1.4.7 Utilities On Structures

1.4.7.1 Utilities on Structures, General

1.4.7.1.1 Roles and Responsibilities

(1) District Roles and Responsibilities - The Districts are the main point of contact for the location of all utilities and will issue all utility permits. Utility companies will only be given a permit for the specific area they actually need for that installation. Space for future lines will need to be included on a separate permit application. If the utility installation requires holes to be drilled into the bridge, if the utility will add a significant amount of additional dead load on the structure, or if the installation has the potential to be in conflict with any of the General Requirements in 1.4.7.1.2, the District will refer the permit application to the Region Tech Center Bridge Unit Manager and the Bridge Engineer for their input and approval. Otherwise, the District Manager will simply approve, monitor the installation of the utility, and assure that all utility installations are labeled in accordance with accepted practices (see below).

(2) Region Tech Center Roles and Responsibilities - (Note: If the utility is associated with an OTIA Project, the Bridge Delivery Unit could perform these same roles).

If the District forwards a copy of a utility permit request to the Region Tech Center for review prior to the issuance of the permit, the Regional Tech Center Bridge Unit Manager will assure that the utility installation is in compliance with the General Requirements in 1.4.7.1.2.

(3) Bridge Engineering Section Roles and Responsibilities - For certain installations, the District and/or Region Tech Center will refer the Utility Permit Request to the Bridge Engineer for input. Bridge Engineering Section will refer input back to the Region Tech Center Bridge Unit Manager for final approval. The Bridge Engineering Section will provide input if the utility installation will have a direct impact on any of the following:

- The installation calls for the installation of a High-Voltage Line on a structure.
- The utility contains a high-pressure line and / or volatile gases.
- Installation has the potential to create a corrosive environment due to dissimilar materials.
- The installation is on a bridge that has a cathodic protection system in place.
- The utility is going to be installed on a drawbridge.
- The installation is in a confined space where its location or operation creates an unsafe environment for bridge inspection and/or bridge maintenance personnel.
- The installation has the potential for adding a significant amount of dead load to the structure.

1.4.7.1.2 General Requirements

All wire line type crossings shall be installed in conduit.

High-voltage lines (greater than 25000 volts) should not be installed on a bridge.

If possible use existing utility provisions located on the structure.

Utility installations should be designed so that a failure will not result in damage to the structure or be a hazard to traffic or endanger the public.

If possible, locate the utility installation to minimize the effect on the appearance of the structure and minimize installation, inspection, and maintenance access problems. In most cases, this will mean installing the utility between girders or in the sidewalk or rail. Locate the utility as close as possible to the exterior of the structure to allow access by snooper crane if no other access is

provided. This may not be possible if staging of the structure is not compatible. See Section 1.4.4 for accessibility requirements.

Provide sufficient space around utilities for maintenance activities such as cleaning and repainting steel members.

Utilities and supports should not normally extend below the bottom of the superstructure.

If the utility is placed on the outside of the rail or exterior girder on stream crossings, place it on the downstream side of the structure to minimize the chance of damage from floating debris.

Utilities are to be labeled according to American Public Works Association (APWA) standards with color code and owner, contact information, etc.:

Electrical – Red
Gas – Yellow
Communication – Orange
Potable Water – Blue
Irrigation – Purple
Sewer - Green

1.4.7.2 Providing for Utility Installations

When permitted by the structure design, provide for utilities as follows:

- Agency Communication Infrastructure – on new National Highway System structures, provide a minimum of two – 2 inch I.D. conduits for Highway communications use. Follow the detailing guidelines for utility installation in Section 1.4.7.3 .
- For structures carrying a freeway over a river, provide for utilities that have been approved by the FHWA. Provision for future utilities should be on a judgment basis.
- For structures carrying highways over freeways and other classes of highways, provide for utilities that have requested space. Provision for future utilities should be on a judgment basis.

Also see Section 1.4.7.6 for acceptable accommodation of utilities in structures.

The proximity to heavily populated areas and the probability of future requests for utilities should be the basis for deciding to provide for future utilities.

- For structures inside city limits, provide for future needs with two 12” diameter holes on each side of the structure in addition to the specific utility requirements.

Provide access for utilities as follows:

- No utilities should be accommodated on structures unless access can be provided for inspection and maintenance by the utility, with the exception of telephone and electrical conduits continuously encased in concrete.

- For structures carrying highways over freeways, access from the freeways should not be provided. In special cases, access may be provided from freeway right-of-way, but not from the traveled roadway or shoulders.

1.4.7.3 Design and Detailing Guidelines

Utility attachments may exert large forces at the point of connection. Individual members and the entire structure should be designed for all loads imposed by the utility. Consideration should be given to loads or movements that might be imposed on the utility by the structure, such as from temperature movements.

Make sure all loads are considered in the design, including dead, temperature, vibration, inertia loads, etc. Longitudinal and transverse supports or anchorages may be needed. Hydraulics or Facilities Design may need to be contacted to determine appropriate loads for design or review.

If attachment connections or brackets are designed by the utility company, the submittal should be accompanied by calculations for the designer to review. For pressure systems, maximum design and operating pressures should be stated. See Special Provisions 00589 – "Utility Attachments to Structures" for additional requirements.

If the proposed utility weighs more than 100 pounds per linear foot, the utility company will be required to provide a load rating of the structure, with the utility loading superimposed onto the structure, so that it can be determined whether the structure has sufficient loading carrying capacity for the installation of the utility. If available, ODOT will provide a set of bridge plans for their use. All plans must be field verified, because not all as-constructed bridge plans are correct.
If a proposed utility installation requires a structural evaluation, the utility plans / calculations must be stamped by an Engineer that is registered in the State of Oregon.

Design the installation so that a failure does not damage the structure or endanger the public. This includes designing for earthquake movement (some utilities are sensitive to movement, i.e., gas, water, sewer, fiber optic cables).

Submittal should include calculations for:

- Vertical, lateral, and longitudinal loading, as appropriate.
- Maximum and operating pressures for pressurized systems.
- Waterline thrust blocks
- Loadings to be carried by the structure and their location

Attachment designs that use a single anchor at each attachment point must be designed to remain serviceable if one of the other attachments were to fail.

In general, place holes in transverse members near the inside face of the outside longitudinal beams.

The alignment of utility holes should be kept as straight as possible, both vertically and horizontally, to avoid difficulties in placing utility pipes.

Construction tolerances and variables need to be considered in the design of brackets and hangers. Slotted holes, adjustable rod lengths, etc. should be incorporated into the attachment design.

Where utility holes are provided in the ends of the structures for future utilities and an approach slab is required, provide each hole with concrete culvert pipe, galvanized smooth steel pipe (1/4" min. thickness), or Sch.40 PVC pipe of the same inside diameter as the utility hole, extending from the hole to a point 5' minimum beyond the end of the approach panel. Normally, such pipes should be extended parallel to the centerline of the structure. An oversized hole (1" larger diameter than the pipe) should be formed into the backwall or end beam. When the pipe is

installed, the void around the pipe should be filled with a compressible type of material.

Utility holes and pipes under end panels may need to be a larger diameter to accommodate joint splices, couplers, or bells at connections.

In the absence of specific instructions from the utility company, provide hot-dip galvanized expanded coil concrete inserts with closed-back ferrule, threaded for 3/4" diameter bolts installed in the deck at 10' maximum centers above each line of utility holes(minimum insert length 5-1/2", minimum safe working load in tension 6000 lbs). Install short galvanized bolts in the inserts to prevent rusting of the threads, if the inserts are not to be used immediately.

Encased conduit is to be PVC or approved equal pipe. External conduit should be hot-dip galvanized steel.

Provide suitable expansion joints at structure expansion joints.

Hot-dip galvanize all steel utility supports including fastenings and anchorages.

Steel Structures - Utility lines should be suspended from the deck, not hung from cross frames, diaphragms, or main beams.

Prestressed Slab or Box Structures - Provide for future utilities through the end wall closure pours with capped 8" diameter blockouts or by embedding a 6" diameter PVC pipe in the wall and extending it 8' to 10' beyond the structure bent. See Figure A1.1.8.7A.

1.4.7.3.1 Potential Maintenance Problems

Don't hang utilities against side of decks that have no curb. If necessary to put them on the side, move them out from deck so they do not trap debris.

Avoid exterior mounted utilities in heavily sanded areas.

Some bridges have drains through the concrete railing, do not attach utilities below these drains

Avoid attaching them to timber elements. Many timber elements require replacement during the bridge's life.

Avoid going through shallow end bents with no impact panel and a history of approach settlement. Excavation may increase settlement, settlement may cause utility to shear, or utility may get in the way of installing sheet pile or impact panel in the future.

The utility will agree that they will promptly respond to and provide a process to repair failing utilities and removing abandoned utilities.

1.4.7.4 Special Utility Considerations

(1) Gas Lines - Gas lines or other lines carrying volatile materials are to be Schedule 40 steel pipe or approved equal, and cased full length of enclosed or box type structures. Automatic shut-off valves shall be installed at or near each end of the bridge.

Casings must be vented to outside of the structure at each end and at high points.

Exposed lines should be protected from damage, both accidental and intentional. This could include barrier and/or fencing with locked access.

Transverse supports must be provided for all gas lines.

Proposals must be submitted for approval with details of the pipe, casing, vents and attachments to the structure. Calculations must also be submitted to show that the proposed piping and casing system will be adequate for the intended purpose.

Gas line corrosion protection systems should be reviewed by the Facilities Design Team.

(2) Water Lines and Sewer Lines - Water or sewer lines placed adjacent to bridge footings should be cased if failure of the line could cause undermining of the footing or environmental hazard.

Water lines are to be hot-dip galvanized steel, ductile iron pipe, or approved equal. Corrosion protection systems may include cathodic protection.

Transverse supports must be provided near each coupling for all water lines.

In box girders, make provisions for a water line failure. Provide additional drain holes or grating at low points in the cells. Low pressure sensing shut-off valves will be required, in addition to the line being fully encased.

Water line thrust blocks may be required.

(3) Traffic Barrier - The number and size of conduits should be limited to assure ease of placement and proper consolidation of the concrete in the rail. Special attention should be given to details at expansion joint couplings because these tend to be much larger in diameter than the conduit.

1.4.7.5 Attachments to Existing Structures

Requests for attachments to existing structures normally come to the Region‘s District Manager. The District Manager submits the proposal to Bridge Section Operations Unit for review, comments, and recommendations. The Regions will make the final decision on any proposal. See Special Provisions 00589 – “Utility Attachments on Structures” for additional requirements.

Attachments to existing structures should be reviewed with the same concerns and considerations of new structures. Some additional concerns include:

- Conduits or brackets should preferably be attached to concrete structures with resin bonded concrete anchors.
- Mechanical anchors may be considered on a project-by-project basis if the following considerations are satisfied:
    - Anchors are of a type that will maintain capacity under dynamic or vibratory type loads.
    - Provide at least two anchors (4:1 safety factor per anchor) per attachment for redundancy, or design attachments with a single anchor to provide a factor of safety of 6:1.
    - Drilling through reinforcing steel should be avoided. If critical steel is hit, the anchor location must be moved and the hole must be patched with an approved patching material. The level of concern about cutting reinforcement depends on the location of the section, amount of reinforcement at the section, and the type of

reinforcement (moment, shear, temperature, etc.).

- All exposed pipe and hardware must be protected against corrosion.
- All exposed pipe and hardware must be protected against corrosion.
- The utility request must include utility hanger details.
- Drill holes with low-impact rotary drill.
- Patch any abandoned holes.

1.4.7.6 Utility Costs and Agreements

On new construction, the State normally provides the concrete inserts in the deck for hangers, holes through diaphragms, crossbeams and endwalls, and pipes under the end panels. This is regarded as providing minimal accommodation which essentially has zero or negligible cost ("de minimus", or below the threshold of actually costing the program) compared to not providing these items, and is acceptable per a January 2005 opinion from the Oregon Department of Justice. All other costs for materials and labor related to the utility installation are the responsibility of the utility company.

If a utility company requests the addition of conduits in a sidewalk or concrete rail, special attachment brackets, inspection walkways, etc., it is normally at the expense of the utility company.

In such a case, an agreement is needed between the State and the utility company before the work can be included in the project. The Utility & Railroad Coordinator in the Right of Way Section, Project Administration Unit writes the agreement. Notify the Utility & Railroad Coordinator as soon as possible in the project development process (preferably at the TS&L stage or before), to ensure an agreement can be reached and the work can be included in the project.