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Pipeline Screw Anchor Buoyancy Control: Direct and Indirect Savings

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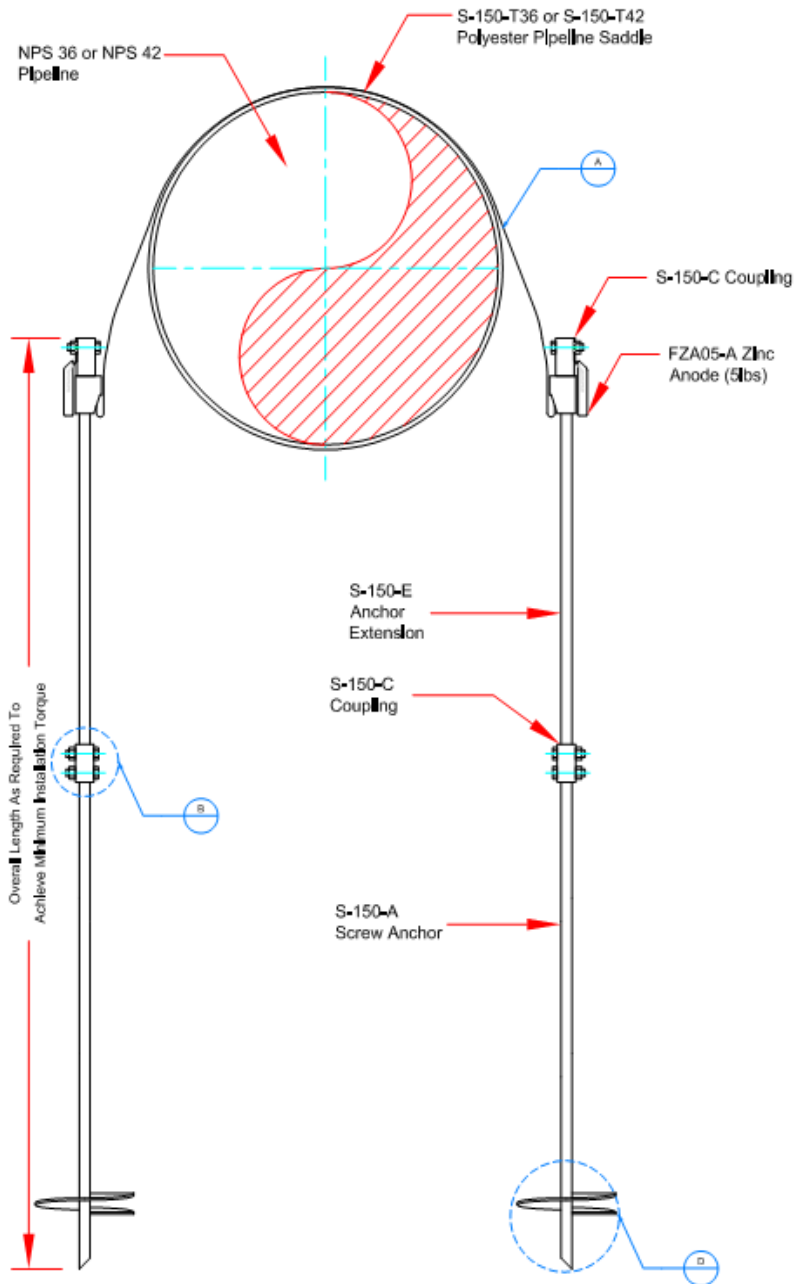
Cyntech's Areas of Operation

Pipeline Buoyancy Control Systems



High-Capacity Helical Pile Foundations





Anchor Capacity

Determined by:

- Number and diameter of helices
- Soil strength / density
- Factor of safety
- Installation torque
- Client Requirements

Pipe Stress

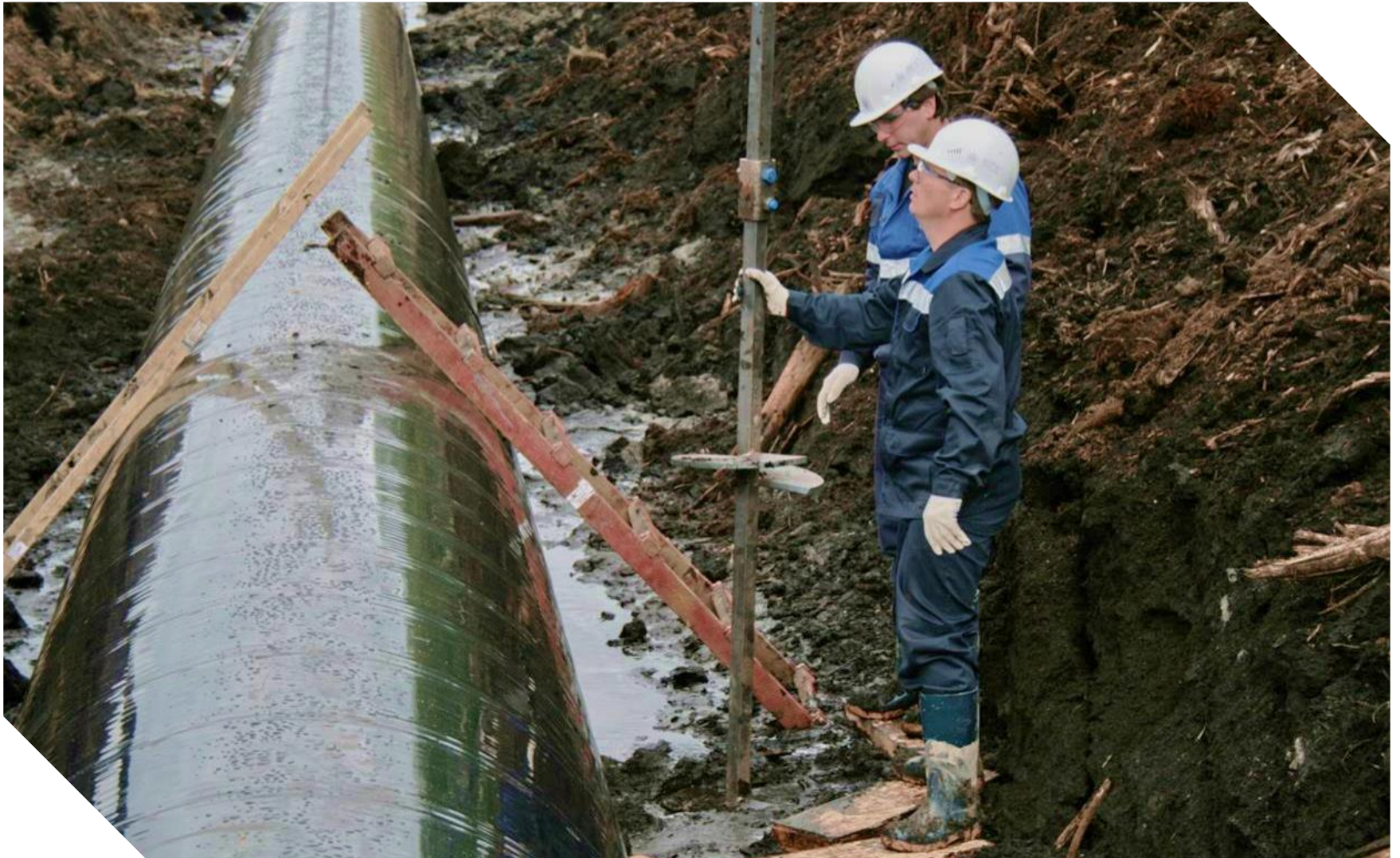
Pipe stresses considered include:

- Hoop Stress
 - differences in gas or liquid
- Bending Stress
 - compression and bending
- Longitudinal Stress
 - thermal stress (-20° versus +20°)
- Contact Stress
 - contact area of the saddle
- Combined Stress

Acceptance criteria based on:

- ASME B31.8 Para. 833 and A842
- CSA Z-662 Para. 4.7 and 4.8

Installation: Lead Section



Installation: Adding an Extension



Installation: Polyester Pipeline Saddle



Complete & Ready for Backfill



Pull-Testing



Typical Pipeline Applications

Onshore

- Buoyancy control
- Stress mitigation / thermal uplift
- Seismic mitigation

Offshore

- Pipe stabilization
- Surf zones
- Pipe crossings
- Span rectification

Advantages

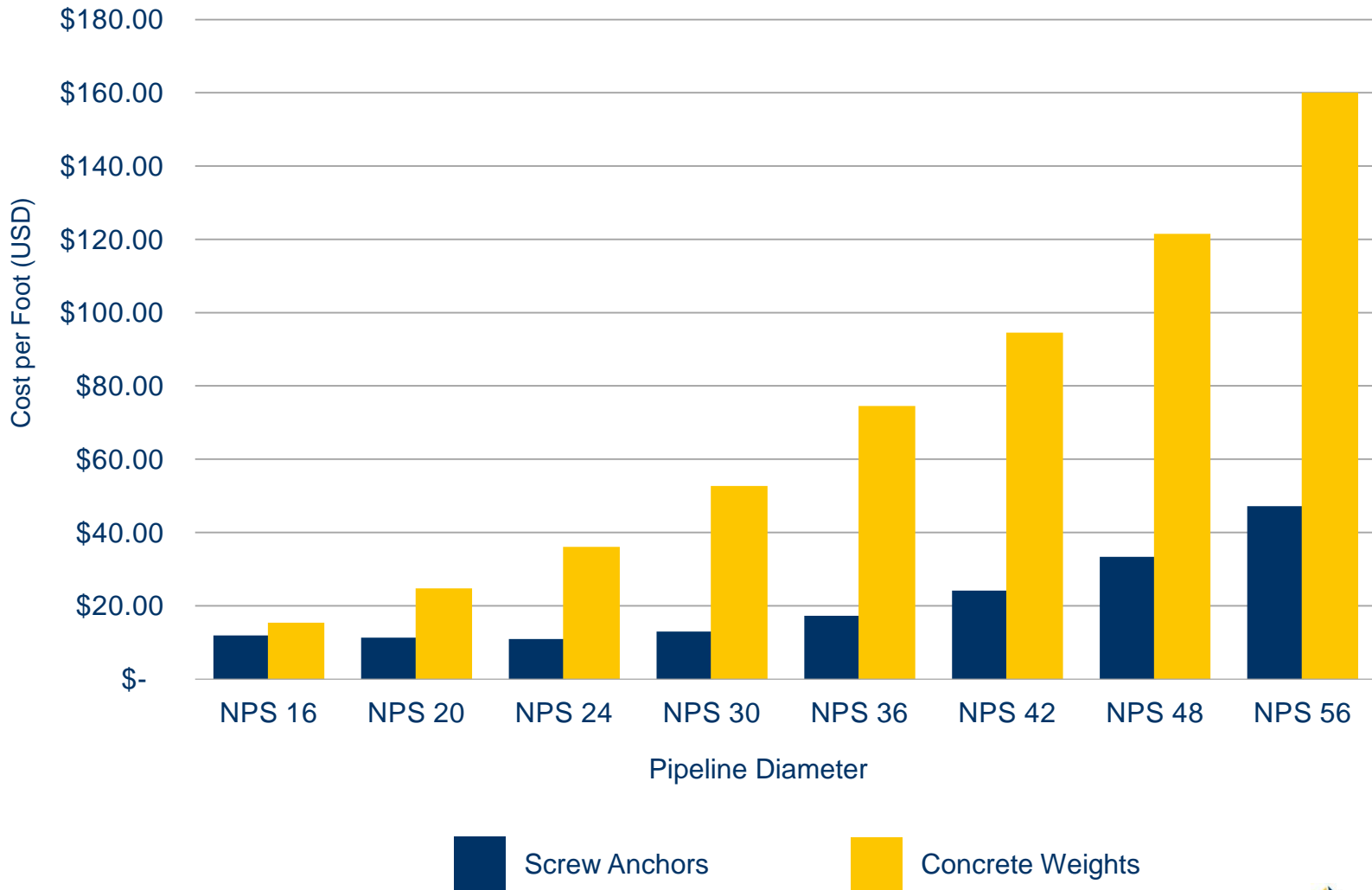
- Significantly greater spacing
- Minimal storage space and shipping costs
- **Drastically** reduced ROW traffic
- No extra pipe cover – deeper ditch
- Reduced worker-hours, safer for installation crews
- Safer for the pipeline (coating damage – CP shielding)
- Safety Factor ≥ 2.0 or 2.5 vs. 1.1
- Mass neutral - No downward force to add stress & sink pipelines
- **Significant overall cost savings**

Pipeline Anchors vs. Concrete Weights

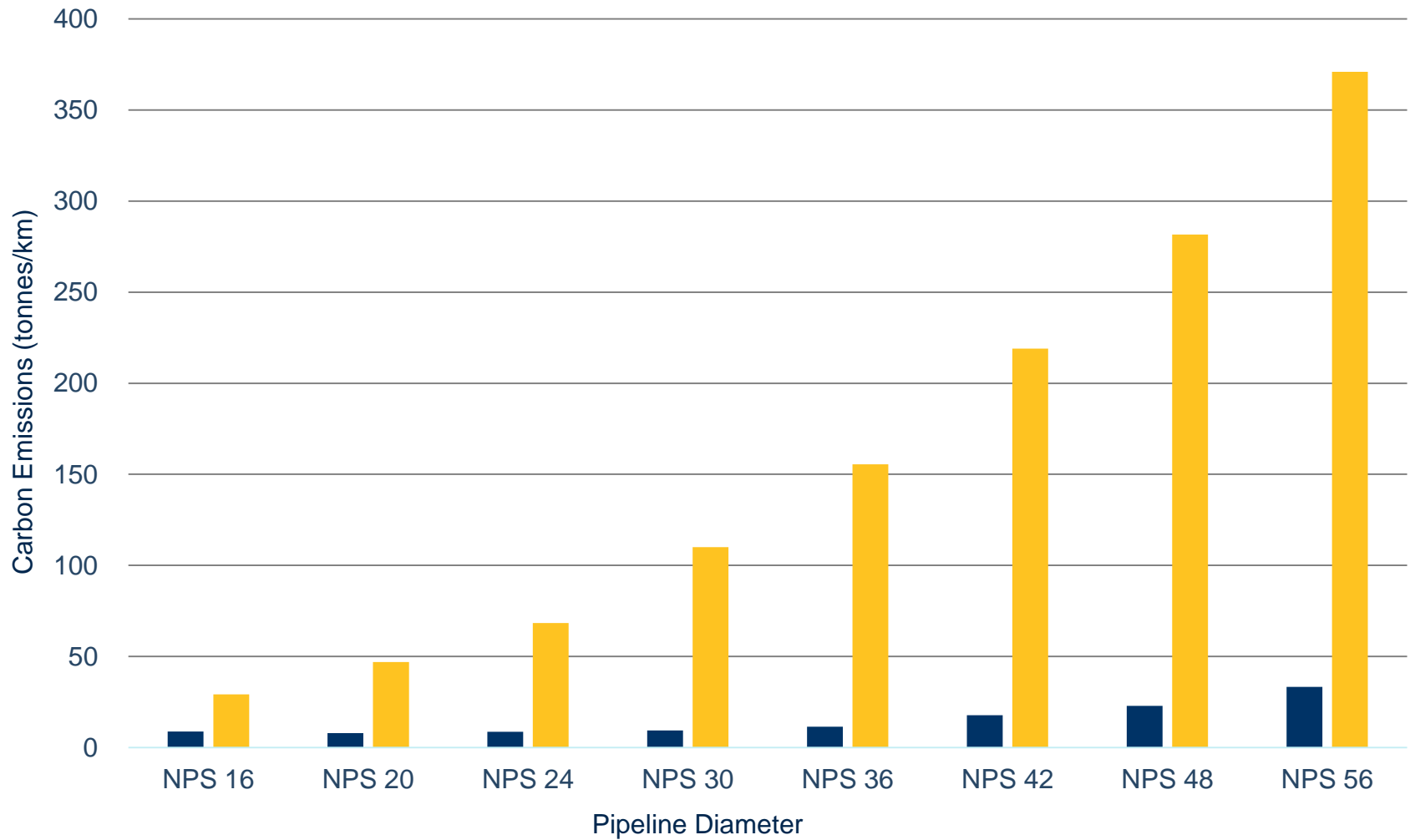
Direct and Indirect Cost Comparison


| Pipe Size | Wall Thk. (in.) | Pipeline Anchor Data | | | | | Concrete Set-On Weight Data | | | |
|-----------|-----------------|----------------------|--------------|---------------------|-------------------|------------------------------|-----------------------------|--------------------|-------------------|------------------------------|
| | | Model | Spacing (ft) | Total Cost (\$/set) | Unit Cost (\$/ft) | Carbon Emissions (tonnes/km) | Weight (lb/ft) | Total Cost (\$/lb) | Unit Cost (\$/ft) | Carbon Emissions (tonnes/km) |
| NPS 16 | 0.3 | S-150 | 105 | \$1,250 | \$11.90 | 8.80 | 140 | \$0.11 | \$15.40 | 29.20 |
| NPS 20 | 0.3 | | 117 | \$1,325 | \$11.32 | 7.90 | 225 | \$0.11 | \$24.75 | 46.94 |
| NPS 24 | 0.4 | | 128 | \$1,400 | \$10.94 | 8.66 | 328 | \$0.11 | \$36.08 | 68.43 |
| NPS 30 | 0.4 | S-175 | 135 | \$1,750 | \$12.96 | 9.33 | 527 | \$0.10 | \$52.70 | 109.95 |
| NPS 36 | 0.5 | | 110 | \$1,900 | \$17.27 | 11.46 | 745 | \$0.10 | \$74.50 | 155.43 |
| NPS 42 | 0.5 | | 85 | \$2,050 | \$24.12 | 17.75 | 1050 | \$0.09 | \$94.50 | 219.07 |
| NPS 48 | 0.7 | | 66 | \$2,200 | \$33.33 | 22.87 | 1350 | \$0.09 | \$121.50 | 281.66 |
| NPS 56 | 0.8 | | 53 | \$2,500 | \$47.17 | 33.30 | 1778 | \$0.09 | \$160.02 | 370.96 |

Buoyancy Control Cost Comparison



Social Cost Comparison



 Screw Anchors

 Concrete Weights

16 Set-On Concrete Weights (64 total tons and 75m coverage)



16 Bolt-On Concrete Weights (68 total tons and 54m coverage)



16 Pipeline Anchors (6.4 total tons and 330 m coverage)



Questions? (randy.robertson@cyntech.com)

- Each company activity is performed with a view to full protection of persons with the lowest possible environmental impact. Our beliefs in this sense are not an achievement but rather an essential prerequisite for all our activities
- **Energy plays a key role in mitigating climate change. We are working to reduce the greenhouse gas emissions associated with our activities**
- The fight against climate change..... through constant investment in competencies, innovation, and environmentally compatible technologies
- Commitment fulfilled by day to day business activities and continued effort to reduce its carbon footprint
- **Actively Encouraging Continual Improvement and promoting innovation..... Consider the appropriate use of materials.....understanding and reducing our carbon and energy footprint**
- **We challenge ourselves to decarbonize every project while generating cost-efficiencies to bring greater value.**
- Developing and implementing methods to reduce or eliminate significant environmental impact.....including carbon emissions and their impact to climate change.
- To search actively for opportunities to continue the reduction of CO2 emissions.....to implement the reduction measures
- Improve energy efficiency, reduce greenhouse gas emissions, and design and build more environmentally friendly facilities