Topics Covered

- Construction Administration’s Role
- Design Problem Areas Found During Construction
- Responsibility for the Design
Construction Administration’s Role

- Single Point of Contact for the District
- How to Build It
  - Constructability
  - Contract Administration
- How to Fix It
  - Redesign Work
    - Do it Ourselves, OGE, Original Designer, District Task Order Contract or Third Party Billing Through the Contractor
Geotechnical Construction Items

- 201 Clearing & Grubbing, 203 Roadway Excavation & Embankment
- 204 Subgrade Compaction & Proof Rolling, 205 Lime Modified Soil
- 206 Lime Stabilized Subgrade, 804 Cement Stabilized Subgrade
- 208 Rock Blasting, 209 Linear Grading
- 304 Aggregate Base, 307 Non-Stabilized Drainage Base
- 410 Traffic Compacted Surface, 411 Stabilized Crushed Aggregate, 617 Reconditioning Shoulders
- 623 Construction Layout Stakes
- 1015 Compaction Testing for Unbound Materials
- Mechanically Stabilized Earth Walls
Design Problem Areas Found in Construction
Large Contingency Quantities

- Do ‘Not’ use Contingency Quantities
  - Contractor Does ‘not’ Know
    - Where, When and How Much
  - Leads to Unbalanced Bidding
    - Unwanted by the Department

- Pick the Quantities and Put them in the Plan

- District will Write a Change Order
  - Normal Business Practice
Excavation Quantities

- Original Quantity = 300,000 cy
- +300,000 cy
  - Summary Quantities Not Added Correctly
- -200,000 cy (negative)
  - Pavement Thickness & Width Differences
- +100,000 cy
  - Ramp Quantities Missing

Net Change = 200,000
  - 200,000 cy x $ 8/ cy = $ 1.6 million

Absolute Change = 600,000 cy
  - 600,000 x $ 8/cy = $ 4.8 Million
Item 204 Subgrade

- Plan notes are ‘not’ Required
- Plot the Location & Depth on the Cross Sections
- Place the Totals in the General Summary
- Item 204 has all the required details
- Use Item 204 Excavation of Subgrade & Granular Embankment Type
  - See CIM page 182
Item 204 Subgrade

- Use GB1 Plan Subgrades and Section 204 in the CIM
  - Used for 10 years in Construction
  - Minimize the Embankment Item on Rehab Projects
    - Not as effective
  - (If N< 5 ) Believe that it is a 5 Foot Undercut
    - Soup or Jell-O (example)
  - Urban Rehabs are the worse (example)
Urban Rehabilitation Project

- No Drainage, Small Areas, and Short Time Frames
Existing Cross Sections Incorrect

- Aerials
  - High trees, weeds, lack of proper ground control or tolerances too loose
- Existing ground 6” lower than plan.
  - Net change… $150,000
- Several Projects like this
Top of Rock

- Do not show the Top of Rock
- Contractors will eat this one up
- If the we show this we are liable
- One Project
  - Actual Rock was 6 to 7 feet higher than the Top of Rock.
  - Total Cost $300,000
Foundation Problems (CIM 130-135)

- Moderately Soft Foundations
  - Fills > 12 feet
  - Fills > 6 feet & < 12 feet
  - Fills < 6 feet

- Severe Soft Foundations
Shallow Fills and Transition Areas (CIM 133)

- Foundation is too soft
  - Can ‘not’ Construct with a Thick Lift
- With Fills < 3 feet and N < 10
  - Stabilize the foundation (205 or 804)
    - Then Build Embankment
    - Stabilize the Subgrade Afterwards
  - Use Granular Type ___ Fills
- Transitions at Cut and Fills
  - Same Problem
  - Changed Drainage, Bad Drainage or Shallow Fills
Severe Soft Foundations
(CIM 134-135)

- Standing Water, Under Water or Buried Equipment
- Can ‘not’ use Embankment
- Use End Dump Method with Granular Material Types
- Use Coarser Granular Types C & D, Blast Rock or Dump Rock
  - Use Larger Mat’l for Softer & Wetter Conditions
  - Pay by the Ton
    - Can not measure
- Plans Called for a 6’ to 10’ Undercut with Embankment
- Water level in the plan 4’-6’ below grade. (Taken in Drought)
- Actual >> Ponded water during clearing, normally 1’ below surface & above the surface after rain.
- Surrounded by Wetland

Severe Soft Foundation
Soft Foundation

- Solution
- Undercut & Place Blast Rock 2’ to 4’ Thick
- Cost $1 Million
Incorrect Boring Location

- Splitting Borings between Ramp and Mainline.
  - Shale not in Boring between Mainline & Ramp
  - Shale found in Ramp Cut
  - Cost $ 550,000

- Borings Taken then Alignment Changed
  - Borings More than 100 feet from Designed Cut
  - Not representative of what we found
  - Happened several times
Drainage Designed after Borings
- If Harder or Different Rock is found
  - We pay because of Differing Site Condition

- Boring at 10 foot showed no rock
  - Pipe Designed at 20 feet
  - Rock at 10 to 20 feet >> Cost $200,000

- Boring at 10 foot showed shale
  - Pipe at 20 foot
  - Harder siltstone at 10 to 20 feet >> Costs $100,000
Sloughing of Sandy-Silt Slopes

- 2:1 Cut Slopes with Water
  - Results in Sloughing
  - Even if the original slopes were 2:1

- Solution
  - 3:1 Slopes
  - Rock and Fabric
Cut it Out

- Cut and Fill all in One Day
Finished Slope

- Type ‘B’ Dump Rock
- 712.09 Type B Geofabric

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Ravines

- Weak Soil Slides into Ravines
  - Since the beginning of time
- Toe of Embankment Designed in or near the Ravine
- No borings in the Ravine
- Slide Results
- Need More Borings and Design Effort at these Locations
- Borings are non-Existing in these Benches
- SSI requires two borings in these areas
- Have been problem areas
- This Slide 20’ of the 40’ fill was Placed
Responsibility for the Design

- There is an increase in Design Errors
  - We look at Change Orders Differently
- Plans should be Complete and Constructible
- There will always be Changes
  - This is the Nature of Geotechnical Engineering
- Extreme Design Errors or Negligence will be Perused
  - For Cost Recovery
- Document the Design Effort
● WOH Soil in the Centerline Borings
  - No additional borings were taken to find the limits.

● 30 foot Fill w/ Toe 50 feet into River.
  - No toe borings
Soft Foundation

- >100,000 cy of Material needed Removed & Replaced.
- $10 Million Change Order
- Collected $500,000 from Consultant
Physical Evidence in the Field Showed a Slide

ODOT Records Show Slide

Resulted in $4 million change

Collected $500,000 from Consultant
Hard and Soft Costs

- **Hard Costs**
  - Cost of the Actual Work Increase
    - More undercut quantity
  - Not Collectible

- **Soft Cost**
  - Increased costs as a result of the Error
    - Destroyed Work
      - Bridge fell down
    - Delay Costs
  - Collectible