Targeted DPS Design for Cities, System Expansion, and Modernization

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Background

- District Energy development in British Columbia
- Climate change policy
- Cities and campuses
  - City of Vancouver
  - City of Surrey
  - City of North Vancouver
  - City of Richmond
  - University of British Columbia
  - Simon Fraser University

How do we best select design methods to suit system expansion?

Considerations

- Corridor Planning
- System planning and future extension options (modeling)
- Existing infrastructure requirements and congestion
- Construction time window
  - Operating temperatures – loads and possible setbacks
  - Cold temperature impact on displacement calculations

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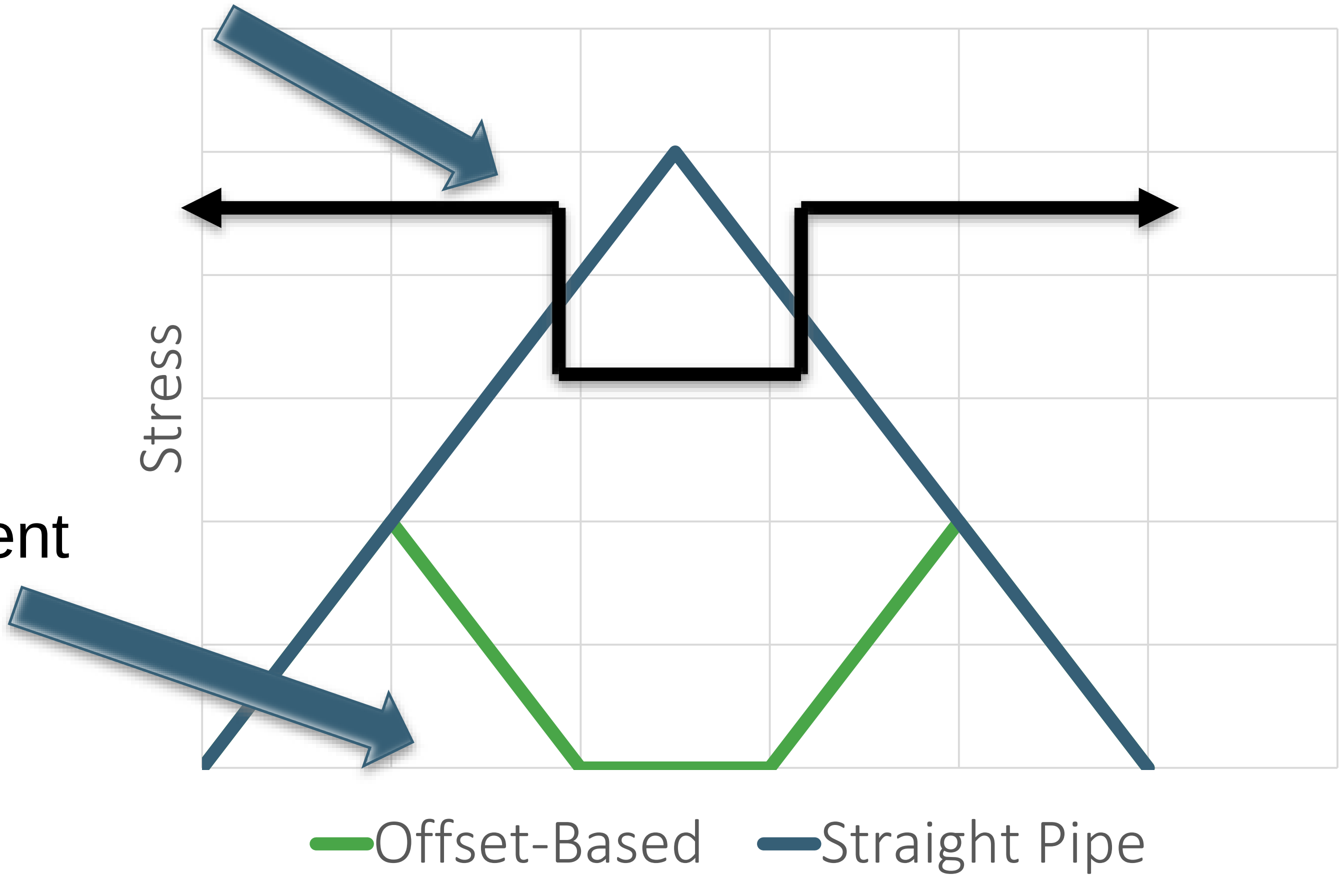
Stress Relief Options

Offset-based design

Controlled displacement at pre-designed nodes

Maximum displacement



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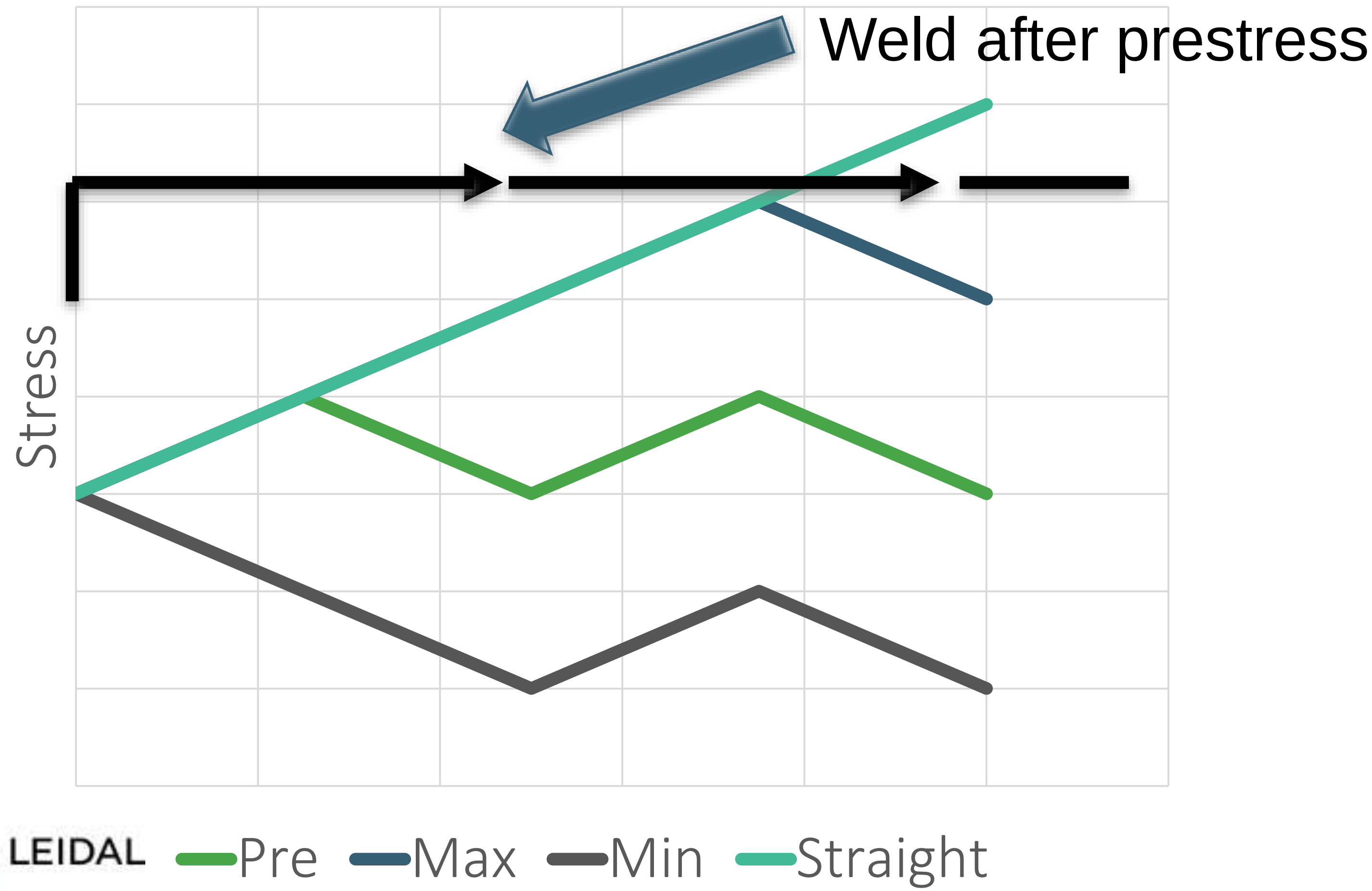
Stress Relief Options

Prestressing (Hot water / electrical / fixture)

Intermediate temperature prior to backfill (various methods)

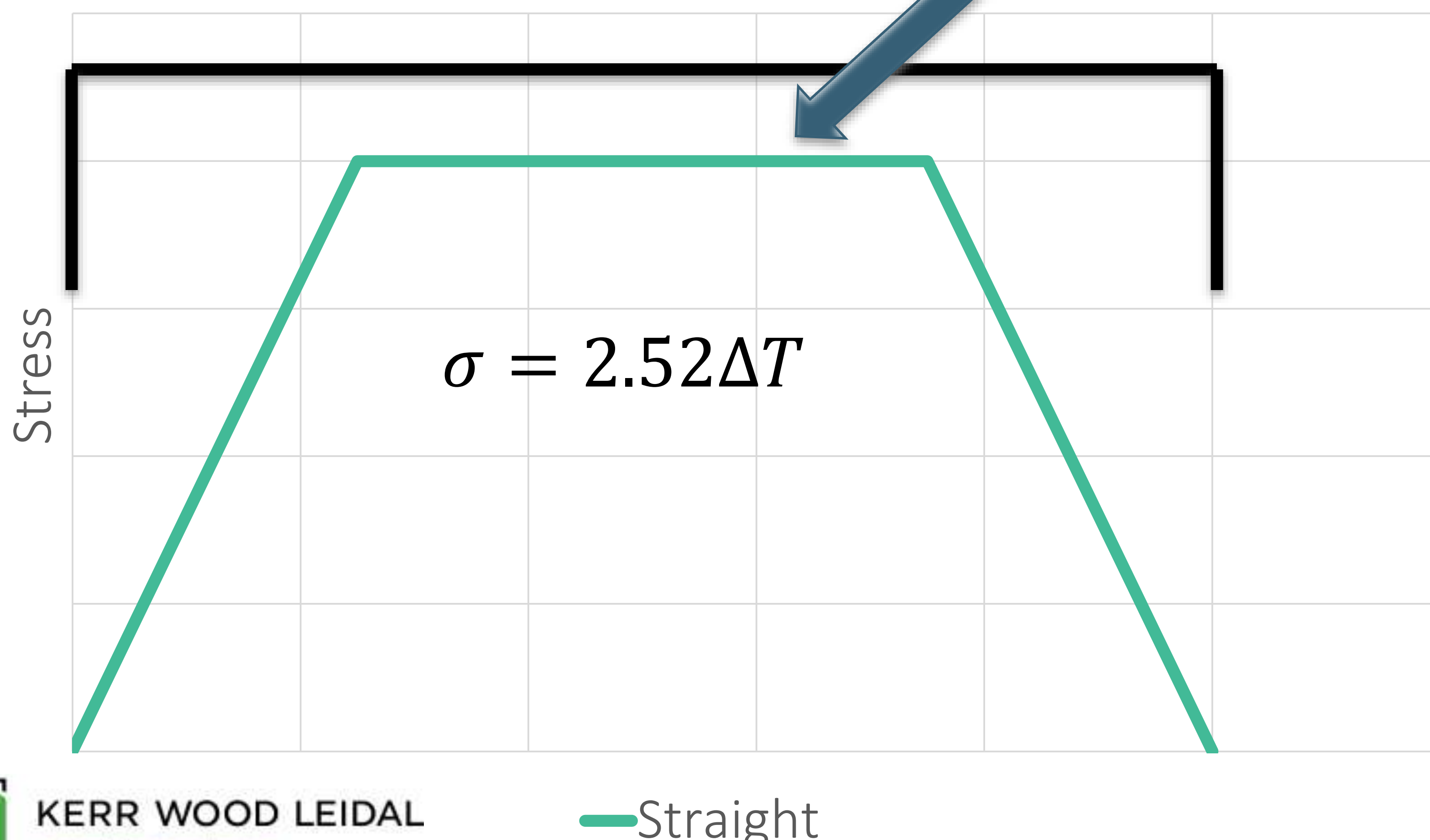


Stress Relief Options

Locked Zone Approach

Europe – higher stresses allowed

Cannot overcome friction force



Offset-Based vs. Prestressing

University of Minnesota Steam System

Prestressing at City of Vancouver NEU

Case Study Outline

#1 – City of Surrey

#2 – UBC

#3 – City of Vancouver

#4 – Lonsdale Energy

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Case Study #1 – City of Surrey

- Design Criteria:
  - Surrey is very large
    - Long distances, registered system
    - High temperature, pressure
  - Rapid densification and infrastructure development
    - But phased in small increments
- Offset-based design for early stages
- City reference for existing infrastructure
  - COSMOS
- Conducting corridor-planning
- Perhaps transition to fixed displacement compensators to free corridor space for future utilities

Case Study #2

University of British Columbia

1) Steam to Hot Water Conversion

2) Building Extensions

3) System Expansions

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Case Study #2 – UBC Conversion

- Large scale project – challenging timeframe
- Varying degrees of infrastructure records
- Offset-based design provided troubleshooting for rerouting requirements and existing utility accommodations
- Registered
- Design Conditions:
  - $120^{o}C$
  - 232 MPa

Case Study #2 – UBC Extensions

- Small building extensions as development progresses
- Potential for constraints and conflicting services – need to control expansion at penetration locations
- Anchor Fittings
- Concrete-encased
- Virtual anchor displacement

Case Study #2 – UBC Expansions

- Conducting smaller expansions as buildings come online
- Additional re-routings to suit campus development requirements
- Utilized fixed displacement compensators for long extension – combined calculations with offset-based design.
  - Over 400m of straight pipe installation with two compensation fittings
  - Each designed for 60mm displacement
  - Coordinated setback temperature with main plant for hot water prestressing

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Case Study #3

City of Vancouver Neighbourhood Energy Utility

1) Prestressing

2) System Expansions

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+ Case Study #3 – NEU Prestressing

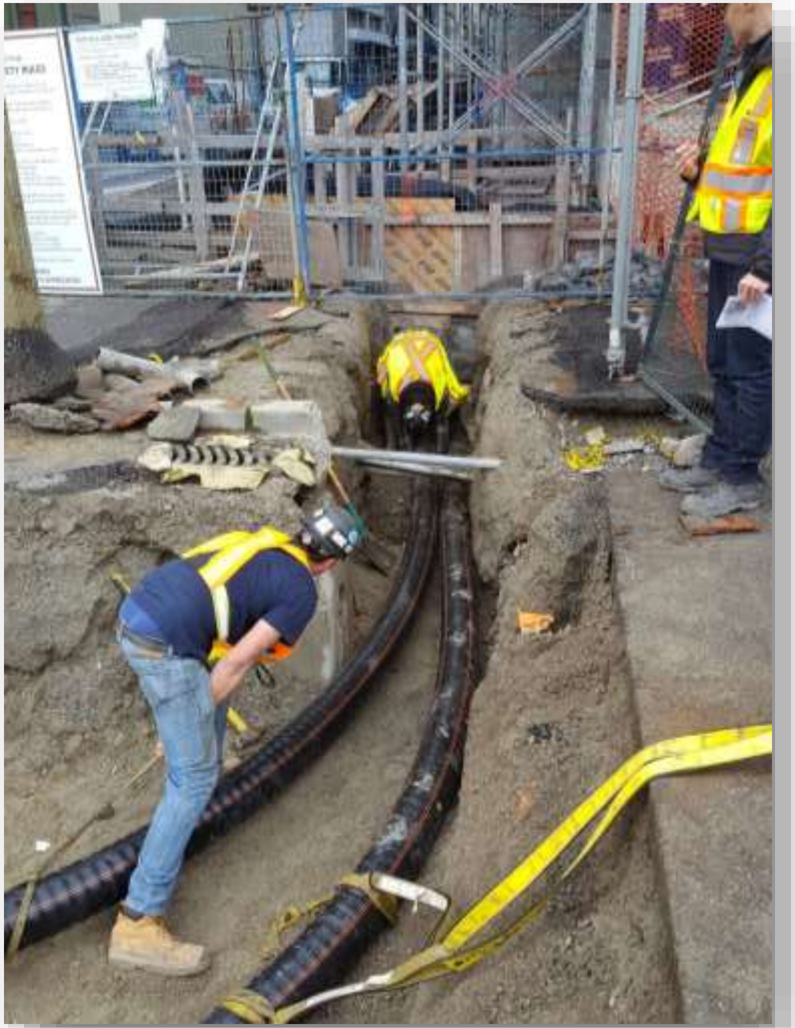
Mid-Electrical Prestressing

Requirements

- Dense city centre near Olympic Village
- Rental of electrical prestressing machine allowed for entirely straight installation
- Consider power requirements
- Time requirements
- Required open trench in sections
  - Road closure was possible

Case Study #3 – NEU Expansion

Self-Compensating (low pressure)

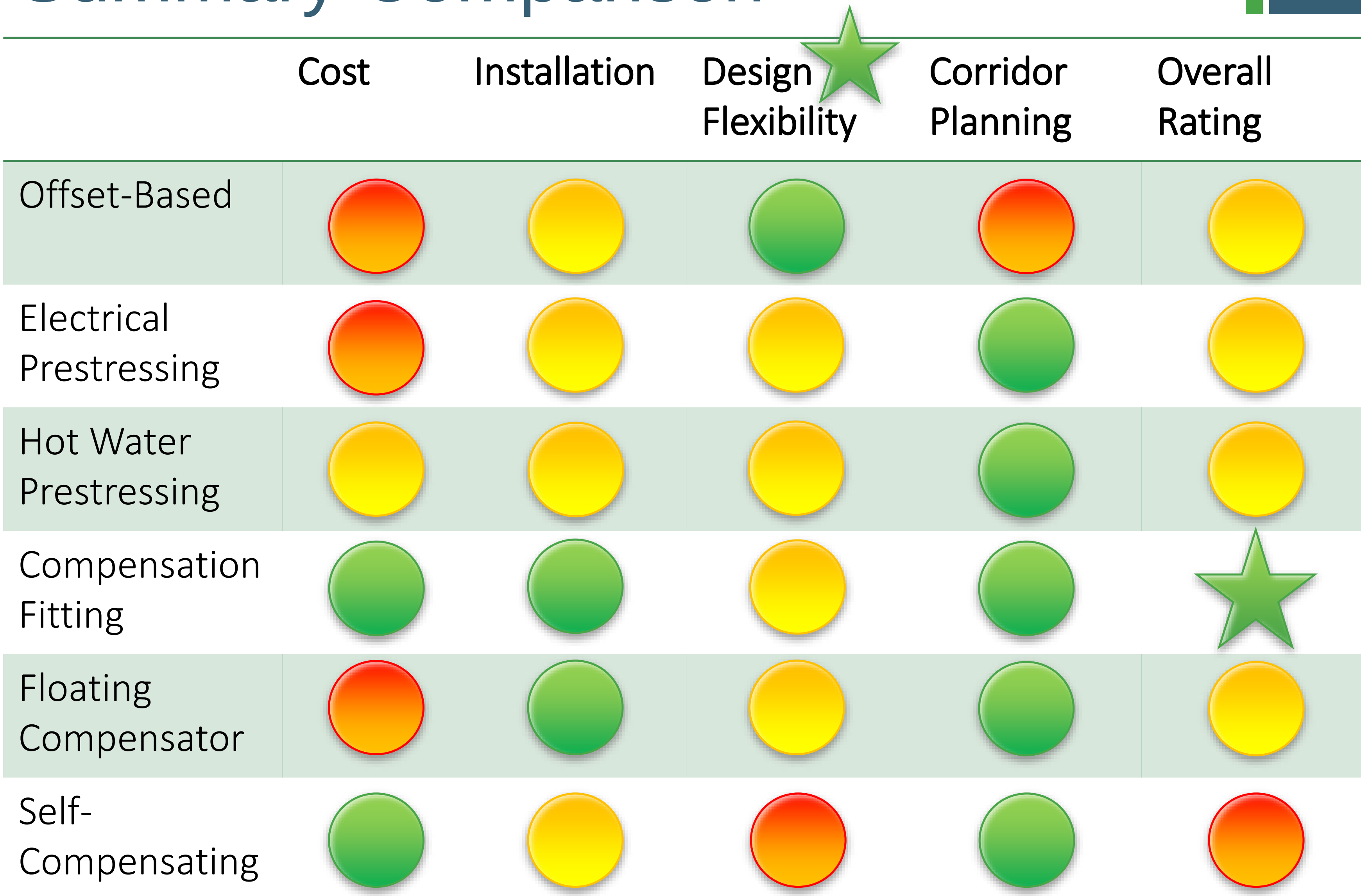


Built-in Offset Requirements

Case Study #4 – Lonsdale Energy

- North Vancouver
- Variable displacement
  - Floating compensator
  - Increased material cost
  - Lower installation cost
  - Less design flexibility
  - Streamlined corridor

Summary Comparison



Thank you!

- DES Questions?
- Restaurant recommendations?
- Good day hikes?

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City of Richmond Alexandra District Energy Utility

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