



SPECIFICATIONS FOR PIPELINE OCCUPANCY OF VIRGINIA PASSENGER RAIL AUTHORITY PROPERTY

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1.0 GENERAL

1.1 Scope

1. This specification shall apply to the design and construction of pipelines carrying flammable or non- flammable substances over, across, and along VPRA property. This specification shall also apply to tracks owned by others (sidings, industry tracks, etc.) over which VPRA operates its equipment.
2. VPRA owns its right-of-way for the primary purpose of facilitating railroad operations. All occupancies shall therefore be designed and constructed so that rail operations and facilities are not interfered with, interrupted or endangered. In addition, the proposed facility shall be located to minimize encumbrance to the right-of-way so that each operating railroad will have unrestricted use of VPRA right-of-way for current and future operations.

1.2 Definitions

1. VPRA - Virginia Passenger Rail Authority
2. Contract Administration - VPRA's Contract Administration Department
3. Owner - Individual, corporation, or municipality receiving an occupancy permit from VPRA
4. Applicant - Individual, corporation, or municipality applying to VPRA for an occupancy permit
5. Professional Engineer - Engineer licensed in the state where the facilities are to be constructed
6. Carrier Pipe - Pipe used to transport the product
7. Casing Pipe - Pipe through which the carrier pipe is installed
8. Sidings or Industry Tracks - Tracks located off VPRA's right-of-way, serving an industry or yard

1.3 Application for Occupancy

1. Individuals, corporations, or municipalities desiring occupancy of VPRA property by pipeline occupations must agree, upon approval of the engineering and construction details by VPRA, to execute an appropriate VPRA occupancy permit, pay any required fees and/or rentals specified therein, and meet all VPRA insurance requirements.
2. Contact Josh Lineberger (Joshua.Lineberger@vp.ra.virginia.gov) for the application for a pipeline occupancy permit.

3. All applications shall be accompanied by PDF files for all design and construction plans, specifications, and engineering computations for the proposed occupancy. On extensive projects, only those plans involving work on, or affecting, VPRA property and operations shall be submitted. Included shall be a plan showing the extent of the total project upon which that portion of the work affecting VPRA is clearly defined.
4. All of the above plans, specifications, and computations must be prepared by and bear the seal of a Professional Engineer.

1.4 Right-of-Entry

1. No entry upon VPRA property for the purpose of conducting surveys or field inspections, obtaining soils information, or any other purposes associated with the design and construction for the proposed occupancy will be permitted without a proper entry permit approved by VPRA. The Applicant must pay the associated fees and execute the permit.
2. Issuance of an entry permit does not constitute authority to proceed with any construction. Construction cannot begin until a formal agreement is executed by VPRA and the Owner, and the Owner receives permission, from the designated inspection agent for VPRA, to proceed with the work.
3. Once permission from the VPRA representative is received to proceed with the work, all personnel are responsible for understanding and following the applicable local, county, state and federal laws and regulations, and any special requirements which may be imposed by the Federal Railroad Administration (FRA) or other regulatory agencies, including FRA fall protection and Roadway Worker Protection, applicable OSHA requirements, and Department of Homeland Security requirements.

Roadway Worker Safety training is provided by RailPros. Training must be specific to the operating railroad.

[Norfolk Southern Roadway Worker training](#)
[CSX Roadway Worker training](#)

4. Contact Josh Lineberger (Joshua.Lineberger@vpra.virginia.gov) for the application for a Right-of-Entry permit.

1.5 Site Inspection

1. For longitudinal occupancy of VPRA property or as otherwise required by VPRA, a site inspection along the proposed pipeline route may be required before final design plans are prepared. When a site inspection is required, the party applying for an occupancy permit (Applicant) and/or its engineer must meet with representatives of VPRA to view the entire length of the proposed occupancy.
2. Prior to the site inspection the Applicant must submit the following information:

- a. A plan view of the proposed route showing all tracks, all VPRA right-of-way lines, and all other facilities located on the right-of-way. The distance from the proposed pipeline to the adjacent track and to the right-of-way lines must be shown.
 - b. A complete "Pipe Data Sheet" (see Plate I)
 - c. Typical cross sections along the proposed route. (see Plate V)
3. Site inspections for pipe crossings are not required unless, in the opinion of VPRA, the size and location of the facility warrant an inspection.

1.6 Information Required for Submission

1.6.1 PLANS AND COMPUTATIONS

1. Plans for proposed pipeline occupancies shall be submitted as a PDF package to and approved by VPRA prior to VPRA issuance of an occupancy permit and start of construction.
2. Plans shall be drawn to scale, dimensioned with US Customary Units, and shall include the following (see Plates I to X):
 - a. Plan view of proposed pipeline in relation to all VPRA facilities and facilities immediately adjacent to VPRA right-of-way including, but not limited to, tracks, buildings, signals, pole lines, other utilities and all other facilities that may affect or influence the pipeline design and construction. (see Plate II)
 - b. The location, in feet, of the pipe crossing from the nearest centerline of a VPRA bridge, giving the VPRA bridge number. If the above is not available, provide distance to the nearest highway railroad grade crossing and the DOT number posted at the highway grade crossing, if available.
 - c. The name of the State and County in which the proposed facilities are to be located.
 - d. The profile of the ground above the centerline of the pipe, from field survey, showing relationship of the pipeline and/or casing pipe to the ground levels, the tracks, and other facilities (See Plate III). For longitudinal occupations, the top of rail profile of the adjacent track shall be shown on the pipeline profile (see Plate IV).
 - e. All VPRA property lines indicated by dimensions, in feet, to the centerline of adjacent track, as well as the overall width of the VPRA right-of-way. If the pipeline is in a public highway, the limits of the dedicated highway right-of-way, as well as the limits of any paving, sidewalks etc., shall be defined, by dimensions in feet, from the centerline of the dedicated right-of-way.
 - f. The angle of the crossing in relation to the centerline of the tracks(s). (see Plate II)
 - g. On pipelines having valves, the distance in feet along the pipeline from the crossing to the nearest valves and/or control stations.
 - h. A separate "Pipe Data Sheet" (see Plate I) shall be submitted in the PDF package.
3. The plan shall be specific, as to the:
 - a. Method of installation. (see Section 5.0)

- b. Size and material of the casing pipe. (see Section 4.3)
- c. Size and material of the carrier pipe. (see Section 4.4)

These items cannot have an alternative, and any application that is received that indicates options in any of the above items will not be processed.

5. Once the application has been approved by VPRA, no variance from the plans, specifications, method of installation, construction, etc., as approved in the occupancy document, will be considered, or permitted without the payment to VPRA of additional fees for the re-processing and approval of the application.
6. All plans and computations associated with the work under the agreement shall be prepared by, and bear the seal of, a licensed Professional Engineer in the state where the work will take place. If not so imprinted, the application will not be processed. This requirement also applies to all data submitted by the Owner's contractor. Contractor's plans and computations that are not stamped will be returned, and construction will not be permitted to proceed.

1.6.2 SPECIFICATIONS

1. Project specifications for all work on and affecting the railroad right-of-way shall be included with the submission. All pertinent requirements of this document shall be met by such submission.

1.7 Notification to Proceed with Construction

1. After approval of the engineering plans, specifications, and execution of the occupancy permit, a VPRA construction representative will reach out to the Owner. VPRA's construction representative will conduct VPRA's inspection of the project and coordinate all other construction aspects of the project that relate to VPRA (flagging, track work, protection of signal cables, etc.).

2.0 GENERAL REQUIREMENTS

2.1 Use of a Casing Pipe

1. A casing pipe will be required for all pipeline crossings carrying liquid flammable or non-flammable substances under pressure.
2. For flammable and nonflammable gas pipelines, the casing pipe may be omitted, provided the carrier pipe meets the requirements provided in the *AREMA Manual for Railway Engineering* Chapter 1, Part 5, Section 5.2.3. VPRA may require use of a casing pipe at locations where increased risks from specific site conditions (track speed, traffic density, etc.) are present.
3. Pressure pipelines that do not cross under the track but are located within 30 feet of the centerline of any track or closer than 45 feet to the nearest point of any bridge, building, or other important structure, shall be encased.
4. Casing pipe crossing the right-of-way shall be laid across the entire width of the right-of-way, except where a greater length is required to comply with Section 4.3.6 of this specification, even though such extension is beyond the right-of-way. For non-pressure sewer or drainage crossing, where a casing is used for carrier pipe installation purposes only, the casing need only to extend from the boring pit to the receiving pit.

2.2 Location of Pipeline on the Right-of-Way

1. Pipelines laid longitudinally on VPRA right-of-way shall be located as far as practicable from any tracks or other important structures and as close to the railroad property line as possible. Longitudinal pipelines must not be located in earth embankments or within ditches located on the right-of-way.
2. Pipelines shall be located, where practicable, to cross tracks at approximate right angles to the track, but at not less than 45 degrees.
3. Pipelines shall not be placed within a culvert, under railroad bridges, nor closer than 50 feet (15.2 m) from any portion of any railroad bridge, building, or other important structure, except in special circumstances, and then by special design, and only as approved by VPRA Engineering.
4. Pipelines shall not be located within 25 feet of the limits of a turnout (switch) when crossing the track. The limits of the turnout extend from the point of the switch to the last long timber.
5. Pipeline installations shall not be designed as an open cut installation where the pipeline is to be located within the limits of a grade crossing. If it is shown that no other method of installation is possible, the Owner will be responsible for reimbursing VPRA for all costs associated with the removal and reconstruction of the grade crossing.

6. Pipelines carrying liquefied petroleum gas shall, where practicable, cross the railroad where tracks are carried on embankment.
7. Longitudinal uncased gas pipelines must not be located within 30 feet of any track.

2.3 Depth of Installation

2.3.1 PIPELINES CONVEYING NON-FLAMMABLE SUBSTANCES

1. Casing/carrier pipes placed under VPRA track(s) shall be not less than 5 ½ feet from base of rail to top of pipe at its closest point, except that under sidings or industry tracks this distance may be 4 ½ feet, as approved by VPRA. On other portions of the right-of-way, where the pipe is not directly beneath any track, the depth from ground surface will be 4 feet or from bottom of ditch to top of pipe shall not be less than 3 feet.
2. Pipelines laid longitudinally on VPRA right-of-way, and 50 feet or less from centerline track, shall be buried not less than 4 feet from ground surface to top of pipe. Where the pipeline is laid more than 50 feet from centerline of track, the minimum cover shall be at least 3 feet.

2.3.2 PIPELINES CONVEYING FLAMMABLE SUBSTANCES

1. Casing pipes under VPRA track(s) shall not be less than 5 ½ feet from base of rail to top of pipe at its closest point, except that under sidings or industry tracks this distance may be 4 ½ feet as approved by VPRA. On other portions of the right-of-way, where the pipe is not directly beneath any track, the depth from ground surface will be 4 feet or from bottom of ditch to top of pipe shall not be less than 3 feet.
2. Per AREMA 5.2.4.2a, uncased gas pipelines crossing under VPRA track(s) shall not be less than 10 feet from the base of rail to the top of the pipe at its closest point. At all locations where uncased gas pipelines cross the right-of-way, the minimum ground cover must be 6 feet. Where it is not possible to obtain the above depths, use of a casing pipe will be required.
3. Pipelines laid longitudinally on VPRA right-of-way, 50 feet or less from centerline track, but no closer than 25 feet, shall be buried not less than 6 feet from ground surface to top of pipe. Where the pipeline is laid more than 50 feet from centerline of track, the minimum cover shall be at least 5 feet.

2.4 Pipelines Within Limits of a Public Highway

1. Pipelines within the limits of a public highway, whether dedicated, conveyed, or acquired by condemnation or by prescription, are subject to all the requirements of this specification and must be designed and installed in accordance with them.
2. The limits of the public highway right-of-way must be clearly shown on the plans.

3. Construction cannot begin until an agreement has been executed between VPRA and the Owner and proper notification has been given to VPRA's designated representative. (see Section 1.7)
4. Pipelines shall maintain a minimum horizontal clearance of 15 feet, or if within 15 feet, a minimum vertical clearance of 15 feet from the base of any railroad signal apparatus.

2.5 Modification of Existing Facilities

1. Any replacement or modification of an existing carrier pipe and/or casing shall be considered a new installation, subject to the requirements of this specification.

2.6 Abandoned Facilities

1. The Owner of all pipe crossings and other occupancies to be abandoned shall notify VPRA in writing of the Owner's intent to abandon.
2. Abandoned pipelines shall be removed or completely filled with cement grout, compacted sand, or other methods as approved by VPRA.
3. Abandoned manholes and other structures shall be removed to a minimum distance of 2 feet below finished grade and completely filled with cement grout or compacted sand.

2.7 Conflict of Specifications

1. Where laws or orders of public authority prescribe a higher degree of protection than specified herein, then the higher degree so prescribed shall be deemed a part of this specification.

2.8 Insulation

1. Pipelines and casings shall be suitably insulated from underground conduits carrying electric wires on VPRA property.

2.9 Corrosion Protection and Petroleum Leak prevention

1. Pipelines on VPRA property that carry petroleum products or hazardous liquids shall be designed in accordance with current federal, state, and/or local regulations that mandate leak detection automatic shutoff, leak monitoring, and sacrificial anodes and/or exterior coatings to minimize corrosion and prevent petroleum releases.

3.0 SOIL INVESTIGATION

3.1 General

1. Test borings or other soil investigations shall be made to determine the nature of the underlying material for all crossings under tracks by pipes sixty inches (60") in diameter and larger. (See section 1.4 relative to procedures)
2. Test borings or other soil investigations may be required by VPRA when, in the judgement of VPRA, they are necessary to determine the adequacy of the design and construction of pipe crossings less than 60 inches in diameter and for other facilities located on the right-of-way.
3. The location of borings, types of borings, and means of access to boring locations shall be subject to VPRA approval.

3.2 Location

1. Borings shall be made on each side of the track(s), on the centerline of the pipe crossing, and as close to the track(s) as practicable. (See Section 1.4 relative to procedures)
2. Test boring logs shall be accompanied with a plan, drawn to scale, showing the location of the borings in relation to the track(s) and the proposed pipe.

3.3 Sampling

1. Test borings shall be conducted by a qualified firm using current methods approved by ASTM for soil sampling. Boring logs and soil data shall be accompanied by an analysis of the pertinent soil characteristics and their impact on the project as it relates to the railway by a certified Geologist or licensed Professional Engineer.

3.4 Boring Logs

1. Test boring logs shall clearly indicate all of the following:
 - a. Boring number as shown on the required boring location plan.
 - b. Ground elevation at each boring using same datum as the pipeline construction plans.
 - c. Engineering description of soils or rock encountered.
 - d. Depth and percent recovery of all soil samples.
 - e. Depth from surface for each change in strata.

- f. Blows for each 6 inches (152mm) of penetration for the standard penetration test described in ASTM D 1586. Blows for lesser penetrations should be recorded.
 - g. Percent recovery and Rock Quality Designation (RQD) for all rock cores.
 - h. Depth to ground water while sampling and when it has stabilized in the bore hole.
2. The location of the carrier pipe and/or casing pipe shall be superimposed on the boring logs before submission to VPRA.
3. All borings shall be sealed, for their full depth, with a 4-3-1 bentonite-cement-sand grout after accurate ground water readings have been taken and recorded.
4. Soil samples taken from auger vanes or return washwater are not acceptable.

3.5 Additional Information

1. When directed by VPRA, additional borings may be required for the purpose of taking undisturbed thin-wall piston samples or Dennison type samples for laboratory testing to determine the index and engineering properties of certain soil strata.

4.0 DESIGN REQUIREMENTS

4.1 Design Loads

4.1.1 GENERAL REQUIREMENTS

1. All pipes, manholes, and other facilities shall be designed for the external and internal loads to which they will be subjected.
2. To allow for placement of additional track(s) or shifting of the existing track(s), all proposed pipelines or structures shall be designed as if a railroad loading is directly above the facility.

4.1.2 EARTH LOAD

1. The dead load of the earth shall be considered as 120 pounds per cubic foot (18.9 kN/m³) unless soil conditions warrant the use of a higher value.

4.1.3 RAILROAD LOAD (LIVE LOAD IMPACT)

1. The railroad live load used shall be a Cooper E-80 loading. This loading consists of 80-kip (356 kN) axle loads spaced 5 feet (1.5m) on centers.
2. An impact factor of 1.75 (multiply live load by the impact factor) shall be used for depth of cover up to 5 feet (1.5m). Between 5 and 30 feet (1.5 and 9.1m), the impact factor is reduced by 0.03 per foot (0.1 per m) of depth. Below a depth of 30 feet (9.1m), the impact factor is one.
3. The values shown in Table 1 shall be used for the vertical pressure on a buried structure for the various heights of cover.

TABLE 1

Live loads, including impact, for various heights of cover for a Cooper E-80 loading.

Height of Cover	Load
Feet	lb/sq ft
2	3800
3	3150
4	2850
5	2550
6	2250
7	1950
8	1700
9	1500
10	1300
12	1000
14	800
16	625
18	500
20	400
25	250
30	150

- a. To determine the horizontal pressure caused by the railroad loading on a sheet pile wall or other structure adjacent to the track, the Boussinesq analysis shall be used. The load on the track shall be taken as a strip load with a width equal to the length of the ties, 8 ½ feet (2.6m). The vertical surcharge, q (psf), caused by each axle, shall be uniform and equal to the axle load divided by the tie length and the axle spacing, 5 feet (1.5m). For the E-80 loading results in:

$$Q = 80,000 / (8.5 \times 5) = 1882 \text{ psf} \quad (q = 356 / (2.591 \times 1.524) = 90.1 \text{ kPa})$$

The horizontal pressure due the live load surcharge at any point on the wall or other structure is p_h and can be calculated by the following:

$$p_h = (2q/\pi) (\beta - \sin \beta (\cos 2\alpha)) \quad (\text{See PLATE IX})$$

- b. The vertical and horizontal pressures given above shall be used unless an alternate design method is approved by VPRA. Proposals to use an alternate design method must include acceptable references and a statement explaining the justification for choosing the alternate method.

4.2 Design Assumptions

1. To design a casing pipe or an uncased carrier pipe for the external loads on VPRA's right-of-way, the following design assumptions shall be used, unless site conditions indicate more conservative values are required:

2. Flexible Pipe (Steel, DIP, CMP, Tunnel Liner Plate)

a. Steel Pipe (Bored and jacked in place)

Spangler's Iowa formula shall be used for design with:

- i. Deflection lag factor, $D_r = 1.5$
- ii. Modulus of soil reaction, $E' = 1080$ psi (7.45 MPa)
- iii. Bedding constant, $K_b = 0.096$
- iv. Soil loading constant, $K_u' = 0.13$
- v. Allowable deflection of pipe, 3% of pipe diameter

b. Ductile Iron Pipe (Open Cut)

ANSI Specification A 21.50 shall be used for design with:

- i. Pipe laying condition = type 3 (see Sec. 5.1.2 for backfill requirements on railroad right-of-way)
- ii. Earth load – ANSI A 51.50 prism method

c. Corrugated Steel Pipe & Corrugated Structural Steel Plate Pipe (Open Cut)

AREMA Chapter 1, Part 4, Sections 4.9 & 4.10 shall be used for design with:

- i. Soil stiffness factor, $K = 0.33$
- ii. Railroad impact as per Section 4.1.3 of this specification

d. Tunnel Liner Plate (Tunneled)

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- i. Soil stiffness factor, $K = 0.33$
- ii. Railroad impact as per Section 4.1.3 of this specification.

4.3 Casing Pipe

4.3.1 GENERAL REQUIREMENTS

1. Casing pipe shall be so constructed as to prevent leakage of any substance from the casing throughout its length, except at ends of casing where ends are left open, or through vent pipes when ends of casing are sealed. Casing shall be so installed as to prevent the formation of a waterway under the railroad, and with an even bearing throughout its length, and shall slope to one end (except for longitudinal occupancy).
2. The casing pipe and joints shall be of steel and of leakproof construction when the pipeline is carrying liquid flammable products or highly volatile substances under pressure.
3. The inside diameter of the casing pipe shall be such as to allow the carrier pipe to be removed subsequently without disturbing the casing or the roadbed. For steel pipe casings, the inside diameter of the casing pipe shall be at least 2 inches greater than the largest outside diameter of the carrier pipe joints or couplings, for carrier pipe less than 6

inches in diameter and at least 4 inches greater for carrier pipe 6 inches and over in diameter.

4. A maximum vertical deflection of the casing pipe of 3 percent of its diameter, plus ½ inch clearance shall be provided so that no loads from the roadbed, track, traffic, or casing pipe itself are transmitted to the carrier pipe. When insulators are used on the carrier pipe, the inside diameter of the flexible casing pipe shall be at least 2 inches greater than the outside diameter of the carrier pipe for pipe less than 8 inches in diameter and at least 3 ¼ inches greater for pipe 8 inches to 16 inches, inclusive, in diameter and at least 4 ½ inches greater for pipe 18 inches and over in diameter.
5. The casing pipe diameter shall not be larger than is necessary to permit the insertion of the carrier pipe.
6. Casing pipe under railroad tracks and across VPRA's right-of-way shall extend the greater of the following distances, measured at right angle to centerline of track:
 - a. Across the entire width of the VPRA right-of-way.
 - b. 3 feet beyond ditch line.
 - c. 2 feet beyond toe of slope.
 - d. A minimum distance of 30 feet from each side of centerline of outside track when casing is sealed at both ends.
 - e. A minimum distance of 45 feet from centerline of outside track when casing is open at both ends.
 - f. Beyond theoretical railroad embankment line. This line begins at a point, on existing grade, 14 feet horizontally from centerline track, and extends downward on a 2 (H) to 1 (V) slope. (See Plate III) The 14 feet is measured from 19 inches below the base of the rail.
7. If additional tracks are constructed in the future, the casing shall be relocated to meet the above requirements at the Owner's expense.

4.3.2 STEEL PIPE

1. Steel pipe may be installed by open cut, boring, or jacking.
2. Steel pipe shall have a specified minimum yield strength, SMYS, of at least 35,000 psi (241 MPa). The ASTM or API specification and grade for the pipe are to be shown on the Pipe Data Sheet (see Plate I).
3. Joints between the sections of pipe shall be fully welded around the complete circumference of the pipe.

4. In situations where the Applicant can demonstrate a situational need, interlocked joints (commonly known as "Permalok" joints) may be considered in place of fully welded joints. Submissions shall include an engineering analysis of the suitability of the proposed interlocked joint for railroad loading and jacking stresses in the given soil.
5. Steel casing pipe, with a minimum cover of 5 ½ feet., shall have a minimum wall thickness as shown in Table 2, unless computations indicate that a thicker wall is required.

TABLE 2

Live loads, including impact, for various heights of cover for a Cooper E-80 loading.

Pipe Diameter	Cathodically Protected	Uncoated and Unprotected
Nominal Pipe Size	Nominal Wall Thickness	Nominal Wall Thickness
Inches	Inches	Inches
10 and under	0.188	0.188
12 & 14	0.188	0.250
16	0.219	0.281
18	0.250	0.312
20 & 22	0.281	0.344
24	0.312	0.375
26	0.344	0.406
28	0.375	0.438
30	0.406	0.469
32	0.438	0.500
34 & 36	0.469	0.532
38	0.500	0.562
40	0.531	0.594
42	0.562	0.625
44 & 46	0.594	0.657
48	0.625	0.688
50	0.656	0.719
52	0.688	0.750
54	0.719	0.781
56 & 58	0.750	0.812
60	0.781	0.844
62	0.812	0.875
64	0.844	0.906
66 & 68	0.875	0.938
70	0.906	0.969
72	0.938	1.000

- a. Coated steel pipe that is bored or jacked into place shall conform to the wall thickness requirements for uncoated steel pipe since the coating may be damaged during installation.
6. Smooth wall steel pipes with a nominal diameter over 72 inches will not be permitted.

4.3.3 CORRUGATED STEEL PIPE AND CORRUGATED STRUCTURAL STEEL PLATE PIPE

1. Corrugated steel pipe and corrugated structural steel plate pipe may be used for a casing only when placed by the open cut method. Jacking or boring through the railroad embankment is not permitted.
2. Corrugated steel pipe and corrugated structural steel plate pipe may be used for a casing provided the pressure in the carrier pipe is less than 100 psi.
3. Pipe shall be bituminous coated and shall conform to the current *AREMA Manual for Railway Engineering* Chapter 1, Part 4.
4. Corrugated steel pipe shall have a minimum sheet thickness as shown in Table 3. Corrugated structural steel plate pipe shall have a minimum plate thickness of 8 gauge, 0.168 inches. If computations indicate that a greater thickness is required, the thicker sheet or plate shall be used.

TABLE 3

Pipe Diameter		Sheet Thickness
Inches	Gauge	Inches
12 to 30	14	0.079
36	12	0.109
42 to 54	10	0.138
60 to 120	8	0.168

4.3.4 STEEL TUNNEL LINER PLATES

1. Liner plates shall be installed by the tunneling method as detailed in Section 5.1.5 of this specification.
2. Tunnel liner plates shall be galvanized and bituminous coated and shall conform to current *AREMA Specifications* Chapter 1, Part 4, Section 4. If the tunnel liner plates are used only to maintain a tunneled opening until the carrier pipe is installed, and the annular space between the carrier pipe and the tunnel liner is completely filled with cement grout within a reasonably short time after completion of the tunnel, then the tunnel liner plates need not be galvanized and coated.
3. Tunnel liner plates are to be a minimum of 12 gauge and shall be fabricated from structural quality, hot-rolled, carbon-steel sheets or plates conforming to ASTM Specification A 569.
4. The following liner plate information must be shown on the Pipe Data Sheet (Plate I):
 - a. Number of flanges (2 or 4).
 - b. Width of plate.
 - c. Type of plate (smooth or corrugated).

4.3.5 CONCRETE ENCASEMENT

1. At locations where the installation is by open cut and a casing pipe is required but cannot be installed due to elbows or other obstructions, concrete encasement may be used when approved by VPRA.
2. The concrete encasement must provide a minimum cover of 6 inches of concrete (152 mm) around the pipe. A 6 x 6 – W 2.9 x W 2.9 (152 x 152 MW 18.7 x MW 18.7) welded wire fabric shall be placed in the concrete on all sides.

4.4 Carrier Pipe

4.4.1 GENERAL REQUIREMENTS

1. The pipe shall be laid with sufficient slack so that it is not in tension.
2. Steel pipe shall not be used to convey sewage, storm water or other liquids which could cause corrosion.
3. Carrier pipes which are not encased and are located on VPRA's right-of-way or under tracks which VPRA operates, shall be manufactured in accordance with the following specifications:
 - a. Steel Pipe – The ASTM or API specification and grade for the pipe is shown on the Pipe Data Sheet (see Plate I). The specified minimum yield strength is to be at least 35,000 psi (241 MPa). For flammable substances, see Sections 4.4.2 and 4.4.3 for additional requirements.
 - b. Ductile Iron Pipe – ANSI A21.51/AWWA C151.
 - c. Corrugated Metal Pipe – AREMA Chapter 1, Part 4.
4. Carrier pipes installed within a casing pipe shall be designed for the internal pressure to which it will be subjected.
5. Gravity flow carrier pipes, when installed without a casing pipe, shall meet the requirements of the particular pipe material as given in Section 4.3 of this specification.

4.4.2 PIPELINES CARRYING FLAMMABLE SUBSTANCES

1. Pipelines carrying oil, liquefied petroleum gas and other flammable liquid products shall be of steel and conform to the requirements of the current ANSI B 31.4 Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols, and other applicable ANSI codes, except that the maximum allowable stresses for design of steel pipe shall not exceed the following percentages of the specified minimum yield strength (multiplied by the longitudinal joint factor) of the pipe as defined in the above codes:

- a. The following percentages apply to hoop stress in steel pipe within a casing under railroad tracks, across railroad right-of-way and longitudinally on railroad right-of-way:
 - i. Seventy-two percent on oil pipelines.
 - ii. Fifty percent for pipelines carrying condensate, natural gasoline, natural gas liquids, liquefied petroleum gas, and other liquid petroleum products.
 - iii. Sixty percent for installations on gas pipelines.
 - b. The following percentages apply to hoop stress in steel pipe laid longitudinally on railroad right-of-way without a casing:
 - i. Sixty percent for oil pipelines.
 - ii. Forty percent for pipelines carrying condensate, natural gasoline, natural gas liquids, liquefied petroleum gas, and other liquid petroleum products.
 - iii. For gas pipelines see Section 4.4.3.1.
2. Computations, based on the above requirements and stamped by a Professional Engineer, shall be submitted with the application for occupancy permit.

4.4.3 UNCASED PIPELINES CARRYING GAS

1. Pipelines carrying flammable and nonflammable gas products shall be steel and shall conform to the requirements of the current ANSI B 31.8 Gas Transmission and Distribution Piping Systems, and other applicable ANSI codes.
2. The minimum wall thickness for uncased carrier pipe shall be in accordance with the values provided in AREMA 5.2.3.
3. A durable coating, which will resist abrasion (fusion bonded epoxy or other suitable material), shall be used to protect the uncased pipeline when the boring method of installation is used.
4. If VPRA determines there is the potential for damage to the uncased pipeline (foreign material in the subgrade, third party damage, etc.), special protection of the pipeline will be required. Special protection may include the use of a protection slab over the pipeline, increased depth of bury, or other means.

4.5 Casing Pipe End Seals

1. Casings for carrier pipes of flammable and hazardous substances shall be suitably sealed to the outside of the carrier pipe. Details of the end seals shall be shown on the plans.
2. Casings for carrier pipes of non-flammable substances shall have both ends of the casing blocked up in such a way as to prevent the entrance of foreign material but allow leakage to pass in the event of a carrier break.

3. The ends of a casing pipe may be left open when the ends are at or above ground surface and above high-water level, provided drainage is provided in such a manner that leakage will be conducted away from railroad tracks and structures.

4.6 Vents

1. Sealed casings for flammable substances shall be properly vented. Vent pipes shall be of sufficient diameter, but in no case less than two inches in diameter. Vent pipes shall be attached near each end of the casing and project through the ground surface not less than 45 feet, measured at right angles from the centerline of the nearest track. If the right-of-way line is less than 45 feet, measured at right angles from the centerline of the nearest track, then the vent pipes shall project through the surface at the right-of-way line.
2. Vent pipes shall extend not less than 4 feet above the ground surface. Top of vent pipe shall have a down-turned elbow, properly screened, or a relief valve. Vents in locations subject to high water shall be extended above the maximum elevation of high water and shall be supported and protected in a manner approved by VPRA.
3. Vent pipes shall be at least 4 feet, vertically, from aerial electric wires or greater if required by national Electrical Safety Code (ANSI C2).
4. When the pipeline is in a public highway, street-type vents shall be installed.

4.7 Signs

1. All pipelines (except those in streets where it would not be practical to do so) shall be prominently marked at right-of-way lines (on both sides of track for crossings) by durable, weatherproof signs located over the centerline of the pipe. Signs shall show the following:
 - a. Name and address of Owner
 - b. Contents of pipe
 - c. Pressure in pipe
 - d. Pipe depth below grade at point of a sign
 - e. Emergency telephone number in event of pipe rupture
2. For pipelines running longitudinally on VPRA property, signs shall be placed over the pipe (or offset and appropriately marked) at all changes in direction of the pipeline. Such signs should also be located so that when standing at one sign, the next adjacent marker in either direction is visible. In no event shall they be placed more than 500 feet apart unless otherwise specified by VPRA.
3. The Owner must maintain all signs on VPRA right-of-way as long as the occupational agreement is in effect.

4.8 Warning Tape

1. All pressure pipelines installed on VPRA right-of-way by open cut shall have warning tape placed 2-feet directly above it.

4.9 Shut-off Valves

1. Accessible emergency shut off valves shall be installed within effective distances for each side of the railroad at locations selected by VPRA and the pipeline company where hazard to life and property must be guarded against. No additional valves will be required where pipelines are provided with automatic control stations located within distances approved by VPRA.

4.10 Cathodic Protection

1. Cathodic protection shall be applied to all pipelines carrying flammable substances on VPRA's right-of-way.
2. For crossings and at other locations where the pipeline must be placed within a casing, the casing is to have cathodic protection, or the wall thickness is to be increased to the requirements of Section 4.3.2, Table 2.
3. Uncased gas carrier pipes must be coated and cathodically protected to industry standards and test sites, for monitoring the pipeline, provided within 50 feet of the crossing.
4. Where casing and/or carrier pipes are cathodically protected by other than anodes, VPRA shall be notified and a suitable test made to ensure that other railroad structures and facilities are adequately protected from the cathodic current in accordance with the recommendation of current Reports of Correlating committee on Cathodic Protection, published by the National Association of Corrosion Engineers.
5. Where sacrificial anodes are used, the locations shall be marked with durable signs.

4.11 Manholes

1. Manholes shall not be located on VPRA property where possible. At locations where this is not practical, including longitudinal occupancies, manholes shall be precast concrete sections conforming to ASTM Designation C 478, "Specification for Precast Concrete Manhole Sections."
2. The top of manholes located on VPRA property shall be flush with the top of ground and shall not be located with service or access roads.
3. The distance from centerline of adjacent track to centerline of proposed manhole shall be shown on the plans.

4.12 Box Culverts

1. Reinforced concrete box culverts shall conform to the requirements of *AREMA Volume 2, Chapter 8, Part 16*.

4.13 Drainage

1. Occupancies shall be designed, and their construction shall be accomplished, so that adequate and uninterrupted drainage of VPRA right-of-way is maintained.
2. All pipes, ditches, spillways, overflows, and other structures carrying surface drainage on or to VPRA property and/or under VPRA track(s) shall be designed to carry the run-off from a one hundred (100) year storm. Computations indicating this design, prepared by a Professional Engineer, and suitable topographic plans, outlining the total drainage area, shall be submitted.
3. If the drainage is to discharge into an existing drainage channel on VPRA's right-of-way and/or through a drainage structure under VPRA track(s), the computations must include the hydraulic analysis of any existing ditch and/or structure.
4. When calculating the capacity of existing or proposed drainage structures under VPRA track(s), the head at the headwater entrance of the structure shall be 2 feet below base of rail, or the head to a depth of 1.5 times the culvert diameter/rise, whichever is less.
5. Pipe(s) used to carry surface drainage on VPRA right-of-way shall have a minimum diameter of 36 inches.
6. Detention ponds must not be placed on any part of VPRA's right-of-way. Also, the railroad embankment must not be used as any part of a detention pond structure.
7. Formal approval of the proposed design, by the appropriate governmental agency having jurisdiction, shall be submitted with the drainage computations.

4.14 Pipelines on Bridges

1. Pipelines of any type shall not be installed on any bridge carrying VPRA tracks.
2. New overhead pipe bridges shall not be constructed over VPRA's right-of-way where underground installation of the pipeline is possible. Where the Applicant can show that no practicable alternative is available, this type of structure will be permitted provided the following conditions are met:
 - a. The vertical clearance distance, from top of rail to bottom of structure, is shown and is a minimum of 23 feet, measured at a point 6 feet horizontally from centerline track.

- b. The support bents for the overhead structure are located off of VPRA's right-of-way or a minimum clear distance of 18 feet from centerline track, whichever distance is greater.
 - c. Support bents within 25 feet of centerline track have pier protection in accordance with AREMA requirements.
 - d. Complete structural plans and design computations for the structure and foundations, stamped by a Professional Engineer, are submitted with the application.
 - e. A fence (with barbed wire) or other measures are provided which will prevent access to the bridge by unauthorized personnel or vandals.
3. Pipelines carrying flammable substances or non-flammable substances, which by their nature might cause damage if escaping on or near railroad facilities or personnel, shall not be installed on bridges over VPRA tracks. In special cases when it can be demonstrated to VPRA's satisfaction that such an installation is necessary and that no practicable alternative is available, VPRA may permit the installation, but only by special design approved by VPRA.
4. When permitted, pipelines on bridges over VPRA tracks shall be so located as to minimize the possibility of damage from vehicles, railroad equipment, vandalism, and other external causes. Leak protection extending across the VPRA right-of-way shall be provided as directed by VPRA (see Plate VII).

5.0 CONSTRUCTION REQUIREMENTS

5.1.1 METHOD OF INSTALLATION

1. Bored, jacked, or tunneled installations shall have a bore hole essentially the same as the outside diameter of the pipe plus the thickness of the protective coating.
2. The use of water or other liquids to facilitate casing emplacement and spoil removal is prohibited except when used in conjunction with Directional Boring Method "A" (see section 5.1.6).
3. If during installation an obstruction is encountered which prevents installation of the pipe in accordance with this specification, the pipe shall be abandoned in place and immediately filled with grout. A new installation procedure and revised plans must be submitted to, and approved by, VPRA before work can resume.

5.1.2 OPEN CUT

1. The Owner must request open cut approval when making an application for occupancy.
2. Installations beneath miscellaneous, non-passenger track by open trench methods may be permitted in certain circumstances.
3. Installations by open cut will not be permitted under mainline tracks, tracks carrying heavy tonnage, or tracks carrying passenger trains. Also, open cut shall not be used within the limits of a highway/railroad grade crossing or its approaches, 25 feet of either side of traveled way, where possible.
4. At locations where open cut is permitted, the trench is to be backfilled with crushed stone with a top size of the aggregate to be a maximum of 2 inches and to have no more than 5 percent passing the number 200 sieve. The gradation of the material is to be such that a dense stable mass is produced.
5. The backfill material shall be placed in loose 6-inch lifts and compacted to at least 95 percent of its maximum density with a moisture content that is no more than 1 percent greater than or 2 percent less than the optimum moisture as determined in accordance with current ASTM Designation D – 1557 (Modified Proctor). When the backfill material is within 3 feet of the subgrade elevation (the interface of the ballast and the subsoil), a compaction of at least 98 percent will be required.
6. All backfilled pipes laid either perpendicular or parallel to the tracks must be designed so that the backfill material will be positively drained. This may require the placement of lateral drains on pipes laid longitudinally to the track and the installation of stub perforated pipes at the edge of the slopes.
7. Unless otherwise agreed upon, all work involving rail, ties, and other track material will be performed by employees of the operating railroad, at such times as are consistent with

railroad work schedules regarding the availability of said employees, and at the sole expense of the Owner.

5.1.3 BORE AND JACK (STEEL PIPE)

1. This method consists of pushing the pipe into the earth with a boring auger rotating within the pipe to remove the spoil.
2. The boring operation shall be progressed on a 24-hour basis without stoppage (except for adding lengths of pipe) until the leading edge of the pipe has reached the receiving pit.
3. The front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger from leading the pipe so that no unsupported excavation is ahead of the pipe.
4. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered. If the obstruction cannot be removed without excavation in advance of the pipe, procedures as outlined in Section 5.1.1 c. must be implemented immediately.
5. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than a ½ inch. If voids should develop or if the bored hole diameter is greater than the outside diameter of the pipe (plus coating) by more than approximately 1 inch, grouting (see Section 5.2) or other methods approved by VPRA, shall be employed to fill such voids.
6. The face of the cutting head shall be arranged to provide a reasonable obstruction to the free flow of soft or poor material.
7. Plans and description of the arrangement to be used shall be submitted to VPRA for approval and no work shall proceed until such approval is obtained.
8. Any method that employs simultaneous boring and jacking for pipes over 8 inches in diameter that does not have the above approved arrangement will not be permitted. For pipe 8 inches and less in diameter, augering or boring without this arrangement may be considered for use only as approved by VPRA.

5.1.4 JACKING (STEEL PIPE)

1. This method consists of pushing sections of pipe into position with jacks placed against a backstop and excavation performed by hand from within the jacking shield at the head of the pipe. Ordinarily 36-inch pipe is the least size that should be used, since it is not practical to work within smaller diameter pipes.
2. Jacking shall be in accordance with the current AREMA, Chapter 1, Part 4 "Jacking Culvert Pipe Through Fills." This operation shall be conducted without hand-mining ahead of the pipe and without the use of any type of boring, auguring, or drilling equipment.
3. Bracing and backstops shall be so designed, and jacks of sufficient rating used, so that the jacking can be progressed on a 24-hour basis without stoppage (except for adding lengths of pipe) until the leading edge of the pipe has reached the receiving pit.

4. Immediately upon completion of jacking operation, the installation shall be pressure grouted as per Section 5.2 of this specification.

5.1.5 TUNNELING (TUNNEL LINER PLATE)

1. This method consists of placing rings of liner plate within the tail section of a tunneling shield or tunneling machine. A tunneling shield shall be used for all liner plate installations unless otherwise approved by VPRA.
2. The shield shall be of steel construction, designed to support a railroad track loading as specified in Section 4.1.3 of this specification, in addition to the other loadings imposed. The advancing face shall be provided with a hood, extending no less than 20 inches beyond the face, and extending around no less than the upper 240 degrees of the total circumference. It shall be of sufficient length to permit the installation of at least one complete ring of liner plates within the shield before it is advanced for the installation of the next ring of liner plates. The shield shall conform to and not exceed the outside dimensions of the liner plate tunnel being placed by more than 1 inch at any point on the periphery, unless otherwise approved by VPRA.
3. The shield shall be adequately braced and provided with necessary appurtenances for completely bulkheading the face with horizontal breastboards and arranged so that the excavation can be benched as may be necessary. Excavation shall not be advanced beyond the edge of the hood, except in rock.
4. Manufacturer's shop detail plans and manufacturer's computations showing the ability of the tunnel liner plates to resist the jacking stresses shall be submitted to VPRA for approval.
5. Unless otherwise approved by VPRA, the tunneling shall be conducted continuously, on a 24-hour basis, until the tunnel liner extends at least beyond the theoretical railroad embankment line (see Plate III).
6. At any interruption of the tunneling operation, the heading shall be completely bulkheaded.
7. The liner plates shall have tapped grout holes for no smaller than 1 ½ inch pipe, spaced at approximately 3 feet around the circumference of the tunnel liner and 4 feet longitudinally.
8. Grouting behind the liner plates shall be in accordance with Section 5.2 of this specification.

5.1.6 DIRECTIONAL BORING/HORIZONTAL DIRECTIONAL DRILLING (STEEL PIPE)

Method "A"

1. This method consists of setting up specialized drilling equipment on existing grade (launching and receiving pits are not required) and boring a small diameter pilot hole on the desired vertical and horizontal alignment, using a mechanical cutting head with a high-pressure fluid (bentonite slurry) to remove the cuttings. The drill string is advanced with bentonite slurry pumped through the drill string to the cutting head and then forced back along the outside of the drill string, carrying the cuttings back to the surface for removal. When the cutting head reaches the far side of the crossing, it is removed and a reamer (with a diameter greater than the cutting head) is attached to the lead end of the drill string. The pipeline is attached to the reamer, and the pilot hole is then back reamed while the pipeline is pulled into place.
2. This method is used to place pipelines under rivers, wetlands, and other obstructions which would be difficult to cross by conventional methods. The length of the bore is generally several hundred feet in length, with installations over a thousand feet possible.
3. Consideration will be given where the depth of cover is greater than 10 feet below the base of the rail, or the bore is in rock. Factors considered will be track usage, pipe size, contents of pipeline, soil conditions, etc.
4. The following preliminary information must be submitted with the request for consideration of this type of installation:
 - a. A site plan of the area.
 - b. A plan view and profile of the crossing.
 - c. A Pipe Data Sheet.
 - d. Several soil borings located along the proposed pipeline route.
 - e. A construction procedure, including a general description of equipment to be used.

If VPRA determines this method of installation is acceptable, final design plans and specifications are to be prepared and submitted for approval.

5. The project specifications must require the contractor to submit a complete construction procedure of the proposed boring operation to VPRA for approval. Included with the submission shall be the manufacture's catalog information describing the type of equipment to be used.

Method "B"

1. This method is used to place small diameter conduit for electric lines and other utilities. This method consists of using hydraulic jacking equipment to push a solid steel rod under the railroad from a launching pit to a receiving pit. At the receiving pit, a cone shaped "expander" is attached to the end of the rod and the conduit (casing pipe) is attached to the expander. The rod, expander, and conduit are then pulled back from the launching pit until the full length of the conduit is in place.
2. This method may be used to place steel conduit (casing pipe), up to and including 6 inches (152 mm) in diameter, under the railroad.
3. The project specifications must require the contractor to submit a complete construction procedure of the proposed boring operation to VPRA for approval. Included with the submission shall be the manufacturer's catalog information describing the type of equipment to be used.

5.1.7 TUNNEL BORING MACHINES AND MICROTUNNELING

1. A tunnel boring machine (TBM), also known as a "mole," is a machine used to excavate tunnels with a circular cross section through a variety of soil and rock strata. May also be called Microtunneling for smaller tunnels.
2. Use of TBM will be considered for installations of pipelines at least 20 feet below base of rail.
3. Plans must indicate locations and depth of boring and receiving pits, and shoring details as required in Section 5.8 below.
4. The submission must include a detailed soil analysis and the details of the machine to be used, including the type of boring head, type of slurry to be used (if applicable), and type of guidance system.

5.1.8 SLIP-LINING

1. Slip-lining is the process of replacing an existing carrier pipe within an existing casing pipe.
2. The submission must demonstrate that the existing casing is constructed of a material described in section 4.3 of this specification, including appropriate wall thickness and joints.
3. The submission must demonstrate that the existing casing is of an adequate length to meet the requirements of section 4.3.1 of this Specification.
4. The submission must include documentation that clearly demonstrates that the casing has not deteriorated to a point where it no longer complies with items 2 and 3, above. If necessary, the Applicant may apply for a right-of-entry permit as outlined in Section 1.4 of this Specification in order to excavate the ends of the existing casing for a thorough inspection.

5.1.9 CURED IN PLACE PIPE (CIPP)

1. CIPP is a trenchless rehabilitation method used to repair existing pipelines from existing access points.
2. CIPP will be considered for rehabilitation of existing non-pressurized sewer and storm drains only.
3. Submission must include details of proposed access to existing pipe on either side of the railroad right-of-way and a detailed assessment and analysis of the condition of the existing pipe.
4. Submission must include details of the proposed pipe bypass system to be used during construction.
5. The submission must include documentation that clearly demonstrates that the casing has not deteriorated to a point where it no longer complies with items 2 and 3 of Section 5.1.8. If necessary, the Applicant may apply for a right-of-entry permit as outlined in Section 1.4 of this Specification in order to excavate the ends of the existing casing for a thorough inspection.

5.1.10 PIPE BURSTING AND PIPE RAMMING

1. Pipe Bursting is a trenchless method of replacing buried pipelines such as sewer, water, or natural gas pipes without the need for a traditional trenching by expanding the diameter of the current pipe to receive a new pipe.
2. Pipe Ramming uses pneumatic percussive blows to drive the pipe through the ground without the use of an auger.
3. Neither Pipe Bursting nor Pipe Ramming will be considered for installations beneath railroad track. Both methods may be considered at VPRA's discretion if the installation will not come closer than 25-feet to the centerline of any railroad track or closer than 50-feet to any other railroad structure.

5.2 Grouting

1. For jacked and tunneled installations, a uniform mixture of 1:6 (cement to sand) cement grout shall be placed under pressure through the grout holes to fill any voids which exist between the pipe or liner plate and the undisturbed earth.
2. Grouting shall start at the lowest hole in each grout panel and proceed upwards simultaneously on both sides of the pipe.
3. A threaded plug shall be installed in each grout hole as the grouting is completed at that hole.
4. When grouting tunnel liner plates, grouting shall be kept as close to the heading as possible, using grout stops behind the liner plates if necessary. Grouting shall proceed as

directed by VPRA, but in no event shall more than 6 lineal feet (1.8 m) of tunnel be progressed beyond the grouting.

5.3 Soil Stabilization

1. Pressure grouting of the soils or freezing of the soils before jacking, boring, or tunneling may be required at the direction of VPRA to stabilize the soils, control water, prevent loss of material, and prevent settlement or displacement of embankment. Grout shall be cement, chemical, or other special injection material selected to accomplish the necessary stabilization.
2. The materials to be used and the method of injection shall be prepared by a Registered Professional Soils Engineer or by an experienced and qualified company specializing in this soil stabilization work and submitted for approval to VPRA before the start of work. Proof of experience and competency shall accompany the submission.

5.4 Dewatering

1. When water is known or expected to be encountered, pumps of sufficient capacity to handle the flow shall be maintained at the site, provided the contractor has received approval from VPRA to operate them. Pumps in operation shall be constantly attended on a 24-hour basis until, in the sole judgment of VPRA, the operation can be safely halted. When dewatering, close observation shall be maintained to detect any settlement or displacement of railroad embankment, tracks, and facilities.

5.5 Safety Requirements

1. All operations shall be conducted so as not to interfere with, interrupt, or endanger the operation of trains nor damage, destroy, or endanger the integrity of railroad facilities. All work on or near VPRA property shall be conducted in accordance with VPRA safety rules and regulations. The contractor shall understand and comply with the VPRA safety rules and shall give written acknowledgment to VPRA that they have been received, read, and understood by the contractor and its employees. Operations will be subject to VPRA inspection at any and all times.
2. All cranes, lifts, or other equipment that will be operated in the vicinity of the railroad's electrification and power transmission facilities shall be electrically grounded as directed by VPRA.
3. At all times when the work is being progressed, a field supervisor for the work with no less than twelve (12) months' experience in the operation of the equipment being used shall be present. If boring equipment or similar machines are being used, the machine operator also shall have no less than twelve (12) months' experience in the operation of the equipment being used.
4. Whenever equipment or personnel are working closer than 25 feet from the centerline of an adjacent track, that track shall be considered as being obstructed. Insofar as possible, all operations shall be conducted no less than this distance from the centerline of any track.

Operations closer than 25 feet (4.6) from the centerline of a track shall be conducted only with the permission of, and as directed by, a duly qualified VPRA employee, or employee of the operating railroad present at the site of the work.

5. Crossing of tracks at grade by equipment and personnel is prohibited except by prior arrangement with, and as directed by, VPRA.

5.6 Blasting

1. Blasting will not be permitted.

5.7 Protection of Drainage Facilities

1. If, in the course of construction, it is necessary to block a ditch, pipe, or other drainage facility, then temporary pipes, ditches, or other drainage facilities shall be installed to maintain adequate drainage, as approved by VPRA. Upon completion of the work, the temporary facilities shall be removed, and the permanent facilities restored.

2. Soil erosion methods shall be used to protect railroad ditches and other drainage facilities during construction on and adjacent to VPRA right-of-way.

5.8 Support of Excavation Adjacent to Track

5.8.1 LAUNCHING AND RECEIVING PITS

1. The location and dimensions of all pits or excavations shall be shown on the plans. The distance from centerline of adjacent track to face of pit or excavation shall be clearly labeled. Also, the elevation of the bottom of the pit or excavation must be shown on the profile.

2. The face of all pits shall be located a minimum of 25 feet from centerline of adjacent track, measured at right angles to track, unless otherwise approved by VPRA.

3. The limits and type of required excavation support shall comply with Plate VIII – Railway Shoring Requirements.

4. All plans and calculations for shoring shall be prepared, signed, and sealed by a registered Professional Engineer licensed in the state of the project. The Engineer will be responsible for the accuracy for all controlling dimensions as well as the selection of soil design values which will accurately reflect the actual field conditions.

5. The plans shall contain details of the shoring system showing sizes of all structural members, details of connection, and embedment depth. The plans shall include a plan view showing all the proposed excavations and distances from centerline of track to face of excavation. Plans shall show a section normal to the track showing the shoring location relative to the centerline of track and showing the height of sheeting and track elevation in relation to the bottom of excavation. The plans must be complete and accurately describe the nature of the work.

6. Shoring location in Zone 2 as shown on Plate VIII – Shoring Requirements shall be designed using interlocking sheeting. Soldier piles and lagging will be considered only when its use is specifically approved by VPRA. Consideration for the use of soldier piles and lagging will only be made if the required penetration of steel sheet piling cannot be obtained and when dry, stable material will be encountered.
7. All excavations with the limits shown on Plate VIII – Shoring Requirements shall be designed for railroad live load surcharge. All shoring designed for railroad live load surcharge shall be based on Cooper's E-80 live load. AREMA Chapter 8, Part 20, Section 3, Paragraph 2(b), refers to the Boussinesq equation as a method to determine lateral pressure values for railroad surcharge loading. Plate IX – Shoring Design Guide – Lateral Pressures from Train Loads indicates the lateral pressures associated with various depths of excavation and distances from centerline of track as determine by the Boussinesq equation.
8. Calculations for the proposed shoring shall include deflection calculations. The maximum deflection for excavations within 18'-0" of the centerline of the nearest tack shall be $\frac{3}{8}$ inches. For all other cases, the maximum deflections shall not exceed $\frac{1}{2}$ inch.
9. Railings shall be constructed around all excavations on VPRA property. Walkways with railings shall be constructed over open excavations adjacent to the tracks located within the normal walkway. Refer to AREMA Section 15 for walkway and railing design criteria. Railings shall not be closer than 10'-0" horizontally from centerline of track. Railing shall be indicated on plans submitted for VPRA acceptance.
10. Approval of the excavation plan does not relieve the Owner of ultimate responsibility and liability for the excavation plan.
11. If the excavation pit design and shoring system will be created on behalf of the Owner's contractor, the Owner's contract specifications must require the Owner's contractor to obtain VPRA approval prior to beginning any excavation.

5.8.2 PARALLEL TRENCHING AND OTHER EXCAVATION

1. Plate VIII – Shoring Requirements shall govern the limits and type of excavation support.
2. The design and construction requirements for this construction shall be in accordance with the requirements of Section 5.8.1.

5.9 Inspection and Testing

1. For pipelines carrying flammable or hazardous materials, ANSI Codes, current at time of constructing the pipeline, shall govern the inspection and testing of the facility on VPRA property, except as follows:
 - a. One hundred percent of all field welds shall be inspected by radiographic examinations, and such field welds shall be inspected for 100 percent of the circumference.

- b. The proof testing of the strength of carrier pipe shall be in accordance with ANSI requirements.

5.10 Reimbursement of VPRA Costs

1. All VPRA costs associated with the pipe installation (inspection, flagging, track work, protection of signal cables, etc.) shall be reimbursed to VPRA by the Owner. Failure to make such payment within thirty (30) days of demand therefore may lead to revocation of occupancy permit.

PUBLICATION STANDARDS SOURCES

- ANSI American National Standards Institute, Inc.
1899 L Street, NW, 11th Floor
Washington, DC 20036
Tel: 202.293.8020
- AREMA American Railway Engineering Maintenance-of-Way Association
4501 Forbes Blvd., Suite 130
Lanham, MD 20706
Tel: 301.459.3200
- ASTM American Society for Testing and Materials
100 Barr Harbor Drive, PO Box C700
West Conshohocken, PA 19428
Tel: 610.832.9500
- AWWA American Water Works Association, Inc.
6666 West Quincy Avenue
Denver, CO 80235
Tel: 303.794.7711 or 800.926.7337
- NACE National Association of Corrosion Engineers
15835 Park Ten Place
Houston, TX 77084
Tel: 281.228.6200

NOTE: If other than ANSI, AREMA, ASTM, AWWA or NACE specifications are referred to for design, materials, or workmanship on the plans and specifications for the work, then copies of the applicable sections of such other specifications referred to shall accompany the plans and specifications for the work.