Appendix I. Electric Rail (light rail and streetcar) Requirements

This section is intended for the additional unique considerations required for the Water Supply Transmission & Distribution Systems when electric rail is to be located in proximity.

Electric Rail Design Guideline (Electric Rail)

A. General Criteria

1. Apply the following criteria when installing new water facilities in the vicinity of rail projects or determining mitigation needed for the existing water system to be protected from rail projects:

   (a) Ensure that the integrity of the water system is maintained to the same standards or better than that which existed prior to the rail project.

   (b) Ensure that the water system can be operated and maintained with reasonable access and without obstructions, delays, or complications.

   (c) Ensure that the water system can remain in service with no service disruptions, except for planned maintenance or emergency shutdowns.

   (d) Ensure that the rail system can remain in service with no disruption for normal water operations and maintenance, except planned maintenance or emergency water system repairs.

   (e) Ensure that safe working conditions can be maintained for PWB personnel to carry out operations and maintenance in the vicinity of the rail system.

2. The design life of the water system, which is estimated to be 200 years or more for pipelines and 100 years or more for services and other appurtenances, is expected to be maintained.

3. See Appendix 3.6 of the Portland Water Bureau Design Manual for the general application of these criteria.

B. Main Isolation Valves

1. Design for new and existing distribution mains capable of being fed from two directions to have isolation valves on both sides of rail crossings and located to minimize customer service disruptions caused by shutdowns of the water mains. Main shutdowns are needed to accommodate the rail project construction and future water system maintenance, repair, and construction. Mains fed from one direction may be isolated upstream of the rail crossing.

2. Locate isolation valves between services and rail crossings to allow the main under the rail crossing to be replaced with minimal or no service outages.

3. Restrain isolation valves on both directions to allow the main on either side of the valve to be removed without shutting down the main upstream of the valve.

4. Design for isolation valves to be appropriately spaced on distribution mains parallel to rails to facilitate rail project construction and minimize future service disruptions. Locate distribution system line valves on each side of intersections and not exceeding 500 feet between line valves.

5. Supply and transmission line valves should not exceed 500 foot spacing.

C. Clearances

1. Relocate, maintain, and protect all water facilities in conflict with other utilities. Maintain minimum clearances between water mains and appurtenances and other utilities and structures per Appendix D, except as stated below.

2. Relocate existing mains and other water facilities under or near rail alignments to ensure continued access 24 hours/day, 7 days/week for operations and maintenance. This requires that water mains and facilities have 10-foot minimum clearance between the outer skin of the water facility and the nearest rail slab or edge of ballast to be able to excavate them without disrupting rail operations.

3. Determine the allowable construction loads applied directly to subgrade over mains and other facilities that will have less than 9 feet of cover. Replace cast iron pipe and other facilities if construction traffic loads are expected to exceed allowable loads.

4. Consider replacing cast iron pipe if the existing pavement is removed.

5. Install casings under any facility that cannot be readily removed to access mains or that will adversely affect the loading on the facility. Portland Water Bureau casing pipe guidelines available from Portland Water Bureau staff upon request.

6. See the Transportation and Utility Impacts Section of Appendix 3.6 of the Portland Water Bureau Design Manual for design standards involving highway, street, and utilities construction conflicts.

D. Electric Rail Substations

1. Install or relocate all water mains and facilities to be a minimum of 200 feet from electric rail substation DC ground mats.

2. Install or replace all water mains and facilities that must be located with 200 feet from electric rail substation DC ground mats to be dielectrically isolated and have full corrosion protection systems.

E. Mains Near Rails

1. Dielectrically isolate and cathodically protect all new or relocated water mains and facilities that are within 100 feet of rail slabs or the outermost edge of rail ballasts.

2. Relocate, dielectrically isolate and cathodically protect all water mains and facilities to be a minimum of 10 feet from the nearest rail slab or outermost edge of the ballast (skin-to-skin clearance).

3. Mains may be located within 10 feet of a rail slab or edge of ballast on an exception basis, provided:

(a) No space exists to have a 10-foot clearance.

(b) The main is dielectrically isolated and cathodically protected from surrounding mains. Note: Cathodic protection can rarely be installed on existing mains. Existing mains must typically be replaced with new cathodically protected pipelines.

(c) The main is not in conflict with recommended rail isolation criteria, the rail slab is encased in a dielectric membrane and there is no additional risk of failure or reduced life expectancy of the main or facility.

4. Existing water mains that are over 10 feet from the rail slab or outermost edge of the ballast may not need to be relocated, dielectrically isolated or cathodically protected provided:

(a) There are no conflicts with the risk assessment of the water system.

(b) There are no conflicts with the recommended rail isolation criterion.

(c) No other physical impact exists such as unacceptable loading on the pipe; unacceptable vibrations on the pipe; conflicts or unacceptable clearance with other structures, utilities, duct banks, rail slabs, tie and ballasts, walls, catenary poles, stations, drainage, etc.

F. Mains Crossing Under Electric Rail Rails

1. Replace existing mains and construct new mains so they are in casing pipe, dielectrically isolated, and cathodically protected where crossing electric rail alignments.

2. Also dielectrically isolate and cathodically protect metallic casing pipe crossing under electric rail alignments.

3. Design for at least 1-foot vertical clearance from top or bottom of casing to duct banks and other utilities and structures. (Note: Typically, clearances are a 3-foot to 5-foot excavation envelope for the rail slab, duct banks, and catenary poles, etc., so minimum cover from ground surface to top of casing is about 4 feet to 6 feet).

4. Extend casings at least 10 feet beyond the rail slab or outermost edge of the ballast. Extend casings 5 feet beyond station platforms, but no less than 10 feet from the rail slab.

5. See the Tunneling and Casing Installation section of the Portland Water Bureau Design Manual for casing pipe design guidelines. See Appendix 3.6 of the Portland Water Bureau Design Manual for light rail crossings.

G. Services and Hydrants

1. Replace existing services and hydrant runs with new pipe in casings and any new pipe in casings that cross under electric rails.

2. Dielectrically isolate and cathodically protect metallic casing, service pipe and hydrant runs.

3. Extend casings at least 10 feet beyond the rail slab or outermost edge of the ballast. Extend casings 5 feet beyond station platforms, but no less than 10 feet from the rail slab.

4. Require watertight seals on both ends of service casing ends.

5. Provide 1-foot minimum vertical clearance from the top or bottom of casing pipe and duct banks or other utilities.

6. Require ground rods at each meter on the customer side for electrical grounding.

7. Copper Services:

   (a) Dielectrically isolate copper service runs at the main and at the backside of the meter.

   (b) Encase copper services that cross under rails with PVC from the main to the meter.

   (c) Tape-wrap the ends of copper services that are not encased.

8. DI Services and Hydrants:

   (a) Dielectrically isolate DI service runs at the backside of the meter only and protect the runs with the main's corrosion protection system.

   (b) Dielectrically isolate and cathodically protect metallic casing pipe.

H. Cathodic Protection

1. Many elements of the corrosion protection system are uniquely designed for specific applications. General measures are noted below for electric rail projects. See the corrosion protection chapter of the Portland Water Bureau Design Manual for corrosion design guidelines.

2. Mains: Bond all joints to be electrically continuous; coat or encase (wrap) all pipe with polyethylene wrap and install anodes at intervals per the corrosion design, but not exceeding 100-foot intervals. Provide isolation joints with test stations at the beginning and end of every cathodically protected main.

3. Parallel mains: Provide for isolation joints for mains parallel to the rails every 500 feet and test stations (TS) at the beginning and end of corrosion protected main sections and at each insulating joint.

4. Rail crossings: Provide insulating joints and test stations on the main as per the corrosion protection design, on each side of the rail crossing.

5. Steel Casings: Provide test stations and anodes on each end of the casing. Dielectrically isolate the casing pipe from the pressure pipe. Provide a protective coating on the casing pipe, i.e., HDPE wrap, epoxy, tape wrap, polyurethane, coal tar, etc.

6. Ductile Iron (DI) Services: Dielectrically isolate the end of services, behind the meter or property valve and install test stations at isolation joints and bond joints. Encase all service crossings under rails. Provide a coating or polyethylene wrap on all sections not cased. Provide anodes on all DI services as per the corrosion design.

7. Copper services: Dielectrically isolate each end of copper service branches. Provide insulating corporations at the main and IJs at the meter. Encase copper service crossings of rails with PVC. Tape wrap all copper service pipes not encased with PVC.

8. Acceptance Criteria: Acceptance testing is required for all joint bonding and isolation joints. Rail acceptance testing varies with the rail design.