



May 10, 2013

Successful Replacement of Failing AC Water Distribution Pipe Using Trenchless Methods in Olympia, WA

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ANTEC CORPORATION,
North Bend, WA**



Company Background

- **Received NASTT's 15th Anniversary Award in recognition of contributions to the trenchless technology industry and the development of Certa-Lok restrained joint pipe**
- **Member of Various AWWA Committees**
 - C900, C905, C605, M23
- **Member of the Uni-Bell PVC Pipe Association**
- **Member, Plastics Pipe Association (PPI) Hydrostatic Stress Board (HSB)**



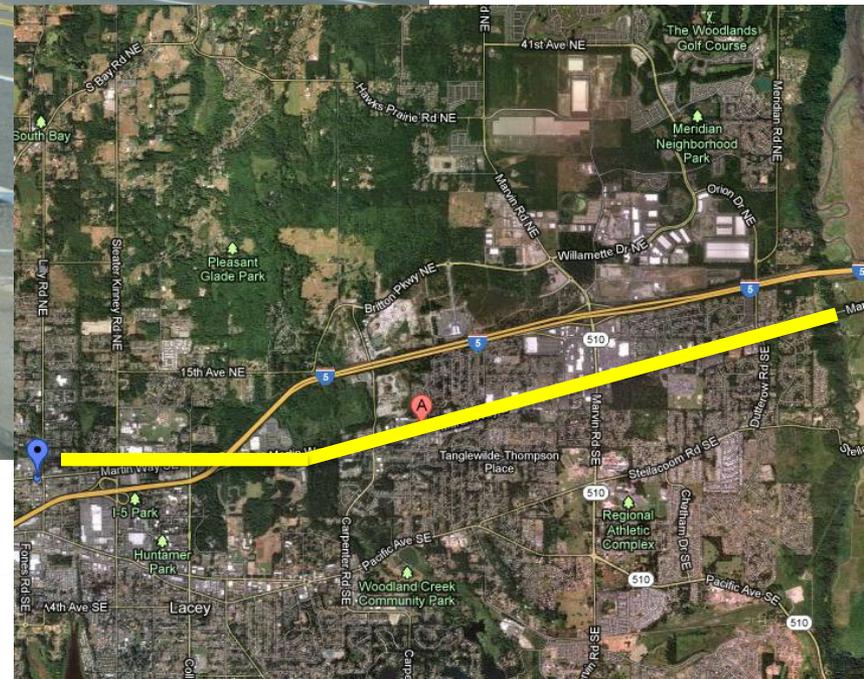
Project Description

- In 2011, the city of Olympia, WA, was faced with finding the best replacement pipe material and installation method for an aging Asbestos-Cement (AC) water main



- The main, aged between 50 and 60 years, had experienced three breaks over three years, and had yet another during the design phase of the replacement project
- Adding to the predicament was the pipe's location underneath Martin Way, one of the city's busiest streets, in a district with multiple businesses and multifamily developments

Martin Way, Olympia, WA



Project Description

- Original intent was to use open trench for the project
 - “Traditional” method, and more local contractors would be able to bid
 - But with open-trench installation, Owner would have to:
 - Replace the asphalt-paved roadway
 - Significantly restrict traffic during construction
- Decision made to “Go Trenchless”
 - Installation would only require closing one of four lanes of traffic

Vermeer 36x50 directional drill

- 36,000 pounds pullback
- 5,000 foot pounds radial torque



Project Description

- Olympia then looked into various trenchless installation methods:
 - Cured-in-place pipe (CIPP) rehabilitation technology
 - Too expensive, and would require the original water main to be shut down during the project
 - Static pipe bursting
 - Environmental sensitivities about driving fragmented AC pipe into the surrounding soil
- Directionally boring adjacent to the existing main, installing new pipe, and disconnecting and abandoning the old pipeline, was determined to be the best engineering solution, and the most cost-effective option
 - *Wiseman Utilities: Attempting this in an open-trench installation would have been more complicated and less safe than it was with HDD*
 - Project came out with less than half of the expense of what it would have cost for open trench - didn't have to repair the concrete and asphalt or make frontage improvements

Project Description

- With a decision made to use HDD for installation, next critical decisions were:
 - *What pipe material?*
 - Thermoplastic, Metal, Other??
 - Maintenance crew already had the proper tools and fittings in stock for PVC, but didn't have the fusion equipment or parts for HDPE pipe.
 - Suggested use of PVC on the project instead of HDPE
 - *What joining system?*
 - Segmented, Fused, . . . ??



Advantages of PVC Pipe

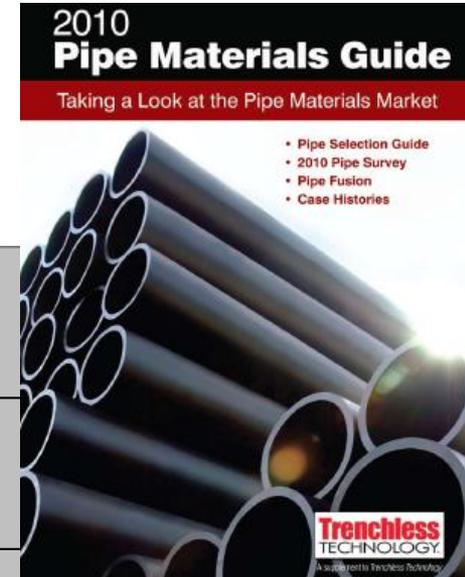
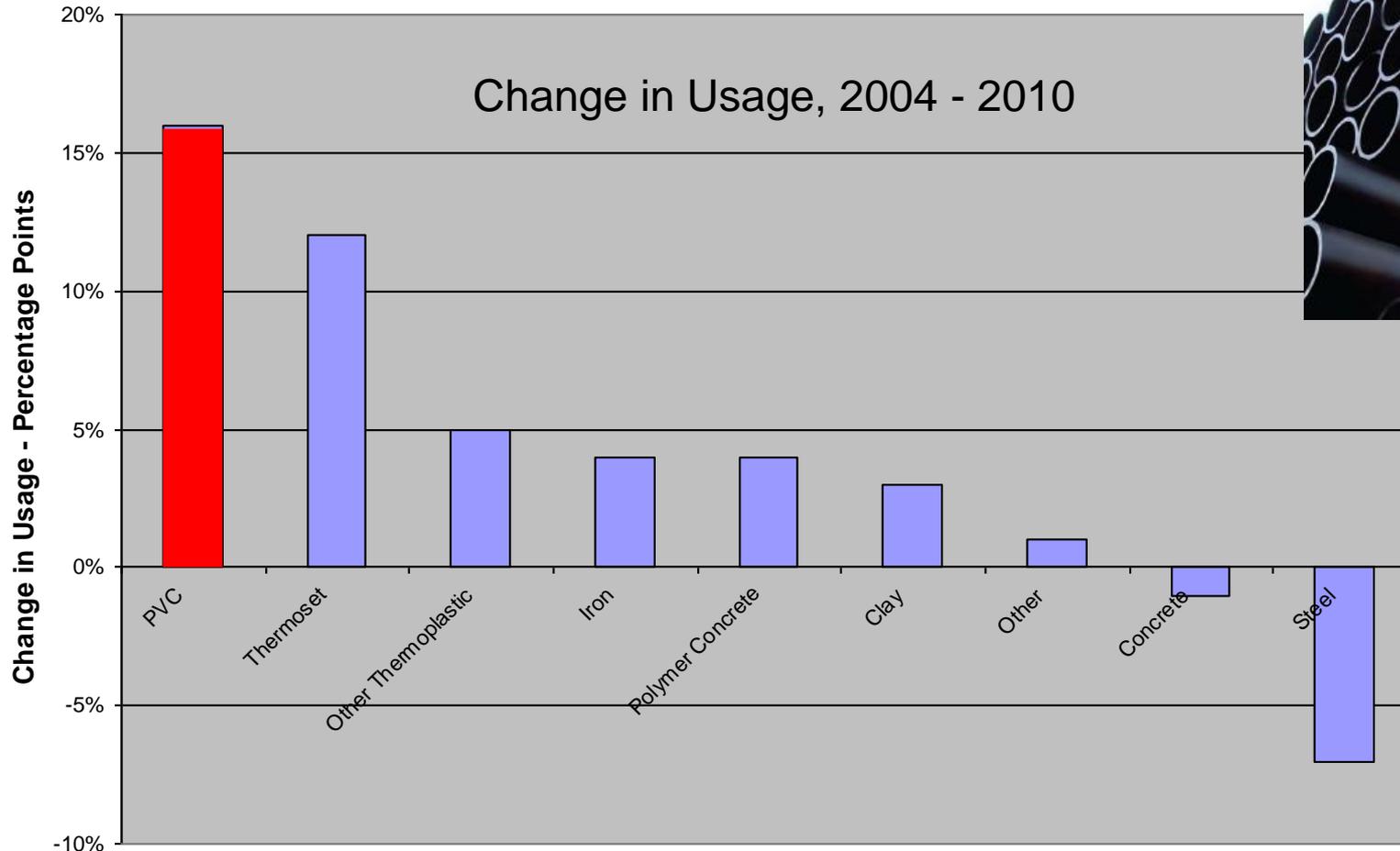
1. Water Quality & Superior Flow Characteristics



2. PVC – Fastest Growing Pipe Material in Trenchless Construction . . .

Trenchless Technology Magazine Pipe Survey

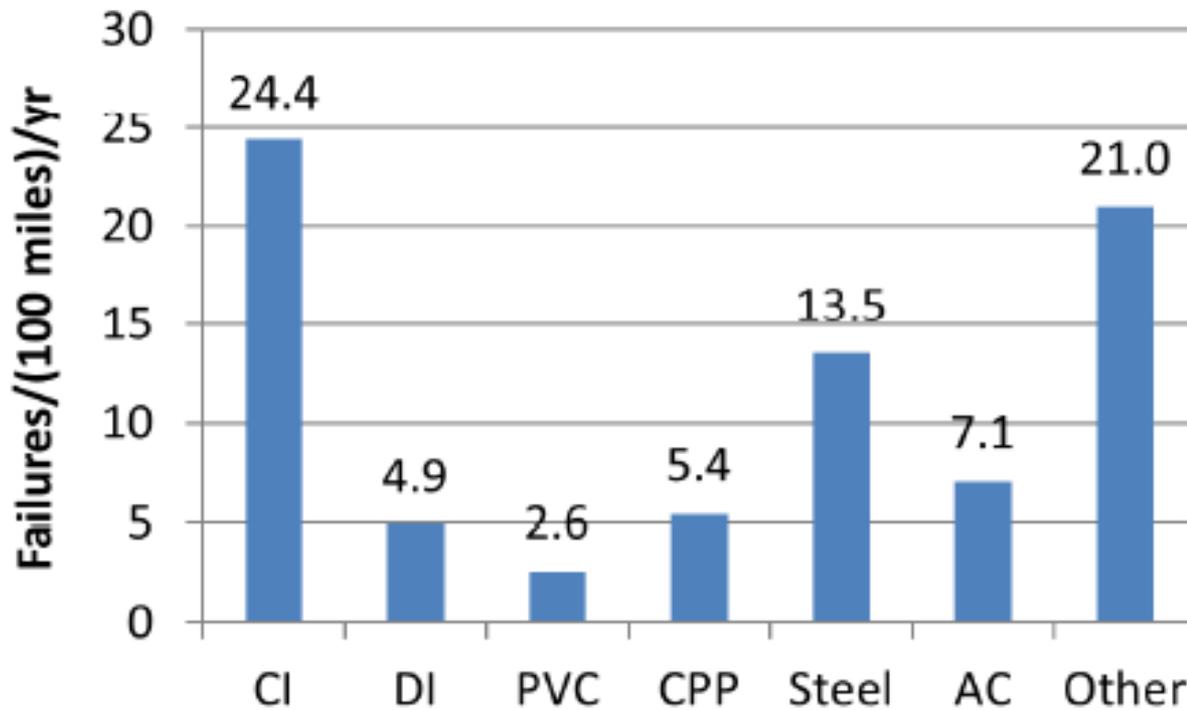
Q. What types of pipes do you use for trenchless projects?



. . . driven in large part by it's superior longevity

Most Important Conclusion

- PVC has the lowest failure rate of the six mostly commonly used pipe materials



Other includes HDPE, galvanized, steel, and copper

*Water Main Break Rates
In the USA and Canada:
A Comprehensive Study
April 2012*



Utah State University
Buried Structures Laboratory

Steven Folkman, Ph.D., P.E.



3. Corrosion Resistance

Iron Pipe is Subject to Severe Corrosion in “Hot” Soils



3. Corrosion Resistance



1. Polyethylene encasement reduces, but does not prevent corrosion of DIP
2. Polyethylene encasement cannot be installed without damage to the polyethylene
 - *Especially true in trenchless*

Project Description

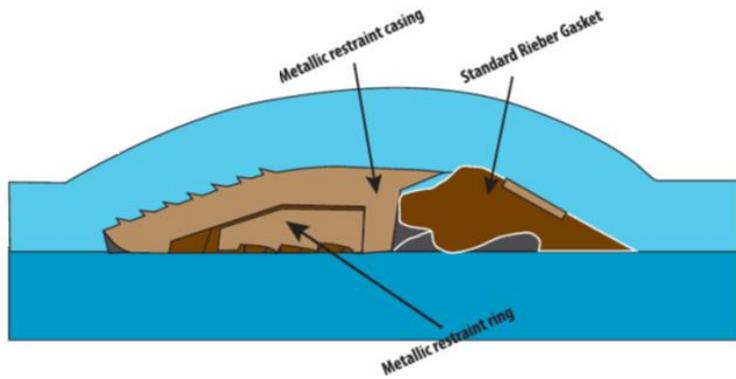
- With a decision made to use HDD for installation, next critical decisions were:
 - *What pipe material?*



- ***What joining system?***
 - **Segmented**, Fused . . . ??

Project Description

- Segmented system selected
 - Initial product failed, and had to be removed



Certa-Lok (Segmented) Restrained-Joint PVC Pipe



Restrained-Joint PVC Pipe
Efficiency • Performance • Simplicity • Sustainability

- Precision groove on pipe
- Precision Coupling (or Integral Bell) with matching groove and stop
- High shear-strength spline
- Reliable O-ring Seal (Teflon[®] coated)
 - Zero-leak joining system
- Basic pipe lubricant
- Over 55 Million feet successfully installed over 20 years

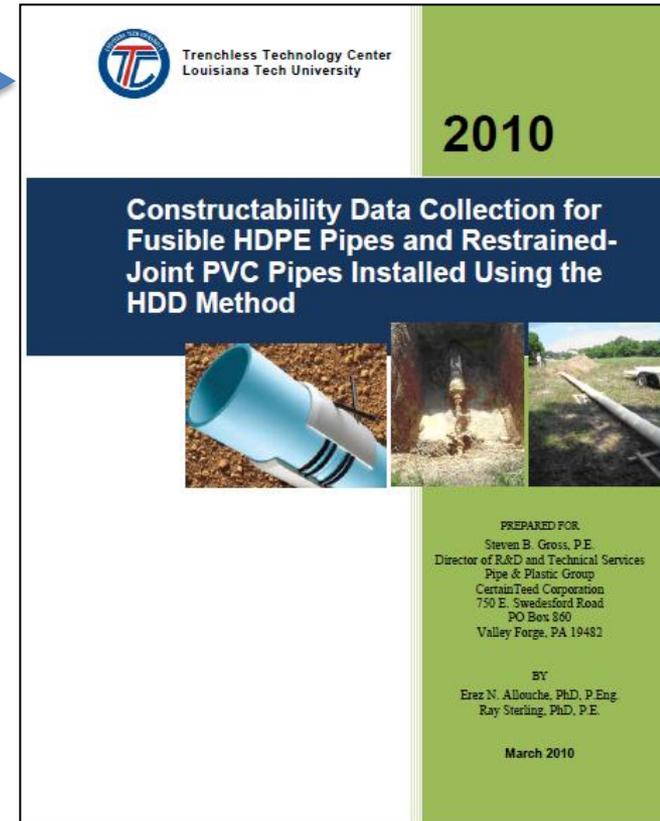


Significantly more than any other PVC pipe product for trenchless construction

Takes minutes or less to assemble – generally with no special tools

Advantages of Certa-Lok PVC Pipe in Trenchless Construction

1. Smaller staging area and less traffic disruption
2. Assembles quickly as the pullback continues
 - In all weather conditions
3. Ease of assembly
 - No fusion = faster process & lower cost →
 - Ability to assemble “in-pit”
4. Better flow performance
5. Superior corrosion resistance
6. High Strength – and accommodates bi-directional loading

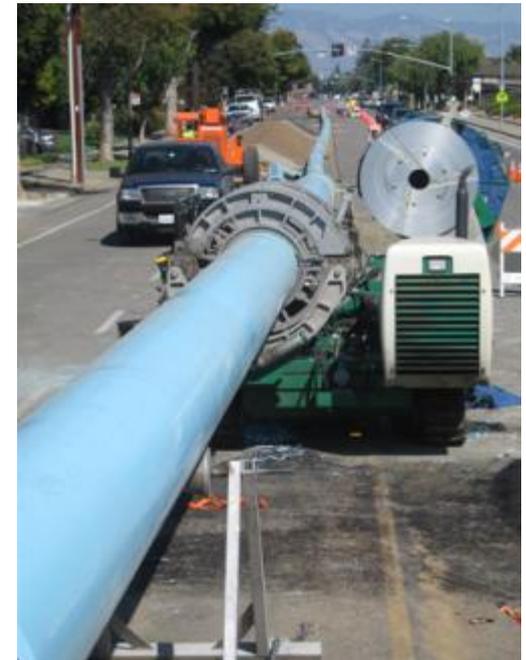
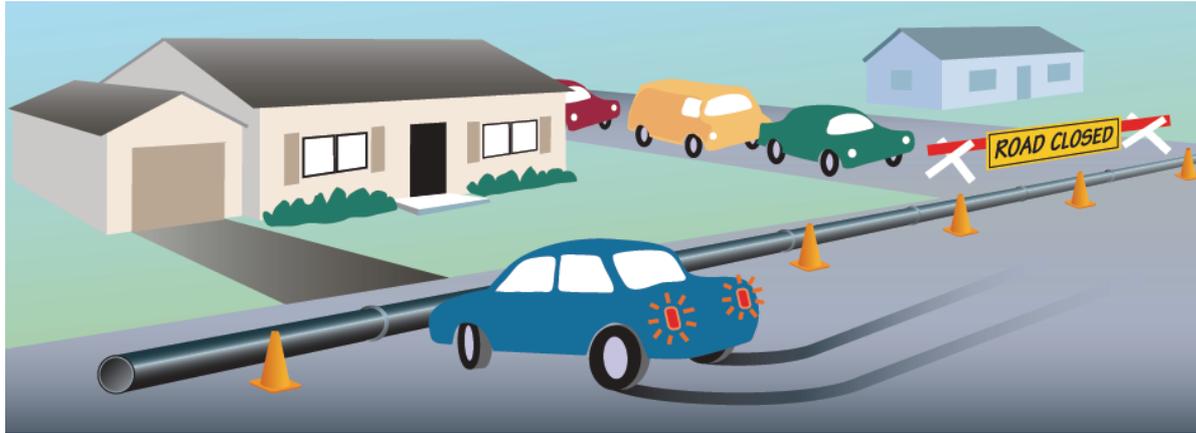


Advantages of Certa-Lok PVC Pipe in Trenchless Construction

1. *Smaller Staging Area*



Great in congested or developed areas where there is **no room** to string-out hundreds of feet of pre-fused pipe which blocks streets and driveways



Advantages of Certa-Lok PVC Pipe in Trenchless Construction

2. Assembles Quickly as the Pullback Continues



1. Assemble Joint



2. Insert Spline



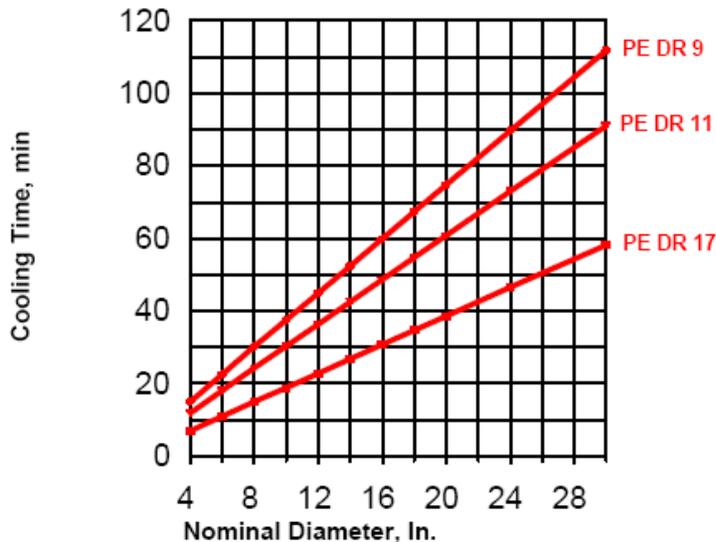
3. Pullback Continues

Advantages of Certa-Lok PVC Pipe in Trenchless Construction

3. Ease of Assembly

- Eliminates the heat welding (fusion) necessary on other thermoplastic pipes prior to startup:
 - **Save \$\$** on machine costs and costs for trained labor
 - **Save significant time** (fusion *and* cooling) – especially on large, heavy-wall joints

Cooling Times for PE Pipe



Advantages of Certa-Lok PVC Pipe in Trenchless Construction

3. Ease of Assembly and Installation

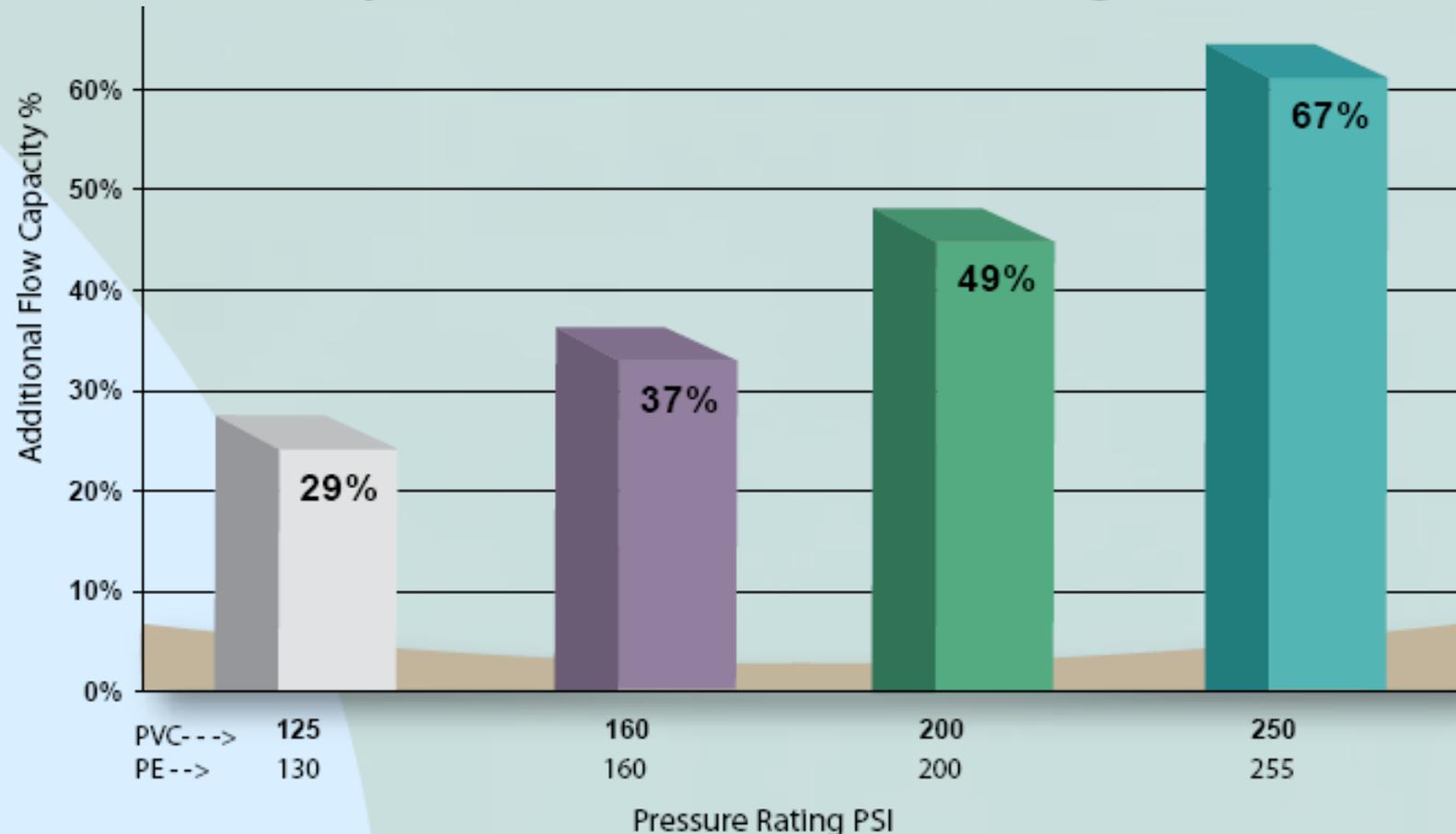
- Segmented restrained-joint pipe (20 ft. lengths) can be maneuvered down into a small entry pit
 - Difficult process with large-diameter fused pipelines, and can typically only be done if an additional tail ditch is excavated
- Segmented pipe systems can be assembled directly in the pit
 - In-pit assembly using other joining techniques such as heat-fusion is impractical



Advantages of Certa-Lok PVC Pipe in Trenchless Construction

4. Better Flow Performance

Figure 1: PVC Pipe Additional Flow Capacity Compared to PE Pipe of a Similar Pressure Rating



Calculating Pipe Flow Performance

Flow performance is of the utmost importance in piping system design; an optimal design will reduce capital, installation, and operating costs. The flow calculator allows the user to easily determine critical flow properties (flow rate, velocity, and friction loss) of thermoplastic piping systems, and facilitates a rapid comparison between alternate pipe materials.

Additionally, the calculator can be used to determine approximate energy costs associated with the specified amount of water being delivered (energy calculations based on electrical rates provided by the Department of Energy).

Default values have been provided for many of the parameters used in the calculator; please feel free to adjust these parameters to your specific requirements.



Pipe Parameters

	PVC	HDPE
Diameter Classification *	Select	Select
Pipe Nominal Diameter, In *		
Dimension Ratio/Pressure Rating *		
Flow Rate, GPM *		

Enter HDPE flow rate, or leave blank to calculate flow-rate based on same frictional loss as PVC

Main Geometry

	PVC	HDPE
Transmission Main Elevation Entry, ft		
Transmission Main Elevation Exit, ft		
Transmission Main Length, ft		

Pump Parameters

	PVC	HDPE
Pump Efficiency (%)	60	60
Hours per day pump runs (hr)	24	24
Days per year pump runs (days)	365	365

Economic Parameters

	PVC	HDPE
State Where Pump Will Operate	Select	Select
Electricity Cost (\$/KWH)		
Cost Per Pound (\$/lb)	1.1	0.8
Growth Rate In Electrical Costs (%)	0	0
Discount Rate (%)	4	4
Expected Useful Life (Years)	50	50

Reset Calculate →

– Based on the work performed by ASU, and presented at the 2011 UCT Show

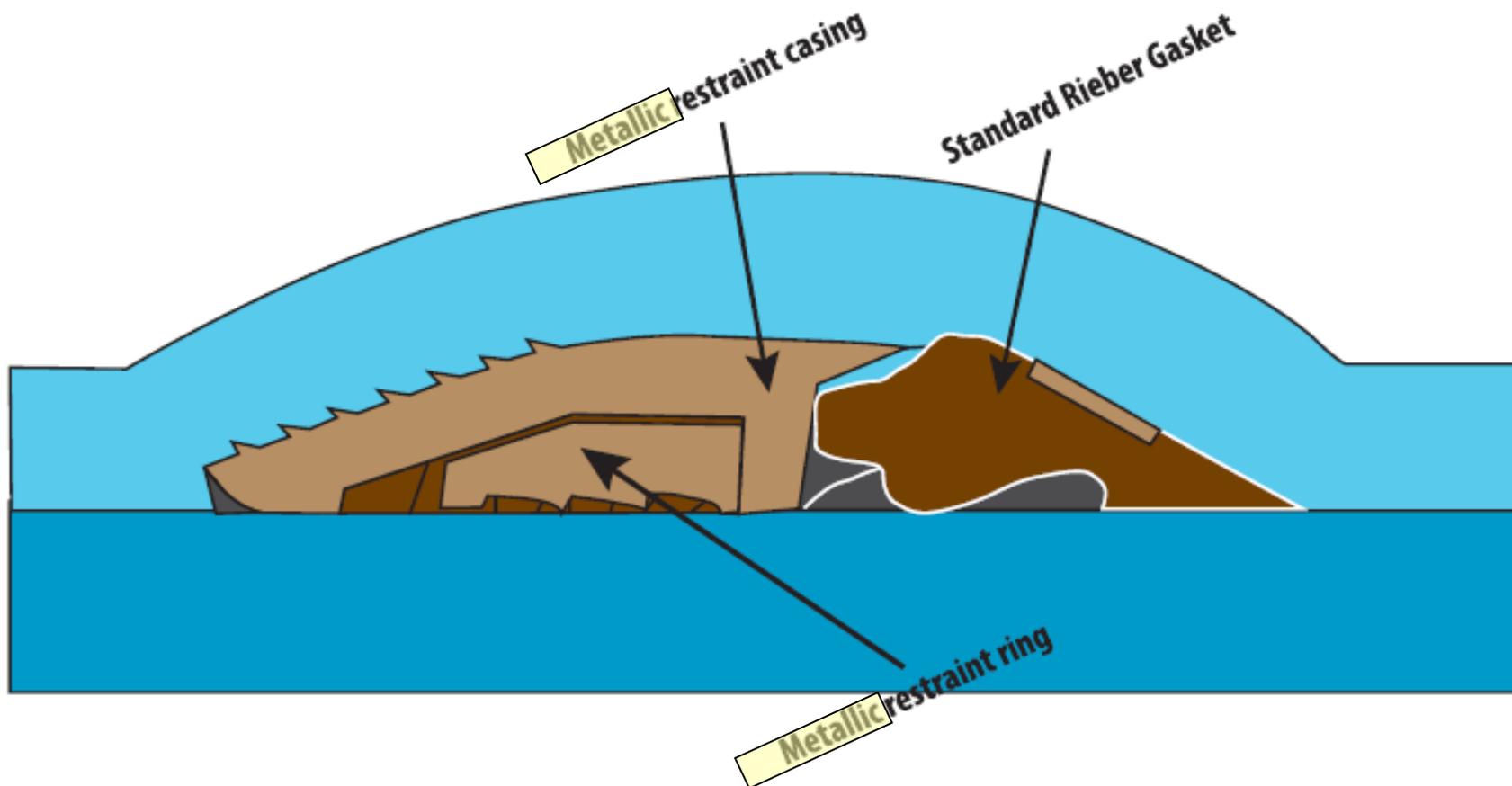
- COMPARISON OF PIPE MATERIALS IN WATER DISTRIBUTION SYSTEMS CONSIDERING ECONOMIC SUSTAINABILITY (Leuke, Carey, Gross)

– New program also calculates:

- Material Cost
- Joint Assembly Cost

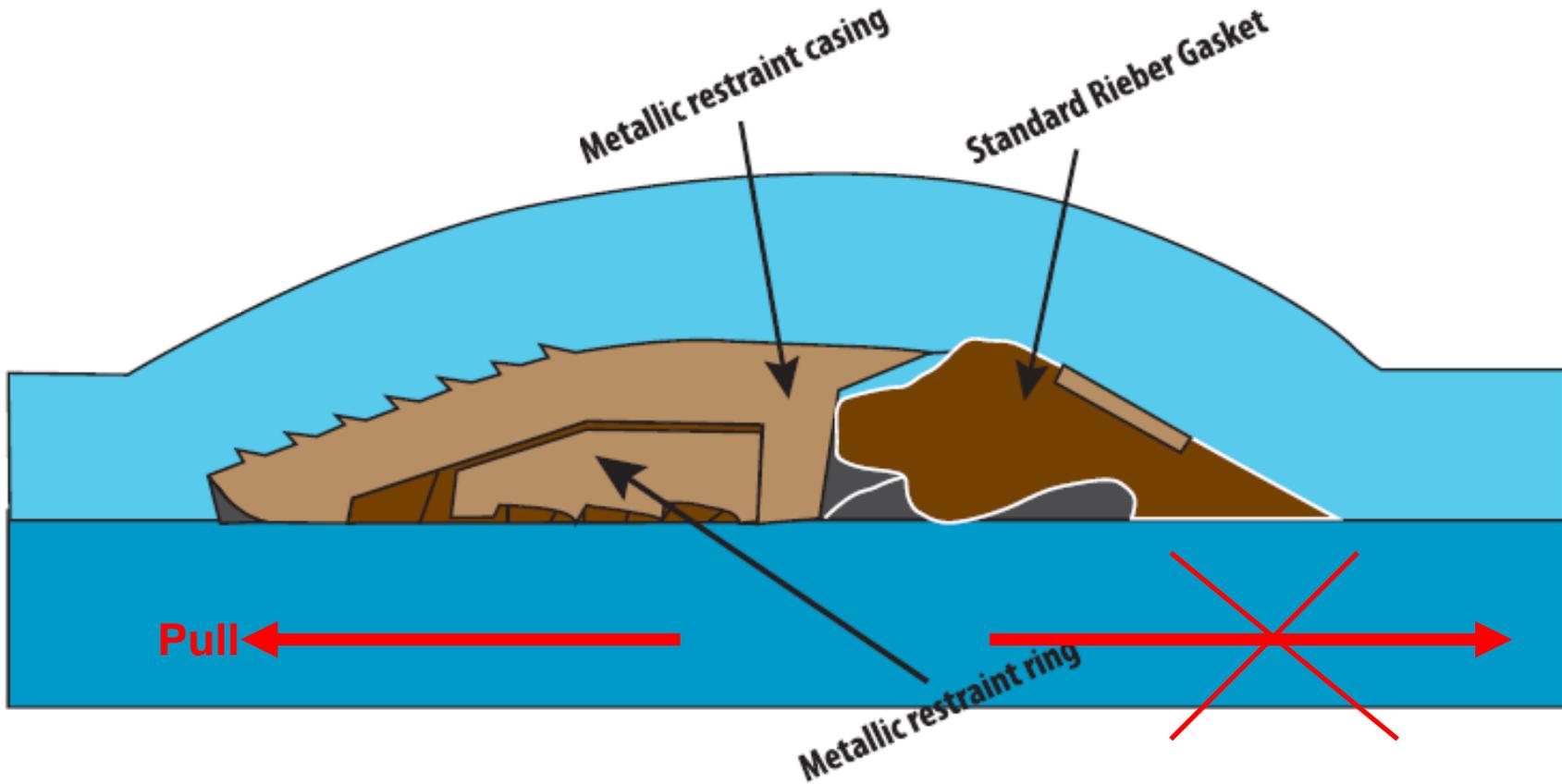
5. Superior Corrosion Resistance

- Unlike other systems, Certa-Lok has no metal components which can corrode



Advantages of Certa-Lok PVC Pipe in Trenchless Construction

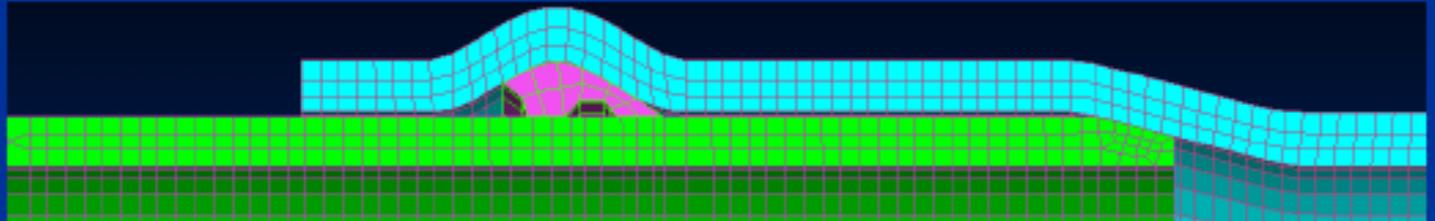
6. *Alternate Segmented Pipe Systems also cannot be pushed - - - - - so joints are subject to over-insertion*



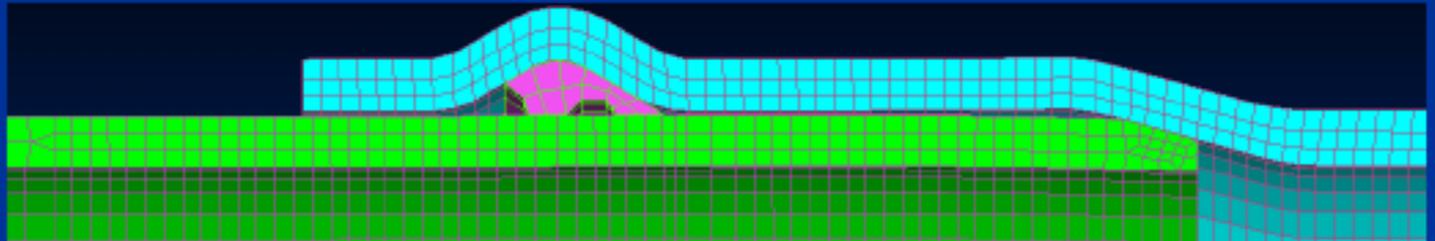
No push allowed

- Pipe joint failures are typically associated with over insertion of the pipe

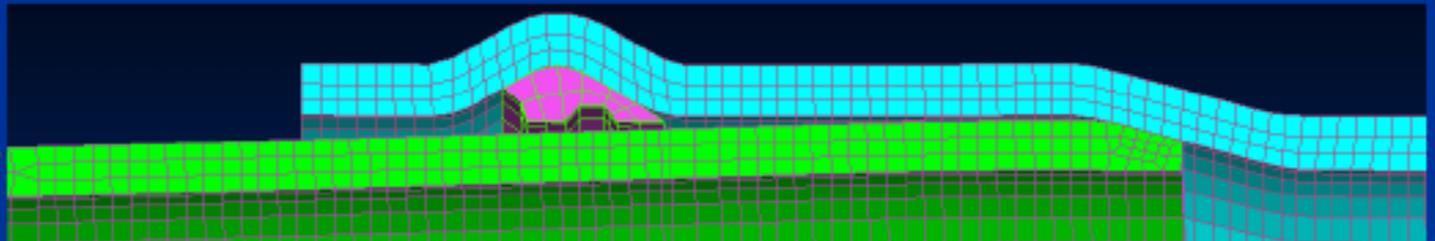
Initial Model



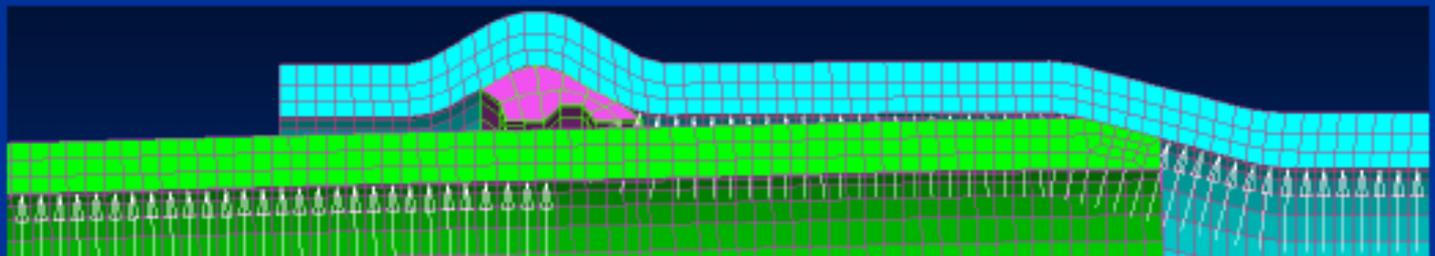
Step 1: Forced Insertion



Step 2: 1.5° Joint Rotation



Step 3: Pressurization



Project Details

- In reaching the 3,400 foot length of the pipeline, the crew made a series of bores, ranging from 450 to 500 feet, based on the distance between intersections, where valves and hydrants would later be tied in
- Challenges: As the project moved into winter, the crew ran into some days of snowy and icy weather, which occasionally stalled progress
- The contractor still met its deadline, finishing in 45 work days, and the new water main easily passed pressure testing
- After it was brought online, the old AC water main was plugged with control density fill and abandoned, per the regulations of the State of Washington Department of Ecology
- In addition to HDD helping the project run more smoothly and keep down disturbance, it considerably decreased project costs by minimizing the need for road restoration. The city of Olympia was very pleased with all of these results



Technology Developments

Next-Gen Products for “In-Line” Trenchless Construction Methods

Flush-Joint PVC Pipe

- Proven spline-lock system
- Easy to assemble
- Less pull-in resistance
- Smaller borehole required
- Shorter lengths



Field Trial, November 2012, 15” Pipe

Key Players – Olympia, WA Pipe Replacement Project

Project Owner



General Contractor



Olympia, WA

Pipe Supplier



NAPCO Pipe Production Facilities



Lodi, CA



McPherson, KS

Questions?