HDD Pilot Design Basics From a Driller's Perspective

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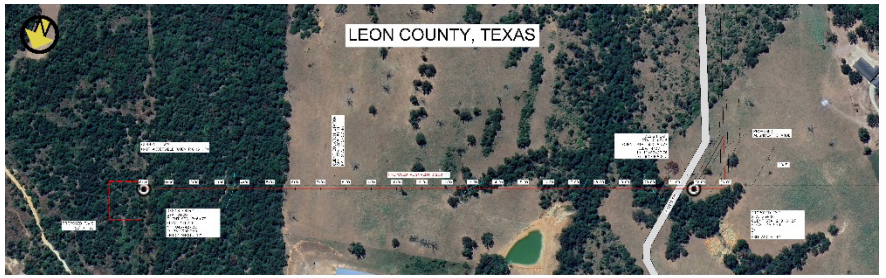
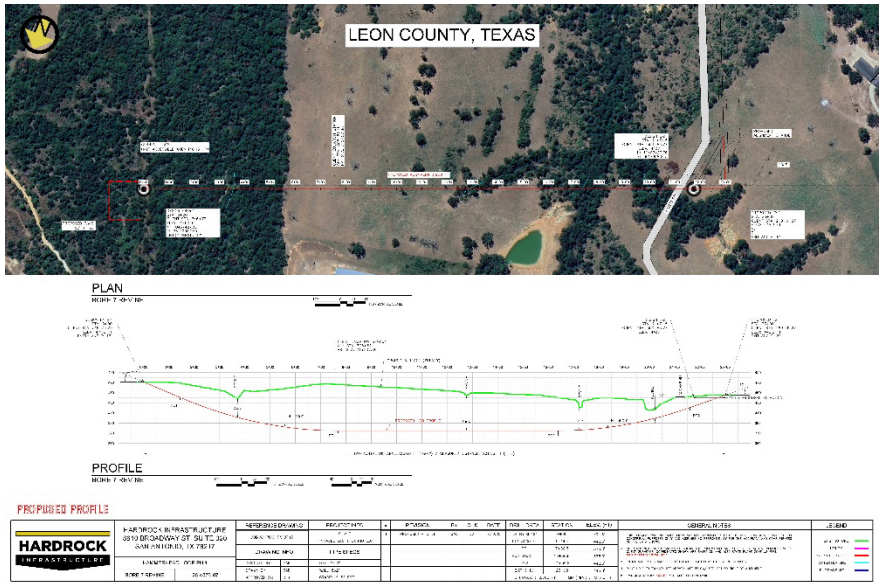
Objectives

- Overview of Design Parameters
- How Design Impacts Constructability
- Recommended Parameters
- Cost Considerations



Design Parameters

- Entry and Exit Angle
- Tangent Sections
- Bottom Flat
- Vertical and Horizontal Curves



Entry Angle

- Entry Angle Realistic for Rig Setup
- 12-15 Degrees for Most Rigs
- Too Shallow = Increased Exposed Stem
- Too Steep = Safety Issue for Hands

Exit Angle

- Consider Product Pipe Diameter
- Overbend
- Equipment Requirements
- Overhead Safety

Tangent Sections

- Straight Section on each end
- Hold the angle for at least 30’
- Thread Alignment
- Surface Casing

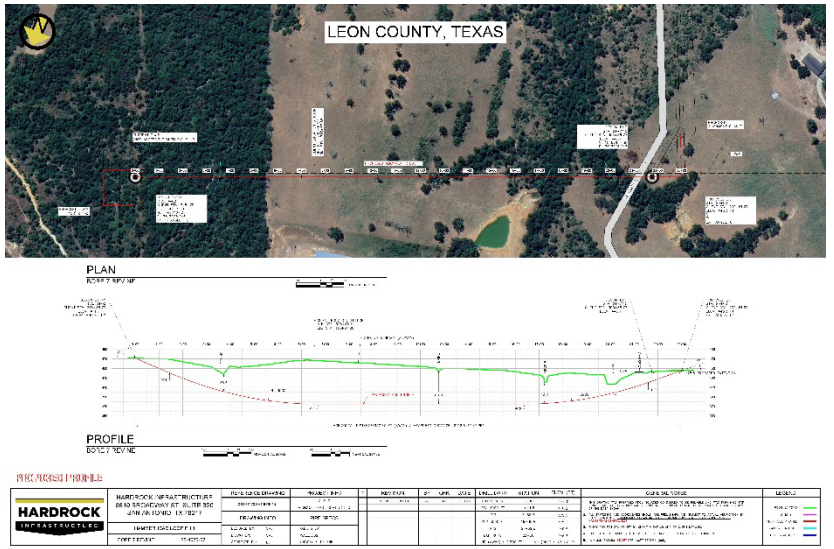
Bottom Flat

30’ Minimum under Rivers

Road / DOT Minimums may not be sufficient

For Large Diameter Pipes

Anecdotally, Pullback is Better with a 100’ Flat Section in the bottom



Vertical and Horizontal Curves

Radius of Curvature

Combined Radius

Curve Radius

- Minimum Radius of Product Pipe
- 100’ / 1” Diameter Rule of Thumb
- Actual Calculated Minimum
- Design at 30% Greater than Minimum
- Drill Pipe / Tooling Minimum if HDPE

Curve Radius

30" X52 Steel

R(min)=4*Modulus of Elasticity*Pipe Radius/12*SMYS

R(min)=(4*29,000,000*30)/(12*52,000)

R(min)=2788.46'

Recommended Design Radius = R(min)*1.3

Recommended Design Radius = 2788*1.3

Recommended Design Radius = 3624'

30" X70 Steel

R(min)=4*Modulus of Elasticity*Pipe Radius/12*SMYS

R(min)=(4*29,000,000*30)/(12*70,000)

R(min)=2071.43

Recommended Design Radius = R(min)*1.3

Recommended Design Radius = 2071*1.3

Recommended Design Radius = 2692'

Combined Radius

Turning in Vertical and Horizontal Plane at the same time

Calculate Combined Minimum Radius

Design at 30% Greater than Combined Minimum

Combined Radius

$$R(combined) = \sqrt{\frac{R(vert)^2 * R(horiz)^2}{R(vert)^2 + R(horiz)^2}}$$

$$R(combined) = \sqrt{\frac{3000^2 * 3000^2}{3000^2 + 3000^2}}$$

$$R(combined) = 2121.3$$

$$R(combined) = \sqrt{\frac{R(vert)^2 * R(horiz)^2}{R(vert)^2 + R(horiz)^2}}$$

$$R(combined) = \sqrt{\frac{4250^2 * 4250^2}{4250^2 + 4250^2}}$$

$$R(combined) = 3005$$

Radius Takeaways

However you come up with your Minimum Radius,
Design at least 30% greater for Drilling Constructability

Account for Combined Radius if there is a Compound Curve

If Designing for HDPE or Small Diameter Steel Pipe,
Don't forget Minimum Radii for Drill Stem and Mud Motors

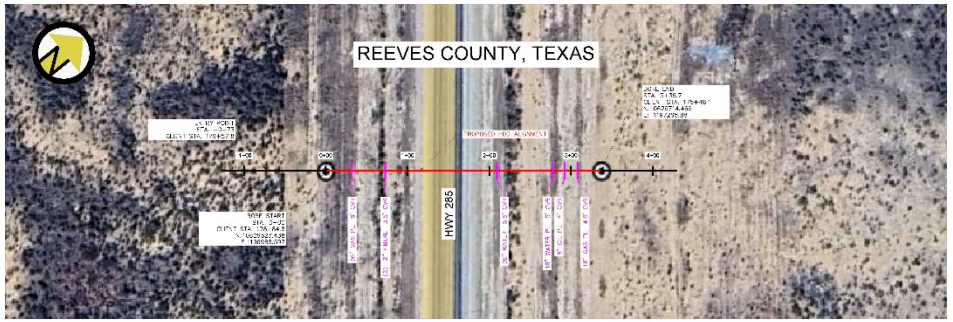
Cost Considerations

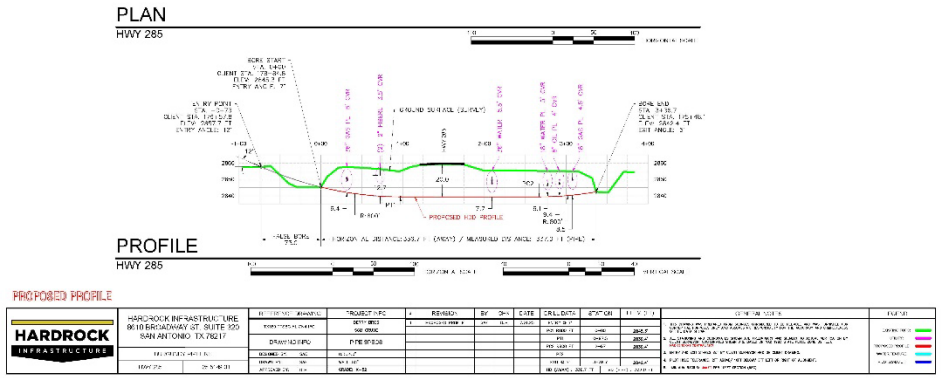
Yes, but all these recommendations Lengthen the drills….

Bid by Foot, Longer Drills = More $$?

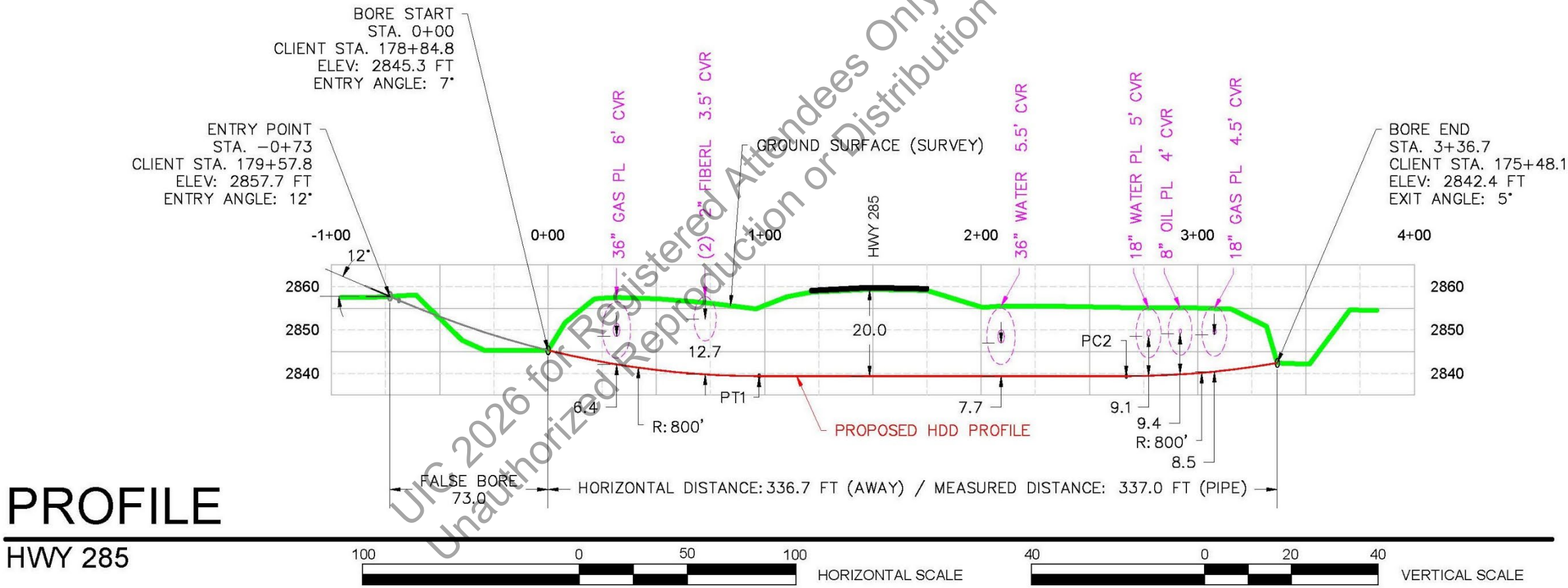
Price per Foot is Based on

Days Estimated Divided by Length of Drill





Cost Considerations



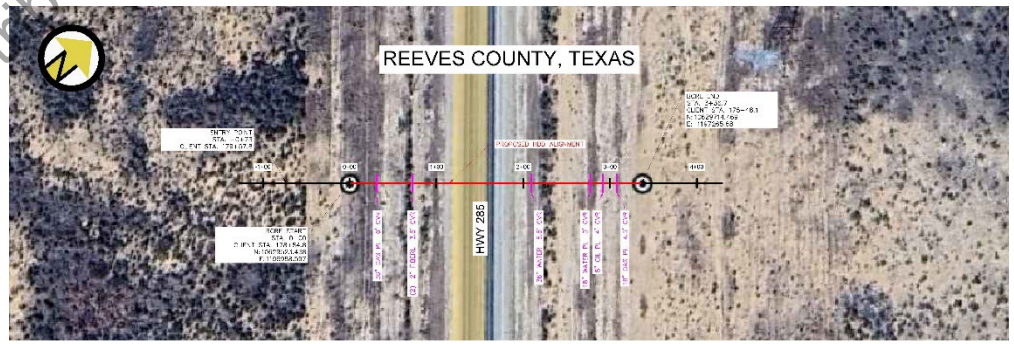
Cost Considerations

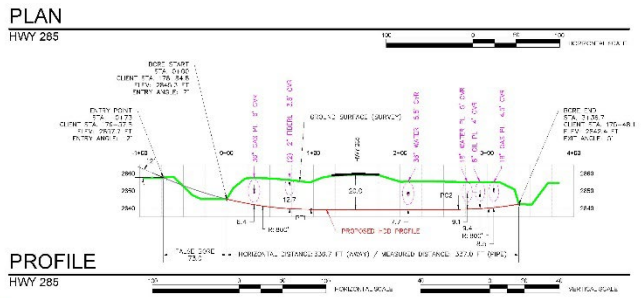
Drillers Estimate by Days per Drill

337’ with a Day of Waiting on Pits

525’ Without a day of Waiting

337’ at $65/ft is more $$ than 525’ at $40/ft with Shallower/Safer Tie ins





Questions?

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