Overview of Presentation

- Tunnel design concepts
- SR-66 design issues
- Tunnel components and construction
Tunnel Design Concepts

- Matching equipment, methods, and materials to ground conditions
  - Tunneling Machine
  - Initial Support
  - Final Lining
- Satisfy project goals
- Avoid disasters
- Economical

Design and Construction Considerations

- Utilities
- Third party impacts
  - Settlement
  - Traffic
  - Businesses
- Muck disposal
- Settlement
- Staging area(s)
Ground Settlement

Sand below water Table: Flowing ground
Clean sand above water: Running ground
Dirty sand: Raveling ground
Hard clay: Firm ground
Soft clay: Squeezing ground
Combinations are common
Construction Overview

- Shafts
- Tunnel Excavation and Support
- Pipe Installation
- Backfill Annulus and Contact Grout
- Clean Up

Shafts

- Access shaft - main work area
- Generally 0.5-2 acres required for staging
- Access shaft size depends on pipe diameter and length
- Must balance access shaft size between contractor needs/wants and costs
- Exit shafts are smaller than access shafts
Tunnel Excavation and Support

- Tailor excavation and support methods to the ground
- Must control loss of ground
- One-pass or Two-pass method
- Positive face control or open face
- Different methods better for different ground conditions

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Two-Pass Tunnel

- Initial Support
- Annulus Backfill
- Carrier Pipe
Circular Shield with Doors

Soft Ground Rotating Tunnel Head
Earth Pressure Balance Machine

Potential Problems

- Broken Utilities
- Surface settlement/sinkhole
- Settlement of nearby foundations
- Poor pipe connections (leaks)
- Noise complaints
- Traffic congestion
SR-66 Design Issues

- No open cut
- No shafts along SR-66 in this phase – no manholes, pipe jacking not allowed
- Earth Pressure Balance Machine (EPB) to control soils beneath the water table
- Control settlement of roadway, utilities, and pedestrian bridge

SR-66 Contract Documents

- Data Report
- Geotechnical Baseline Report
- Specifications – combination of prescriptive and performance requirements
- Drawings
- Overall approach – allowed as many methods as possible
Specifications

- Dewatering and water control
- Shaft excavation and support
- Tunnel boring machines
- Tunnel excavation and initial support
- Contact grouting
- Tunnel final lining
- Geotechnical instrumentation
- Reinforced concrete pipe
- Low density cellular concrete

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Tunnel Cross Section

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Lyman Henn, Inc.
Block Outs

Pipe Block Outs

Lyman Henn, Inc.
Existing Pump Station

Staging Area
Staging Area

Tunnel Supports
Access Shaft

Access Shaft Layout
Access Shaft

Tunnel Heading
Set of Tunnel Supports

Tail Tunnel

Lyman Henn, Inc.
Block-Out in Tunnel

Lyman Henn, Inc.

Special Pipe at Block-Out

Lyman Henn, Inc.
Pipe at Plant

Precast Pipe

Lyman Henn, Inc.
Lowering Pipe into Shaft

Pipe Placement Using Carrier
Questions?

Lyman Henn, Inc.