

Summary of 2016 Update to Light Rail Engineering Standards

2015 Light Rail Engineering Standards	2016 Light Rail Engineering Standards	Revision
Throughout document	Throughout document	Replace 2015 with 2016
Detail	Detail	Replace “January 2015” with “January 2016”, Add “City of Bellevue” above detail

**CITY OF BELLEVUE UTILITY STANDARDS
DESIGN CRITERIA
PROTECTION FOR PIPE CROSSING OR PARALLELING LIGHT RAIL**

1.01 General

This section of the City of Bellevue (“City”) Utility Standards establishes the policies, procedures, and guidelines relating to utilities within the light rail corridor. The criteria for protection of pipe in a shared utility corridor shall include considerations for direct physical interferences, maintenance access encroachments, and stray current corrosion control.

1.02 General Design Guidelines

A. Restricted Utility Zone (RUZ) defines the clearance for all utilities around a light rail as follows:

1. Horizontally no less than 10- ft from the outside edge of the light rail guideway unless otherwise approved by the City, without regard to depth and additional length as required to accommodate a 2 to 1 slope excavation for pipe proximate to ballasted track, a ballast wall or other retaining wall, or for deep excavations.
2. Vertically the top of utilities, encasements, sleeves, or casings crossing the rail shall be a minimum of 1 ft vertical clearance from the power and signal ducting or other structures and typically 6 ft below top of rail. Where a sewer or storm pipe is crossing below the rail and the pipe needs to maintain a certain line or grade for gravity flow, the vertical clearance may be reduced subject to the approval by the City.
3. For elevated sections of track, horizontally at a minimum distance of 10 ft clearance to columns and vertically wherever the overhead clearance is reduced to less than 14 ft.

B. All utilities within RUZ shall be relocated unless otherwise approved by the City. Pipe outside this zone may remain in place unless affected by grade changes, limited access, clearances or otherwise affected by light rail construction. Hence, all utilities horizontally within the following limits shall be relocated.

1. 10-ft minimum from the outside edge of the light rail guideway; and
2. 10-ft minimum clearance to columns of elevated sections of track.

Replaced crossings shall be a minimum of 1-ft clearance from the power and signal ducting. Where there is no alternative to reinstalling a parallel metallic pipe within the RUZ, the pipe shall be cathodically protected and the adjacent track slab section shall be constructed with a dielectric insulating liner.

C. Design considerations must anticipate construction sequencing and ongoing utility service needs. Provide design to maintain critical services during construction.

D. The design depth of the track section shall be kept to a minimum by modifying the under-track power and signal ducting to lessen the impact on crossing utilities.

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- E. In exceptional instances where the distance to accommodate a benched 2 to 1 slope for excavation is not feasible, the design criteria shall allow for shoring, however the minimum distance from the track shall be sufficient for the pipe excavation to be shored a minimum of 10 ft from the edge of the light rail guideway. Any section of pipe not meeting these criteria shall be specifically identified and additional corrosion control measures taken to include, as a minimum, a secondary insulating liner for the adjacent track.
- F. All utilities shall cross the rail at 90° to the rail centerline unless approved by the City. Manholes, valves, and other utility-related appurtenances requiring periodic maintenance or operation should not be placed within the RUZ.
- G. If the light rail traction substation is DC grounded, including diode grounding, relocate all metallic pipes a minimum distance of 200 feet from the traction substation ground mat; and where facilities must be relocated within the 200-foot zone, dielectrically isolate and cathodically protect that section of pipe. If the light rail design includes a contingency DC collector cable parallel to the rail, then all utilities within the transit corridor ROW shall be protected in accordance with the RUZ criteria for a distance extending 100 feet beyond both ends of the cable.
- H. All abandoned pipes shall be plugged and filled with Controlled Low Strength Material (CLSM).
- I. Contract documents shall require all specified pipeline testing and verification for utilities installed by Sound Transit prior to acceptance of their construction.

1.03 Water System Relocation and Corrosion Protection

- A. All water mains and appurtenances within RUZ shall be relocated.
- B. Water pipe crossing a light rail system shall be cased under the track within the limit defined in 1.02.B. Wherever possible, steel casings shall be located to facilitate future retrieval of the carrier pipe.
- C. At water main crossings, provide cathodic protection for both the casing and the carrier pipe, and provide valves and dielectric isolation both sides of the track crossing at the connection to the adjoining pipe and at interties between pipes crossing and pipes paralleling the light rail.
 - 1. At intersections, locate the valves and dielectric isolation in the adjacent streets.
 - 2. Locate valves to minimize outages at service connections
 - 3. To facilitate construction and minimize future service disruptions provide valves with a maximum spacing of 500 feet on mains paralleling the light rail guideway.
- D. Pipe Thrust and Joint Restraint Design:

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1. All carrier pipe joints in the casing shall be restrained. But this restrained length does not contribute to restrained length design.
 2. Restrain both sides of the valve to allow the pipe on either side of the valve to be removed.
 3. Restrain all fittings.
- E. Steel casing pipe shall have welded joints, dielectric coating, and be protected with galvanic anodes. Casing pipe installed in an open trench shall have tape wrap coating, and casing pipe that is bored shall have fusion-bonded epoxy coating with field-coated joints and all appurtenances shall be epoxy coated. Casing installations shall include dielectric spacers, end seals, anodes, and test stations. Open trenching is the preferred casing installation method. Where open trenching is not feasible, casing can be bored if it is approved by the City. For bored installations, steel casing pipe may be uncoated without anodes in lieu of coated steel pipe with anodes. Regardless of construction methods used, the minimum wall thicknesses shall be based on American Railway Engineering and Maintenance-of-Way Association (AREMA) design standards.

Casing Nominal Diameter (inch)	Wall Thickness (inch)
6 thru 14	0.25000
16	0.28125
18	0.31250
20	0.34375
22	0.34375
24	0.37500
26	0.40625
28	0.43750
30	0.46875
32	0.50000
34	0.53125
36	0.53125

- F. Refer to Specification Section 264213 and Sheet 1 and Sheet 2 of the Cathodic Protection Standard Details for the requirements of test stations and galvanic anodes.
- G. Ductile iron mains inside the casing shall be of Class 56.
- H. When grade and construction changes are needed along an existing cast iron water main, the cast iron pipe strength and potential joint leakage due to excessive deflection from added loadings (earth and live loads) shall be evaluated. Mitigation measures shall be taken to resolve identified issues.
- I. Casings shall be used for all pipe crossings except that solvent welded Schedule 80 PVC sleeves may be used for water service pipes 2" and smaller. The sleeve inside diameter

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shall be at least 2” larger than the service pipe outside diameter. Refer to Sheet 3 of the Cathodic Protection Standard Details.

- J. Copper services crossing light rail track shall be of continuous tubing with no fittings and shall be tape wrapped and sleeved under the track and for a minimum of 10 feet beyond the edge of rail guideway (as referenced by face of curb outside of the rail slab). The interstitial space between the tape wrapped copper service and the plastic pipe shall be dry and sealed with a water tight connection.
- K. All new ductile iron water mains within the street right-of-way and running parallel to the light rail shall be made electrically continuous with joint bonds and shall be dielectrically isolated into sections of 500 feet maximum length and at all connections. In addition, the ductile iron mains shall be poly wrapped, and have anodes and test stations.
- L. Cathodically protected pipe shall be dielectrically isolated from adjoining mains and services. Provide ground rods on the customer side of meters that are isolated from the service. Provide polarization cell replacements (PCRs) or other devices as required for safety where there may be a touch or step potential between the local grounding and remotely grounded pipe such as at hydrants and services near platforms or power traction stations.
- M. Additional fire hydrants shall be provided as necessary to allow for fire suppression without requiring hoses to cross the tracks.
- N. Construction, Maintenance and Repair Provisions – To accommodate construction and future water system maintenance and repair, provide isolation valves for both sides of a rail crossing and at maximum 500-ft lengths along water lines that parallel the light rail.
- O. Test stations shall be provided at all dielectric isolation joints, casings, and at minimum 500-ft length intervals and as shown.
- P. Pipes below the overhead tracks shall be treated the same as those for the tracks on grade except the distance for clearance shall be based on the horizontal location of structural column and vertically wherever overhead clearance is reduced to less than 14 feet.

1.04 Sanitary and Storm Sewer Relocation and Corrosion Protection

- A. All sewers within the RUZ shall be relocated.
- B. All sewer crossings shall be in casings unless where otherwise approved by the City of Bellevue.
- C. All new ductile iron sewer mains and metallic storm drain pipe within the street right-of-way and running parallel to the light rail shall be made electrically continuous with joint

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bonds and shall be dielectrically isolated into sections of 500 feet maximum length and at all connections. In addition, the ductile iron and metallic mains or pipe shall be poly wrapped, and have anodes and test stations.

D. For casings, refer to 1.03 above.

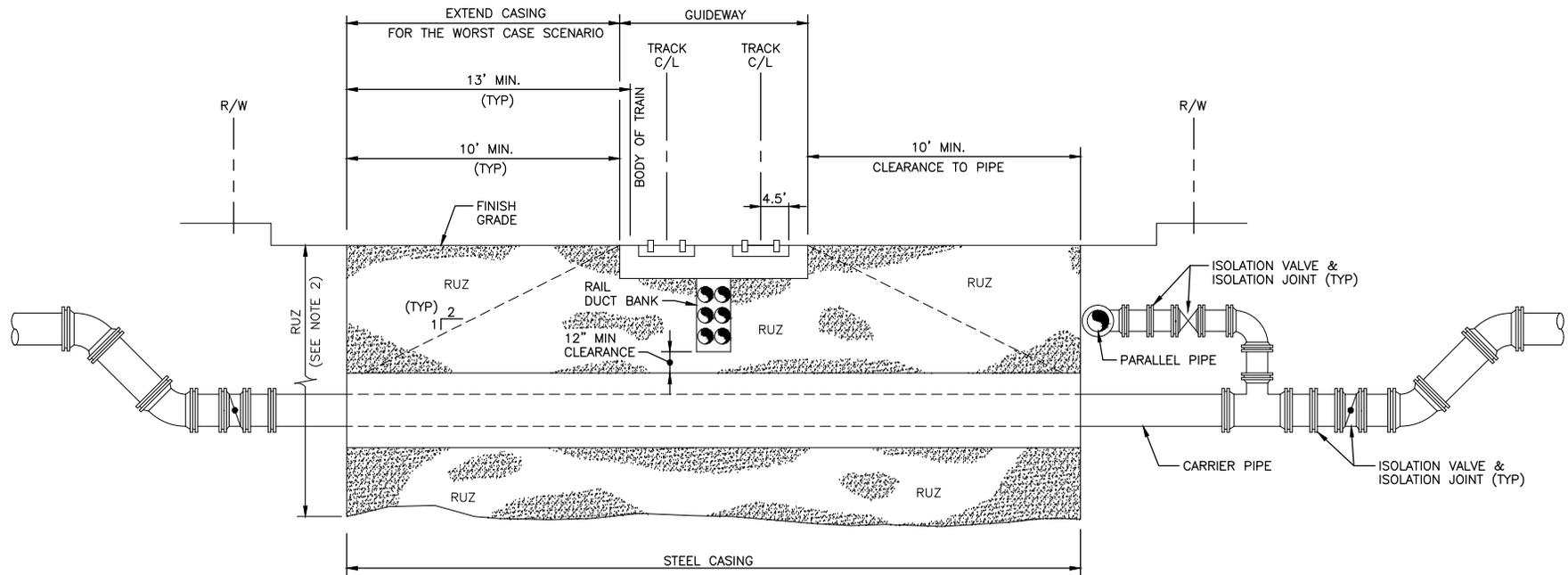
1.05 Criteria for Light Rail Track-to-Earth Resistance.

- A. Rail-to-Earth resistance shall be a minimum of 250 ohms/1,000-ft of four rail tie-and-ballast track, 250 ohms /1,000 -ft of four rail direct fixation track, and 250 ohms/1,000- ft of four rail embedded track.
- B. The test method shall assure that no one short is greater than 20 ohms. Construction methods shall include high voltage holiday tests; for sections of embedded rail holiday testing shall be done prior to concrete placement and provide isolation testing between rail and rebar immediately prior to placing concrete.
- C. If the Rail-to-Earth Resistance criteria are not met, the transit authority will make all reasonable efforts to determine the cause and correct the deficiency. If correction is not feasible the transit authority will consult with the City to arrive at an acceptable remedy.

1.06 Criteria for Maintenance Agreement

- A. The transit authority shall provide the following documentation to the City for approval:
 - 1. A baseline report of stray current control including as a minimum Rail-to-Earth Resistance, and if traction substations are DC grounded provide current measurements, and if a proprietary stray current system is installed provide findings.
 - 2. A light rail track cleaning program;
 - 3. Immediate Rail- to-Earth Resistance testing of all repaired and replaced track;
 - 4. A monitoring and maintenance program to assure continued Rail-to-Earth Resistance and stray current control.
 - 5. The City of Bellevue shall be notified if the Transit Authority elects to operate the system DC (diode) grounded.

City of Bellevue



NOTES:

1. WATER PIPE CROSSING SHOWN, DETAIL FOR OTHER UTILITY CROSSINGS SIMILAR.
2. CASING AND CARRIER PIPE SHALL BE CATHODICALLY PROTECTED REGARDLESS OF DEPTH.
3. PARALLEL PIPE WITHIN 10-FT OF TRACK TO BE RELOCATED.
4. CATHODICALLY PROTECT RELOCATED / NEWLY INSTALLED PIPE.
5. VERTICAL AND HORIZONTAL THRUST RESTRAINT AND RESTRAINED JOINT PIPE ELEMENTS ARE REQUIRED BUT NOT SHOWN ON THIS DETAIL.

LEGEND

 RESTRICTED UTILITY ZONE (RUZ)

PIPE CROSSING DETAIL

N.T.S.