Accepted Value Engineering Proposal
Recognized Advantages of PREDL Concrete Protective Liner Systems
[ Rohnert Park, CA ]

Owner: City of Rohnert Park [ Rohnert Park, CA ]
Engineer: GHD Engineering [ Santa Rosa, CA ]
Contractor: Ghilotti Construction Company [ Santa Rosa, CA ]
Precaster: Jensen Precast [ Sacramento, CA ]

PREDLsystems.com
Custom Connection Detail for PREDL Bell & Compression Gasket

**C300 DR 25 Pressure Class 165 PSI**

<table>
<thead>
<tr>
<th>SIZE RICH</th>
<th>O.D. RICH</th>
<th>I.D. RICH</th>
<th>WALL THICKNESS RICH</th>
<th>Working P.S.I.</th>
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<td>4.60</td>
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<td>6&quot;</td>
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<td>8&quot;</td>
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**C305 DR 25 Pressure Rated 165 PSI**

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<td>30&quot;</td>
<td>33.00</td>
<td>32.35</td>
<td>1.970</td>
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**STEP 1**
Cut the bell to fit the form (by Predli)

**STEP 2**
The cut pieces will be delivered to site with our product - to be used as shown (if required)

**STEP 3**
The contractor may use additional tape at the edges (tape supplied by others)

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**PREDL 24" and 18" FRP BELL ASSEMBLY DETAIL**

**PREDL 24" FRP BELL ASSEMBLY DETAIL**

**NOTES:**
- Technical Specification of Raw Materials for Predli System Polypropylene Base Liner (See DWG. 19)
- The 18" bell assembly will be based on the same concept of the above detail
Original Proposal vs. PREDL Systems Accepted Value Engineering Proposal

Competitor’s Design [ Min 60” Dia Required ]

- MH COVER AND FRAME
- HMA PER PLAN
- 60" I.D.
- HDPE LINER (TYP)
- HDPE LINER EMBEDMENT (TYP.)
- LOWLINE OF U-SHAPED CHANNEL

RIGID PIPE CONNECTION

PREDL Design [ 48” Dia Required ]

- MH COVER AND FRAME
- HMA PER PLAN
- HDPE LINER (TYP)
- HDPE LINER EMBEDMENT (TYP.)
- LOWLINE OF U-SHAPED CHANNEL
- PREDL HDPE CORPROTECT
- DR25 C900 PVC PIPE
- GASKET
- PIPE
- BASELINER BRIDGE SUPPORTS

ACCURATE, FLEXIBLE, WATER TIGHT
PREDL PIPE CONNECTION
All tasks with strike through indicate ways in which PREDL systems Accepted Value Engineering Proposal Reduced Time and Cost from Standard Specification.

1. Shop weld HDPE boot flange to HDPE liner on manhole lid (Typ.).
2. Min. of one 3” HDPE grade adjustment ring, max. of one 3/4” HDPE grade ring.
3. Set all barrel sections in plastic gasket, ram-NEK or approved alternate. Typical joint use (2) 3/4” X 2-1/2” ram-NEK seals.
5. After lower ring section is set, cut out top half of pipe flush with inside face of M.H. wall and construct shelf and U-shaped channel. Make elevation changes gradually and directional changes with smooth curves. Slope and size of channels shall match upstream and downstream pipes. Manhole channels shall match the slope of the pipe.
6. Provide coupling (Typ.) per specifications. Wrap coupling with 50 mil corrosion tape.
7. Cast PVC inlet/outlet stub-outs into pre-cast manhole base, or barrel sections (Typ.). Fill and annular voids with non-shrink grout.
8. Overlap HDPE liner 6” min. (Typ.) field weld overlapped sections.
9. Pre-cast manhole base and barrel sections with integral HDPE liner.
10. Glue HDPE boot to PVC stub-out (Typ.).
11. Verify inlet/outlet elevations and orientation before ordering precast products.
12. Install external joint seal at all barrel connection sections.
13. Provide dual SST straps over HDPE boot to secure boot (Typ.).
14. Cut and remove any excess PVC inside manhole without disturbing HDPE boot flange.
15. Weld HDPE liner to HDPE grade ring (Typ.).
16. Trim bottom of first HDPE grade ring to sit flush on MH slab.
17. Spark test per Spec. (Typ.).
18. Vacuum test ring joints per Spec. (Typ.).
19. Tape wrap HDPE grade ring joints with 50 mil corrosion tape (Typ.).
20. Apply sealant between frame and grade ring (Typ.).
Integral HDPE Transition Strip Allows Extrusion Weld Joint Connection to HDPE Lined Precast Risers
48” Dia MH

24” C905 DR25 PVC PIPE

90°
Post Pour - No Additional Finishing Steps Required... Pour, Strip and Ship
Field Installation Method for Downstream Pipe - PREDL Bell & Compression Gasket

Lubricant Applied to Gasket Lip

Excavator Drives MH onto Pipe

Pipe Cut to Length then Chamfered

Field Chamfered Spigot w/ Applied Lubricant
METHODOLOGY AND FINDINGS

The 3.5 mile (5.6 km), 12- to 42-inch (300 to 1,060 mm) diameter ESTS conveys a flow rate of up to 14 mgd (53 ML/d) from various contributing sewers. Due to the size of the project, the planning, design, and construction was split into three phases to meet intermediate flow conditions and City budget needs. As the project was implemented over time, the City and design team embraced and applied wastewater industry and job-specific lessons learned, emerging construction materials, and revised planning numbers for collection system flows. A summary of project hydraulics and construction materials and techniques is provided below, which are based on lessons learned from the local project experience and conditions, as well as current trends in the wastewater industry.

Hydraulic Considerations

Job planning involved hydraulic evaluation and modeling of the City’s collection system. Emphasis was set on updating previous models with current planning numbers that accounted for water conservation measures, flows for various planned developments, and measured infiltration and inflow (I/I) rates. A reduction in base flows from planned developments resulted in a reduction in the ESTS pipeline diameter for Phases II and III. A summary of the planning numbers is provided below:

- Water conservation and flows for planned developments: Base flows were adjusted in the City’s model to account for a new state law generally requiring a 20 percent reduction in water use for urban water suppliers.
- I/I flow rates: Results of flow monitoring study showed that performance of the City’s collection system more closely matched a reference standard. The model was calibrated to simulate observed conditions.

Through this analysis, the alignment and hydraulic performance needed for the ESTS was determined, which confirmed that conveyance of flows from the collection system by gravity was feasible, albeit challenging.

Emerging Construction Materials and Techniques

Due to aging collection system infrastructure, high groundwater table, and the use of pea gravel backfill for a majority of the City’s utilities, management of I/I has become a system-wide necessity. City collection system planning includes the use of modern construction materials and techniques to minimize I/I and promote high quality construction. Tables 1 and 2 provide a summary of construction materials and techniques used for the ESTS project.

INTRODUCTION

In contrast to many collection systems, the City of Rohnert Park system conveys all wastewater (with the exception of one small lift station) from the City’s service area (population ~45,000) by gravity through various collector, trunk, inverted siphon, and lateral sewers to the City’s effluent pump station. Planning for the Eastside Trunk Sewer (ESTS), which serves a majority of the east side of the City, followed the same planning scheme: to achieve gravity flow. This presented various challenges for design and construction, including: deep utility trenching in unconsolidated native soils within a high groundwater table and a seismically-active region; tunneling; resource agency permitting; and community impacts.

The ESTS alleviated hydraulic deficiencies within a large portion of the existing collection system by intercepting flows at key locations to relieve hydraulic impacts to undersized sewers. Completion of the project also allows for new development with the City’s service area. Figure 1 provides an overview of the project limits and phases, including the completion date for each phase.

KEYWORDS

Collection systems, infiltration/inflow, innovative technology

ABSTRACT

The Eastside Trunk Sewer (ESTS) conveys a majority of the wastewater from the City of Rohnert Park (population ~45,000) to the City’s effluent pump station. This 3.5 mile (5.6 km), 18- to 42-inch (460 to 1,060 mm) pipeline conveys up to 14 mgd (53 ML/d) from various contributing sewers and traverses City commercial and residential corridors.

Planning and design for the ESTS involved a gravity pipeline that would manage various challenges such as high groundwater and poor soils during construction and minimize infiltration and inflow (I/I) over the service life of the construction materials. As the ESTS progressed through three phases of design and construction from 2005 to 2015, new and improved construction materials and techniques were incorporated into the project. Materials focused on two primary goals: 1) keeping manholes and pipelines water tight; and, 2) extending the useful life of the project to reduce future rehabilitation needs. Construction techniques focused on coordinating construction activities and quality assurance for excavation in difficult ground conditions and quality control for completed work.

Challenges and findings from the implementation of the materials and techniques are presented herein.

The Challenge with Gravity – How to Build a Better Trunk Sewer

Matt Winkelman, PE, GHD Inc. (matt.winkelman@ghd.com)
Iver Skavdal, PE, GHD Inc.
Darrin Jenkins, PE, City of Rohnert Park
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### Table 1. ESTS Construction Materials

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<thead>
<tr>
<th>Material</th>
<th>Benefits</th>
</tr>
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</table>
| Fiberglass manhole base insert | • Increased water-tight design at pipe penetrations using integral pipe bells with compression gasket fittings  
• Improved quality control with factory fabrication of fiberglass insert in combination with precast concrete manhole base  
• Increased efficiency for construction with the complete manhole base delivered to the site ready for installation  
• Reduced manhole diameters, typically from 60 inches to 48 inches, which reduced the excavation footprint and impacts to adjacent utilities. |
| High density polyethylene manhole liner | • Increased water-tight design and resistance to hydrostatic pressure for manhole barrels and barrel joints using embedded HDPE anchors (a.k.a. “studs”) and welded seams.  
• Improved corrosion resistance. |
| High density polyethylene manhole grade rings with external joint seal and tape wrap | • Improved water-tight design near ground surface. |
| Composite manhole frame and cover | • Reduced cover weight while maintaining structural integrity for use in roadways.  
• Standardization of locking and opening mechanisms. |
| Water main piping (AWWA C905) | • Increased hoop strength to account for pipe loading.  
• Improved water-tight design at pipe joints using water main gasket connections. |

### Table 2. ESTS Construction Techniques

<table>
<thead>
<tr>
<th>Construction Technique</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potholing all crossing existing utilities</td>
<td>• Verify design conditions and coordinate with utility providers ahead of utility construction.</td>
</tr>
<tr>
<td>Stabilized unconsolidated soils in critical utility zones using an injected cement mixture</td>
<td>• Increased the stiffness of native soils to reduce caving and associated impacts to surrounding infrastructure.</td>
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</table>
| Installation of dewatering wells at 50- to 100-foot on center in combination with conventional shoring | • Lowered groundwater levels ahead of utility trenching.  
• Promoted efficient production rates for utility installation by enabling the use of conventional shoring techniques.  
• Dewatered water reused for agricultural benefit during drought conditions. |
| Backfilled trenches using controlled low strength material (CLSM) | • Promoted efficient production rates for utility installation by eliminating need for compaction efforts and testing of soil backfill.  
• Improved backfill quality that reduces the potential for settlement-induced damages to surrounding hardscape. |
| Testing and CCTV inspection for pipelines, with low tolerance for pipe “bellies” | • Verify quality of construction for flat sewer design. |
| Spark and vacuum testing for manholes | • Verify quality of construction for water-tight installation of HDPE manhole liner. |

### SIGNIFICANCE

The ESTS project critically reviewed existing design standards of practice against emerging industry trends for construction materials and techniques. This effort began at job planning, with an assessment of hydraulic design criteria to fit with modern conditions for drought and water conservation, as well as the use of recorded flow data in lieu of empirical data for sizing of infrastructure. A review of industry trends continued during the design phase to incorporate modern construction materials that target reduced I/I and enhanced corrosion resistance, as well as construction techniques that promoted efficiencies and quality. During the construction phase, the project team worked with the contractor to promote a beneficial balance between quality and efficiency for production rates, requiring quality checks at regular intervals and for all installed system components.

The City invested capital funds for the long term betterment of its collection system. Future I/I contribution from the ESTS pipeline is anticipated to be very low, and with retrofits planned for other City infrastructure (i.e., replacement of manhole “chimneys”, rehabilitation of aging pipelines and manhole structures using trenchless technologies), operation and maintenance costs are anticipated to decrease.