



SYSTEM TRACK STANDARDS

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Purpose

The primary purpose of these Maryland and Delaware Railroad Company System Track Standards (Standards) is to provide Maryland and Delaware Railroad Company, LLC (Railroad) shippers (Industry)—new and existing—with the necessary information to design and construct railroad track.

These Standards are also applicable to work performed on Railroad Main Line Track and Side Track rehabilitation projects where noted in the project scope.

In general, Industry shall construct (by means of a qualified railroad contractor) all subgrade, sub-ballast and drainage structures necessary for installation of new railroad track on Industry property.

In general, Railroad shall construct (at Industry's cost) all subgrade, sub-ballast and drainage structures necessary for installation of new railroad track on Railroad property.

Prior to the commencement of rail service, a Side Track Agreement must be executed between the Railroad and Industry to address maintenance responsibilities, liability and indemnification.

The following pages in these Standards include specifications, requirements, and recommendations for the design and construction of Industry tracks to be served by the Railroad.

Notwithstanding any specifications contained herein, all materials and work shall meet all applicable AREA Engineering Requirements and Standards, and all track shall meet Federal Railroad Administration Minimum Standards for Class II Track upon completion of work.

Note: These Standards are subject to revision without notice.

Definitions

AASHTO – American Association of State Highway and Transportation Officials

AREMA – American Railway Engineering and Maintenance-of-Way Association

CLEARANCE POINT – That point on a Side Track, Lead Track, or other track located adjacent to a Main Line Track where the distance between tracks is 15 feet, or where the distance between adjacent tracks other than a Main Line Track is 14 feet. The clearance point is established by horizontal measurement between the centerlines of each track and provides the minimum clear distance that will allow for the safe passage of railcars and/or locomotives.

DERAIL – A device built on, or attached to, track for the purpose of derailing railcars, locomotives, and on-track equipment.

END OF TRACK DEVICE – A contrivance built on, or established at the end of a track, for the purpose of stopping the movement of railcars, locomotives, and on-track equipment.

FOULING A TRACK – The placement of an individual, or equipment in such proximity to a track that the individual, or equipment could be struck by a train, engine, or other on-track equipment, or in any case is within four feet of the field side of the near running rail.

FROG – A track structure used at the intersection of two running rails to provide support for wheels and passageways for their flanges, thus permitting wheels on either rail to cross the other.

INDUSTRY – That company and/or individual for which a Side Track, Lead Track or other track is to serve.

INDUSTRY-OWNED – Applies to any property owned, or operated under lease, by Industry.

LEAD TRACK – Track serving, or with the ability to serve, more than one industry with individual side tracks for each industry, or multiple yards, storage, and/or unloading areas within the industry.

MAIN LINE TRACK – Any track owned, or operated under lease, by the Railroad and not specifically designated otherwise.

OTM (OTHER TRACK MATERIAL) – Acronym used to describe track structure components other than rail, ties, and ballast such as rail anchors and spikes.

PLANS – Drawings, maps, cross-sections, and/or profiles showing the character of the work to be performed and prepared as a guide for construction of track.

RAIL OR RUNNING RAIL – A single piece of steel usually paired with another to form a track.

RAILROAD – Maryland and Delaware Railroad Company, LLC, or the operating rail subsidiary company of Maryland and Delaware Railroad Company, LLC within whose territory the track is located.

RAILROAD-OWNED – Applies to any property owned, or operated under lease, by Railroad.

RAILROAD PROJECT REPRESENTATIVE – The Railroad’s primary contact person for the Industry to contact as provided at the onset of a project.

RUNAROUND TRACK – Track used by locomotive(s) to run around to the other end of a cut (group) of railcars.

“SHALL” – Where the term “shall” appears in these Standards, it is to mean that the information following is a requirement.

“SHOULD” – Where the term “should” appears in these Standards, it is to mean that the information following is a recommendation.

SIDE TRACK – Track serving only one Industry.

SIDE TRACK AGREEMENT – An agreement between Railroad and Industry that sets forth predetermined conditions regulating track construction, liability, insurance, clearances, and other standard requirements of Railroad while clearly delineating the division of ownership and maintenance point(s) for the Industry track.

SIDING – Track owned by the Railroad and used for meeting and passing trains.

SWITCHING TRACK – Track used to set off railcars, run around railcars, and/or to facilitate the general switching operations required to serve an Industry.

TRACK – Structure consisting of two rails, crossties, OTM, and ballast, which is designed to carry railcars, locomotives, and equipment.

TURNOUT (SWITCH) – An arrangement of switch points and a frog with closure rails, and appurtenances by means of which rolling stock may be diverted from one track to another.

Side Track Installation Process

Overview

The typical process for the installation of a new Side Track, or the expansion of existing Side Tracks, is:

1. Initial discussion between Industry and Railroad
2. Development of a site plan, including Side Track design and engineering
3. Development and execution of a Side Track Agreement
4. Perform site preparation work
5. Perform track construction work
6. Final inspection and commissioning of new track

Initial Discussion between Industry and Railroad

Industry and Railroad will discuss the project and the Industry's rail service requirements. Railroad will assist in identifying sites for Industry's new location or for new or expanding rail-served facilities.

Development of a Site Plan

Railroad will assist Industry with developing a site plan, and will make recommendations about the layout of buildings, utilities and track. Unless otherwise approved by Railroad, the plans must adhere to the requirements of these Standards.

Development and Execution of a Side Track Agreement

A Side Track Agreement will be executed between Industry and Railroad to set forth the conditions regulating track construction, liability, insurance, clearances, and other standard requirements of Railroad while clearly delineating the division of ownership and maintenance point(s) for the Industry-owned track. Following execution, and the demonstration of all required insurance, construction of track may proceed.

Perform Site Preparation Work

Industry shall be responsible for all required site work as outlined in these Standards and as required for installation of both Industry and Railroad-owned track.

Perform Track Construction Work

Industry shall perform all track work on the Industry-owned portion of the track, and the Railroad shall perform all track work for the Railroad-owned portion of the track. All track work must be performed in accordance with the approved site plan.

Final Inspection and Commissioning of New Track

Industry shall notify Railroad upon completion of all Industry track work. Railroad will inspect the Industry-owned track and components to verify compliance with the approved site plan and these Standards, and shall provide written notice of any defects or subsequent approval. Upon approval, the track will be placed in service.

Safety and Environmental Permitting

Safety

The Railroad's highest priority is the safety of its employees, customers and the communities served by the Railroad. Before entering Railroad property for any purpose—including scouting, surveying, staking out or inspecting—Industry shall obtain a Right of Entry Permit. While on Railroad property, Industry will be responsible for adhering to Railroad requirements for Worker Protection, as deemed necessary by Railroad.

For more information on obtaining a Right of Entry Permit, please visit the following:
http://www.mdde.com/RealEstate_Access.html

Environmental Permitting

Industry is responsible for all required environmental permitting for the project, including work on Railroad property. If it is determined that wetland and/or stream delineation is required on Railroad property for permit application(s), the Industry *shall* contact the Railroad Project Representative *prior to the performance of the delineation*. Upon completion of any environmental field delineation, Industry shall provide Railroad with copies of all data, notes, photographs, and/or other information related to the delineation and shall provide a copy of any draft report(s) prepared for submittal to any governmental entity, court, or third party prior to submittal for Railroad review and comment. Industry shall maintain all information regarding such information as confidential except as required for the purpose of obtaining permit(s).

Field Survey and Stakeout

Field Survey

An accurate field survey is of utmost importance for the development and approval of an acceptable site plan. In particular, the following five categories are important elements of Industry track surveys:

1. Existing track
2. Utilities
3. Structures
4. Control points
5. Topography

Existing Track

Proper depiction of the existing track is essential to developing a workable design. The following items should be located and shown on site and track plans:

1. Centerline of existing track at top of rail
 - a. For tangent track, measurements should be taken at a maximum interval of 100 feet
 - b. For curved track, measurements should be taken at a maximum interval of 50 feet
 - c. Measurements should be collected at closer intervals as needed to define sudden changes in horizontal and vertical alignments such as kinks and dips in the track. Sufficient measurements should be collected to extrapolate existing vertical curves and identify grades.
 - d. Measurements should be collected every 50 feet or less in vertical curves to allow for identification of crests and / or sags.
 - e. Measurements should be collected for the greater of:
 - i. At least 300' or to the nearest curve, on both sides of the proposed turnout location; or
 - ii. The entire length of the project site
2. Point of curve (PC), point of tangent to spiral (TS), point of tangent (PT) and point of spiral to tangent (ST)
3. Existing super-elevation tags
4. Point of switch (PS) for all turnouts and method of operation i.e. hand throw, spring, power operated
5. Whether switch is right hand or left hand throw

6. Point of frog (PF), diverging and straight side, for all turnouts
7. Derails and type (Hayes Model HB or double switch point)
8. Division of ownership and maintenance signs
9. Close clearance signs
10. Nearest milepost and direction of increasing mileposts
11. Track centerline location for all pipes and / or utility lines passing under and / or over track
12. Bumping posts, rail stops, and / or earth mounds
13. Road crossings (centerline of track at edge of crossing surface)
14. Type, size, or weight of all key track components including compromise joints (used between rails of different sizes)
15. Construction of rail, i.e. jointed rail (JTR) or continuously welded rail (CWR)
16. Rail lubricators
17. Insulated joints
18. Track wires for signal circuits connecting to the rails (including crossing activators)
19. Signals and signal structures including AEI tag readers, hot box detectors, dragging equipment detectors, pedestals, signal pole lines, and bungalows

Utilities

Utilities must be accurately depicted on site and track plans, as missed utilities can drastically alter project viability and cost. The following utility items should be located and shown on the drawings:

1. Aerial utility and light poles, guy wires, and guy poles
2. Natural gas line (valves, markers, and/or vents)
3. Telephone or fiber optic lines (junction boxes, or markers)
4. Water lines (taps, valves, meters, markers)
5. Sewer lines (taps, cleanouts, manholes, markers)
6. Storm water facilities (inlets, outfalls, catch basins, manholes)

Overhead wires should be surveyed for their elevation at the point at which they cross the existing track, if applicable. Their location and elevation should also be determined at the point of their greatest sag and referenced to the corresponding existing ground elevation along with an additional point at the centerline of proposed track.

Structures

Structures, existing and / or proposed, have the potential to adversely impact side and/or overhead clearances. The following items shall be shown on the plans with clearance measures to the centerline of track:

1. Doorways, sides and top
2. Corners of docks and finished floor elevations
3. Fences and gates
4. Unloading pits and scales, inside and outside walls
5. Corners/sides of buildings and finished floor elevations
6. Roadways
7. Retention pond levees and drainage structures
8. Retaining walls
9. Utility poles for side clearances
10. Overhead and under grade bridges
11. Other structures that might impact clearances

Control Points

All control points established or found during the course of the field survey should be shown and labeled with description (PK nail, iron pin, survey monument, etc.) and NEZ coordinates based on the controlling datum. The controlling datum shall be identified in the corresponding NAD83, NGVD88 state plane coordinate system for the project site, allowing the Railroad to incorporate the project into the pertinent GIS database.

Real estate information, such as property pins or corners, should also be collected and shown on the plans.

Topography

Although the Railroad does not typically require submittal of complete grading plans, the collection of adequate ground shots to accurately depict the nature of the ground topography and drainage features is important, particularly in the vicinity of track and employee walkways. Large or sudden changes in ground topography adjacent to proposed track must be measured and noted.

Stakeout

Industry shall be responsible for field stakeout of proposed track, including the portion of track to be owned by Railroad.

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Field stakeout work will not be performed on Railroad property until the Side Track Agreement has been executed between Railroad and Industry, and the Industry meets the requirements of any required Worker Protection.

Additionally, the Industry must notify the Railroad Project Representative at least two weeks prior to performing field stakeout so that a Railroad representative may be present for stakeout verification.

The following shall be performed during field stakeout for portion of track to be owned by Railroad:

1. For Main Line Track, the centerline of track at the proposed Point of Switch (PS) and Point of Frog (PF) shall be set with flagging with legible note(s) indicating station and point description. Pins, nails, spikes, etc. shall be nailed flush into the crosstie or set so that the top is flush with the ballast line to prevent tripping hazards.
2. For the Industry Side Track, the centerline for the PS, PF, PC, PT, PVC, PVT and every 50' beyond the turnout (Sta. 1+50, 2+00, etc.) up to and including the proposed derail shall be set with flagging indicating the station and point description. Pins, nails, spikes, etc. shall be nailed flush into the crosstie or set so that the top is flush with the ballast/sub-ballast to prevent tripping hazards.
3. Offset stakes for the above described points on the Industry Side Track shall be set at 12' offset to the proposed Industry Side Track centerline. Stakes shall be painted fluorescent orange and flagged. The station, point description, offset distance, and top of rail elevation with reference mark shall be legibly written on the stake.

Track Design Information

General

The following track design information in these Standards describes the criteria to be used in the design of track(s) served, or to be served, by the Railroad. Any exception to these Standards must be approved by the Railroad.

Horizontal Curvature

Degree of Curve

All horizontal curve calculations shall be based on the chord definition.

The chord definition for horizontal curves is as follows:

$$R \text{ (chord definition)} = 50 / (\sin (D/2))$$

where: R = Radius (feet)

D = Degree of Curve

Tracks should be designed utilizing the minimum degree of curvature practicable, but must be limited to a maximum of 12 Degrees (R = 478.34 feet) on Side Tracks and 10 Degrees (R = 573.69 feet) on Lead Tracks.

Tracks for railcars with coupler-to-coupler length exceeding 73 feet should be designed based on maximum degree of curvature of 10 Degrees (R = 573.69 feet).

Horizontal curves should be at least 100 feet in length if at all possible, but not less than 50 feet.

Reverse Curves

Tangent distance between the points of tangency of reverse curves should be at least 100 feet if at all possible, but not less than 70 feet.

Distance between facing point switches leading from opposite sides of a track (creating a reverse effect) should be at least 100 feet if at all possible, but not less than 70 feet.

Return Curves

Return curves, C2 (in Degrees), shall correspond to *CAD Plan "Turnout Crossovers"* for the proposed turnout(s) to be used for all parallel sidetracks and industry tracks at minimum track centers.

Spirals and Super-Elevation

Spiral curves and/or super-elevation are required where the speed of operation dictates.

Design for Lead Tracks of one mile or longer will be evaluated by the Railroad on an individual basis to determine if spirals and super-elevation are required.

Placement of Curves

Horizontal curves shall not begin on the long ties of a turnout. Horizontal curves should not be located within a double switch point derail (DSPD).

Vertical Curvature

Curve Placement

Vertical curves shall be provided at break points in the profile of the track and should be as long as practicable. A minimum vertical curve length of 100 feet is preferred.

Vertical curves shall not begin or end on the long ties of a turnout. The track profile through the proposed turnout shall match the track profile of the existing track from which it diverges.

Vertical Curve Rate of Change

Vertical curve rate of change (r) shall be calculated as follows:

$$r = \frac{G2 - G1}{L}$$

where: r = Rate of Change

L = Length of Curve in 100' Stations

G1 = Entrance Grade

G2 = Exit Grade

Minimum Curve Length for Lead Tracks

The calculated minimum vertical curve length for Lead Tracks, in feet, is 100 times the algebraic difference of grades in percent for summits and sags, i.e., maximum rate of change for summits and sags = 1.0.

Minimum Curve Length for Side Tracks Up to 1,500 feet in Length

The calculated minimum vertical curve length for Side Tracks up to 1,500 feet in length is 33.3 times the algebraic difference of grades in percent for summits and 40 times the algebraic difference for sags, i.e., maximum rate of change for summits = 3.0 and maximum rate of change for sags = 2.5.

Minimum Curve Length for Side Tracks Over 1,500 feet in Length

The calculated minimum vertical curve length, in feet, for Side Tracks over 1,500 feet in length shall be 40 times the algebraic difference of grades in percent for summits and 50 times the difference for sags, i.e., maximum rate of change for summits = 2.5 and maximum rate of change for sags = 2.0.

Grades

Track grades should be kept to a minimum and shall be restricted to a maximum of 2 percent (compensated) on Lead Tracks, and 3 percent (compensated) on individual Side Tracks.

Grade compensation for curvature shall be a 0.04 percent reduction per degree of curvature. For example, the maximum grade on a Side Track with a 10° horizontal curve is: $3.0\% - (0.04 \times 10) = 2.6\%$.

Side Tracks

Unless otherwise approved by Railroad, a Side Track shall be on a 0% (flat) grade at the point where railcars are loaded and/or unloaded.

Tracks are to be designed to avoid coupling railcars in curves during switching operations. Side Tracks should have 30 feet or 1/2 the proposed car length, whichever is greater, between the end of any vertical curve and the beginning of the nearest car spot for loading and/or unloading.

Side Tracks shall have 30 feet, or 1/2 the proposed car length, whichever is greater, between the end of the last car spot for loading and/or unloading and the end of track device.

Side Tracks with turnouts and (track) ladders at both ends shall be designed to include a clearance buffer equal to 30 feet, or 1/2 the proposed car length, whichever is greater.

Track Centers and Clearance Points

Track Centers on Industry Property

Track centers for parallel tracks located on Industry property shall be no closer than 14 feet, centerline of track to centerline of track, and shall be adjusted (increased) for curvature in accordance with *CAD Plan "Clearance Diagram"*.

Track Centers on Railroad Property

Track centers for Industry-owned track located on Railroad right-of-way and parallel to a Main Line Track (or siding) shall be no closer than 15 feet, centerline of track to centerline of track, to a Main Line Track (or siding) and shall be adjusted (increased) 1" per degree of curve on curved tracks. In multiple curved track territory, when the track on the inside of the curve has less super-elevation than the track on the outside of the curve, track centers shall be increased by 4-1/2 inches for each inch difference in super-elevation between the involved tracks. Additionally, the track centers between multiple Industry tracks shall be no closer than 14 feet and shall be similarly adjusted for curvature.

Note: Where public law or regulation requires clearances greater than Railroad standard, such laws or regulations will govern.

Track Centers on Yard Ladders

Tracks parallel to yard ladder tracks shall be no closer than 22 feet, centerline of any parallel track to the centerline of the yard ladder track.

Clearance Points

The following applies to clearance points and railcar storage limits:

1. Clearance points shall be shown on site plans, and will be indicated in the field by the presence of a derail, clearance post or crosstie painted green.
2. Where practicable, railcars shall not be spotted within 300 feet from the edge of any grade crossing on any track located on Railroad right of way.
3. At locations where a Side Track crosses a grade crossing on property owned by the Industry, railcars shall be spotted as far as practicable from the grade crossing so that motorists are provided with adequate site distance.

Turnouts

Turnout geometry, layout and materials are shown in *CAD Plans "Turnout No. 8", "Turnout No. 10" and "Turnout Crossovers"*.

Main Line Track Turnouts

Main Line Track turnouts:

1. Shall be No. 10 or larger.
2. Shall not be placed within horizontal or vertical curves.
3. Shall not be placed closer than 100 feet from the end of the curve when diverging in the opposite direction from the preceding curve.
4. Shall not be placed within 50 feet of a Railroad signal.
5. Shall not be placed underneath an overpass.
6. Should not be placed within 100 feet of a grade crossing.
7. Should be placed at least 25 feet, but preferably 50 feet, from the end of the curve when diverging in the same direction as a preceding curve.
8. Should not be placed on a Railroad bridge or within 100 feet of a Railroad track bridge face of back-wall.

All work on Railroad tracks, including Main Line Track turnouts, shall be accomplished by the Railroad.

Side Track (or other Industry-owned track) Turnouts

Side Track (and other Industry-owned track) turnouts:

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1. Shall be No. 10 unless space will not permit, in which case a No. 8 turnout will be considered.
2. Shall not be placed within vertical curves.
3. Should not be placed within 10 feet of a grade crossing.
4. Should not be placed within horizontal curves.
5. Should be placed at least 10 feet from the end of curve when diverging in the same direction as a preceding curve.
6. Should be placed at least 50 feet from the end of curve when diverging in the opposite direction as a preceding curve.

For two (2) turnouts diverging in opposite directions from the same track (thereby creating a reverse curve situation) it shall be necessary to provide at least 70 feet, but preferably 100 feet, between the points of switches of the two turnouts.

Facing point switches located in the same track and diverging to the same side of said track shall be separated by a minimum distance of 14 feet.

Derails

Derails are installed on Side Tracks (and other Industry tracks) at the clearance point to protect the Main Line Track from equipment that is not supposed to be occupying the Main Line Track. Derails can also be used to prevent railcars from occupying public or private grade crossings or to prevent general “run-away” situations.

All derails to be operated by Railroad personnel shall be equipped with a Railroad-supplied lock and key, which may only be operated by Railroad personnel.

Double Switch Point (DSP) Derails

A double switch point (DSP) derail shall be installed by the Railroad, with the non-switch end of the derail at the clearance point of the Side Track, on a Side Track with a descending grade towards the Railroad’s Main Line Track (or other Railroad track). The entire DSP derail (43’ long) shall be located in vertical tangent track outside of any vertical curves. DSP derail will be installed at the clearance point on *any* track that handles hazardous materials.

Hayes Model HB Derails

Hayes Model HB Derails will be installed by the Railroad at the clearance point of tracks that have no grade, or tracks with a descending grade away from the Main Line Track. HB Derails are to be painted international orange, and glass beads should be sprinkled on after painting (while paint is still wet) to increase nighttime viability.

Note: Additional derails may be required due to site-specific safety concerns and/or operational considerations.

End of Track Devices

End of Track (ET) Devices shall be placed at the open end of all stub-ended tracks.

Earth mounds are the preferred ET Device. Earth mounds shall be of an approved design similar to ***CAD Plan “Bumping Post Earth Mound”***, shall be sufficient to stop a moving railcar and should be protected against erosion.

Where earth mounds are impractical, bumping posts shall be used on all stub end tracks that end at a structure, dock, or road. Bumping posts shall be either new or secondhand, of good quality and of approved design similar to ***CAD Plan “Bumping Post Metal”***.

The use of wheel stops in lieu of an earth mound or bumping post is prohibited without prior authorization by the Railroad.

Side and Overhead Clearances

Standard vertical and horizontal clearances based on the centerline of track at top of rail are shown on ***CAD Plan “Clearance Diagram”***.

Note: Where law or regulation requires clearance(s) greater than Railroad standard, such laws and regulations will govern.

All substandard clearances must be approved by the Railroad after it is determined that there are no issues related to the proposed substandard clearance.

CAD Plan “Clearance Diagram” should also be referenced for design clearance requirements for all structures including buildings, loading racks, stairways, and overhead fall arrest protection supports, etc. to be constructed adjacent to, or over, any tracks.

Note: Early in the design process, the Industry should review all federal, state and local safety and environmental regulations to determine what structures and/or appurtenances will be required for their particular method of operation and commodity.

Although the maximum vertical distance from the proposed top of rail to a platform, loading dock, or building finished floor elevation is shown as 4 feet – 0 inches on ***CAD Plan “Clearance Diagram”***, the Railroad recommends a design distance of 3 feet – 9 inches, which is the average floor height of a standard boxcar. The Industry’s design engineer should coordinate railcar information with the Railroad Project Representative to verify the proper design distance between the top of rail and the finished floor elevation of the dock or building.

Standard vertical clearances from the centerline of track at top of rail for overhead electric lines are shown on ***CAD Plan “Clearance Wire”***.

“Close Clearance” signs, if required, shall be posted as directed by the Railroad, and shall meet the specifications of *CAD Plan “Signs Close Clearance”*.

Required side clearances for the storage of railcars, and for the storage of hazardous commodities, can be found in the Hazardous Commodities section of these Standards.

Roadbed

Requirements for roadbed shoulder width, ditches, and slopes are shown on *CAD Plan “Roadbed”*, *CAD Plan “Roadbed Steel Ties”*, and *CAD Plan “Roadbed Turnout Pad”* as appropriate.

It is important to construct roadbed sections as prescribed, as they provide proper structural support, proper drainage, and safe walkway for Railroad and Industry personnel.

The Railroad will work with the Industry on any site-specific deviations in the standard CAD roadbed Plans as they may be necessary or appropriate. All such deviations must be approved by Railroad prior to construction.

Grade Crossings

New Vehicular Grade Crossings on Railroad-owned Track

New vehicular grade crossings over tracks owned by Railroad should be avoided. If necessary, the Industry is warned that the design, permitting, and approval for new grade crossings over Railroad-owned tracks can be an extensive and time-consuming process. Applicants so choosing to install a new grade crossing should initiate the crossing permit application process early in the conceptual phase of project planning. For any grade crossings to be installed, the Industry should work closely with the Railroad Project Representative on design and location of the proposed crossing, as well as preparation of plans.

When designing a new grade crossing, factors such as sight distance of train, sight distance of vehicle operators, type of vehicles utilizing the proposed crossing, grade of the proposed road, vehicle braking ability, and accessibility of the location to be served by the crossing if a stopped train blocks the crossing (among other factors) must be considered. It is the Industry’s responsibility to incorporate any local, state or federal regulations, guidelines or mandates governing grade crossing design at their proposed location.

Grade crossing warning devices such as cross bucks (passive warning) or flashing light signals with or without gates (active warning) are highway traffic control devices (control devices). The Railroad shall determine the control devices for a crossing over a private road. For a crossing over a public road or street, the state agency or local road authority with jurisdiction over the road shall evaluate and determine the level of control devices required for the crossing. The Industry should work closely with both the road authority

and the Railroad to assist in determining the proper control devices for the proposed crossing.

If the governmental agency having jurisdiction requires that automatic warning devices be installed at the crossing, before industry purchases and installs said devices, it will be necessary that the plans for installation for such control apparatus and equipment be submitted to the Railroad Project Representative for review and approval.

Engineering plans for installation of the control devices must also be reviewed and approved by the governmental agency prior to installation. This level of involvement may vary depending on the type of Railroad-owned track involved, i.e. Main Line Track v. Lead Track serving an industrial park.

The standard crossing surface for road crossings over Railroad-owned tracks is asphalt paving with rubber flange (a.k.a. Rubber Rail Seal), as outlined in *CAD Plan "Grade Crossings Asphalt Rubber"*. Any desired use of alternative surface types, such as concrete panels as outlined in *CAD Plan "Grade Crossings Precast Concrete"* and *CAD Plan "Grade Crossings Precast Concrete Panels"* must be discussed with, and approved by, the Railroad.

Vehicular Grade Crossings on Industry-owned Track

Private vehicular grade crossings located on Industry-owned track beyond the Railroad's maintenance point in the track shall meet or exceed Railroad standards and will only be permitted under the terms of the Side Track Agreement.

Crossing surface types for private grade crossings are at the discretion of the Industry but shall be built in accordance with Railroad standards as outlined in *CAD Plan "Grade Crossings Asphalt"*, *CAD Plan "Grade Crossings Asphalt Rubber"*, *CAD Plan "Grade Crossings Precast Concrete"* and *CAD Plan "Grade Crossings Precast Concrete Panels"*.

The safety of vehicular traffic around Industry-owned tracks and facilities is the responsibility of the Industry. Design of proper side clearances to tracks from adjacent roads, site distances at grade crossings, and proper signage shall be in accordance with Railroad standards.

Parallel Roads

Roads Parallel to Railroad-owned Track

Roads parallel to Railroad-owned tracks on Railroad property shall be designed to provide for the safety of all parties using the proposed road. Many factors contribute to proper and safe roadway design, and the Industry should work closely with the Railroad in this regard. The use of Railroad-owned property for a parallel road will require a formal Grade Crossing agreement, or will otherwise be part of a Side Track Agreement with Industry.

Roads Parallel to Industry-owned Track

Roads parallel to Industry tracks located beyond the Railroad's maintenance point in the track shall meet or exceed Railroad standards and will only be permitted under the terms of a Side Track Agreement.

The safety of vehicular traffic around Industry-owned tracks and facilities is the responsibility of the Industry. Design of proper side clearances to tracks from adjacent roads, site distances at grade crossings, and proper signage shall be in accordance with Railroad standards.

At-Grade Railroad Crossings

At-grade railroad crossings should be used as little as possible in site plans and track design, and must all be approved by Railroad. The angle of the rail crossing shall be that shown on the approved plans and/or as further defined as staked in the field. Detailed manufacturer's plans and specifications of any at-grade railroad diamonds or other crossing devices shall also be furnished to Railroad for approval.

Plans

General Requirements

The plans submitted by Industry will be utilized by the Railroad for internal review and approval. This process ensures compliance with engineering and safety standards and verifies the feasibility of the proposal from an operational standpoint. A clear, well-labeled plan is essential for a successful submittal and prompt review.

The plans will also be utilized as attachments in the Side Track Agreement between the Industry and the Railroad. As such, clear reference to ownership, and parties to the Side Track Agreement, should be included on the plan.

When overhead structures, retaining walls, or under track structures are involved, submitted plans for these structures shall bear the seal of a current Registered Licensed Professional Engineer in the state of the project.

Plans submitted shall be drawn to scale and show all essential features affecting the track layout. The preferred scale for drawings is 1"=100'. Smaller projects may utilize a scale of 1"=50' and larger projects may utilize a scale of 1"=200'. No other scales will be accepted. The plan should use one of the preferred scales and be sized to have all track fit on one plan sheet.

All tracks depicted on the drawings shall be shown as **CENTERLINE** of track. Tracks showing crossties and rails, or two lines representing rails are not acceptable. Existing track centerlines shall be shown as light weight (thin) and solid lines. Proposed track centerlines shall be shown as a heavy weight (thick) with a dashed line. Tracks to be relocated or removed shall be shown light weight and with a dashed line style distinctly different than the style used for proposed track. Tracks in relocated position shall be shown heavy weight and with a dashed line style distinctly different than the style used for proposed track.

Any questions regarding design specifications not answered in these Standards should be directed to the Railroad Project Representative.

Side Track Plan

The Side Track design plan shall include the following as applicable.

1. General:
 - a. English units, engineering format (decimal)
 - b. Legend clearly defining all line types
 - c. Division of Ownership & Maintenance with stationing
 - d. Centerline stationing for all track

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- e. North arrow
 - f. Direction to and name of the nearest city located along railway tracks
 - g. Distance to the nearest major landmark in each direction if not shown on the plan (i.e. road crossing, bridge, mile post, etc.)
 - h. County in which the project is located
 - i. Location map
 - j. Right-of-way lines
 - k. Location of property lines, other than Railroad right-of-way, where possible
 - l. Coordinate table for all survey control points (point #, Northing, Easting, Elevation, and Description)
2. Tracks:
- a. Existing tracks with description (i.e. Main Line Track, Side Track, etc.)
 - b. Proposed tracks with description (i.e. Main Line Track, Side Track, etc.)
 - c. Track centers or minimum track centers
 - d. Point of Curve (PC) or Point of Tangent to Spiral (TS) with stationing
 - e. Points of Vertical Curvature (PVC) with stationing
 - f. Vertical curve lengths and “r” (rate of change) value
 - g. Point of Tangency (PT) or Point of Spiral to Tangent (ST) with stationing
 - h. Points of Vertical Tangency (PVT) with stationing
 - i. Curve data for all curves based on the chord definition including delta, degree of curvature, radius, tangent, and length of curve
 - j. Average grade of existing and proposed tracks
 - k. Profiles of the existing track, proposed track, and proposed sub-grade
 - l. Top of rail elevations for the proposed track every 100 feet
 - m. Top-of-rail to top-of-subgrade measurement
 - n. Track lease and stationing
3. Switches:
- a. Distance between the proposed point of switch and the nearest railway milepost with a directional arrow towards the milepost
 - b. The proposed point of switch shall be tied to the local State Plane coordinate system
 - c. The State Plane coordinates for the proposed point of switch, derail and end of track(s) shall be shown on the plan either at the location shown, or

in a table. In addition, Lat/Long coordinates *shall* be included on the Side Track agreement plan

- d. Point of Switch (PS) with stationing, turnout size, whether right hand (RHTO) or left hand (LHTO) turnout, and whether switch is hand-throw or power-operated
4. Other Railroad Items:
 - a. Derails with stationing
 - b. End of track device (both existing and proposed) with stationing
 - c. Grade crossing length and stationing at each end
 - d. Level (0%) grades for all loading / unloading areas
 - e. Detailed plans and calculations for proposed unloading pits and scales shall bear the seal of a current Registered Licensed Professional Engineer and shall be approved by the Railroad prior to the commencement of any site work involving the track
 5. Clearances:
 - a. Track clearance points (CP) with stationing
 - b. Clearance buffer with stationing
 - c. Show vertical & horizontal clearance for all structures within 15 feet of centerline of proposed or existing track with stationing
 - d. Door/dock clearances with stationing
 - e. Track centers or minimum track centers
 6. Drainage and Utilities:
 - a. Existing and proposed culverts with stationing, elevations and depth of cover
 - b. Spill containment devices and systems with stationing
 - c. Overhead and underground utilities with stationing and elevations and with horizontal and vertical clearances to proposed/existing track centerline
 - d. Fiber optic cables with line identification
 - e. Signals, signal equipment and shelters
 7. Additional information as applicable:
 - a. A typical roadbed cross-section of the track showing the depth of the subballast, ballast, and design of the sub-grade in compliance with CAD Standards
 - b. Cross-sections at locations of underground utility and culvert crossings

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- c. Typical section and/or detail plan for any unloading pit, or loading/unloading apparatus
- d. Detail of any end of track device
- e. Detail and typical section for spill containment devices and systems
- f. Chart or table listing car type and length, commodity, unloading/loading method, and method of operations i.e. switching by Railroad, Industry or both
- g. Land lease area with both acreage and square footage shown, including dimensions to proposed and existing tracks

Site Work

Clearing and Grubbing

Clearing and grubbing includes the removal of all trees, brush, logs, debris and other undesirable materials from locations where new construction is to occur.

The Industry shall be responsible for the cost of clearing and grubbing of that portion of the Railroad right-of-way affected by new construction. All material removed from the Railroad right-of-way, excepting that reserved by the Railroad, shall be disposed of by the Industry. The Industry shall be responsible for the identification and protection of overhead and underground utility easements, including fiber optic cable easements, within the Railroad right-of-way.

Prior to the commencement of clearing and grubbing on Railroad right-of-way, the Railroad Project Representative shall be contacted in order to schedule the clearing and grubbing operation so as not to interfere with train operations.

Grading

The Industry shall construct, or cause to be constructed, all grading necessary for the installation of any new track. This includes all grading required for that portion of the track located on the Railroad-owned property. The requirement for a wider roadbed to provide a proper walkway in the area of all turnouts is of particular concern. This additional roadbed width shall be graded as shown in *CAD Plan "Roadbed Turnout Pad"* and shall continue along the diverging track until it transitions back to the diverging track's standard roadbed section.

The Industry shall be responsible for compliance with all local, state, and/or Federal regulations governing site construction including, but not limited to erosion control, grading, and storm water runoff.

For new constructions and where cribs are leveled and or sub-roadbed is disturbed, filter fabric shall be installed at least 24" below final top of ties.

Fills and subgrades shall be compacted to a minimum of 90 percent Modified Procter based on American Association of State Highway and Transportation Officials (AASHTO) Designation T-180, or 95 percent Standard Procter based on AASHTO Designation T-99.

Moisture content of soil should be controlled as necessary to obtain specified densities, based on the moisture-density relationship developed by AASHTO tests.

All topsoil shall be removed from the area of the proposed roadbed. Slopes of all cuts shall be true and straight and all loose stones and boulders removed. Slopes of all fills shall be carefully formed and trimmed as they are compacted. Where a fill is placed on

sloping ground or on the side of an existing fill, the surface shall be deeply plowed or stepped and the new material thoroughly mixed and embodied with the old material as the new fill is constructed.

The finished subgrade shall conform to such elevations as shown or otherwise noted on the plans, within a tolerance of \pm 0.1 foot.

Ditches

The Industry shall provide temporary or permanent ditches in order to maintain the Railroad's existing drainage of the tracks. No ponding of water against the Railroad's existing roadbed shall be allowed. Ditches draining Railroad property shall be designed to carry the expected runoff of a storm with a 100-year recurrence interval.

For new construction, or for existing track rehabilitation, existing ditches shall be cleared of track materials, brush, and other debris.

No drainage is to be diverted to ditches owned by the Railroad without the specific notification and written approval of the Railroad.

Seeding

A seed and fertilizer mixture, adhering to local, county or state DOT specifications shall be applied so as to provide adequate slope protection. Creeping grasses shall not be used.

Drainage Culverts and Structures

Responsibilities and Design

Except as otherwise specified hereafter, the current AREMA Chapter 1, part 4 applies to all Drainage Culverts and Structure work on the Railroad, and as required in these Standards.

These Drainage Culverts and Structure Standards apply to *only* under track culverts conveying storm water run-off. Closed pipeline systems for roadway stormwater management shall be designed in accordance with the current *Maryland and Delaware Railroad Company System Standards for Pipeline Occupancy* section titled "*Design Requirements*".

Note: A "Closed pipeline system" is defined as a system that conveys stormwater entirely across the right-of-way. If the drainage system empties onto Railroad right-of-way, then the under track culvert requirements apply.

The Industry shall be responsible for constructing all drainage structures for the proposed track at its own expense, including that portion on the Railroad-owned property.

The Industry shall ensure that post-development storm water runoff rate/volume towards Railroad-owned property does not exceed pre-development conditions. The Industry shall

be liable for all damage claims arising from adverse effects caused by Industry alteration of pre-development drainage patterns.

Any required changes or additions to existing drainage structures under Railroad-owned track(s) due to Industry-owned track, shall be the responsibility of the Industry. The Industry shall furnish to the Railroad, for review and approval, plans, specifications and computations for proposed drainage structures and drainage modifications involving the Railroad right-of-way prior to start of construction. In no case shall the hydraulic capacity of a Railroad drainage structure be reduced. In addition, ponding of water on Railroad right-of-way shall not be allowed.

Culverts shall be designed for Cooper's E-80 Live Loading and the 100-year storm event and the proposed design shall be approved by the Railroad. Maximum headwater build up (for Q 100) for inlet control conditions shall be limited to an HW/D= 1.5 provided the roadbed fill is of sufficient height to maintain the high water elevation below the toe of ballast and the fill material is capable of resisting water infiltration for short durations. With the approval of the Railroad, the HW/D limit may be adjusted for special field conditions.

All plans and calculations for work impacting drainage structures under Railroad-owned tracks shall bear the seal of a current registered licensed professional engineer in the state of the project.

Culverts shall be sized based on the actual drainage basin. The minimum culvert size shall be 36 inches in diameter for all culverts on Railroad right-of-way unless otherwise approved by the Railroad. The "Rational Method" shall be used for drainage areas less than 500 Acres. For drainage areas greater than 500 Acres, one of the following methods should be considered, and may provide more realistic runoff estimates provided data is available:

- a. Soil Conservation Service (Unit Hydrograph Theory Method) SCS
- b. Frequency Regression Theory
- c. Seven Parameter Estimating Equation

Culvert Options

The following requirements shall be met for all culverts placed under Railroad-owned tracks, or tracks that will be Railroad-owned in the future.

All culverts shall be installed to the line, grade, and elevations and be of the size as shown on plans approved by the Railroad. All culverts shall be installed for the full width of the section, properly bedded as per *CAD Plan "CMP Backfilling"* and shall be backfilled with select material and carefully compacted.

Corrugated metal with various coatings, corrugations, shape, and manufacturing processes, smooth wall steel pipes and concrete, both pre-cast and cast-in-place, and

HDPE will be considered by Railroad. Alternatives may be permitted with the approval of the Railroad.

Corrugated Metal Pipe culverts of 42" or larger diameter shall be formed to a specified 5 percent vertical elongation with tension wires or turnbuckle rods at horizontal axis. These tension wires are to be removed when grading is complete. At no time shall the corrugated metal pipe gage exceed 12. For more specific gage detail, see ***CAD Plan "CMP Pipe"***.

High Density Polyethylene (HDPE) pipe is approved for non–Main Line Track under track applications. See ***CAD Plan "HDPE Pipe Existing" and CAD Plan "HDPE Pipe Proposed"*** for HDPE pipe material and installation requirements.

Smooth Wall Casing Pipes are the Railroad's basic design for culverts where jack and bore method of installation is required due to traffic condition or fill height greater than 10 feet.

Liner Plate installed by tunneling method may be required when diameter, length, presence of rock or other unusual site conditions exist. Refer to *Table 1 – SMOOTH WALL CASING PIPE MINIMUM WALL THICKNESS* and *Table 2 – MINIMUM LINER PLATE GAGE TABLE* shown on **Page 33** of these Standards.

Aluminized Type 2 Uncoated or Bituminous Coated Galvanized Steel Pipe may be used for a PH range of 5-8. Suggested uses are runoff from non-industrial rural areas.

Fiber Bonded Bituminous Coated Pipe or Plastic Coated Pipe may be used where soil and water conditions warrant, such as farm fields (high concentrations of fertilizer runoff), coal fields (acidic runoff), salt water marsh areas, and in areas where high soil concentrations of heavy metals are present.

A **Pipe Arch** may be considered for special cases where physical constraints and opening requirements warrant.

Except as approved by the Railroad, **Concrete Pipe Culverts and Pre-cast Concrete Culverts** may not be used under Railroad-owned tracks or tracks to be Railroad-owned due to the risk for differential settlement and joint separation. Such culverts will only be considered if they have headwalls on each end to prevent joint separations. Concrete pipe culverts or pre-cast concrete culverts may be used under Industry-owned tracks where the Railroad has no maintenance responsibilities. Concrete culverts shall be of adequate cross section to provide the proper drainage opening conforming to ASTM C-76 Class V, reinforced Wall B.

The use of **Pre-cast Concrete Box Culverts** is acceptable. Boxes shall be designed and fabricated in accordance with the current AREMA Manual for Railway Engineering, Chapter 8, for Cooper's E-80 Live Loading. Cast-in-place concrete structures may be used where appropriate.

Structural Plate Pipes and Pipe Arches are to be used where size and conditions dictate (generally considered culverts greater than 72-inch diameter). The coating is to be either bituminous coated or fiber bonded depending on soil and runoff water condition (PH range).

Tunnel Liner Pipe shall be used when the culvert diameter exceeds pipe sizes economically installed by the jack and bore method (generally larger than 60-inch diameter). All tunnel liner pipe shall be bituminous coated and have paved inverts. Grouting of voids between the pipe and adjacent soil at regular intervals, not to exceed once daily, is required.

Paved Inverts and End Treatments for BCCMP

Paved inverts shall be used in corrugated metal pipes where water velocities are medium to high (above 10 f.p.s.) or the possibility of excessive wear from sand and gravel is likely.

1. Corrugated metal culverts shall have bituminous or asphalt paved inverts where needed due to high water velocities or the possibility of excessive wear from sand and gravel is likely.
2. Concrete or asphalt paved inverts shall be used in structural plate, tunnel liner and pipe arches that are field assembled. If concrete is used, a minimum concrete compressive strength shall be 3000 p.s.i. after 28 days. The bottom 25% of culvert periphery shall be covered with concrete (or asphalt) to a depth of 1 inch above the crest of the corrugations for circular pipes and 40% of the periphery for pipe arches. The concrete pavement shall be reinforced with 6 x 6 (W2.9 x W2.9) welded wire fabric. This wire shall be attached to the pipe by either directly welding to the pipe or by mechanical attachment to the bolts.

Preformed bituminous-coated end sections may be used in place of headwalls when erosion at the inlet is expected. Minimum end section gage shall be 12 gage. Headwalls and/or End Sections should be considered on both ends of all culverts greater than or equal to 60-inch diameter.

Connecting Bands for BCCMP

Connecting bands for annular bituminous-coated corrugated metal pipe shall consist of a single piece 24" wide, one gage thinner, with the same corrugations and same cover treatment as the drainage pipe. Connecting bands for drainage pipe 42" and larger diameter shall be fully bolted with a minimum of four - 0.5 inch diameter rods and silotype lugs. Dimpled bands are not acceptable.

Steel Casing Pipe and Tunnel Liner Plate Size Charts

**TABLE 1 -SMOOTH WALL CASING PIPE MINIMUM WALL THICKNESS
(REVISED 1/17/91)**

Nominal Size (Inches)	Minimum Wall Thickness (Inches)
24	0.500
30	0.500
36	0.500
42	0.625
48	0.625
54	0.750
60	0.875
66	0.875
72	1.00

**TABLE 2 - MINIMUM LINER PLATE GAGE TABLE
(REVISED 7/10/91)**

Diameter (feet)	2 Flange		4 Flange	
	Gage	Cover (feet)	Gage	Cover (feet)
4	12	4 to 50	12	4 to 50
5	12	4 to 50	12	4 to 50
6	12	4 to 50	10	4 to 50
7	12	6 to 50	10	4 to 50
7	10	4 to 50	--	--
8	10	4 to 50	8	6 to 50
9	10	4 to 50	8	8 to 50
10	8	4 to 32	5	8 to 50
10	7	34 to 50	--	--

Notes: The above Minimum Liner Plate Gage Table was developed using 1989 AREMA Specifications Chapter 1, Part 4.

The following factors of safety are used:

Joint Strength = 3.0

Minimum Stiffness = ("3.0" for 2-Flange and "1.5" for 4-Flange)

Critical buckling = 2.0.

The effects of highly corrosive environments may be compensated for by adding one (1) gage to the above Minimum Liner Plate Gage Table values.

Blasting

Use of explosives on and adjacent to Railroad-owned property is subject to strict provisions and safety precautions. If the use of explosives during grading, or any other kind of work, is anticipated, the Industry shall contact the Railroad Project Representative so that the proper insurance requirements, safety provisions, methods and procedures may be met. Since failure to plan ahead with regard to these requirements can cause significant delays to the construction process, the Industry should fully investigate if blasting will be necessary well in advance of any planned construction.

Track Materials and Standards

Roadbed

Roadbed width, ditches and slopes shall conform to *CAD Plan "Roadbed"* or *CAD Plan "Roadbed Steel Ties"* or *CAD Plan "Roadbed Turnout Pad"* as appropriate. State or local regulations may increase the width of roadbed for walkway or other purposes, and shall always govern if larger than the Railroad requirements.

Gage

For new construction, and rail replacement, rail shall be gauged to a nominal 56-1/2", with a maximum 1/4" deviation.

For crosstie replacement on existing track, rail shall be gauged to a nominal 56-1/2", with a 1/4" maximum deviation at new crossties and a maximum 1/2" deviation on the plus side, at old crossties.

Any existing track with a gauge in excess of 57-1/2" shall be re-gauged to 56-1/2", with a 1/4" deviation.

Surface and Line

New and resurfaced track shall be in line with, and run off into existing track unless otherwise specified.

Tangent track shall have 0" cross level with a maximum deviation of 1/2", at any point.

Curve track shall have a 1" cross level in the body of the curve with smooth spirals and a maximum deviation of 1/2", at any point.

Sub-ballast

Sub-ballast shall be crusher-run dense graded aggregate, preferably limestone or granite material, and shall meet the requirements as set out in Chapter 1, Part 2, Article 2.11, "Sub-ballast Specifications" of the AREMA Manual.

Gradation as follows:

Sieve Size	2"	1"	3/8"	No. 10	No. 40	No. 200
% Passing Size (optimum)	100	95	67	38	21	7
Permissible Range % Passing	100	90-100	50-84	26-50	12-30	0-10

Sub-ballast shall be spread on a graded roadbed as a base, with sufficient width to accommodate the desired number of tracks (see *CAD Plan "Roadbed"*, *CAD Plan "Roadbed Steel Ties"* and *CAD Plan "Roadbed Turnout Pad"*). The subballast shall be compacted to 95 percent of its maximum dry density and have a minimum depth of 6 inches.

For sub-ballast quantity estimates, placement of 6 inches of compacted sub-ballast on a single Side Track roadbed requires approximately 0.84 ton of subballast per foot of track construction.

Ballast

Material for ballast used on Railroad and Industry-owned tracks shall be clean 2-1/2" hard rock ballast with a minimum depth of 9 inches between bottom of tie and top of sub-ballast (see *CAD Plan "Roadbed"* and *CAD Plan "Roadbed Steel Ties"*). Ballast shall be tamped, regulated, and broomed, to support a uniform line and surface, and to fill all cribs, and provide uniform shoulders, with run offs as required to any existing track.

Ballast on Railroad-owned Tracks

Stone for use as ballast on Railroad-owned property shall be furnished by a Railroad-approved quarry and shall be granite-crushed stone conforming to the requirements of Railroad.

#3 Modified ballast shall be used under all tracks on Railroad-owned property.

Ballast on Industry-owned Tracks

Subject to approval of the Railroad, limestone ballast conforming to AREMA Specifications may be used for Industry-owned tracks on Industry-owned property.

For Industry-owned tracks on Industry-owned property, the Industry may use either #3 Modified or #5 ballast.

Ballast Graduation

Gradation shall conform to the following table:

Sieve Designation	Sieve Opening	#3 Modified Ballast % Passing Sieve	#5 Ballast % Passing Sieve
2 ½"	2.5"	100	-
2"	2"	95-100	-
1 ½"	1.5"	30-65	100
1"	1"	0-15	90-100
¾"	0.75"	-	40-75
½"	0.5"	0-5	15-35
3/8"	0.375"	-	0-15
No. 4	0.187"	-	0-5
No. 200	0.0029"	0.5 Max	0.5 Max

Rail

Rail shall be new or #1 relay #115RE or #136RE. Relay rail should be free from local bends, kinks, battered ends, excessive engine burns and surface corrugations. Rail should be furnished in lengths not less than 39 feet except in turnouts, connection to existing track, or when adjusting staggers in curves or grade crossings. Rail should be drilled to accept the proper size joint bars for the section of rail being used, with a standard drilling for 1 1/8" bolts.

Based on planned track usage and/or tonnage a heavier rail section (continuous welded rail) should be considered. If welded rail is used, the type of welding shall be subject to approval of the Railroad.

Existing Industry-owned track with a rail section of less than 115 pounds/yard that is out of service or inactive may be subject to rail replacement as determined by the Railroad's inspection, and/or track geometry, type of commodity, traffic volume, and operations.

Rails should be laid one at a time. The bottom of the rail and the bearing surface of the tie plate should be cleaned of all debris before the rail is laid. Joints in opposite rails shall be staggered not less than 8 feet and not more than 14 feet apart, except as close joints may be required at insulated joints or turnouts. To minimize the cutting of full-length rails, short rails of not less than 15 feet may be used in adjusting for proper spacing of joints. Proper allowance for expansion should be provided at rail joints by installing rail expansion shims conforming to the section of rail being used.

When necessary to cut and/or drill a rail, it should be cut with an approved rail saw, and drilled with an approved rail drill. Flame cutting of rail will not be permitted.

Turnouts

Turnouts shall be new #115RE or #136RE. The turnouts shall be the size and shape as called for on the plans and shall meet all requirements in accordance with an approved design, AREMA, or equal. All Railroad-owned Main Line Track turnouts shall be new #136RE.

The turnout material shall be complete in every respect to construct the needed turnouts ready to receive train traffic. Package switches shall be of an approved design, AREMA, or equal, equipped with standard reinforced points and of correct length for the size of turnout of which they are a part. Frogs shall be of the same section as the turnout, of an appropriate design, AREMA or equal, equipped with plates of the proper size and type to fit the designed track layout, and shall be rail bound manganese, with guardrails.

Turnouts to be used in Railroad-owned tracks shall conform to the Railroad's standard turnout plans, not AREMA turnout plans. Reference *CAD Plan "Turnout Crossovers"* for turnout geometry.

Crossties

Timber

Crossties shall be new 6" x 8" x 8' 6" – Grade 3, or 7" x 9" x 8' 6" – Grade 5 for oak and mixed hardwood ties.

All crossties shall be air dried to a maximum to 50% moisture content for oak and 40% for mixed hardwoods before treatment.

Crossties shall be sterilized during treatment by holding them in 190°- 210°F temperature creosote for at least 6 hours. This time shall not include creosote filing or emptying, not temperature adjustments or final vacuum time. Final retentions shall be 8#/CF in oak and 10#/CF for mixed hardwoods.

Except as noted above, all treatment shall be governed by American Wood- Preservers' Association Standards C1, C6, M1, M3, and M4. A 60/49 creosote-coal tar solution conforming to AWWA Standard P-2 shall be used. The solution shall be tested according to AWWA Standard A-1.

Certification of the crossties shall be furnished to Railroad from the contractor and/or supplier.

Wood crossties on new construction shall be placed on the prepared subballast at right angles or normal to the centerline of the track. Crossties shall be spaced 20 inches, center to center (60 ties per 100 feet) with the ends of the ties along one side of the centerline on tangent track and along the inside on curved track being placed 18 1/2" from the base of rail.

For crosstie replacement on existing track, existing crosstie spacing shall be maintained unless otherwise specified. Suspended rail joints are preferred over supported rail joints. Where rail is replaced or track is re-gauged, ties that are not replaced shall be plugged and re-spiked with new spikes.

Steel

Steel crossties may be used on Railroad-owned or Industry-owned tracks.

Steel crossties shall meet the requirements listed in the most current version of Chapter 30, Part 6 of the AREMA Manual and shall be pre-gauged for the specified rail section. Steel crossties shall be new North American Railway Steel Tie Corporation (NARSTCO) Type M10 or equivalent. Rail fastening clips and hook-in shoulders shall meet manufacturer's specifications for the crossties used.

For new construction, steel crossties shall be placed on the prepared sub-ballast at right angles or normal to the centerline of the track. Steel crossties shall be spaced 24" center to center in tangent track and 20" center to center in curved track and installed per the typical section shown on *CAD Plan "Roadbed Steel Ties"*. For existing track, steel crossties shall be spaced evenly between existing crossties.

Steel crossties shall be fully tamped so that ballast fills inspection holes. Steel crossties having Pandrol fasteners do not require anchoring.

Steel crossties shall not be installed in the approaches to railroad crossings where automatic warning devices are installed.

On curves of more than 1 degree, steel crossties shall not be installed where there is more than one in-effective tie holding gauge on either side.

Switch Timbers

Timber

Switch timbers shall be new oak and mixed hardwood ties of 7" x 9" in cross section and in 12" length increments as required for the turnout being used. All switch timbers shall be air dried and treated as called for in "Crossties Timber" above. No second hand switch timbers may be used.

Switch ties shall be placed on finished sub-ballast and spaced according to the Railroad's standard plan for the turnout being used, which will be *CAD Plan "Turnout No 8"* or *CAD Plan "Turnout No 10"*.

Steel

Steel switch timbers may be used on Railroad-owned or Industry-owned tracks.

Steel switch timbers shall meet the requirements listed in the most current version of Chapter 30, Part 6 of the AREMA Manual. Steel switch timbers shall be new North

American Railway Steel Tie Corporation (NARSTCO) or equivalent. All OTM shall meet manufacturer's specifications for the switch timbers used.

Steel switch timbers shall be fully tamped so that ballast fills inspection holes. Steel switch timbers having Pandrol fasteners do not require anchoring.

Steel crossties shall not be installed in the approaches to railroad crossings where automatic warning devices are installed.

Bridge Timbers

Bridge timbers shall be new creosoted grade hardwood to the dimensions specified by the bridge plans and notched or lagged to bridge structure.

Crosstie Plates

Crosstie plates shall be new or #1 relay and must be of an approved design for the weight of rail to be used. Existing tie plates may also be re-used when ties are replaced provided that they are not bent or broken and are appropriate for the size of the tie and section of rail.

For new construction, new or #1 relay double shoulder crosstie plates shall be used and shall have a minimum size of 7 1/2" x 11", with proper punching to fit the base of the rail being used. The down slope (1:40 cant) of the crosstie plate shall be directly over and parallel with the centerline of the crosstie. The tie plate shall be set so that the outside shoulder of the tie plate shall bear squarely against the base of the rail, having a full bearing for the rail, and at the same time, a full bearing on the crosstie.

Two tie plates per crosstie, under the base of rail, must be used. Crosstie plates shall also be used on all switch timbers not protected by switch plates, frog plates, or guard rail plates.

Rail Joints

Joint bars shall be either new or #1 relay and shall be of the size, drilling, and hole spacing to fit the cross section of rail. Joint bars shall not have any cracks.

For new construction and rail replacement, six (6) hole bars shall be used.

Rail joints shall be kept out of grade crossings.

When different size rails are to be connected, forged compromise joint bars shall be used. Compromise bars shall new or #1 relay and shall have the correct drilling, cross sections and be of the appropriate orientation for the rail sections being joined. The above-mentioned recommendation for rail joints in grade crossings shall apply to compromise joints.

New Alleghany (or equivalent) encapsulated insulated joint bars shall be used where required and shall match the drilling and cross section of rail.

All types of joint bars shall be properly installed, with the full number, and the correct size, of bolts, nuts and spring washers. Bolts shall be placed with nuts alternately on inside and outside of rail and shall be drawn tight before spiking. Bolts shall be tightened by the use of approved track wrenches or track bolt machines.

Any field fabrication of compromise joints shall be strictly prohibited; that is, the cutting down of larger standard joints to fit smaller rail shall not be allowed.

Bolts and Nuts

Bolts and nuts for the track and turnouts shall be new or approved relay, and shall be of the correct diameter and length to fit the rail and joints being used. Bolts and nuts shall conform to the latest AREMA Specifications.

Lock Washers

Lock washers shall be new, and shall be of correct diameter to fit the bolts being used. Each track bolt shall be equipped with a spring lock washer, conforming to the most current AREMA Specifications for Spring Washers.

Rail Anchors

Rail anchors shall be new or relay of good quality and shall be the correct size, and shall be of approved design, for the rail used. Rail anchors to be used on Railroad-owned tracks shall conform to the Railroad's standards.

The anchor pattern for all tracks should be in accordance with *CAD Plan "Track Anchoring Pattern"* and shall be performed as required for Continuous Welded Rail Territory unless otherwise instructed by Railroad.

Rail anchors shall be installed through turnouts in accordance with the Railroad's standard plan for the turnout being used, which will be *CAD Plan "Turnout No 8"* or *CAD Plan "Turnout No 10"*.

Track Spikes

Only standard, new 5/8" x 6" track spikes shall be used and shall conform to current AREMA Specifications for Low Carbon Steel Track Spikes and *CAD Plan "Spikes"*. A minimum of two spikes per cross tie plate is required on tangent track.

Spikes through a turnout shall be applied in the number and location required in accordance with the Railroad's standard plan for the turnout being used, which will be *CAD Plan "Turnout No 8"* or *CAD Plan "Turnout No 10"*.

The spiking pattern for curves shall be in accordance with *CAD Plan "Track Spiking Pattern"*.

Drive Screw Spikes

New 7/8" x 7" drive screw spikes conforming to *CAD Plan "Spikes"* shall be used for turnouts in accordance with the Railroad's standard plan for the turnout being used, which will be *CAD Plan "Turnout No 8"* or *CAD Plan "Turnout No 10"*.

New drive screw spikes of appropriate size shall be used for grade crossings in accordance with *CAD Plan "Grade Crossing Asphalt"* and *CAD Plan "Grade Crossing Asphalt Rubber"*.

Derails

Derails shall be new and shall be the type indicated on the approved plans and shall be placed at the designated location on the plans.

Where double switch point derails are required they shall be installed in accordance with *CAD Plan "Derails"*. The standard double switch point derail is 43 feet long. Derails other than double switch point derails shall be Hayes Sliding Derail, Model HB or approved equal.

Derails shall be sized to fit the rail and be thrown with an operating stand meeting the requirements of *CAD Plan "Switch Stands"*. Operating stands shall be New Century Model 51-A or equivalent, shall be equipped with an ergonomic bow handle by G&B Specialties, Inc. or equivalent, and shall be furnished with targets.

Care shall be taken when installing derails to insure that they are installed in the proper direction to derail railcars away from a Main Line Track.

Derails shall be painted international orange, and glass beads shall be sprinkled on after painting while paint is still wet to increase night time visibility.

Earth Mounds and Bumping Posts

Earth Mounds shall be of an approved design sufficient to stop a moving car and should be protected against erosion.

Bumping posts shall be either new or second-hand, of good quality and approved design.

Switch Point Protectors

Depending upon volume of traffic anticipated through turnouts and/or location of turnouts, switch point protectors may be required. Where required, these protectors shall be new or second hand, of good quality and compatible with the size and type of switch point being used. The design for switch point protectors to be used on Railroad-owned turnouts shall be approved by the Railroad.

Frog Guard Rails

Guard rails shall be installed for all frogs, except self guarded frogs. They shall be new or second hand, of good quality, of an approved design (AREMA or equal), and equipped with proper plates.

Switch Stands

New switch stands meeting the requirements of *CAD Plan "Switch Stands"* shall be installed for each turnout, and shall be located on the diverging side of left handed turnouts and on the straight side of right handed turnouts. Switch stands shall be New Century Model 51-A or equivalent, and shall be equipped with an ergonomic bow handle by G&B Specialties, Inc. or equivalent.

All switch stands shall be complete in every respect and throw rods shall be adjusted for proper throw, including grinding of stock rails if necessary for positive closure of the switch point against stock rail.

Switch stands and latches shall be securely fastened to head block ties using 5/8" bolts, or standard cut spikes as specified by the Railroad. Switch stand cranks shall be made of forged steel.

Track Construction

All tracks shall be constructed to the alignment and grade as shown on approved plans and profiles.

Final approval of any track for service is the prerogative of the Railroad. No work may be performed on Railroad-owned track by contract forces, or in such proximity to Railroad-owned track as to interfere with the operation or integrity of Railroad-owned track or roadbed without explicit permission of the Railroad.

No track or turnout shall be laid, and no track or turnout shall be placed on the roadbed, until the finished subballast has been approved. All track and turnout materials shall be handled in such a manner to protect materials from being damaged. The alignment of the centerline of the track and the locations of turnouts shall conform to that shown on the approved plans, and as further defined by an on-the-ground staked location.

The final step for construction of track or turnouts should be the removing of all waste and rubbish from the track project site. The track project shall not be considered complete and the final payment made until this clean up of the work site is accomplished.

Crossings

Grade Crossings

General Public Grade Crossing Requirements

Public grade crossings shall be installed where indicated on the plans.

The standard crossing surface for road crossings over Railroad-owned tracks is asphalt paving with rubber flange (a.k.a. Rubber Rail Seal), as and shall be installed in accordance with *CAD Plan “Grade Crossings Asphalt Rubber”*.

Any desired use of alternative surface types on Railroad-owned tracks, such as concrete panels as outlined in *CAD Plan “Grade Crossings Precast Concrete”* and *CAD Plan “Grade Crossings Precast Concrete Panels”* must be discussed with, and approved by, the Railroad, and shall be installed in accordance with appropriate plan.

If the governmental agency having jurisdiction requires that automatic warning devices be installed at the crossing, before Industry purchases and installs said devices, it will be necessary that the plans for installation for such control apparatus and equipment be submitted to the Railroad Project Representative for review and approval. It is the Industry’s responsibility to incorporate any local, state or federal regulations, guidelines or mandates governing grade crossing design at their proposed location, and the plans for installation of the control devices must be reviewed and approved by the governmental agency and the Railroad prior to installation. Industry is responsible to perform the control device installation work in accordance with the engineering plans and standards for the control devices.

Additional Public Grade Crossing Requirements

Unless otherwise specified by Railroad, the following requirements shall be met when installing a new public grade crossing:

1. Rail
 - a. New #136RE welded rail shall be installed between the insulated joints of the crossing and for one (1) 39-foot rail length outside of the insulated joints on each side of the crossing.
 - b. New #136RE rail must be compromised to New #115RE rail before compromising further. Short rails and compromise joints of appropriate cross section shall be used to transition to existing rail and staggers. The short rails shall be at least twelve (12’) long, and staggers shall not be less than six (6) feet.
 - c. Rails shall be staggered not less than six (6) feet or more than ten (10) feet and according to Railroad preference. The crossing rails shall be installed so that the two opposing insulated joints closest to the roadway are about equal distance from the curb line or edge of roadway or sidewalks.

2. Crossties

- a. New 7"x9" 8'x6" crossties shall be installed and must be spaced 18" within the entirety of the crossing, as well as the entirety of the island circuit of the crossing.
- b. Fifty (50) new 6"x8" 8'x6" crossties shall be installed on both approaches to the crossing.

3. Insulated Joints

- a. Insulated joints must be offset by at least three (3) feet, and by no more than four (4) feet.
- b. Two (2) New insulated joints must be installed on each side of the island circuit around the crossing (four total insulated joints).

4. Surface

- a. Crossing surface shall extend at least five (5) feet beyond the curb line or edge of roadway or sidewalk
- b. Crossing surface shall be placed at an elevation and in a line specified by the Railroad. All new construction shall be in the same surface and line. Existing tracks shall be lined and surfaced to meet new construction. The final elevation of the road crossing must match the height of the existing road.
- c. Asphalt paving, if used, shall be used for a minimum distance of 15 feet on both sides of the centerline of the track, and shall be hot mix and shall meet the requirements of the governmental agency having jurisdiction.

5. Conduit

- a. Schedule 80 PVC pipe with pull strings, shall be buried at least twelve (12) inches under roadway on both sides and parallel to the tracks, and under tracks at least twelve (12) inches below ties on both sides and parallel to roadway, providing conduit for warning devices and connecting all four quadrants.

Private Grade Crossings and Roads

Private grade crossings and roads shall be installed where indicated on the plans.

The standard crossing surface for road crossings over Railroad-owned tracks is asphalt paving with rubber flange (a.k.a. Rubber Rail Seal), as and shall be installed in accordance with ***CAD Plan "Grade Crossings Asphalt Rubber"***.

Any desired use of alternative surface types on Railroad-owned tracks, such as concrete panels as outlined in ***CAD Plan "Grade Crossings Precast Concrete"*** and ***CAD Plan "Grade Crossings Precast Concrete Panels"*** must be discussed with, and approved by, the Railroad, and shall be installed in accordance with appropriate plan.

Private vehicular grade crossings located on Industry-owned track beyond the Railroad's maintenance point in the track shall meet or exceed Railroad standards and will only be permitted under the terms of the Side Track Agreement. Crossing surface types for private grade crossings on Industry-owned property are at the discretion of the Industry but shall be built in accordance with Railroad standards as outlined in *CAD Plan "Grade Crossings Asphalt"*, *CAD Plan "Grade Crossings Asphalt Rubber"*, *CAD Plan "Grade Crossings Precast Concrete"* and *CAD Plan "Grade Crossings Precast Concrete Panels"*.

If the governmental agency having jurisdiction requires that automatic warning devices be installed at the crossing, before Industry purchases and installs said devices, it will be necessary that the plans for installation for such control apparatus and equipment be submitted to the Railroad Project Representative for review and approval. It is the Industry's responsibility to incorporate any local, state or federal regulations, guidelines or mandates governing grade crossing design at their proposed location, and the plans for installation of the control devices must be reviewed and approved by the governmental agency and the Railroad prior to installation. Industry is responsible to perform the control device installation work in accordance with the engineering plans and standards for the control devices.

Roads parallel to Railroad-owned and Industry-owned tracks shall be no closer than 9 feet to the centerline of track in tangent track and greater in track curves and at switch stands as per *CAD Plan "Clearances"*.

Additional Private Grade Crossing Requirements

Unless otherwise specified by Railroad, the following requirements shall be met when installing a new private grade crossing:

1. Rail
 - a. Rail through crossing shall match the cross section of rail in both approaches.
2. Joints
 - a. No rail joints may be located in the roadway or may be interfering with flangeway material.
 - b. If an existing joints fall in the roadway or interferes with the installation of flangeway material, the existing rail shall be replaced with CWR, of the cross section and length, as specified by the Railroad.
3. Crossties
 - a. New 6"x8" 8'x6" crossties shall be installed and must be spaced 18" within the entirety of the crossing.
 - b. Ten (10) new 6"x8" 8'x6" crossties shall be installed on both approaches to the crossing.
4. Surface

- a. Crossing surface shall be placed at an elevation and in a line specified by the Railroad. All new construction shall be in the same surface and line. Existing tracks shall be lined and surfaced to meet new construction. The final elevation of the road crossing must match the height of the existing road.
- b. Asphalt paving, if used, shall be used for a minimum distance of 15 feet on both sides of the centerline of the track, and shall be hot mix and shall meet the requirements of the governmental agency having jurisdiction.

Pipeline Crossings

All pipelines located under Railroad-owned property shall comply with current American Railway Engineering and Maintenance-of-Way Association (AREMA) specifications for conveying flammable and non-flammable substances, Chapter 1, Part 5, Article 5.1 through Article 5.2.7 and the *Maryland and Delaware Railroad Company System Standards for Pipeline Occupancy*.

All pipeline crossings and parallel right-of-way encroachments shall be approved by the Railroad before installation may be permitted. Additionally, no work shall be performed where crossing Railroad-owned property until the Railroad has been notified of the proposed work schedule and a representative of the Railroad is available to be at the work site during the time the work is performed.

For a pipeline crossing of Railroad-owned property, the Industry shall submit complete plans for the proposed crossing to the Railroad for approval and handling, and for preparation of an agreement to cover such crossing or encroachment.

For pipeline crossings concerning Industry-owned property, but to be operated over by the Railroad, the Industry shall submit complete plans for the proposed crossing to the Railroad for approval.

Pipeline crossings shall not be attached to or located closer than fifty (50) feet to a bridge, culvert, or other major Railroad structure. Reinforced concrete pipe will not be allowed except as a carrier pipe when the pipeline is operated under gravity flow and a casing pipe is provided. The jack and bore method of installation is preferred for pipelines crossing under Railroad-owned property.

Maryland and Delaware Railroad Company System Standards for Pipeline Occupancy can be found at http://www.mdde.com/RealEstate_Documents.html

Wire, Conduit and Cable Crossings

All overhead and underground wire, conduit and cable line crossings located on or encroaching upon Railroad-owned property shall comply with the *Maryland and Delaware Railroad Company System Standards for Wire, Conduit and Cable Occupancy*.

Maryland and Delaware Railroad Company System Track Standards

All wire, conduit and cable crossings and parallel right-of-way encroachments shall be approved by the Railroad before installation may be permitted. Additionally, no work shall be performed where crossing Railroad-owned property until the Railroad has been notified of the proposed work schedule and a representative of the Railroad is available to be at the work site during the time the work is performed.

For a wire, conduit and cable crossing of Railroad-owned property, the Industry shall submit complete plans for the proposed crossing to the Railroad for approval and handling, and for preparation of an agreement to cover such crossing or encroachment.

For wire, conduit and cable crossing concerning Industry-owned property, but to be operated over by the Railroad, the Industry shall submit complete plans for the proposed crossing to the Railroad for approval.

Maryland and Delaware Railroad Company System Standards for Wire, Conduit and Cable Occupancy can be found at http://www.mdde.com/RealEstate_Documents.html.

Bridges, Trestles, Boxed Culverts, Unloading Pits, Scales

General

All proposed bridges, trestles, box culverts, unloading pits and structures over which the Railroad's equipment will operate shall be designed in accordance with American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering, Chapters 7 (Timber), 8 (Concrete), and 15 (Steel Structures), for E-80 Live Loading and appropriate Impact. Prior to the beginning construction, the proposed design of any bridges, trestles, box culverts, unloading pits or structures shall be approved by Railroad. Sufficient time should be allowed for proper review and approval.

Drawings covering temporary sheeting and bulkheads to protect the Railroad's tracks during adjacent structure construction shall be subject to approval of the Railroad.

All plans and calculations shall bear the seal of a current registered licensed professional engineer in the state of the project certifying that the design is in accordance with AREMA requirements.

Unloading Pits

Plans for unloading pits shall be submitted to the Railroad and shall be approved before construction begins. The plans must include the distance and direction from centerline of the unloading pit to the nearest switch point, and to the Main Line Track switch point.

There shall be no rail joints in the running rail over an unloading pit. Welding or torch cutting of running rail shall not be permitted.

The top of the unloading pit shall be equipped with a removable cover, which will be kept in place when the unloading pit is not in use, and which shall be designed in accordance with AREMA Chapter 15, Section 8.5.3.2.

Minimum distance from centerline of any adjacent track to nearest edge of unloading pit walls is to be 15 feet. Closer clearances require special approval, and indemnity if permitted.

Minimum horizontal distance from centerline of unloading pit track to adjacent obstructions above the top of the pit is to be 9 feet, per *CAD Plan "Clearances"*.

The unloading pit cover and top of pit are to extend a minimum of 10 feet from the centerline of the unloading pit track on open side of the unloading pit.

Embankment side slopes shall not be steeper than 2 to 1.

Additional unloading pit design information is found in *CAD Plan "Pits Unloading"*.

Single Span Unloading Pits (with span length of 15 feet or less)

Live Load: Cooper's E-80 with 28 percent impact.

Design specifications and workmanship shall be in accordance with current AREMA Specification, Chapters 7 (Timber), 8 (Concrete) and 15 (Steel Structures).

General single-span unloading pit details can be referenced from Figures 8-5, 8-6, and 8-7 in the AREMA Manual Chapter 15, Section 8. However, the Railroad requires the top of the unloading pit to extend a minimum of 10 feet from the centerline of the unloading pit track, not the eight feet shown by AREMA in Figure 8-5.

Single Span Unloading Pits (with span length greater than 15 feet), or Multi-span Pits

General:

All portions of the unloading structure that are subjected to train or equipment loading shall be designed as a bridge in accordance with the current AREMA Manual.

If computer programs are utilized in the design, the submittal shall include a complete summary of the input data used and all design assumptions. Additional manual calculations may be required to document compliance with AREMA requirements. Thirty days should be allowed in scheduling for the Railroad's review of unloading structure plans and calculations.

Steel Superstructure:

Span Type: All spans shall be designed as simple spans. The use of side plates, bolted to beam webs, will be permitted as a means to stabilize or maintain alignment between adjacent spans. All beam ends shall have bearing stiffeners and shall bear directly on pit walls, floorbeams or columns. Attachment of ends of floorbeams to vertical steel plates, embedded in pit wall, is prohibited.

Loadings: All steel super-structure shall be designed for Cooper's E-80 live loading and appropriate impact. All loads outlined in Section 1.3 of AREMA Chapter 15 must be considered in the design. A reduction in wind load (Section 1.3.7) may be considered where justified by local conditions. To the extent possible, hoppers and mechanical features of the unloading structure should be supported independent of the superstructure carrying train loading.

Fatigue: By AREMA definition, all rail support beams and floorbeams are fracture critical members and must be so designated on the plans. The steel superstructure shall be designed to include fatigue consideration for 2,000,000 cycles and allowable stresses reduced, based on the fabrication and connection details used. All material specifications, including notch toughness requirements, shall be shown on plans. All non-destructive testing requirements shall be shown on the plans. When requested to do so, the Industry or its designated representative shall furnish the Railroad with copies of material certifications and test results, as well as copies of results of testing required during fabrication.

Erection: The steel superstructure supporting train loading shall be shipped, handled and erected in such manner as to avoid injurious bends, nicks or gouges to the steel.

Field welding may be used only for minor connections, not subject to train live load force, as outlined in Section 1.5.10 of AREMA Chapter 15.

Concrete Substructure:

All concrete portions of under track unloading structures that are subjected to train loading shall be designed in accordance with Chapter 8 of the AREMA Manual. Pit end walls shall be designed for the effects of vertical load from rail support beams and live load surcharge from train on ground track adjacent to the pit. Surcharge from adjacent parallel tracks, roadways and buildings shall be considered in the design of pit side walls.

Calculation and application of train surcharge loadings shall be as outlined in AREMA Chapter 8.

Foundations: Submittal of unloading structure plans shall include a geotechnical report defining the characteristics of the soils at the site and their suitability for supporting the design loads. All foundations for unloading structures shall be designed in accordance with the requirements in AREMA Chapter 8.

Approach Walls: If approaches to the main pit span, or spans, are to be constructed of parallel reinforced concrete walls, with the rails attached directly to the top of the walls, the approach walls shall be designed in accord with AREMA Chapter 8, Concrete Structures and Foundations. The two parallel walls shall have a single footing supporting both walls. Where necessary to obtain safe bearing capacity, the approach walls shall extend to the same depth as the pit walls. The rails shall be attached to the walls using standard Pandrol plates and clips, unless other attachment is approved by the Railroad. Pandrol plates and clips shall be spaced at 2'-0" maximum.

Retaining Walls

All proposed retaining walls that will support both Railroad-owned and Industry-owned tracks and roadbeds shall be designed in accordance with AREMA Chapters 7 and 8. The design shall be approved by the Railroad.

Scales

All proposed scales over which the Railroad's equipment will operate shall be designed in accordance with the "*Bridges, Trestles, Boxed Culverts, Unloading Pits*" section of these Standards. Furthermore, if the scale will be used for certified weights/commercial purposes then the scale shall also be in compliance with:

1. Association of American Railroads (ARR) Scale Handbook
2. National Institute of Standards & Technology (NIST) Handbook – 44
3. Any additional requirements mandated by local, state and federal agencies.

Maryland and Delaware Railroad Company System Track Standards

The Railroad shall approve any proposed design plans prior to the beginning of any construction.

Plans shall include, at a minimum, the following:

1. A site plan showing scale and instrument building location with track elevations and distances to point of curvature
2. A Geotechnical report that includes pertinent recommendations of compliance with Section 2.22.19 Bearing Pressures Under Foundations of the AAR Scale Handbook
3. A complete structural detail with design calculations
4. The stamp of a current registered licensed professional engineer in the state of the project
5. The Industry name and location
6. The National Type Evaluation Program (NTEP) Certificates of Conformance (COC) for Load Cells, Instrumentation and Weight Bridge

Hazardous Commodities

General

Rules and regulations governing the location of new loading, unloading and storage facilities for flammable liquids, combustible liquids, pyrophoric liquids, compressed gases and other hazardous commodities on Railroad-owned property will be considered on an individual basis upon application by Industry to the Railroad.

Application Procedure

Applications for location or relocation of facilities for loading, unloading or storage of flammable liquids, combustible liquids, pyrophoric liquids, compressed gases or other hazardous commodities, shall be submitted to the Railroad.

To expedite handling of such applications, it is essential that all available facts be contained in the application and accompanied by a detailed print. Please bear in mind that these regulations are the minimum, and that safety is the foremost concern. Each application shall be considered on its merits and factors, such as exposures to high valued property and density of traffic adjacent to unloading and storage points.

In no case will hazardous materials or contaminants be allowed to drain onto Railroad-owned property or be carried in Railroad-owned drainage systems.

The Industry shall be responsible for researching and complying with all federal, state, and local regulations concerning the safe handling and accidental release containment for the particular material being handled. The Industry shall submit the final state-approved spill containment plan to the Railroad for review and approval.

For additional information, please see the “*American Association of Railroads Circular NO. OT-55, latest revision, Recommended Railroad Operating Practices for Transportation of Hazardous Materials*”.

Storage of Hazardous Materials

The requirements of Table 14.03.1 apply to storage on Railroad-owned property and on Industry-owned property that is located in close proximity to a Main Line Track.

**Table 14.03.1 Separation Distance for New Facilities
Loaded Tank Cars and Storage Tanks from Mainline**

ACTIVITY	COMBUSTIBLE LIQUID, CORROSIVE MATERIAL AND ORM'S	PIH (HAZARD ZONE A OR B), FLAMMABLE LIQUID, FLAMMABLE GAS, NON FLAMMABLE GAS AND ALL OTHER HAZARD CLASSES
LOADING AND UNLOADING	50 FEET	100 FEET
LOADED TANK CAR STORAGE	25 FEET	50 FEET
STORAGE IN TANKS	50 FEET	100 FEET

NOTE: Above distances are centerline of rail to centerline of rail and/or closest part of structure.

Definitions:

ORM- Oxidized and Radioactive Material
PIH- Poisonous Inhalation Hazard

With regard to existing facilities, maximum reasonable effort shall be made to conform to the standard in Table 14.03.1, taking into consideration not only cost, but also physical and legal constraints.

Protection from Stray Electric Currents

Industry Side Tracks used for loading or unloading of oil, gas, or other flammable or explosive commodities shall be protected from stray electric currents per the standards of *CAD Plan "Track Current Protection"*.

Double Switch Point (DSP) Derail

A double switch point derail shall be installed at the clearance point on *any* track that handles hazardous materials.

Spill Containment System

Spill containment devices and systems shall be shown on the design plans and include plan views with proper stationing, typical sections, details and catalog cuts as needed.

Kean's Field Guide for Installing Railroad Crossties

This guide is intended to supplement railroad standards and specifications.

1. **GAUGE** ~ Track shall be gauged to 56-1/2" in curves, tangents, turnouts, and other special track work, as measured by a real track gauge, not a tape measure.

Where steel ties are used, gauge shall be fixed by the pregauged steel ties -- typically 56-1/4" plus rail wear. Wood ties shall be gauged to match steel ties.

2. **SPIKES** ~ No more than two (2) spikes shall be used per plate. Spikes shall be installed in a diagonal pattern. Under no circumstances shall spikes be installed in notches in joint bars.

Spiking rotted ties is a waste of time and material.

3. **SPACING** ~ Ties shall be spaced longitudinally on 24" centers for new construction and where nests of three (3) or more ties are replaced.

Single ties shall be replaced as per existing tie spacing, taking into consideration missing ties, and ties that are skewed or moved over time by rail expansion/running.

When in doubt, install ties equal distant between adjacent effective or non-effective ties.

4. **PERPENDICULAR ALIGNMENT** ~ Ties shall be inserted perpendicular to line side rail.
5. **CENTER ALIGNMENT** ~ Ties shall be centered under running rails, by marking ties before installation to line up with outside base of rail on line side. For 8'6" long ties, use these measurements:

Rail Base	Tie should extend beyond base of rail
5"	18-3/4"
5-1/2"	18-1/2"
6"	18-1/4"
6-3/4"	18"

Formula is 21-1/4" less 1/2 base of rail.

6. **PLATES** ~ Tie plates of uniform design shall be used throughout project, i.e. single shoulder/double shoulder, flat/canted, etc. Canted plates shall be used on wood ties in areas where steel ties are installed.

Ties shall not be installed without plates except where joint bars wrap under rail.

7. **JOINT BARS** ~ Joint bars shall be fully bolted and broken bars shall be replaced, before ties are installed under joints.
8. **SURFACE** ~ Ties shall be installed in existing track, tight against bottom of rail, disturbing roadbed as little as possible and taking care not to hump track.

No more than three (3) steel ties shall be installed in a row unless track can be mechanically tamped before use under regular traffic.

9. **GAUGE RODS** ~ Gauge rods immediately adjacent to installed ties shall be removed to facilitate surfacing, and shall be salvaged for reuse when practicable.
10. **RE-GAUGING** ~ When re-gauging is required, adjustment shall be made in low rail on curves. Ties shall be plugged before re-spiking.
11. **REFUSE & SCRAP** ~ Old ties, garbage, scrap metal and especially old spikes shall be collected and stockpiled or disposed of according to arrangement.

12. **QUALITY CONTROL**

These tolerances shall apply for quality control and/or acceptance of new work.

1. Deviation from nominal gauge at installed ties shall not exceed 1/4"
2. No more than two (2) spikes shall be in any plate on installed ties.
3. Tie spacing shall not deviate by more than 2" per installed tie or overall installed ties.
4. Installed ties shall not be skewed by more than 1" measured at gauge side base of rail opposite of line side.
5. Installed ties shall not be more than 1" short or long on line side, measured from outside base of rail.
6. Incorrect ties plates shall not be used.
7. Missing bolts or broken bars shall not exist at joints where ties are installed.

Where spikes need to be pulled out of new ties or re-spiked to correct Quality Control issues, a reduction in payment can be expected to compensate for shortened expected life of ties.

Attachments

Plan “Bumping Post Earth Mound”
Plan “Bumping Post Metal”
Plan “Clearance Diagram”
Plan “Clearance Wire”
Plan “CMP Backfilling”
Plan “CMP Pipe”
Plan “Derails”
Plan “Grade Crossing Asphalt”
Plan “Grade Crossing Asphalt Rubber”
Plan “Grade Crossing Precast Concrete”
Plan “Grade Crossing Precast Concrete Panels”
Plan “HDPE Pipe Existing”
Plan “HDPE Pipe Proposed”
Plan “Pits Unloading”
Plan “Roadbed”
Plan “Roadbed Steel Ties”
Plan “Roadbed Turnout Pad”
Plan “Signs Close Clearance”
Plan “Spikes”
Plan “Spikes Timber Screw”
Plan “Switch Stands”
Plan “Track Anchoring Pattern”
Plan “Track Current Protection”
Plan “Track Spiking Pattern”
Plan “Turnout Crossovers”
Plan “Turnout No 8”
Plan “Turnout No 10”