

SPECIFICATIONS
FOR
PIPELINE OCCUPANCY
OF
SEDA-COG JOINT RAIL AUTHORITY PROPERTY



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1.0 GENERAL

1.1 Scope

a. This specification shall apply to the design and construction of pipelines carrying flammable or non-flammable substances and casings containing wires and cables across and along JRA property and facilities. This specification shall also apply to tracks owned by others (siding, industry tracks, etc.) over which JRA operates its equipment.

b. It is to be clearly understood that JRA owns its right-of-way for the primary purpose of operating a railroad. 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 the railroad will have unrestricted use of its property for current and future operations. The JRA contracts with a private railroad operating compANy, which operates the freight over JRA tracks. Any utility requesting a railroad occupation shall be required to cooperate with the JRA's operating company as well.

1.2 Definitions

- a. JRA - SEDA-COG Joint Rail Authority
- b. Consulting Engineer - JRA's Consulting Engineer - Design and Construction or JRA's designated representative
- c. Property Manager - JRA's property management staff
- d. Owner (Applicant) - Individual, corporation or municipality desiring occupancy of JRA property. Entity which will be responsible for maintenance of said occupation.
- e. Professional Engineer - Engineer licensed in the state where the facilities are to be constructed.
- f. Carrier Pipe - Pipe used to transport the product.

- g. Casing Pipe - Pipe through which the carrier pipe is installed.
- h. Operating Railroad - JRA's contract operating company moving freight across their tracks.

1.3 Publication Standards

PUBLICATION STANDARDS SOURCES

ANSI American National Standards institute, Inc.
1430 Broadway
New York, NY 10018

AREA American Railway Engineering Association
50 F Street, N.W.
Washington, DC 20001

ASTM American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

AWWA American Water Works Association, Inc.
6666 West Quincy Avenue
Denver, CO 80235

The National Association of Corrosion
Engineers Houston, TX 77026

NOTE: If other than AREA, ASTM or AWWA specification 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.

1.4 Application For Occupancy

a. Individuals, corporations or municipalities desiring occupancy of JRA property by pipeline occupations must agree, upon approval of the engineering and construction details by the Consulting Engineer, to execute an appropriate occupational agreement and pay any required fees and/or rentals specified therein.

b. The application for an occupancy shall be by letter addressed to the Property Manager - SEDA-COG Joint Rail Authority, RR 1 BOX 372, Lewisburg, PA 17837, giving the following:

- (1) Full name of Owner.
- (2) Complete mailing address of the applicant.
- (3) Name and title of person who will sign the agreement.
- (4) The State in which the applicant is incorporated.

c. All applications shall be accompanied with six (6) copies of all design and construction plans and three (3) copies of all specifications and engineering computations for the proposed occupancy. On extensive projects, only those plans involving work on or affecting JRA property and operations shall be submitted. Included shall be a plan showing the extreme of the total project upon which that portion of the work affecting JRA is clearly defined.

d. All of the above plans, specifications and computations must be prepared by and bear the seal of a Professional Engineer.

1.5 Right of Entry

a. No entry upon JRA property for the purpose of conducting surveys, 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 prepared by the Property Manager. The applicant must pay the associated fees and execute the entry permit.

b. It is to be clearly understood that the issuance of an entry permit does not constitute authority to proceed with any construction. Construction can not begin until JRA executes a formal agreement and the Owner receives permission, from the operating Railroad to proceed with the work.

1.6 Site Inspection

a. For longitudinal occupancy of JRA property a site inspection along the proposed pipeline route may be required before final design plans are prepared. When a site inspection is required, the applicant and/or his engineer must meet with representatives of the JRA and operating railroad to view the entire length of the proposed occupancy.

b. Prior to the site inspection the applicant must submit the following information:

- (1) A plan view of the proposed route showing all tracks, both JRA 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.
- (2) A complete "Pipe Data Sheet" (See Plate I)
- (3) Typical cross sections along the proposed route. (See Plate V)

c. Site inspections for pipe crossings are not required unless, in the opinion of the Property Manager, the size and location of the facility warrant an inspection.

1.7 Information Required for Submission

1.7.1 Plans and Computations

a. Plans for proposed pipeline occupancies shall be submitted to and approved by the Property Manager and/or Consulting Engineer, prior to JRA's issuance of an agreement and start of construction.

b. Plans are to be prepared in sizes as small as practical and shall be folded, individually, by the applicant to an 8 ½ inch by 11 inch size, as shown on

Plate X, prior to submission. Where more than one plan is involved, the folded plans shall be assembled into complete sets by the applicant before submission. Failure of the applicant to comply with these requirements may be sufficient cause for rejection of the application.

c. Plans shall be drawn to scaled and shall include the following (See Plated I to VII):

- (1) Plan view of proposed pipeline in relation to all JRA facilities and facilities immediately adjacent to JRA including, but not limited to, tracks, building, signals, pole lines, other utilities and all other facilities that may affect or influence the pipeline design and construction. (See Plate II)
- (2) The location (in feet) of the pipe from the nearest JRA Milepost and/or from the centerline of a JRA bridge, giving the JRA bridge number.
- (3) In all cases, the name of the State and County in which the proposed facilities are located must be shown. In States where Townships, Ranges and Sections are used, show the distance in feet to the nearest Section line and identify the Section number, Township and Range.
- (4) 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 profile of the adjacent track, or tracks, shall be shown. (See Plate IV)

- (5) All JRA property lines indicated by dimensions, in feet, to the centerline of adjacent track as well as the overall width of the JRA right-of-way.

If the pipeline is in a public highway, the limits of the dedicated highway right-of-way, as well the limits of any paving, sidewalks etc.,

shall be defined, by dimensions in feet, from the centerline of the dedicated right-of-way.

- (6) The angle of the crossing in relation to the centerline of the track(s).
- (7) On pipelines having valves, the distance in feet along the pipeline from the crossing to the nearest valves and/or control stations.
- (8) A separate "Pipe Data Sheet" (See Plate I) shall be submitted on 8 ½ inch by 11 inch sheet size for each crossing.

d. The plan shall be specific, on JRA property and under tracks that are not on JRA property, as to:

- (1) The method of installation. (See Section 5.1)
- (2) The size and material of the casing pipe.
- (3) The size and material of the carrier pipe.

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

e. Once the application has been approved by the Property Manager, 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 JRA of additional fees for the re-processing of the application.

f. All plans and computations associated with the work under the agreement shall be prepared by, and bear the seal of, a Professional Engineer. If not so imprinted, the application will be given no further consideration. This requirement also applies to all data submitted by the Owner's contractor. Contractor's plans and computations which are not stamped will be returned and construction will not be permitted to proceed.

1.7.2 Specifications

a. 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 included.

1.8 Notification to Proceed with Construction

a. After approval of the engineering plans and specifications and execution of the occupational agreement, the Owner will be notified of the appropriate Operating Railroad personnel which must be contacted prior to start of construction. The operating railroad will provide JRA's inspection of the project and coordinate all other construction aspects of the project which relate to JRA (flagging, track, work, etc.). Charges for this work will be billed by and paid directly to the Operating Railroad.

b. The Operating Railroad must be notified a minimum of seven (7) working days prior to desired start of construction.

2.0 GENERAL REQUIREMENTS

2.1 Use of Casing Pipe

a. A casing pipe will be required for all pipeline crossings carrying oil, gas, petroleum products, or other flammable or highly volatile substances under pressure, and all non-flammable substances which, from their nature or pressure, as determined by the Consulting Engineer, might cause damage if escaping on or near JRA property.

b. For non-pressure sewer or drainage crossings where the installation can be made without interference to railroad operations, as determined by the Consulting Engineer, the casing pipe may be omitted.

c. Pressure pipelines which do not cross under the track but are located within 25 feet of the centerline of any track or closer than 45 feet to nearest point of any bridge, building or other important structure shall be encased.

d. The casing pipe shall be laid across the entire width of the right-of-way, except where a greater length is required to comply with Section 4.2.1f of this

specification, even though such extension is beyond the right-of-way. The casing may only be required at the "zone of influence" instead of the entire R-O-W width. This will be at the discretion of the Consulting Engineer.

2.2 Location of Pipeline on the Right-of-Way

a. Pipelines laid longitudinally on JRA's 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.

b. Pipelines shall be located, where practicable, to cross tracks at approximate right angles to the track, but preferably at not less than 45 degrees.

c. Pipelines shall not be placed within a culvert, under railroad bridges, nor closer than 45 feet to any portion of any railroad bridge, building, or other important structure, except in special cases, and then by special design, as approved by the Consulting Engineer.

d. Pipelines shall not be located within the limits of a turnout when crossing the track.

e. Where possible, pipelines shall not be located within the limits of a grade crossing when open cut is the method of installation.

f. Pipelines carrying liquefied petroleum gas shall, where practicable, cross the railroad where tracks are carried on embankment.

2.3 Depth of Installation

a. Pipelines placed under JRA track(s) and across JRA's right-of-way shall be not less than 5-1/2 feet from base of rail to top of pipe at its closest point, except that under sidings or industry tracks this distance may be 4-1/2 feet as approved by the Consulting Engineer. On other portions of the right-of-way, where the pipe is not directly beneath any track, the depth from ground surface or from bottom of ditch to top of pipe shall not be less than three (3) feet. Where three (3) feet of cover can not be provided from bottom of ditch, a 6-inch thick concrete slab shall be provided over the pipeline for protection.

b. Pipelines laid longitudinally on JRA's right-of-way, 50 feet or less from centerline track, shall be buried not less than five (5) feet from ground surface to top of pipe for pipelines carrying oil, gas, petroleum products, or other flammable or highly volatile substances under pressure and all non-flammable substances which by their nature or pressure, in the judgment of the Consulting Engineer, may be hazardous to life or property. For pipelines carrying water, sewage and non-flammable substances, the distance from surface of ground to top of pipe may be four (4) feet.

c. Where the pipeline is laid more than 50 feet from centerline of track, the minimum cover shall be at least three (3) feet.

2.4 Pipelines within Limits of a Dedicated Highway

a. Pipelines within the limits of a dedicated highway are subject to all the requirements of this specification and must be designed and installed in accordance with them.

b. The limits of the dedicated highway (right-of-way) must be clearly shown on the plans.

c. Construction can not begin until an application has been made to the PA Public Utility Commission.

2.5 Modification of Existing Facilities

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

2.6 Abandoned Facilities

a. The owner of all abandoned pipe crossings and other occupancies shall notify the Property Manager, in writing, of the intention to abandon.

b. Abandoned pipelines shall be removed or completely filled with cement grout, compacted sand or other methods as approved by the Consulting Engineer.

c. Abandoned manholes and other structures shall be removed for a minimum distance of two (2) feet below existing grade and completely filled with cement grout or compacted sand.

2.7 Conflict of Specifications

a. 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

a. Pipelines and casing shall be suitably insulated from underground conduits carrying electric wires on JRA property.

2.9 Corrosion Protection and Petroleum Leak Prevention

a. Pipelines on JRA 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

a. For all pipe crossings sixty (60) inches in diameter and larger under tracks, and at other locations the Consulting Engineer may direct, test borings or other soil investigations, approved by JRA, shall be made to determine the nature of the underlying material. (See Section 1.4 relative to procedures)

b. For pipe crossings less than sixty (60) inches in diameter under tracks, and at other locations as the Consulting Engineer may direct, test borings or other approved investigations may be required when, in the judgment of the Consulting Engineer, they are necessary to determine the adequacy of the design and construction of the facilities.

3.2 Location

a. Borings shall be made on each side of the tracks, on the centerline of the pipe crossing, and as close to the tracks as practicable. (See Section 1.4 relative to procedures)

b. 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

a. Test borings shall be made in accordance with current ASTM Designation D 1586 except that sampling must be continuous from the ground surface to 5 feet below the proposed invert unless rock is encountered before this depth. Where rock is encountered it is to be cored using a Series "M" Double Tube Core Barrel, with a diamond bit, capable of retrieving a rock core at least 1 5/8" in diameter. Individual core runs are not to exceed 5 feet in length.

3.4 Boring Logs

a. Test boring logs shall comply with Plate VIII and clearly indicate all of the following:

- (1) Boring number as shown on the required boring location plan.
- (2) Ground elevation at each boring using same datum as the pipeline construction plans.
- (3) Engineering description of soils or rock encountered.
- (4) Depth and percent recovery of all soil samples.
- (5) Depth from surface for each change in strata.
- (6) Blows for each six inches of penetration for the standard penetration test described in ASTM D 1586. Blows for lesser penetrations should be recorded.
- (7) Percent recovery and Rock Quality Designation (RQD) for all rock cores.

(8) Depth to ground water while sampling and when it has stabilized in the bore hole.

b. The location of the carrier pipe and/or casing pipe shall be superimposed on the boring logs before submission to the Consulting Engineer.

c. 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.

d. Soil samples taken from auger vanes or return washwater are not acceptable.

3.5 Additional Information

a. When directed by the Consulting Engineer, 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

a. All pipes, manholes and other facilities shall be designed for the external and internal loads to which they will be subjected.

b. To allow for placement of additional track(s) or shifting of the existing track(s), all proposed facilities shall be designed as if a railroad loading is directly above the facility.

4.1.1 Earth Loads

a. The dead load of the earth shall be considered as 120 pounds per cubic foot unless soil conditions warrant the use of a higher value.

4.1.2 Railroad Loads

a. The railroad live load used shall be a Cooper E-80 loading with 50% added for impact. 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.

<u>Height of Cover (FT)</u>	<u>Load (LB/SQ FT)</u>
2	3800
5	2400
8	1600
10	1100
12	800
15	600
20	300
30	100

b. 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'-6'). The vertical surcharge, q (psf), caused by each axle, shall be uniform and equal to the axle weight divided by the tie length and the axle spacing, (5'-0"). For the E-80 loading this results in;

$$Q = 80,000 / (8.5 \times 5) = 1882 \text{ psf.}$$

The horizontal pressure due to live load surcharge at any point on the wall is p_{η} and can be calculated by the following:

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

c. The vertical and horizontal pressures given above shall be used unless the Consulting Engineer approves an alternate design method. Proposals to use an alternate design method must include acceptable references and a statement explaining the justification for choosing the alternate method.

4.2 Casing Pipe

4.2.1 General Requirement

a. 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 installed so as to prevent the formation of a waterway under that railroad, and with an even bearing throughout its length, and shall slope to one end (except for longitudinal occupancy).

b. The casing pipe and joints shall be of metal and of leakproof construction when the pipeline is carrying oil, gas, petroleum products, or other flammable or highly volatile substances under pressure.

c. 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 two (2) inches greater than the largest outside diameter of the carrier pipe joints or couplings, for carrier pipe less than six (6) inches in diameter; and at least four (4) inches greater for carrier pipe six (6) inches and over in diameter.

d. For flexible casing pipe, a minimum vertical deflection of the casing pipe of 3 percent of its diameter, plus $\frac{1}{2}$ inch, 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 two (2) inches greater than the outside diameter; at least 3-1/4 inches greater for pipe 8 inches to 16 inches, inclusive, in diameter; and at least 4-1/2 inches greater for pipe 18 inches and over in diameter.

e. In no event shall the casing pipe diameter be larger than is necessary to permit the insertion of the carrier pipe.

f. Casing pipe under railroad tracks and across JRA's right-of-way shall extend the **Greater** of the following distances, measured at right angle to centerline of track:

(1) Across the entire width of the JRA right-of-way.

(2) Three (3) feet beyond ditch line.

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

(4) A minimum distance of 25 feet from each side of centerline of outside track when casing is sealed at both ends.

(5) A minimum distance of 45 feet from centerline of outside track when casing is open at both ends.

(6) Beyond the theoretical railroad embankment line. This line begins at a point, on existing grade, 10'-0" horizontally from centerline track and extends downward on a 1 ½ (H) to 1 (V) slope. (See Plate III)

g. If additional tracks are constructed in the future, the casing shall be extended correspondingly at the Owner's expense.

4.2.2 Steel Pipe

a. Steel pipe may be installed by open cut, boring or jacking.

b. Steel pipe shall have minimum yield strength of 35,000 psi. The ASTM or API specification and grade for the pipe is to be shown on the Pipe Data Sheet (Plate I).

c. Joints between the sections of pipe shall be fully welded around the complete circumference of the pipe.

d. Steel pipes with a minimum cover of 5'-6" shall have a minimum wall thickness as shown in Table 2, unless computations indicate that a thicker wall is required.

Table 2

Coated or
Cathodically
Protected

Uncoated and
Unprotected

Nominal Diameter (Inches)	Nominal Thickness (Inches)	
10 and under	.188	.188
12 & 14	.188	.250
16	.219	.281
18	.250	.312
20 & 22	.281	.344
24	.312	.375
26	.344	.406
28	.375	.438
30	.406	.469
32	.438	.500
34 & 36	.469	.532
38	.500	.562
40	.531	.594
42	.562	.625
44 & 46	.594	.657
48	.625	.688
50	.656	.719
52	.688	.750
54	.719	.781
56 & 58	.750	.812
60	.781	.844
62	.812	.875
64	.844	.906
66 & 68	.875	.938
70	.906	.969
72	.938	1.000

e. 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.

f. Smooth wall steel pipes with a nominal diameter over 72 inches will not be permitted.

4.2.3 Ductile Iron Pipe

a. Ductile iron pipe shall be installed by open cut only.

b. Ductile iron pipe shall conform to the requirements of ANSI A21.51/AWWA C-151, Class 56.

c. The pipe shall have mechanical or push on type joints.

4.2.4 Corrugated Steel and Corrugated Structural Steel Plate Pipe

a. 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.

b. Pipe shall be bituminous coated and shall conform to the current American Railway Engineering Association Specifications Chapter 1, Part 4.

c. Corrugated steel pipe shall have a minimum sheet thickness as shown in Table 3. Corrugated structural steel plate pie shall have a minimum plate thickness of 0.168-in. (8 gage). If computations indicate that a greater thickness is required, the thicker sheet or plate shall be used.

TABLE 3

Pipe Diameter (inches)	Sheet Thickness	
	(inches)	(gage)
12 to 30	0.079	14
36	0.109	12
42 to 54	0.138	10
60 to 120	0.168	8

4.2.5 Steel Tunnel Liner Plates

a. Liner plates shall be installed by the tunneling method as detailed in Section 5.1.5 of this specification.

b. Tunnel liner plates shall be galvanized and bituminous coated and shall conform to current AREA Specification Chapter 1, Part 4.17. 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 or coated.

c. Tunnel liner plates are to be a minimum of 12 gage and shall be fabricated from structural quality, hot-rolled, carbon-steel sheets or plates conforming to ASTM Specification A 569.

d. The following liner plate information must be shown on the Pipe Data Sheet (Plate I):

- (1) Number of flanges (2 or 4)
- (2) Width of plate
- (3) Whether plate is smooth or corrugated

4.2.6 Reinforced Concrete Pipe

a. Reinforced concrete pipe shall be installed by the open cut or jacking method.

b. Reinforced concrete pipe may be used for a casing provided the pressures in the carrier pipe is less than 100 psi.

c. Pipe placed by open cut shall be installed in accordance with AREA Chapter 8, Part 10, Section 10.4 except that back fill and compaction shall be in accordance with Section 5.1.2 of this specification.

d. Pipe jacked into place shall have tongue and groove joints and shall be installed in accordance with Section 5.1.4 of this specification.

e. Reinforced concrete pipe shall conform to the current ASTM Specification C-76, Class V, Wall C.

4.2.7 Concrete Encasement

a. At locations where the installation is by open cut and a casing pipe is required, but can not be installed due

to elbows or other obstructions, concrete encasement may be used when approved by the Consulting Engineer.

b. The concrete encasement must be a minimum of six (6) inches thick around the pipe. A 6 X 6 - W 2.9 X W 2.9 welded wire fabric shall be placed in the concrete on all sides.

4.3 Carrier Pipe

a. Carrier pipes within a casing shall be designed for railroad live loads as if they were not encased.

b. The pipe shall be laid with sufficient slack so that it is not in tension.

c. Steel pipe shall not be used to convey sewage, storm water or other liquids which could cause corrosion.

d. The following shall be the minimum requirements for all carrier pipes located on JRA's right-of-way or under tracks which JRA operates:

(1) Ductile Iron Pipe - ANSI A21.51/AWWA C-151, Class 56

(2) Reinforced Concrete Pipe - ASTM C-76, Class V, Wall C

(3) Vitrified Clay Pipe - ASTM C-700, Extra Strength

(4) Corrugated Metal Pipe - AREA Chapter 1, Part 4

(a) Minimum gate of Pipe to be in accordance with Section 4.2.4 (Table 3) of this specification.

(5) Steel Pipe -

(a) Steel pipe must have minimum yield strength of 35,000psi. The ASTM or API specification and grade for the pipe is to be shown on the Pipe Data Sheet.

(b) Minimum wall thickness to be in accordance with Section 4.2.2 (Table 2) of this specification.

(6) Others - As approved by the Consulting Engineer.

4.3.1 Pipelines Carrying Flammable Substances

a. Pipelines carrying oil, liquefied petroleum gas, natural or manufactured gas and other flammable products shall be of metal and conform to the requirements of the current ANSI B 31.4, with Addenda, Liquefied Petroleum Transportation Piping Systems, ANSI B 31.8, "Gas Transmission and Distribution Piping Systems" 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 ANSI Codes:

(1) 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:

(a) Seventy-two percent on oil pipelines.

(b) Fifty percent for pipelines carrying condensate, natural gasoline, natural gas liquids, liquefied petroleum gas, and other petroleum products.

(c) Sixty percent for installations on gas pipelines.

(2) The following percentages apply to hoop stress in steel pipe laid longitudinally on railroad right-of-way without a casing:

(a) Sixty percent for oil pipelines.

(b) Forty percent for pipelines carrying condensate, natural gasoline, natural gas liquids, liquefied petroleum gas, and other petroleum products.

(c) Forty percent for gas pipelines.

4.4 End Seals

a. Casings for carriers of flammable and hazardous substances shall be suitably sealed to the outside of the carrier pipe. Details of the seals shall be shown on the plans.

b. Casings for carriers 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 allowing leakage to pass in the event of a carrier break.

c. Where ends of casings are at or above ground surface and above high water level they may be left open, provided drainage is afforded in such a manner that leakage will be conducted away from railroad tracks and structures.

4.5 Vents

a. Sealed casings for flammable substances shall be properly vented. Vent pipes shall be of sufficient diameter, but in no case less than two (2) inches in diameter, and shall be attached near each end of the casing and project through the ground surface at right-of-way lines or not less than 45 feet (measured at right angles) from centerline of nearest track.

b. Vent pipes shall extend not less than four (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 the Consulting Engineer.

c. Vent pipes shall be at least four (4) feet (vertically) from aerial electric wires or greater if required by National Electrical Safety Code (ANSI C2).

d. When the pipeline is in a public highway, street-type vents shall be installed.

4.6 Signs

a. 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:

- (1) Name and address of owner
- (2) Contents of pipe
- (3) Pressure in pipe
- (4) Pipe depth below grade at point of a sign

(5) Emergency telephone number in event of pipe rupture

b. For pipelines running longitudinally on JRA 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 the Consulting Engineer.

c. The Owner must maintain all signs on JRA's right-of-way as long as the occupational agreement is in effect.

4.7 Shut-off Valves

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

4.8 Cathodic Protection

a. Cathodic protection shall be applied to all pipelines carrying flammable substances on JRA's right-of-way

b. 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 4.2.2. Table 2.

c. Where casing and/or carrier pipe is cathodically protected by other than anodes, the Consulting Engineer 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.

d. Where sacrificial anodes are used the locations shall be marked with durable signs.

4.9 Manholes

a. Manholes shall not be located on JRA 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".

b. The top of manholes located on JRA property shall be flush with top of ground.

c. The distance from centerline of adjacent track to centerline of proposed manhole shall be shown on the plans.

4.10 Box Culverts

a. Reinforced concrete box culverts shall conform to the requirements of AREA Chapter 8, Part 16.

4.11 Drainage

a. Occupancies shall be designed, and their construction shall be accomplished, so that adequate and uninterrupted drainage of JRA's right-of-way is maintained.

b. All pipes, ditches and other structures carrying surface drainage on JRA property and/or under JRA tracks shall be designed to carry the run-off from a one hundred (100) year storm. Computations indicating this design and suitable topographic plans, prepared by a Professional Engineer, shall be submitted for JRA's approval.

c. If the drainage is to discharge into an existing drainage channel on JRA's right-of-way and/or under JRA tracks, the computations should include the hydraulic analysis of any existing structure.

d. Detention ponds must not be placed on any part of JRA's right-of-way. Also, the railroad embankment must not be used as any part of a detention pond structure.

e. Submitted with the computations shall be formal approval of the proposed design by the appropriate governmental agency having jurisdiction.

4.12 Pipelines on Bridges

a. Pipelines of any type shall not be installed on any bridge carrying JRA tracks.

b. New overhead pipe bridges shall not be constructed over JRA's right-of-way where underground installations 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:

- (1) The vertical clearance, distance from top of rail to bottom of structure, is shown and is a minimum of 23'-0".
- (2) The support bents for the overhead structure are located off of JRA's right-of-way or a minimum distance of 18'-0" from centerline track, whenever distance is greater.
- (3) Support bents within 25'-0" of centerline track have pier protection in accordance with AREA, Chapter 8, Part 2, Section 2.1.5.
- (4) Complete structural plans and design computations for the structure and foundations, stamped by a Professional Engineer, are submitted with the application.

c. 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 JRA tracks. In special cases when it can be demonstrated to the Consulting Engineer's satisfaction that such an installation is necessary and that no practicable alternative is available, the Consulting Engineer may permit the installation and only by special design approved by him.

d. When permitted, pipelines on bridges over JRA tracks shall be so located as to minimize the possibility of damage from vehicles, railroad equipment, vandalism and other external causes. They shall be encased in a casing pipe as directed by the Consulting Engineer (See Plate VII).

5.0 CONSTRUCTION REQUIREMENTS

5.1 Method Of Installation

5.1.1 General Requirements

a. 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.

b. The use of water or other liquids to facilitate casing emplacement and spoil removal is prohibited.

c. If during installation an obstruction is encountered which prevents installations of the pipe in accordance with this specification, the pipe shall be abandoned in place and immediately filled with grout. A new installations procedure and revised plans must be submitted to, and approved by, the Consulting Engineer before work can resume.

5.1.2 Open Cut

a. The Owner must request open cut approval when making application for occupancy.

b. Installations beneath the track by open trench methods will be permitted only with the approval of the Operation Railroad's Track Supervisor of the territory involved.

c. Installations by open cut will not be permitted under mainline track(s), track(s) carrying heavy tonnage or track(s) carrying passenger trains. Also, open cut shall not be used within the limits of a highway/railroad grade crossing or its approaches (25 feet either side of traveled way) where possible.

d. 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 not more than 5% passing the number 200 sieve. The gradation of the material is to be such that a dense stable mass is produced.

e. The backfill material shall be placed in loose 6 inch lifts and compacted to at least 95% of its maximum density with a moisture content that is no more than 1%

greater than or 2% 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 % will be required. Compaction test results confirming compliance must be provided to JRA's Consulting Engineer by the Owner.

f. 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.

g. Unless otherwise agree upon, all work involving rail, ties and other track material will be performed by railroad employees at the sole expense of the Owner.

5.1.3 Boring

a. This method consists of pushing the pipe into the earth with a boring auger rotating within the pipe to remove the spoil

b. 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.

c. 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 there will be no unsupported excavation ahead of the pipe.

d. 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.

e. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than one half 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 the Consulting Engineer shall be employed to fill such voids.

f. The face of the cutting head shall be arranged to provide a reasonable obstruction to the free flow of soft or poor material.

g. Plans and description of the arrangement to be used shall be submitted to the Property Manager for approval and no work shall proceed until such approval is obtained.

h. Any method which employs simultaneous boring and jacking for pipes over 8 inches in diameter which does not have the above approved arrangement **will not be permitted.** For pipe 8 inches and less in diameter, auguring or boring without this arrangement may be considered for use only as approved by the Consulting Engineer.

5.1.4 Jacking

a. 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 lease size which should be used, since it is not practical to work within smaller diameter pipes.

b. Jacking shall be in accordance with the current American Railway Engineering Association Specifications, 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.

c. 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.

d. When jacking reinforced concrete pipe, a jacking shield shall be fabricated as a special section of reinforced concrete pipe with a steel cutting edge, hood, breasting attachments, etc., cast into the pipe. The wall thickness and reinforcing shall be designed for the jacking stresses.

e. When jacking reinforced concrete pipe, grout holes tapped for no smaller than 1 ½ inch pipe spaced at approximately 3 feet around the circumference and 4 feet longitudinally shall be cast into the pipe at manufacture.

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

5.1.5 Tunneling

a. This method consists of placing rings of liner plates 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 the Consulting Engineer.

b. The shield shall be of steel construction, designed to support a railroad track loading as specified in Section 4.1 of this specification, in addition to other loading it must sustain. 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 one inch at any point on the periphery unless otherwise approved by the Consulting Engineer.

c. 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.

d. 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 the Consulting Engineer for approval.

e. Unless otherwise approved by the Consulting Engineer, 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).

f. At any interruption of the tunneling operation, the heading shall be completely bulkheaded.

g. The liner plates shall have tapped grout holes for no smaller than 1-1/2 inch pipe, spaced at approximately 3 feet around the circumference of the tunnel liner and 4 feet longitudinally.

h. Grouting behind the liner plates shall be in accordance with Section 5.2 of this specification.

5.2 Grouting

a. For jacked and tunneled installations a uniform mixture of 1:6 (cement: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.

b. Grouting shall start at the lowest hole in each grout panel and proceed upwards simultaneously on both sides of the pipe.

c. A threaded plug shall be installed in each grout hole as the grouting is completed at that hole.

d. 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 the Consulting Engineer, but in no event shall more than six (6) lineal feet of tunnel be progressed beyond the grouting.

5.3 Soil Stabilization

a. Pressures grouting of the soils or freezing of the soils before jacking, boring, or tunneling may be required at the direction the Consulting Engineer 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.

b. 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 work and submitted for approval to the Property Manager before the start of work. Proof of experience and competency shall accompany the submission.

5.4 Dewatering

a. When water is known or expected to be encountered, pumps of sufficient capacity to handle the flow shall be maintained at the site and, upon approval of the Consulting Engineer to operate them, they shall be in constantly attended operation on a 24-hour basis until, in the sole judgement of the Consulting Engineer, their 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

a. 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 JRA's property shall be conducted in accordance with the operation Railroad safety rules and regulations. The contractor shall secure and comply with the safety rules and shall give written acknowledgment to JRA that they have been received, read, and understood by the contractor and his employees. Operations will be subject to JRA inspection at any and all times.

b. 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 the Consulting Engineer.

c. 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.

d. Whenever equipment or personnel are working closer than fifteen (15) 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. Operations closer than fifteen (15) feet from the centerline of a track shall be conducted only with the permission of, and as directed by, a duly qualified railroad employee present at the site of the work.

e. Crossing of tracks at grade by equipment and personnel is prohibited except by prior arrangement with, and as directed by the operating railroad's Track Supervisor. Any associated costs for the Railroad personnel will be billed by and paid directly to the railroad.

5.6 Blasting

a. Blasting will not be permitted under or on JRA's right-of-way.

5.7 Temporary Track Supports

a. When the jacking, boring or tunneling method of installation is used, and depending upon the size and location of the crossing, temporary track supports shall be installed at the direction of the Consulting Engineer.

b. The Owner's contractor shall supply the track supports with installation and removal performed by railroad employees.

c. The Owner shall reimburse the railroad for all costs associated with the installation and removal of the track supports.

5.8 Protection of Drainage Facilities

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

b. Soil erosion methods shall be used to protect railroad ditches and other drainage facilities during construction on and adjacent to JRA's right-of-way.

5.9 Support of Excavation Adjacent to Track

5.9.1 Launching and Receiving Pits

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

b. The face of all pits shall be located a minimum of twenty-five (25) feet from centerline of adjacent track, measured at right angles to track, unless otherwise approved by the Consulting Engineer.

c. If the bottom of the pit excavation intersects the theoretical railroad embankment line (See Plate III) interlocking steel sheet piling, driven prior to excavation, must be used to protect the track stability. The use of trench boxes or similar devices are not acceptable in this area.

d. Design plans and computations for the pits, stamped by a Professional Engineer, must be submitted by the Owner at the time of application or by the contractor prior to start of construction. If the pit design is to be submitted by the contractor, the project specifications must require the contractor to obtain JRA's approval prior to beginning any work on or which may affect JRA property.

e. The sheeting shall be designed to support all lateral forces caused by the earth, railroad and other surcharge loads. See Section 4.1 for railroad loading.

f. After construction and backfilling all sheet piling within ten (10) feet of centerline track must be cut off eighteen (18) inches below final grade and left in place.

g. All excavated areas are to be illuminated (flashing warning lights not permitted), fenced and otherwise protected as directed by the Consulting Engineer or his designated representative.

5.9.2 Parallel Trenching and Other Excavation

a. When a pipeline or other structure is to be placed adjacent to a JRA track within the theoretical railroad embankment line (See Plate V), interlocking steel sheet piling must be used.

b. The design and construction requirement for this construction shall be in accordance with the requirement of Section 5.9.1.

5.10 Inspection and Testing

a. For pipelines carrying flammable or hazardous materials, ANSI Codes B 31.8 and B 31.4, current at time of constructing the pipeline, shall govern the inspection and testing of the facility on JRA property, except as follows:

- (1) 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.
- (2) The proof testing of the strength of carrier pipe shall be in accordance with the requirements of ANSI B 31.8 for Class Locations 2, 3, or 4, or ANSI B 31.4, as applicable.

5.11 Reimbursement of JRA Costs

a. All costs associated with the pipe installation (inspection, flagging, track work, etc.) shall be reimbursed to the operating railroad by the Owner of the Facility. Reimbursement by the contractor is not acceptable.