  66106

June, 2005
# INDUSTRIAL TRACK PROJECTS - DESIGN HANDOUT

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GENERAL PROCEDURE FOR DEVELOPMENT OF TRACK PLANS AND

ESTIMATES FOR INDUSTRIAL TRACK PROJECTS

1. Customer will contact Economic Development (E.D.) or Marketing Representative. A questionnaire will be completed that will be used in preparing a preliminary opportunity package to be reviewed by various BNSF groups, including Service Design & Performance (SDP).

2. Customer will be requested 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 E.D./Marketing, 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 SDP. 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 designer can attend this meeting. Following meeting, BNSF Engineering will prepare a preliminary track layout sketch (see appendix, page A-1, for example) and forward to Division Operating, Division Maintenance, Signal Engineering and E.D./Marketing for review and approval. Approvals and comments should be returned to BNSF Engineering and the sketch updated with names and dates of approvals. E.D./Marketing will furnish a copy to the Customer.

3. The Customer may use a designer or contractor of its choice to prepare the track plans. The preliminary track layout sketch 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.

4. The Customer will develop an industrial track plan (in electronic format), including plan/profile and drainage plan, which is to be submitted to the E.D./Marketing representative for further handling by BNSF. Design plans shall include all information contained in "Industrial Spur Track Survey and Plan Requirements" section, pages 10 and 11. Two hard-copy sets of the proposed track plan should also be furnished. Engineering will review and approve the track design, and the Division General Manager will review and approve, in writing, the track layout (location of switches and derails).

5. BNSF Engineering will comment directly to Customer (copying E.D.) regarding any plan revisions. Any revisions will be documented on the prints and returned to the Customer for inclusion on track plans.

6. BNSF Engineering will prepare a cost estimate, chargeable to the Customer, for the BNSF portion of track construction, and revise the track layout sketch if necessary.

7. Upon receiving the Firm Bid Cost Estimate, E.D. will present the formal industrial track package, including all agreements, to the Customer for consideration.

8. Upon Customer's acceptance of the proposal (check, fully executed agreements, and submittal of the final plans) E.D. 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 are then ordered, work scheduled and construction completed.

Rev’d 4/15/04
STANDARDS FOR INDUSTRIAL TRACKAGE

1. Roadbed:

Roadbed and ballast section for industrial trackage shall conform to the special roadbed section (see appendix, page A-2). Embankment side slopes to be minimum of 1.5:1. 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). 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.

Subballast shall be crushed gravel or crushed stone with a minimum 75% of the material having two fractured faces. Subballast must meet the quality requirements of ASTM Designation: D 1241 and be approved by the Engineer.

6. 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.

3. Profile Grade:

Track profile grades shall be limited to a maximum of 1.5%. Grades steeper than 1.5% will require approval by BNSF Engineering and Division General Manager.

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-27 and A-28 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. 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 gauge side of the rail. 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.

6. Turnouts:

All main line, controlled siding and passing track turnouts will be a minimum new No. 11-136 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. 11-136 lb. recommended, and a No. 9 - 112
lb. as the minimum (see appendix, pages A-7 to A-18). 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-5.

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-20).

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-19) and installed so that the derailed car is directed away from BNSF trackage. Derails 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 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 approved by BNSF Engineering.

9. Road Crossings

The standard for a road crossing surface installed and maintained by the BNSF is concrete plank (for 136-lb. rail) placed on 10-ft. switch ties. Also, ten 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-21 to A-23).

10. Clearances:

BNSF will adhere to the "Clearance Requirements By State," BNSF Dwg. No. 2509, Sheet No. 1 (see appendix, page A-24) for each state. If a state does not have its own clearances, the "BNSF Minimum Clearances Diagram," BNSF Dwg. No. 2509, Sheet No. 2 (see appendix, page A-25) 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-26).

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-3 depicts requirements for most states.

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 meeting.

13. Inspection:

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 track before placing it into service.

14. 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 is to be approved by BNSF Engineering, and the track layout (location of switches and derails) to be approved, in writing, by the Division General Manager.

b. Pipelines under track are to be encased per BNSF requirements. Wirelines are to be installed per BNSF requirements. Refer to "BNSF Utility Accommodation Guide" booklet.

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. Check with the Dept. of Transportation for each state's regulations. 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-6) or suitable bumping post or wheel stop shall be installed 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 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.
1. **Roadbed:**

Roadbed and ballast section for industrial trackage shall conform to the special roadbed section (see appendix, page A-2). Embankment side slopes to be minimum of 1.5:1. 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). 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.

Subballast shall be crushed gravel or crushed stone with a minimum 75% of the material having two fractured faces. Subballast must meet the quality requirements of ASTM Designation: D 1241 and be approved by the Engineer.

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.

3. **Profile Grade:**

Track profile grades shall be limited to a maximum of 1.5%. Grades steeper than 1.5% will require approval by BNSF Engineering and Division General Manager. 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-27 and A-28 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. 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 gauge side of the rail. 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.

6. **Turnouts:**

All main line, controlled siding and passing track turnouts will be a minimum new No. 11-136 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, page A-29).
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-19) and installed so that the derailed car is directed away from BNSF trackage. Derails 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 Operating Department requirements. 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.

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 approved by BNSF Engineering.

9. Road Crossings

The standard for a road crossing surface installed and maintained by the BNSF is concrete plank (for 136-lb. rail) placed on 10-ft. switch ties. Also, ten 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-21 to 23).

10. Clearances:

BNSF will adhere to the "Clearance Requirements By State," BNSF Dwg. No. 2509, Sheet No. 1 (see appendix, page A-24) for each state. If a state does not have its own clearances, the "BNSF Minimum Clearances Diagram," BNSF Dwg. No. 2509, Sheet No. 2 (see appendix, page A-25) 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-26). 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 pp. A-3 and A-4 for typical sections of roads and walkways.

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 meeting.

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 pp. A-3 and A-4 for typical sections of roads and walkways. A standard section with a 13-ft wide roadway is shown in the appendix, page A-4. The roadway can be constructed using subballast materials as specified in the Roadbed section of this document.

14. **Inspection:**

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

15. **General:**

a. Minimum Track Length: 7,200 feet of clear track length for unit train facilities

b. 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 is to be approved by BNSF Engineering, and the track layout (location of switches and derails) to be approved, in writing, by the Division General Manager.

c. Pipelines under track are to be encased per BNSF requirements. Wirelines are to be installed per BNSF requirements. Refer to "BNSF Utility Accommodation Guide" booklet.

d. 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. Check with the Dept. of Transportation for each state's regulations. Less than the required sight distance will be the liability of the Industry.

*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)."

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e. An earthen berm (see appendix, page A-5) or suitable bumping post or wheel stop shall be installed at the end of track.

f. **Customer is responsible for all grading including placing all subballast up to BNSF ballast and the placement of a construction berm, if required.**

g. Customer 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.

h. **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.
INDUSTRIAL SPUR TRACK SURVEY AND PLAN REQUIREMENTS

Provide a Plan View of new spur track:

Show complete description of all proposed trackage, including mainline or lead track stationing, curvature, milepost location and size (#9, #11) of proposed or future turnouts, car capacities, and location of bumpers or wheel stops and derailed.

Show location of 14’ clearance point, railroad property line and pertinent property corners, and any previously dedicated railroad easements. Note length of storage capacity of 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 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" = 100’. **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. Furnish all survey notes and other field data with two complete sets of plan documents (hard copies) to railroad for review and approval. All information is to be in English units. Upon approval, BNSF Engineering will revise the preliminary track layout sketch, if necessary.

Establish and document one local benchmark near industrial track site.

Provide a Profile View of new track:

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 scale for profiles and cross-sections: 1" = 10’.

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

Example: “Construct 169 track feet including a #11 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.”
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 the Railroad and close contact with Railroad's System Engineering and Division Engineer (if applicable) is required. No work is to be performed on Railroad's right-of-way, or in such proximity as to interfere with the Railroad's tracks or roadbed, without advance permission by the Railroad, including insurance and if necessary, flagging protection.

INSURANCE REQUIREMENTS

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

GRADING

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 material shall be removed and wasted or stockpiled for other use. Topsoil removed from embankment areas shall be spread uniformly over the embankment slopes.

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. Subballast shall be crushed gravel or crushed stone with a minimum 75% of the material
having two fractured faces. Subballast 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.

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.

ROADBED AND BALLAST SECTION

Minimum roadbed and ballast section for track shall conform to "Typical Sections for Industry Track,"
BNSF Dwg. No. 1000, Sheet No. 3 (see appendix, page A-2). Compliance with all applicable State and
Federal rules and regulations regarding walkways is required.

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 the Railroad System 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 pipe shall meet the requirements shown in Table 1.
### TABLE 1

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

* 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 Railroad System 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 Guide." Applications for utility crossings and relocations are handled by Staubach Global Services, 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 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. 1 (see appendix, page A-24) for each state. If a state does not have its own clearances, the "BNSF Minimum Clearances Diagram," BNSF Dwg. No. 2509, Sheet No. 2 (see appendix, page A-25) 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-26).

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 90# section, with 112# (5-1/2" base) recommended, and shall be compatible with Burlington Northern Santa Fe 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. Rail shall be standard full lengths or cropped with not more than 10% short lengths and shall be free from defects. Minimum length shall not be less than 27 feet except in turnouts. 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.

Anchors:
Rail anchors shall be new or reconditioned, sized to fit the rail section, and shall be provided per industrial track design criteria on page 3. 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 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.

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.
New or secondhand compromise joints of manufactured type (welded or homemade 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.

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:
Ballast shall be minimum of AREMA size 5 (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 the Railroad.

Bumping Post:
An earthen berm (see appendix, page A-6) or suitable bumping post or wheel stops, approved by the Railroad, shall be installed at the ends of tracks.

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-19) and installed so that the derailed car is directed away from BNSF trackage. Derails 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 Operating Department requirements. 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.

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 protected 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.

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.

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:
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.

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 to be tightened to a range of 20,000 to 30,000 lbs. tension. If a bolt tightening machine is not used, a standard track wrench with a 42" long handle may be used.

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. Gage to be checked at every third tie.

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.
Joints:
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:

<table>
<thead>
<tr>
<th>Rail</th>
<th>Temperature</th>
<th>Expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>39-Ft. Rail</td>
<td>Over 85</td>
<td>None</td>
</tr>
<tr>
<td>33-Ft. Rail</td>
<td>Over 85</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>66 to 85</td>
<td>1/16</td>
</tr>
<tr>
<td></td>
<td>46 to 65</td>
<td>1/8</td>
</tr>
<tr>
<td></td>
<td>26 to 45</td>
<td>3/16</td>
</tr>
<tr>
<td></td>
<td>6 to 25</td>
<td>1/4</td>
</tr>
<tr>
<td></td>
<td>Below 6</td>
<td>5/16</td>
</tr>
</tbody>
</table>

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. Do not strike rail directly with a maul, either on top when driving, or on side to obtain track gage. 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.

Final Inspection:
   After ballasting and surfacing are completed, inspect track to see that joints are tight and rail attachments to ties are secure.
   The BNSF Roadmaster, or designate, will inspect the finished trackwork and complete the checklist on Page 20, or similar document. After the Roadmaster’s approval the track will be placed in service by the Division’s General Manager and can then accept rail cars.
ACCEPTANCE

Final acceptance of the work will be subject to the inspection of the Burlington Northern Santa Fe, 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:

<table>
<thead>
<tr>
<th>Subgrade</th>
<th>Drainage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ballast</td>
<td>Curvature &amp; Alignment</td>
<td></td>
</tr>
<tr>
<td>Surface</td>
<td>Any Clearance Problems?</td>
<td></td>
</tr>
<tr>
<td>Rail</td>
<td>Anchors</td>
<td></td>
</tr>
<tr>
<td>Tie</td>
<td>Switches, Frogs &amp; Guard Rails</td>
<td></td>
</tr>
<tr>
<td>Tie Plates</td>
<td>Joint Bars</td>
<td></td>
</tr>
<tr>
<td>Spikes</td>
<td>Bolts, Nuts &amp; Washers</td>
<td></td>
</tr>
<tr>
<td>Bumping Post or Wheel Stops</td>
<td>Derails, Derail Signs</td>
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<tr>
<td>Track or Highway Crossings</td>
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</tbody>
</table>

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. 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 Railroad 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 either a "Right of Entry Permit" or a "Release of Claim and Indemnity," or both, depending on the duration of the project. To obtain a permit, contact Staubach Global Services, phone number 1-866-498-6647. These permits require a preparation fee.

2. Any de-watering utilizing drains or ditches on BNSF property must be approved by a BNSF Engineering.

3. Contractor must have BNSF approved "Construction Plans" prior to commencing work on a project. No change will be made to "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 the Railroad, 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 the Railroad not covered by construction easement, permit, lease or agreement. A 10-foot clear area on both sides of a main track must remain unobstructed at all times to allow for stopped train inspection.

Rev’d 4/15/04
10. No construction will be allowed within 25 feet of center of any track unless authorized by Burlington Northern Santa Fe's Division Engineer and as shown on 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 safety job briefing will be held prior to beginning work each day and anytime 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.
TANGENT TRACK LIGHT TRAFFIC LINES

CURVED TRACK LIGHT TRAFFIC LINES

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
   5" BALLAST 2,435 CU. YARDS CURVED

3. FOR INDUSTRY TRACK BALLAST SECTION TO BE LEVEL WITH TOP OF TIE WHERE WALKING REQUIRED, 8'-6" MN FROM CENTER LINE.

INDUSTRY TRACK
NOT TO SCALE - TO BE USED AS REFERENCE ONLY

CONSTRUCTION OF PAD FOR PLACEMENT OF PACKAGE TURNOUT.

THIS FILL SHALL BE PLACED BY INDUSTRY AS PART OF GRADING FOR NEW INDUSTRY SPUR.

CONTRACTOR SHALL COORDINATE WITH ROADMASTER FOR ANY DEVIATION OF FILL AND FOR FLAGMAN PROTECTION.
43'-6" P.S. TO TURNOUT INSULATED JOINT

28'-6 1/2" RAIL

32'-9 3/4" RAIL

48'-10 1/2" P.S. TO CLOSURE INSULATED JOINT

3'-1" 1/2"

2'-3 5/16"

10" TO TIE 20

7 @ 10"

11 @ 18 1/2"

18 1/2" TO TIE 40

ACCUMULATIVE TIE SPACING FROM 1 TIE 1

WOOD TIE QUANTITIES BY LENGTH
(18) 11'-0"

(8) 12'-0"

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, AND 341003 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.
ACUMULATIVE TIE SPACING FROM Q TIE 1

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

WOOD TIE QUANTITIES BY LENGTH

(1) 12'-0"
(2) 16'-0"
(3) 18'-0"
(4) 18'-0"
(5) 13'-0"
(6) 14'-0"

COMBINATION STANDARDS

NO. 9 TURNTOUT 136 LB.

PANEL NO. 3

UPRR | BN/SHF RH | BN/SHF LH
---|---|---
RBM: | N/A | 518030072 | 518030078
SOLID: | N/A | 518030077 | 518030078
DASHED TIES ARE NOT INCLUDED IN PANEL WEIGHTS (TYP.)

WOOD TIE QUANTITIES BY LENGTH

(10) 10'-0"
(2) 16'-0"
(13) 10'-0"
(7) 11'-0"

MANUAL OPERATED
PANEL WEIGHT: 20,000 LBS.

NOTES:
1. SEE DWG 343001, 343002, AND 343003 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. FULL BOX ANCHOR STOCK RAIES, TIES 3-15 FOR SHIPPING OF PANELS ONLY.
6. APPLY 6" SAFE BOND WIRE ONE CRIB AHEAD OF HEEL OF SWITCH ON STOCK AND SWITCH POINT RAILS.
7. ALL SWITCH POINT AND STOCKRAIL DIMENSIONS ARE TO BE INSTALL, SEE PLAN 241500 FOR FULL LENGTH.

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

POWER OPERATED
PANEL WEIGHT: 20,000 LBS.

COMMON STANDARDS

NO. 11 TURNOUT 136 LB.
PANEL NO. 1

POWER
MANUAL
MAN. SPR. SW.

UPRR 5180300083 5180300079
BNSF RH 5180300000 5180300081
BNSF LH 5180300064 5180300085

FILE OWNER: BNSF  DATE: MAY 6, 2005
REV. NO.: 2  DWG NO: 343000
NOTES:
1. WHEN INSULATED JOINTS ARE REQUIRED, THE LOCATION OF THE JOINTS SHOULD BE STAGGERED NO CLOSER THAN 5' AND NOT MORE THAN 4'-6" APART, MEASURED ALONG THE TURNOUT.
2. SEE DWG 343000, 343002, AND 343003 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 LB.
PANEL NO. 2

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>11'-4&quot;</td>
<td></td>
<td>32'-6&quot;</td>
</tr>
<tr>
<td>B</td>
<td>21'-6&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLOSURE INSULATED JOINT RAIL</td>
<td>8'-2&quot;</td>
<td>27'-11&quot;</td>
<td>30'-1&quot;</td>
</tr>
</tbody>
</table>

FILE OWNER: BMBF | DATE: JULY 24, 2003
REV. NO.: 1 | DIAG NO: 343001
NO. 11 TURNOUT 136 LB
PANEL NO. 3

COMMON STANDARDS

UPRR BNSF RH BNSF LH
RBM N/A 5180300084 5180300086
SPR N/A 5180300087 5180300088
SOLID N/A 5180300089 5180300090

FILE OWNER: BNSF DATE: APR 20, 2003
REV. NO.: 1 DWG NO: 343002

NOTES:
1. SEE DWGS 343000, 343001, AND 343003 FOR THE BALANCE OF LAYOUT PLANS.
2. ALL TIES 7" X 6" BODY UNLESS OTHERWISE SHOWN.
3. SEE DWG 343100 FOR TURNOUT GEOMETRY.
4. SEE DWG 343200 FOR TURNOUT BILL OF MATERIAL.
5. APPLY 6" 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.
NOTES:
1. SEE DWGS 343000, 343001, AND 343002 FOR THE BALANCE OF LAYOUT PLANS.
2. ALL TIES 7” X 8” 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”.

WOOD TIE QUANTITIES BY LENGTH

(2) 15'-0”
(6) 15'-0”
(7) 17'-0”

ACCUMULATIVE TIE SPACING FROM TIE 1

20'-7 1/2" RAIL
20'-11 3/4" RAIL
20'-10" RAIL
20'-8" RAIL

211/2"
EQUIVALENT TURNOUT CURVE

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

NUMBER 11 TURNOUT TRACK ALIGNMENT GEOMETRY

THE BURLINGTON NORTHERN AND SANTA FE RAILWAY CO.
FIELD ENGINEERING - FORT WORTH, TEXAS

DGN FILE: T:\FIELDENG\FTWORTH\TURNOUTS.DGN

REVISED 8/23/01 to SHOW EQUIVALENT CURVE DATA & NEW T.O. LENGTH PER REVISED STANDARD PLANS
ELEVATION VIEW
36 EH STANDS,
SHOWN WITH HIGH STAFF
AND TRI-HANDLE.

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

BILL OF MATERIALS

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>SWITCH STAND DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 EA.</td>
<td>36E LOW TARGET WITH TRI-HANDLE @ 30° .......... ITEM NO. 517740985N</td>
</tr>
<tr>
<td>1 EA.</td>
<td>36E LOW TARGET WITH STRAIGHT BALL HANDLE @ 30° .... ITEM NO. 517740018N</td>
</tr>
<tr>
<td>1 EA.</td>
<td>36EH HIGH TARGET WITH TRI-HANDLE @ 30° ............. ITEM NO. 517740995N</td>
</tr>
<tr>
<td>1 EA.</td>
<td>36EH HIGH TARGET WITH STRAIGHT BALL HANDLE @ 30° .. ITEM NO. 517740017N</td>
</tr>
<tr>
<td>1 EA.</td>
<td>36D RETRO-FIT KIT WITH TRI-HANDLE @ 30° ............. ITEM NO. 513960006N</td>
</tr>
<tr>
<td>1 EA.</td>
<td>36D RETRO-FIT KIT WITH STRAIGHT BALL HANDLE @ 30° ... ITEM NO. 513960007N</td>
</tr>
</tbody>
</table>

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.
TYPICAL 24' CROSSING AT 30° SKEW

EDGE OF CROSSING NO CLOSER THAN 1 FOOT FROM TRAVELED ROADWAY.

LOCATION TIMBER SPIKES

8 & 16 PANELS SHOWN, TYPICAL

3/4" STEEL DOWEL 3 PER 8' PANEL

1/2" CHAMFER

3 1/2"

6"

17"

TWO PIECE PANEL

H = 7 1/2" FOR 115 LB RAIL
H = 8" FOR 136 LB RAIL

2 1/2"

2 1/2" MAX.

17"

8.6" CROSS TIE

MATERIAL & FABRICATION

1. HARDWOOD PANELS TO BE TREATED (BNSF SPECIFICATIONS) MIXED HARDWOOD, FIRE OF WARE.
2. BRANDING: EACH CROSSING PANEL SHALL BE IDENTIFIED ON THE END WITH MANUFACTURER D, YR MANUFACTURED, WEIGHT RAIL.

INSTALLATION

1. BALLAST THROUGH CROSSING AREA SHALL BE CLEAN CRUSHED ROCK BALLAST, 12" BELOW BOTTOM OF TIES, TOP 6" BALLAST TO BE 2" BELOW TOP OF TIES. TIES THROUGH CROSSING SHALL BE NO. 5 TREATED HARDWOOD 18 3/16" ON CENTERS, IN GOOD CONDITION.
2. PERFORATED DRAINAGE PIPE RECOMMENDED FOR PROPER DRAINAGE PER BNSF DWG. 2259.01.
3. ENDS OF CROSSING PANELS SHOULD BE CENTERED ON TIE.
4. TERMINAL WELDS ON RAIL JOINTS SHOULD BE LOCATED OUTSIDE THE CROSSING. IF EVER POSSIBLE, WELDED RAIL SHOULD BE RELAYED THROUGH CROSSING (MINIMUM RAIL WEIGHT, 1/2 LB) BEFORE NEW TIES AND CROSSING PANELS ARE INSTALLED.
5. PANELS SHALL BE HANDLED CAREFULLY, SLANTED AND STACKED ON LEVEL GROUND TO PREVENT WARPING.
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. 5/8" X 12" TWIN LEAD TIMBER SPIKES FURNISHED SEPARATELY.
8. 3/8" DIAM HOLE SHOULD BE BORING IN FIELD, TO PATTERN SHOWN.
9. CAGE 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 HEAVY 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

<table>
<thead>
<tr>
<th>WT.</th>
<th>RAIL DESCRIPTION</th>
<th>ITEM NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>115</td>
<td>8 FULL DEPTH PANEL 12 PCS, DOwELED</td>
<td>058440998N</td>
</tr>
<tr>
<td>115</td>
<td>16 FULL DEPTH PANEL 12 PCS, DOwELED</td>
<td>058440998N</td>
</tr>
<tr>
<td>136</td>
<td>8 FULL DEPTH PANEL 12 PCS, DOwELED</td>
<td>058440000N</td>
</tr>
<tr>
<td>136</td>
<td>16 FULL DEPTH PANEL 12 PCS, DOwELED</td>
<td>058440999N</td>
</tr>
<tr>
<td>5/8&quot;</td>
<td>TAN LEAD TIMBER SPIKE</td>
<td>317S/0998N</td>
</tr>
</tbody>
</table>

BURLINGTON NORTHERN SANTA FE
ENGINEERING DEPT., COT, NORTHERN, TX.

TIMBER CROSSINGS PANELS
FOR LOW DENSITY RAIL TRAFFIC
ON 8.6" WOOD TIES

R/E: 05/27/98 SCALE: NONE

DWG. NO.   SHEET NO.   REV. NO.
2253       02         02
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

<table>
<thead>
<tr>
<th>RAIL SIZE</th>
<th>PANEL HEIGHT</th>
<th>GAGE PANEL WEIGHT</th>
<th>FIELD PANEL WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>115</td>
<td>7 1/8&quot;</td>
<td>2850 LBS.</td>
<td>1550 LBS.</td>
</tr>
<tr>
<td>133-141</td>
<td>7 7/8&quot;</td>
<td>3125 LBS.</td>
<td>1675 LBS.</td>
</tr>
</tbody>
</table>

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

ITEM NUMBERS

<table>
<thead>
<tr>
<th>133-141 LB, UPRR</th>
<th>133-141 LB, BNSF</th>
<th>115 LB, UPRR</th>
<th>115 LB, BNSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>540-1301</td>
<td>055590975</td>
<td>540-0202</td>
<td>055590973</td>
</tr>
</tbody>
</table>
NOTES:
1. NUMBERS IN PARENTHESES REPRESENT THE COLUMN NUMBERS FOR DIMENSIONS IN COLUMNS ON DWG. 2509.02.
2. SEE DWG. 1000.01 AND 1000.02 FOR EXISTING AND NEW CONSTRUCTION TRACK CENTERS.
3. STEPPED PLATFORMS ARE NOT ALLOWED.
4. DIMENSIONS ON THIS PLAN ARE BNSF GENERAL CLEARANCES ONLY. WHERE DIMENSIONS ARE NOT SHOWN, REFER TO DWG. 2509.02 FOR DETAILS. STATE REGULATIONS SUPERSIDE BNSF RECOMMENDED CLEARANCES.
EXAMPLE 1

EXAMPLE 2

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

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 EA.</td>
<td>SIGN NO. 44 NO CLEARANCE, ITEM NO. 047220983</td>
</tr>
<tr>
<td>1 EA.</td>
<td>SIGN NO. 44A NO CLEARANCE, ITEM NO. 047220984</td>
</tr>
<tr>
<td></td>
<td>OPTIONAL HARDWARE</td>
</tr>
<tr>
<td>1 EA.</td>
<td>2 L.B. PER LIN. FT. GALVANIZED FLANGED CHANNEL STEEL POST, 8'-0&quot; LONG WITH 3/8&quot; O MONITOR HOLES, 1&quot; CENTERS, WITH POINTED END.</td>
</tr>
<tr>
<td>2 EA.</td>
<td>5/16&quot; DIA. X 2&quot; GALVANIZED ROUND HEAD SQUARE NECK MACHINE BOLT, ALL THREAD, WITH LOCK NUT AND WASHER.</td>
</tr>
</tbody>
</table>

BURLINGTON NORTHERN SANTA FE
STANDARD PLAN
ENGINEERING DEPT., C/O R. R. MTH. PLANS

CLEARANCE SIGNS

RAIL:  3044  01  04
DATE:  06/10/96  SCALE: 
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: \[ R = \frac{D}{L} \]

Where:

\[ R = \text{Rate of change per station} \]
\[ D = \text{Algebraic difference of the two intercepting grades} \]
\[ L = \text{Length of vertical curve in 100-ft. stations} \]
\[ M = \text{Correction from the straight grade to the vertical curve} \]

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 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:

<table>
<thead>
<tr>
<th>Station</th>
<th>Elevation</th>
<th>Correction</th>
<th>Percent Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>90.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>90.50</td>
<td>+0.06</td>
<td>–.00</td>
</tr>
<tr>
<td>12</td>
<td>91.00</td>
<td>+0.24</td>
<td>+.32</td>
</tr>
<tr>
<td>13</td>
<td>91.50</td>
<td>+0.04</td>
<td>+.20</td>
</tr>
<tr>
<td>14</td>
<td>91.28</td>
<td>+0.08</td>
<td>+.08</td>
</tr>
<tr>
<td>15</td>
<td>91.06</td>
<td>–0.04</td>
<td>–.04</td>
</tr>
<tr>
<td>16</td>
<td>90.84</td>
<td>–0.16</td>
<td>–.16</td>
</tr>
</tbody>
</table>