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Distribution Piping System Best Practices

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Introduction

District Energy Development

- Neighbourhood Densification
- City Greening

- DE System Components:
  - Energy Source(s)
  - Distribution Piping System (DPS)
  - Energy Transfer Stations

Presentation Overview

- Best Practices for DPS
  - Planning
  - Design
  - Construction

Planning Stage

Consider Your Design Including:

- Energy sources
- System at build-out
- Temperature/pressure ratings
- Heating/cooling requirements
- Existing ground conditions
- Design disciplines

Complete System Design

- Next, consider the energy transfer mediums…

DPS Design Options – Ambient

Ambient Systems

- Advantages
  - Heating/cooling
  - Low capacity
  - Low temperature
  - Lower cost DPS
- Disadvantages
  - Mandatory decentralization
  - Design challenges

DPS Design Options – Steam

Steam Systems

- Advantages
  - Resilience
  - High capacity
  - Centralized
- Disadvantages
  - System losses
  - O&M costs
  - Operator requirements

Steam Plant in Downtown Vancouver, BC

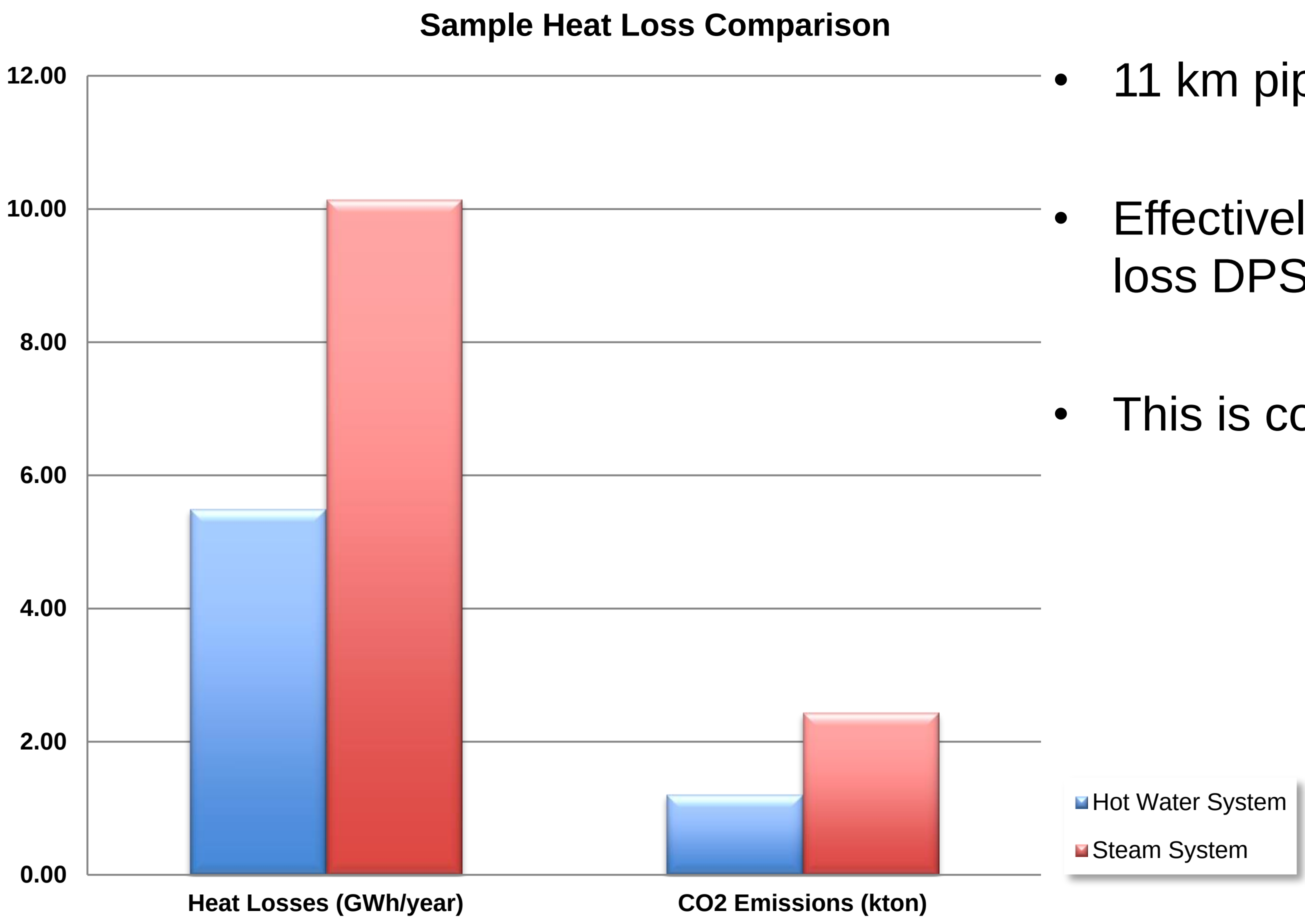
DPS Design Options – Hot Water

Hot Water Systems

- Typical installation for Greater Vancouver
- Advantages
  - Heat transfer
  - Efficiency optimization
  - Centralized option
- Disadvantages
  - Distribution requirements

False Creek Energy Centre

Loss Comparison – Steam to Hot Water



- 11 km piping system
- Effectively 150 to 300 homes heat loss DPS only
- This is comparing two new systems

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DPS Piping Design – Steel

Higher Pressure/Temperature

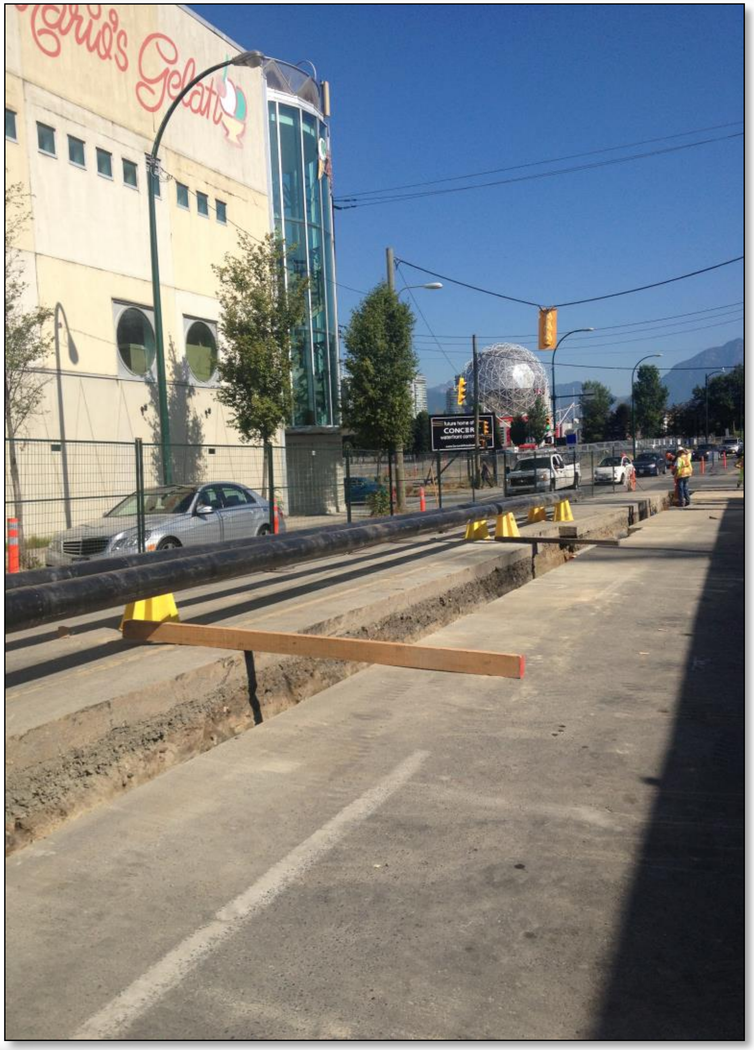
Higher Cost

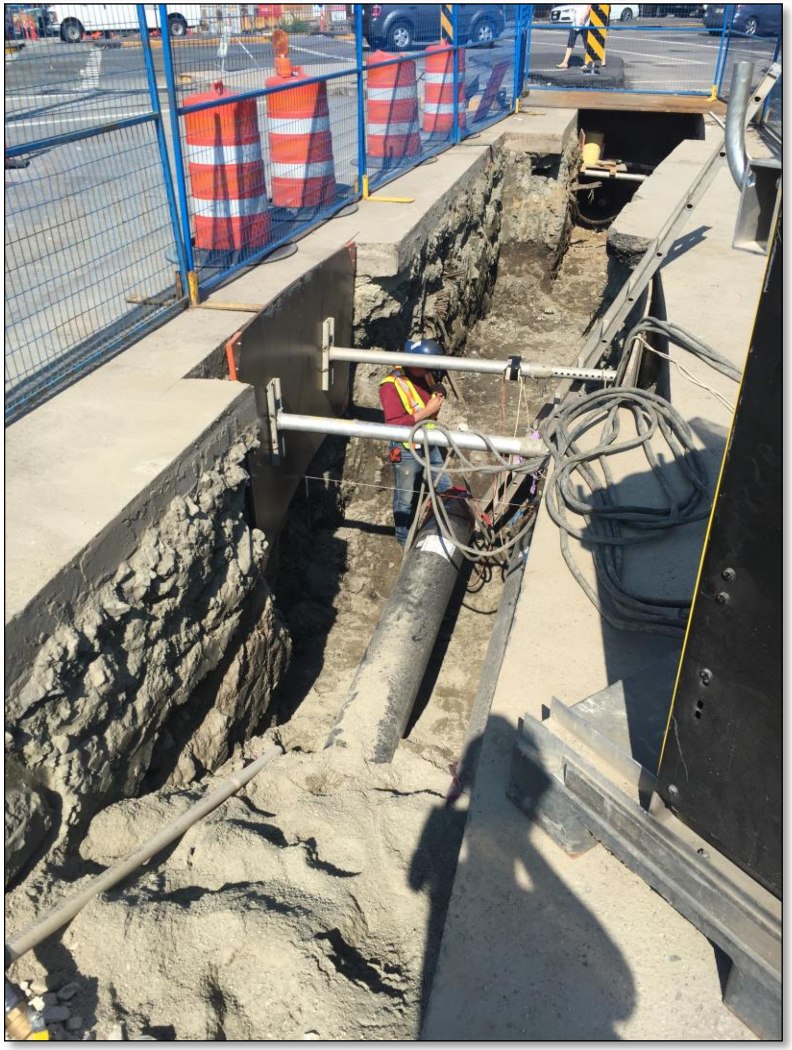
Direct-Buried

Design Considerations:

- Bonded System
- Expansion Compensation
- Pre-Stressing
- Material lead time

DPS Piping Design – Steel





Case Study: University of British Columbia

Steam to Hot Water Conversion Project

- Replacement of Aging Steam Infrastructure
- Multi-year transition (2011-2015)
- Commissioned over 11 km piping and 130 buildings
- Ongoing new building connections
- Lower temperature: 190° C to 80° C (374 to 176 F)
- Reduced costs >$5M/year
- Reduced GHG Emissions >20%
- Campus Research Opportunities

Case Study: University of British Columbia

- Phased construction – temporary steam to hot water conversion plant for transition period
- Maintain process steam requirements
- New 60 MW energy centre
- Repurposed steam tunnels throughout campus

Image Credit: UBC

Case Study: University of British Columbia

- Underground Tunnels
- Direct-Buried
- Above Ground

Repurposed Steam Tunnels →

Case Study: University of British Columbia

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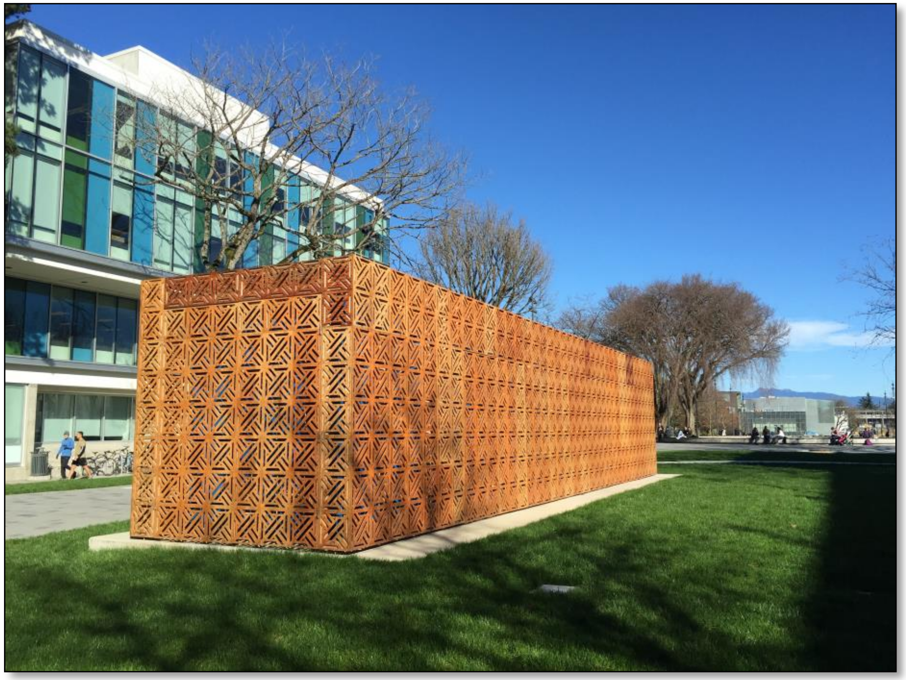
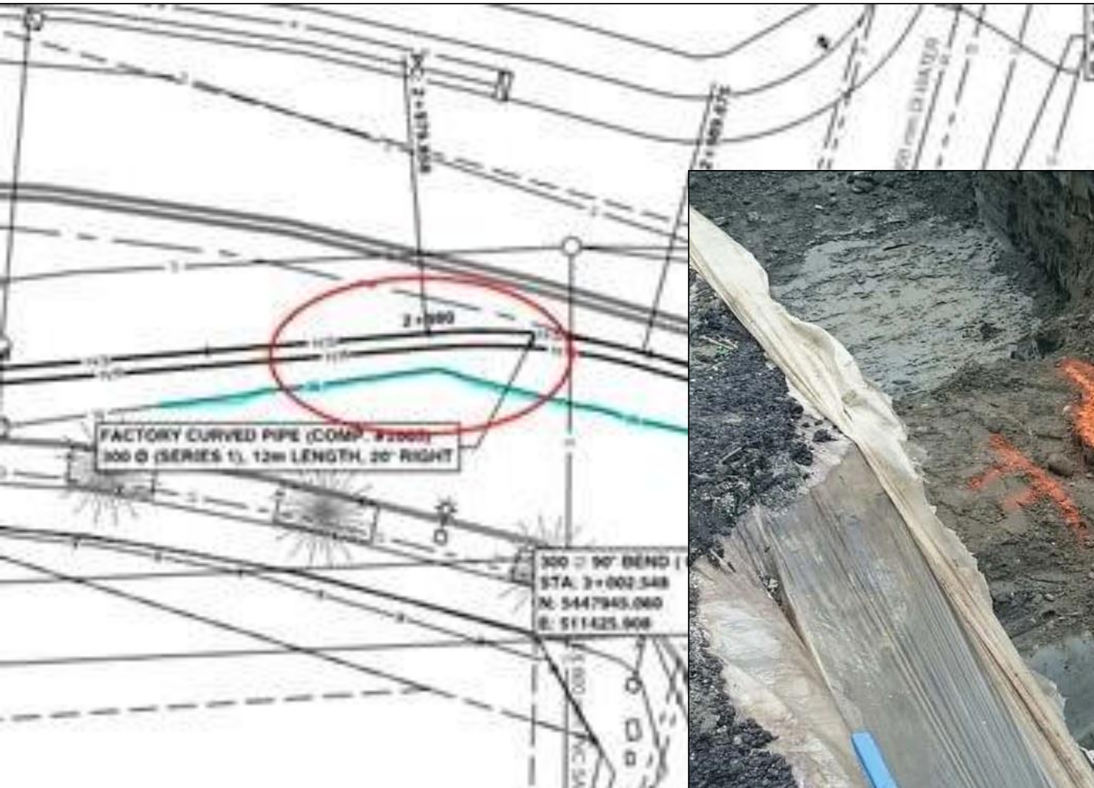


Design/Construction Lessons

- Performed value engineering
  - Real-time data
  - More aggressive sizing
- Large work phases
  - Economies of scale
- Standardized system
  - EN 253 Piping, ETS
  - Consistent owner, consultant, contractor
- Reduced standard pipe cover
- Developed standing supplier agreement
- Refined form of tender

Case Study: Utility Conflict



Construction Practices

Concealed Unknowns

- Know your jurisdictional requirements
- Compile best-available existing information
- Establish your team
- Check design interfaces
- Discuss risk trade-off with client

Installation Quality Control

- Moisture content control
- Leak detection?
- Welding Procedures
- Ensure correct expansion compensation

Conclusions

Understand System Goals

Design for Complete System

Phasing Approach

- Evaluate decisions
- Cost/schedule efficiencies

Adapt Contract Structure

For Designers

- Check interfaces
- Maintain design flexibility
- Standardize where possible

Questions?

Thank you!

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