Pipeline Crossings of Bridges

Pete Slocum, PE, SE

Critical Design Features

When possible:

- Avoid thrust forces and separation = restrained or welded joints
- Avoid snaking
- Redundancy and safety factor for supports and anchors (4:1 safety factor on overhead anchors)
- Provide flexible restrained joints and lateral supports

“Snaking”

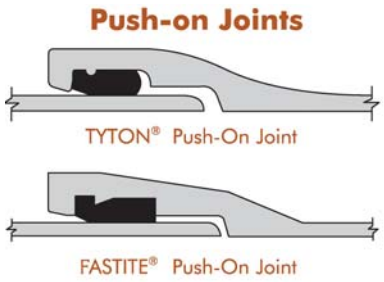
Reasons

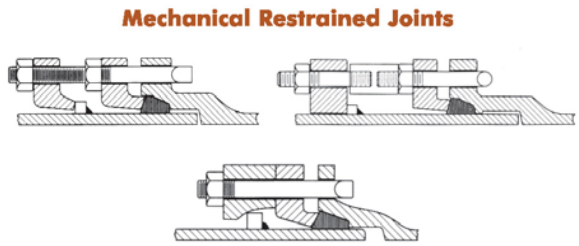
- Didn’t extend pipe prior to pressurizing
- Ball joints
- Lack of adequate lateral restraint

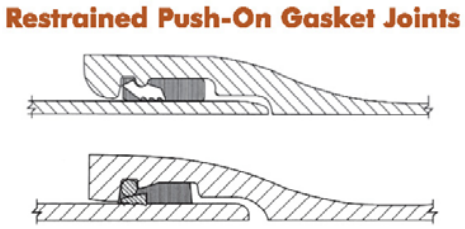
Lack of Adequate Support

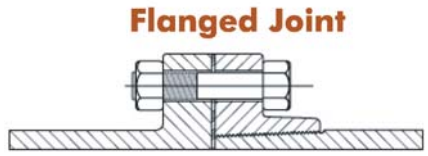
Joints

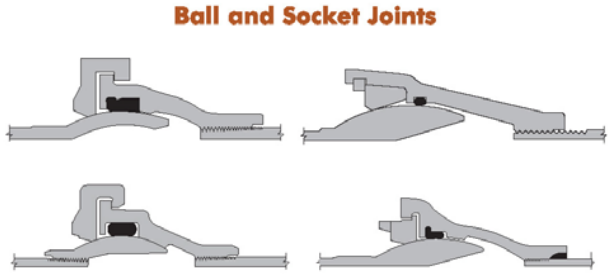
- Push-on
- Restrained push-on
- Mechanical restrained
- Flanged
- Ball
- Victaulic for casings



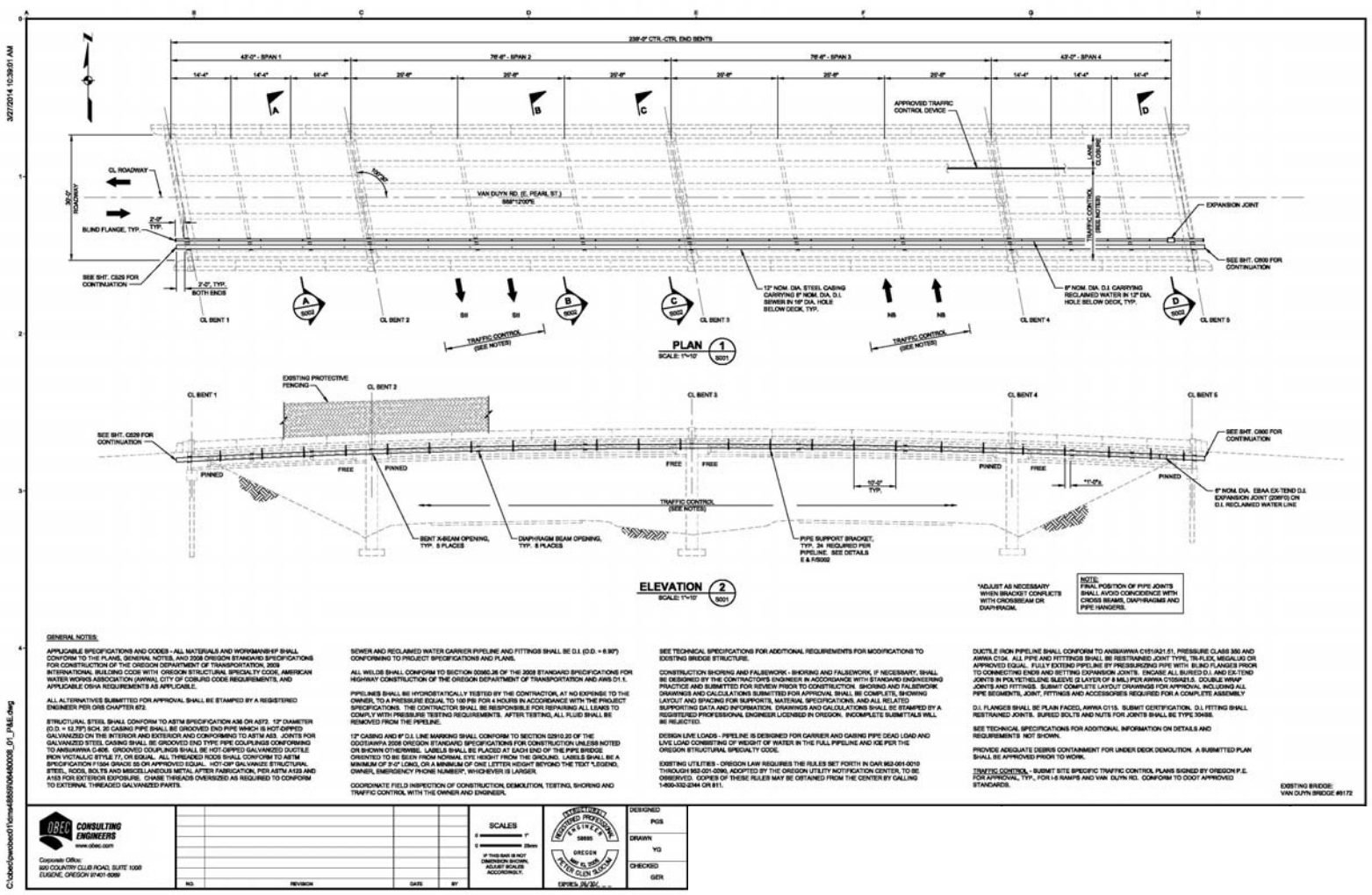




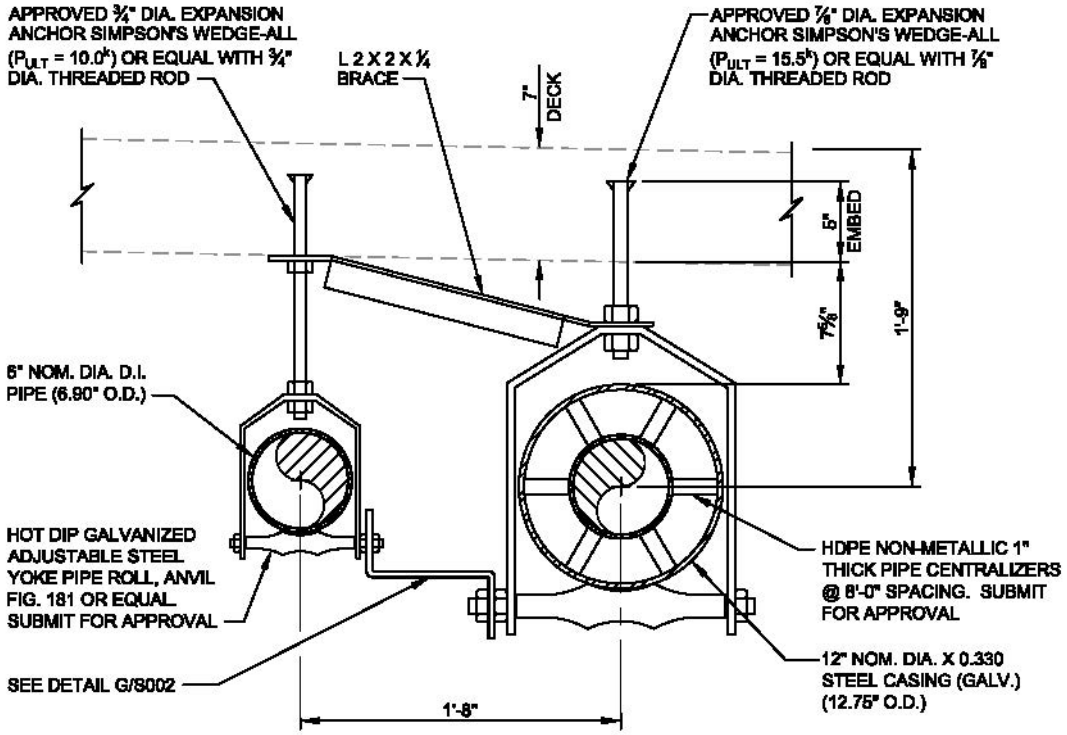




Complete Design Documents



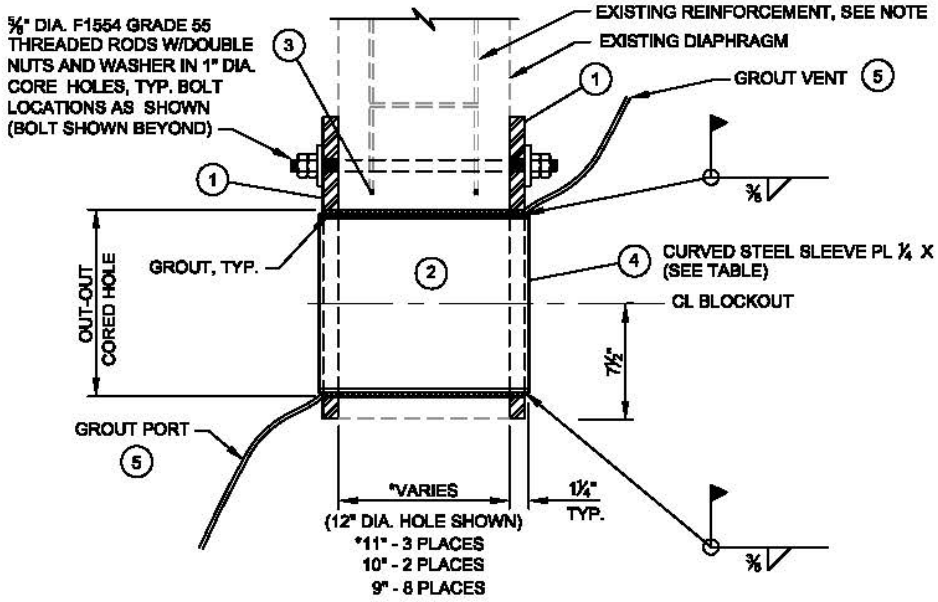
Complete Design Documents



PIPE SUPPORT DETAIL - SPANS 1 & 4 (E / S001)

(SHOWN NORMAL TO ROAD CENTERLINE) SCALE: 1 1/2"=1'-0"

Complete Design Documents



SECTION B (TYP. ALL BLOCKOUTS)
SCALE: 1 1/2"=1'-0" S003

INSTALLATION SEQUENCE:

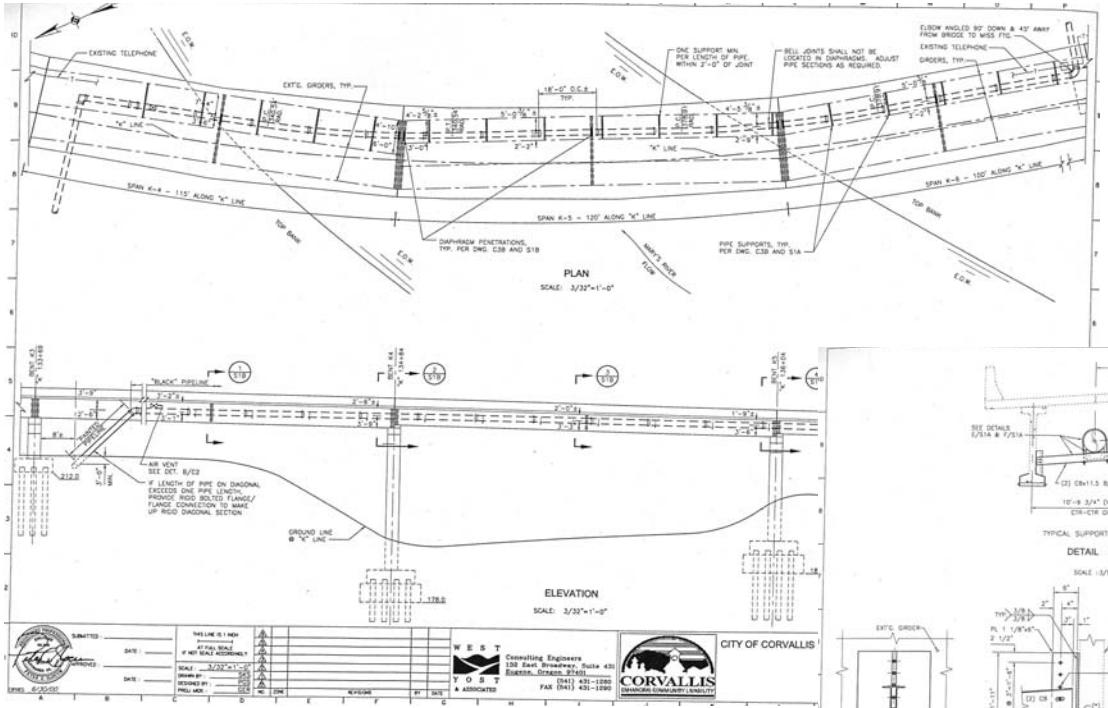
1. INSTALL ⅝" THICK PL'S EACH SIDE WITH BOLTS IN CORED HOLES.
2. REMOVE PIPE BLOCKOUT CONCRETE BY CORING AND DRYPACK ADDITIONAL VOIDS.
3. BURN BACK REINFORCEMENT 1" AND EPOXY COAT ENDS.
4. INSTALL HDG STEEL SLEEVE, WELD AND ZINC COAT.
5. PRESSURE GROUT ANNULAR SPACE.

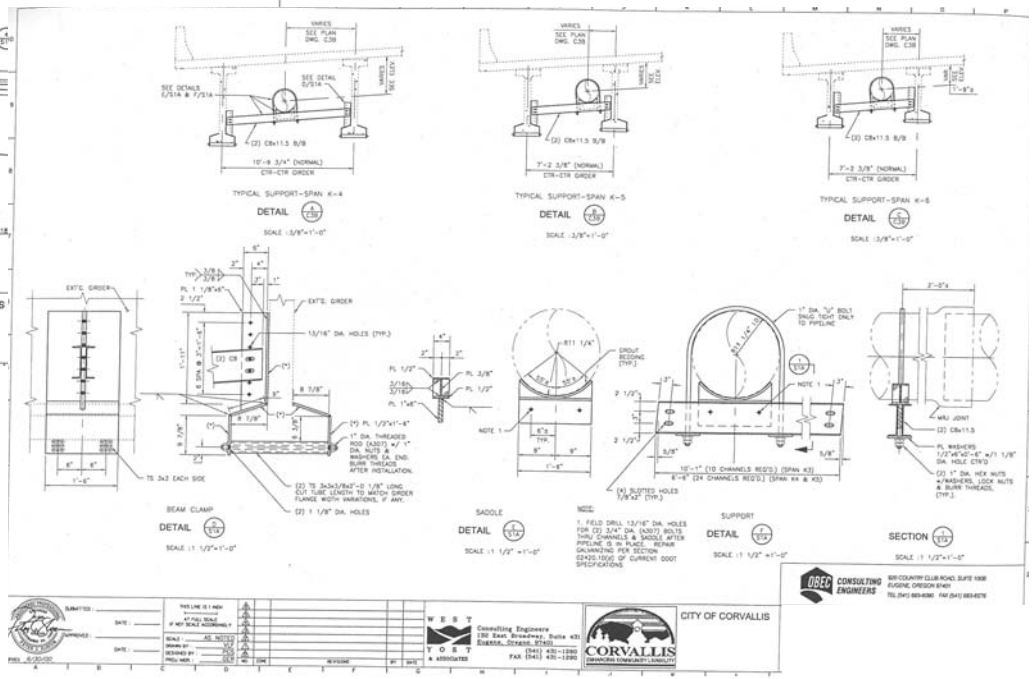
STEEL SLEEVE TABLE			
HOLE DIAMETER	PLATE O.D.	PLATE I.D.	PLATE SIZE
12"	11½"	11"	¼"
16"	15½"	15"	¼"

Abutments / Diaphragms

- Additional supports at bends and alignment deviations are recommended
- Provide sleeves under end panels
- Provide holes to pass bells
- Reinforce as required

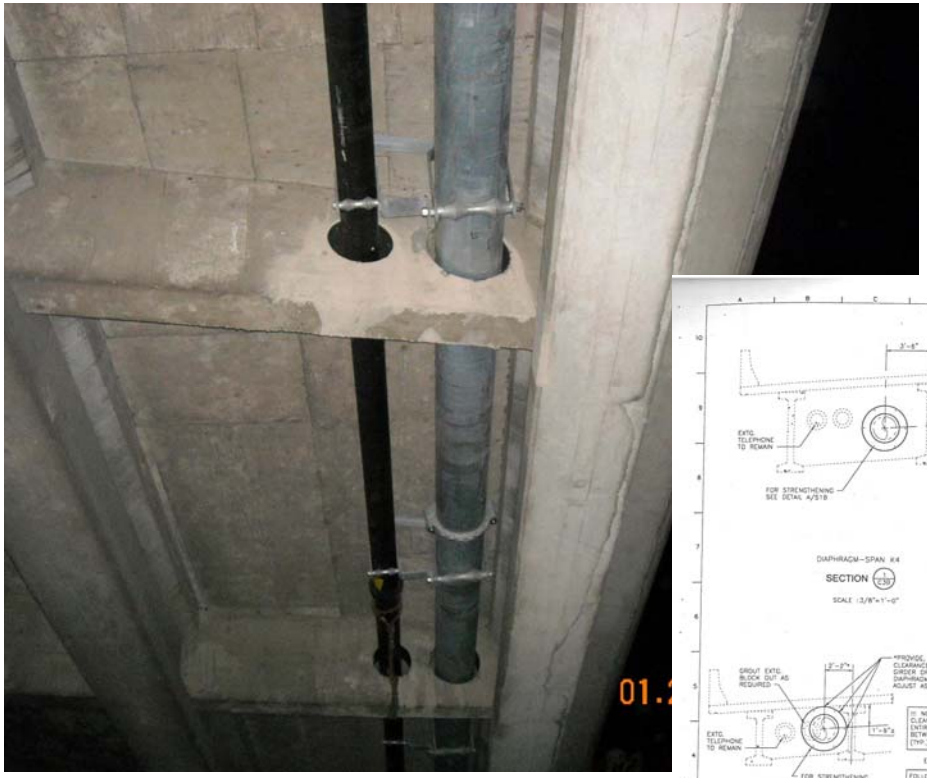
Curved Alignment

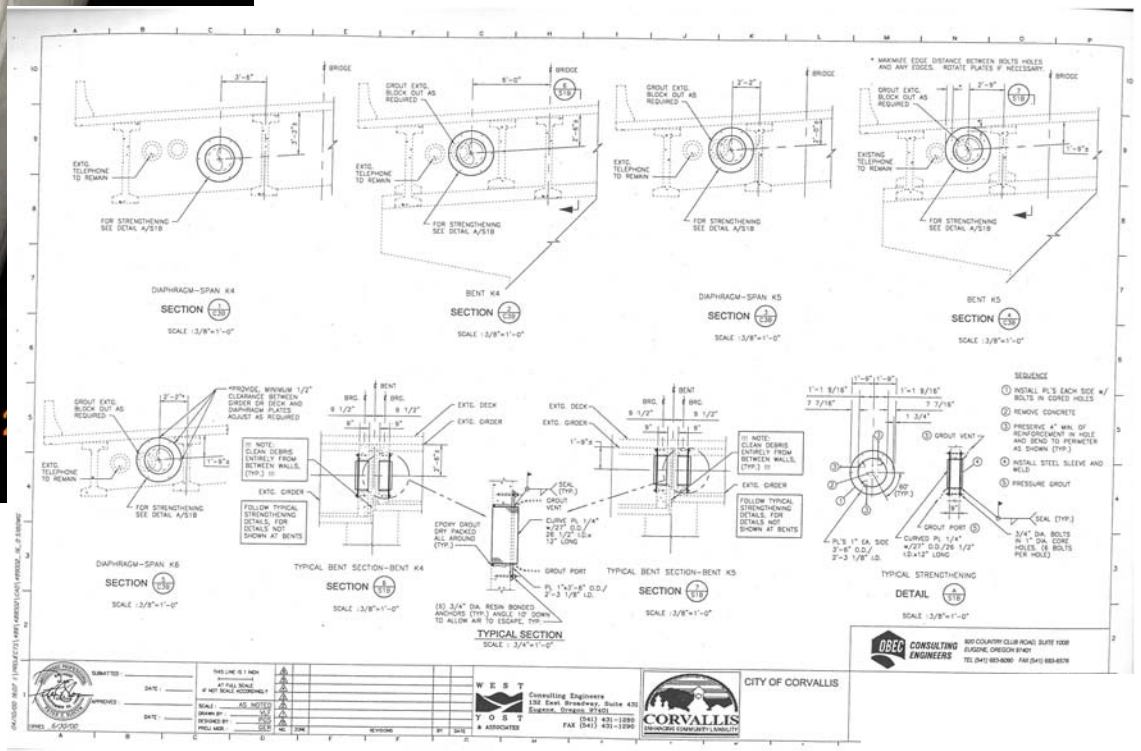




Curved Alignment

Underside view of bridge





Restraint at Bridge End

- Tricky transition at bridge end to stay out of “in-water work.”
  - Access deterrant
  - Ball joint
- Thrust design
  - Don’t forget about it!
  - Restrain joints and/or thrust block vertically & horizontally

Restraint at transition/bend

Supports

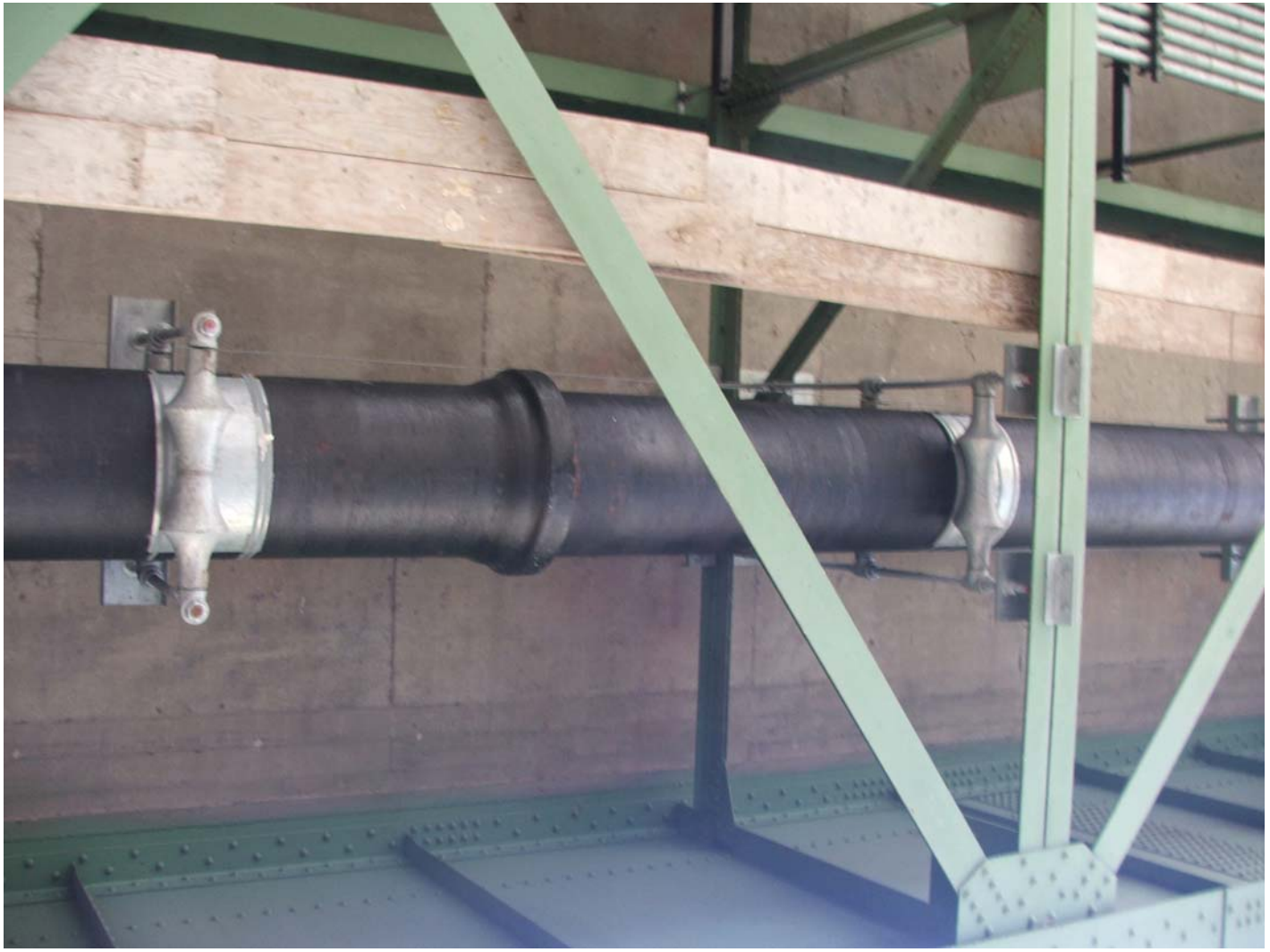
- Minimize loads to hangers/supports
- Minimal supports = 1 per pipe segment, typically at 10’ spacing
- Long spans need rollers
- Avoid prestressing in bridge girder with support anchors
- Place behind bells, not spigots
- Hot dip galvanize all support elements
- Anchors (4 to 1 safety factor)
- Check pipe and contents for span between supports

Supports, braces, rollers

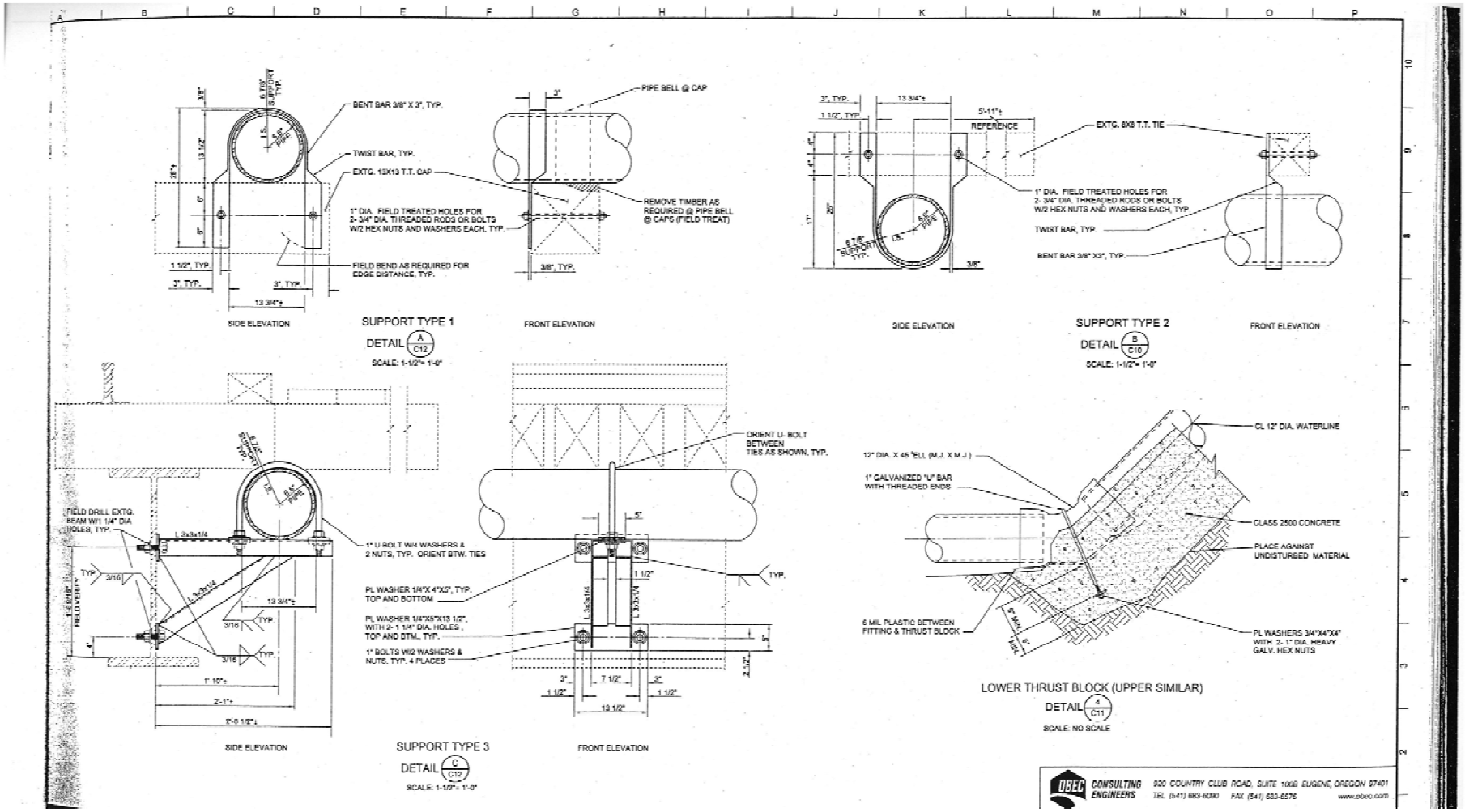
Pipe hangers under steel girder bridge

Pipe hangers under steel girder bridge

Steel bands under rollers to protect pipe



Supports on timber bridge



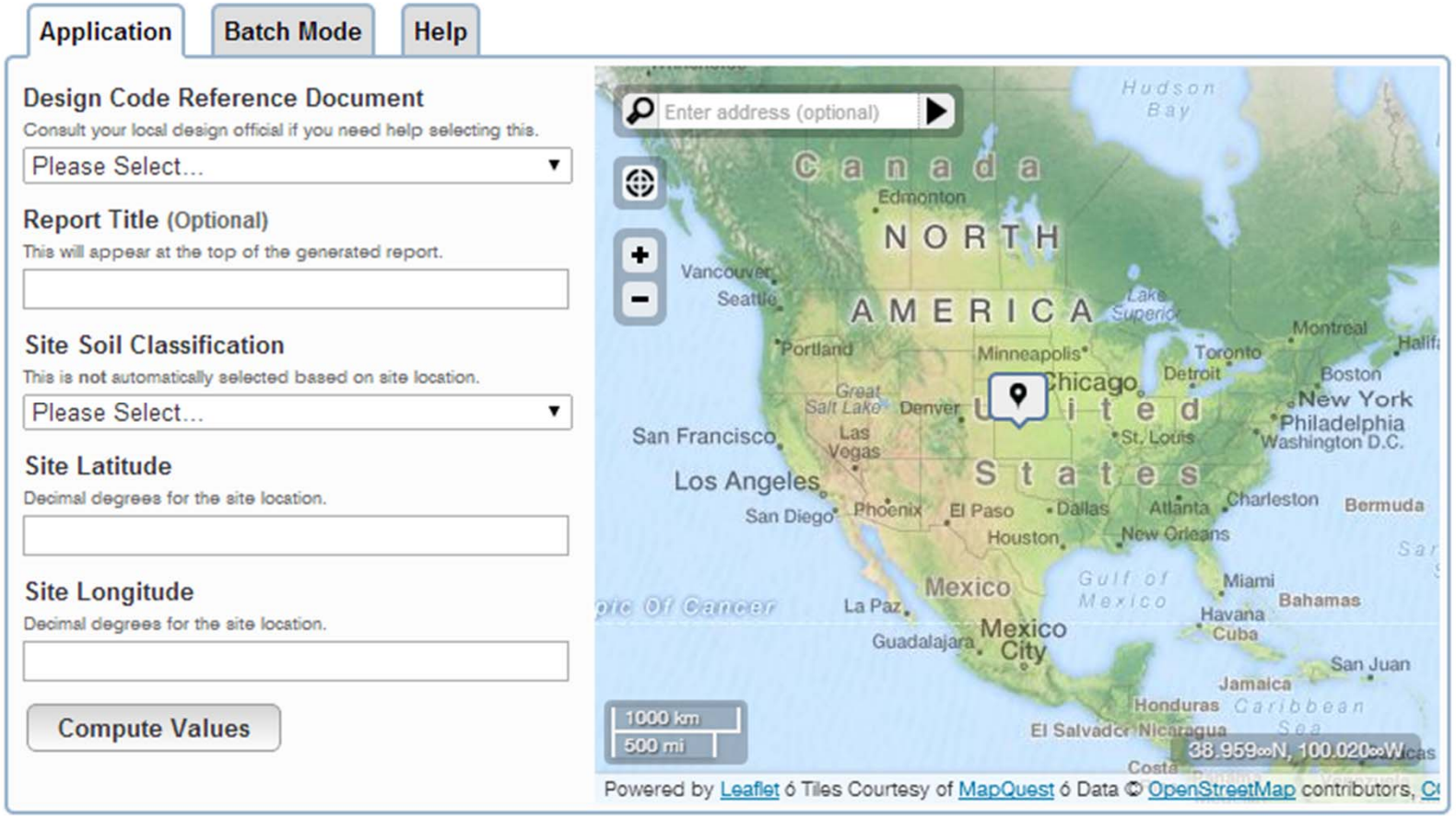
Freeze protection and high points

- **Insulation against freezing**
- **CARV at high points**

Casing

Seismic

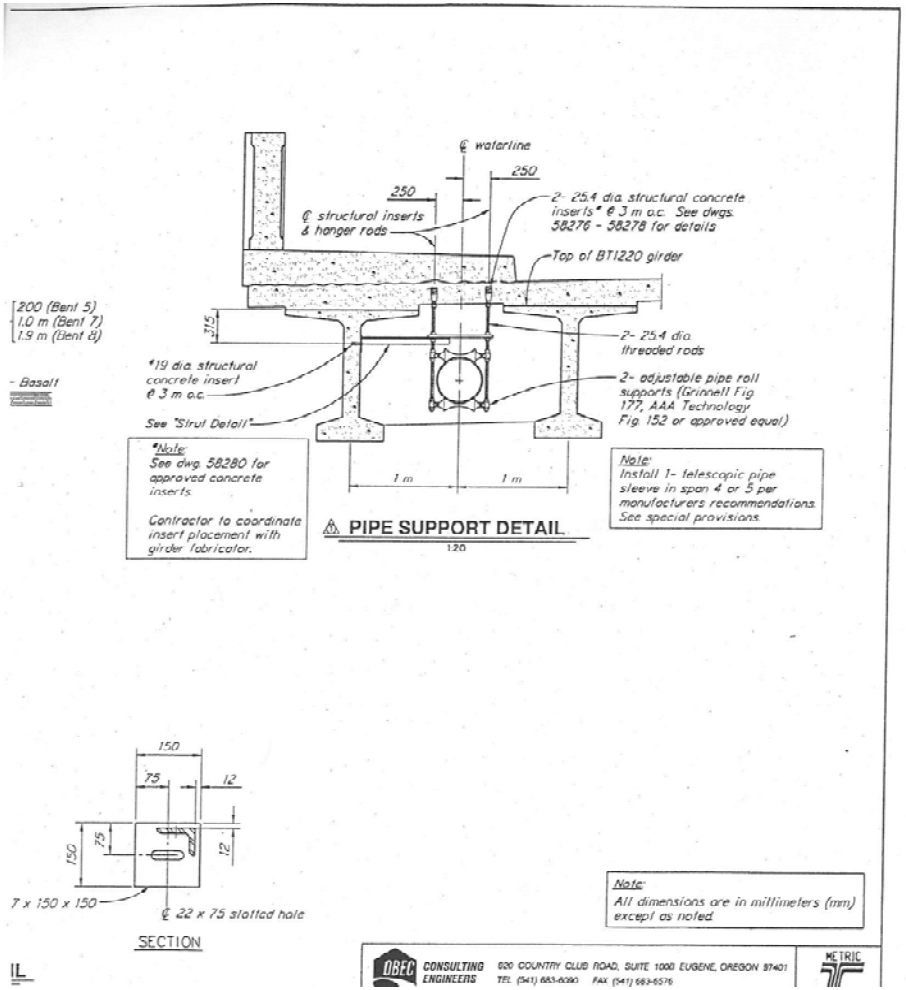
USGS Earthquake Hazards Program

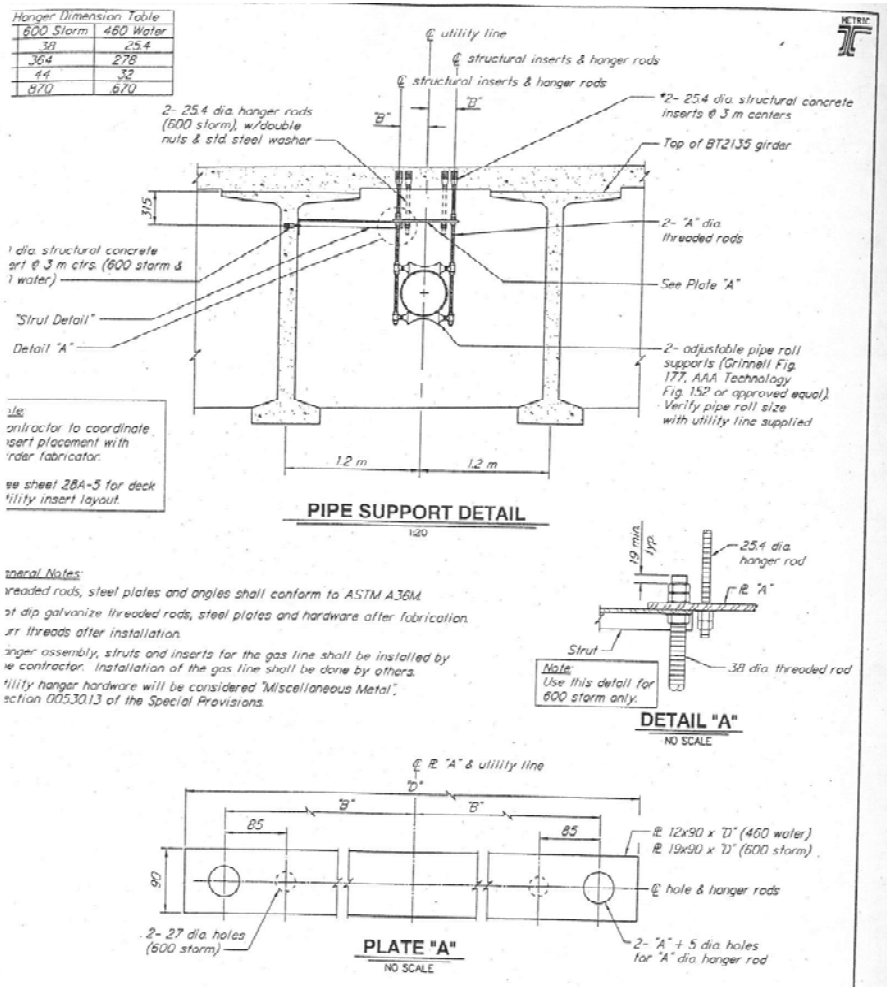


Seismic

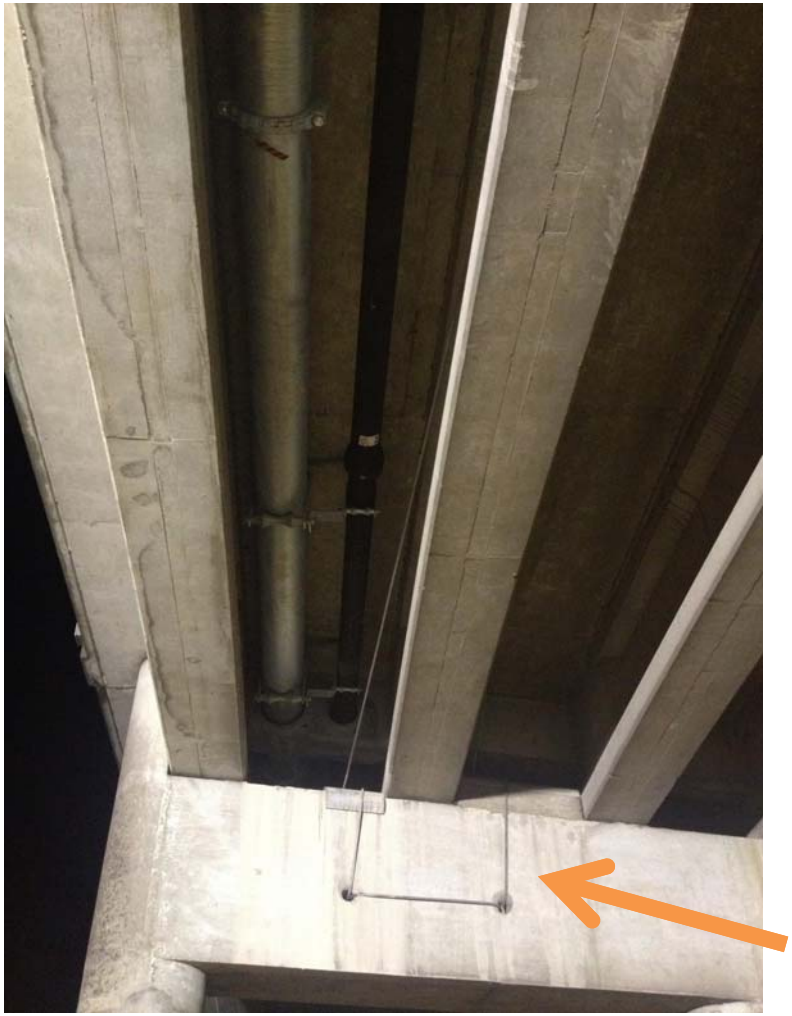
- Provide lateral support as needed. Always near flexible couplings and all gas lines
- Provide relative movement feature = expansion and ball joints
- Flexible restrained pipe
- Place restraint on top of pipe for vertical earthquake forces

Seismic


℄ waterline
250
250
℄ structural inserts & hanger rods
2- 25.4 dia. structural concrete inserts* @ 3 m o.c. See dwgs. 58276 - 58278 for details
Top of BT1220 girder
315
*19 dia. structural concrete insert @ 3 m o.c.
2- 25.4 dia. threaded rods
2- adjustable pipe roll supports (Grinnell Fig. 177, AAA Technology Fig. 152 or approved equal)
See "Strut Detail"
*Note:
See dwg. 58280 for approved concrete inserts.
Contractor to coordinate insert placement with girder fabricator.
1 m
1 m
Note:
Install 1- telescopic pipe sleeve in span 4 or 5 per manufacturers recommendations. See special provisions.
PIPE SUPPORT DETAIL
1:20
150
75
12
150
75
12
7 x 150 x 150
℄ 22 x 75 slotted hole
SECTION
Note:
All dimensions are in millimeters (mm) except as noted.
CONSULTING ENGINEERS
620 COUNTRY CLUB ROAD, SUITE 1000 EUGENE, OREGON 97401
TEL (541) 683-6090 FAX (541) 683-6576
METRIC


Hanger Dimension Table
600 Storm
460 Water
38
25.4
364
278
44
32
870
670
℄ utility line
℄ structural inserts & hanger rods
℄ structural inserts & hanger rods
2- 25.4 dia. hanger rods (600 storm), w/double nuts & std. steel washer
"B"
"D"
*2- 25.4 dia. structural concrete inserts @ 3 m centers
Top of BT2135 girder
315
2- "A" dia. threaded rods
See Plate "A"
"Strut Detail"
Detail "A"
2- adjustable pipe roll supports (Grinnell Fig. 177, AAA Technology Fig. 152 or approved equal). Verify pipe roll size with utility line supplied
1.2 m
1.2 m
PIPE SUPPORT DETAIL
1:20
General Notes:
threaded rods, steel plates and angles shall conform to ASTM A36M.
hot dip galvanize threaded rods, steel plates and hardware after fabrication.
per threads after installation.
hanger assembly, struts and inserts for the gas line shall be installed by the contractor. Installation of the gas line shall be done by others.
Utility hanger hardware will be considered "Miscellaneous Metal", section 00530.13 of the Special Provisions.
19 min. typ.
25.4 dia. hanger rod
℄ "A"
Strut
38 dia. threaded rod
Note:
Use this detail for 600 storm only.
DETAIL "A"
NO SCALE
℄ "A" & utility line
"D"
"B"
"B"
85
85
℄ 12x90 x "D" (460 water)
℄ 19x90 x "D" (600 storm)
90
℄ hole & hanger rods
2- 27 dia. holes (600 storm)
2- "A" + 5 dia. holes for "A" dia. hanger rod
PLATE "A"
NO SCALE

Importance of as-builts



Bridge retrofit seismic cables

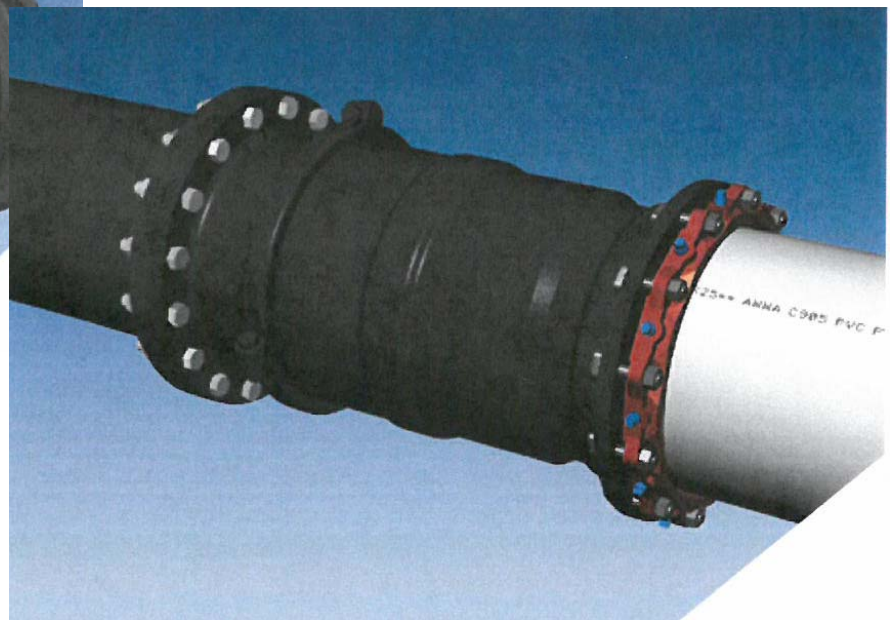
Expansion / Contraction

- Temperature movements
- Short span may use couplings
- Long spans require expansion joints
- Curved/bent routing requires ball joint
- Long spans require rollers
- Provide pipe expansion joints at bridge expansion joints

Restraint at transition/bend

Double ball joint

Axial joint



(From EBAA Iron Website)

Axial expansion joint – lateral restraint

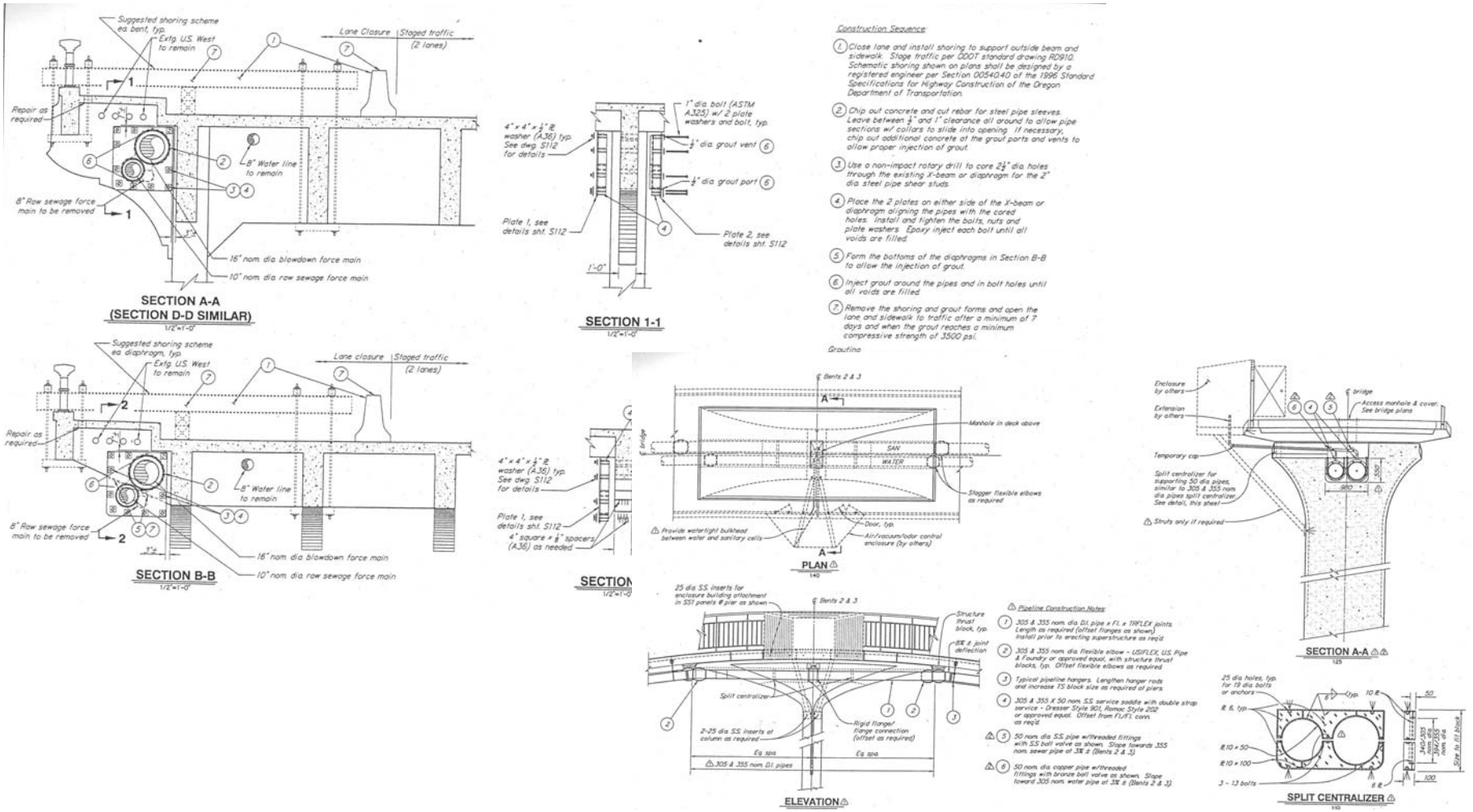
Location – Damage & Maintenance Control

- Locate on downstream side to protect from river debris, truck impact
- Locate near exterior for access with snooper crane
- Provide sufficient space around utilities for cleaning, repainting bridge, etc.
- Don’t extend utility below bridge superstructure
- Avoid settlement issues off end of bridge

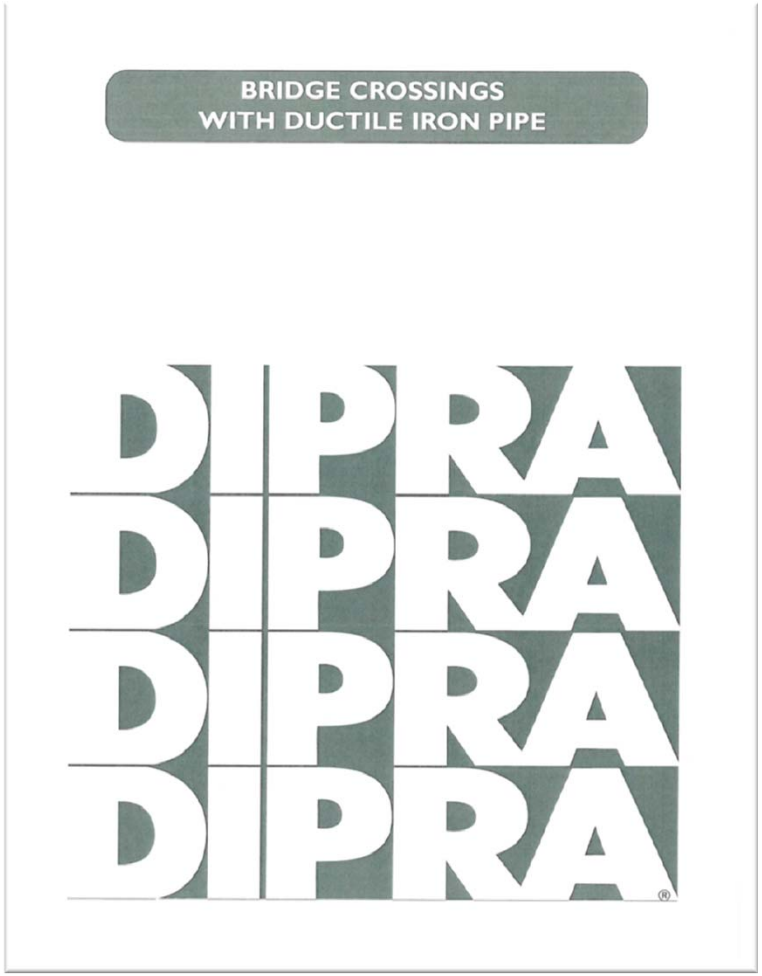
Location

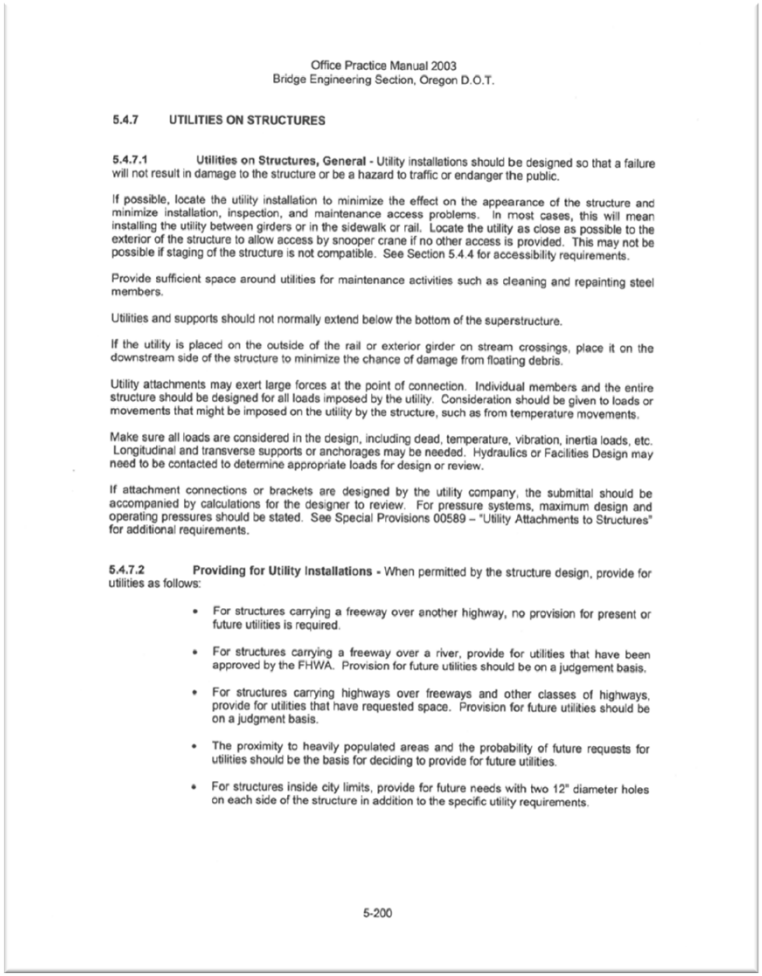
Hidden pipe

Location


SECTION A-A
(SECTION D-D SIMILAR)
SECTION 1-1
SECTION B-B
Construction Sequence:
Grouting:
PLAN
ELEVATION
SECTION A-A
SPLIT CENTRALIZER

References





Office Practice Manual 2003
Bridge Engineering Section, Oregon D.O.T.

5.4.7 UTILITIES ON STRUCTURES

5.4.7.1 Utilities on Structures, General - 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 5.4.4 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.

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.

5.4.7.2 Providing for Utility Installations - When permitted by the structure design, provide for utilities as follows:

- For structures carrying a freeway over another highway, no provision for present or future utilities is required.
- 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 judgement 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.
- 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.

5-200

Questions?

Thanks for attending!