

# S.R. 66 Storm Sewer Project

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Tunnel Design and Construction  
by  
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## Overview of Presentation

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

## Tunnel Design Concepts

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

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## Design and Construction Considerations

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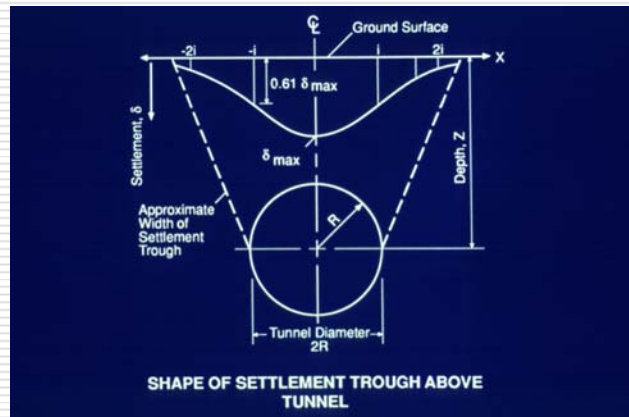
- Utilities
- Third party impacts
  - Settlement
  - Traffic
  - Businesses
- Muck disposal
- Settlement
- Staging area(s)

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## Ground Settlement

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## Ground Conditions & Behavior

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- 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

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## Construction Overview

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

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## Shafts

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- 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

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## Tunnel Excavation and Support

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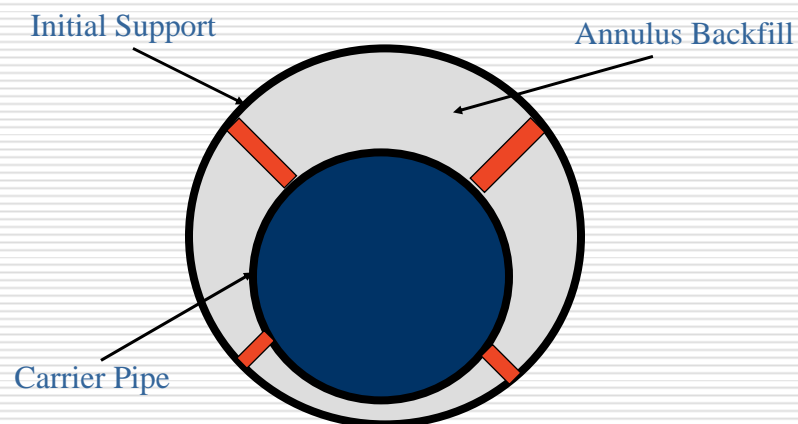
- ❑ Tailor excavation and support methods to the ground
- ❑ Must control loss of ground
- ❑ One-pass or Two-pass method
- ❑ Positive face control or open face
- ❑ Different methods better for different ground conditions

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## Two-Pass Tunnel

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## Circular Shield with Doors

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## Soft Ground Rotating Tunnel Head

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## Earth Pressure Balance Machine

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## Potential Problems

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

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## SR-66 Design Issues

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- 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

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## SR-66 Contract Documents

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

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## Specifications

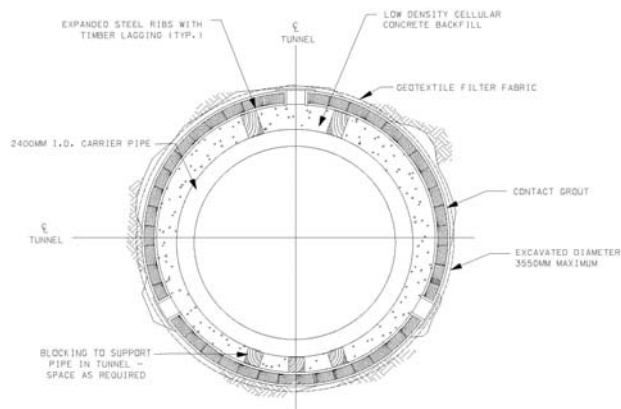
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- ❑ Dewatering and water control
  - ❑ Shaft excavation and support
  - ❑ Tunnel boring machines
  - ❑ Tunnel excavation and initial support
  - ❑ Contact grouting
  - ❑ Tunnel final lining
  - ❑ Geotechnical instrumentation
  - ❑ Reinforced concrete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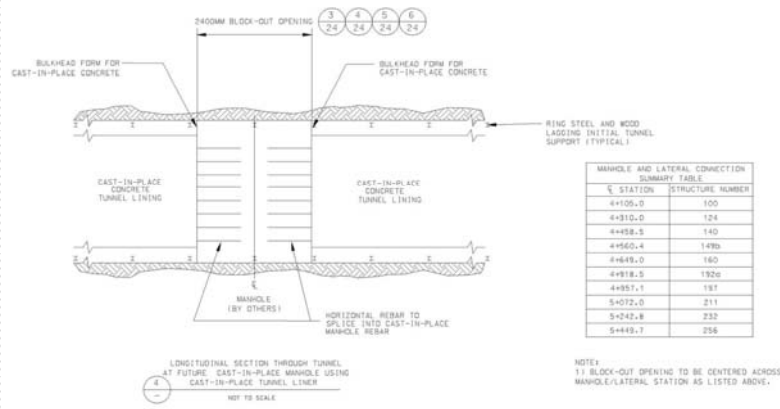
## Tunnel Cross Section

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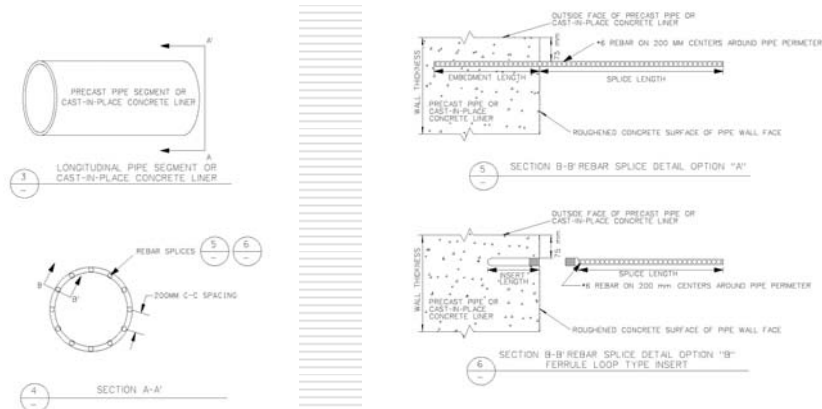
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# Block Outs



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# Pipe Block Outs



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## Existing Pump Station

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## Staging Area

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## Staging Area

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## Tunnel Supports

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## Access Shaft

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## Access Shaft Layout

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## Access Shaft

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## Tunnel Heading

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## Set of Tunnel Supports

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## Tail Tunnel

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## Block-Out in Tunnel

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## Special Pipe at Block-Out

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## Pipe at Plant

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## Precast Pipe

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## Lowering Pipe into Shaft

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## Pipe Placement Using Carrier

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# Questions?

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