



# Performance Review

Washington County, Oregon  
Gravel Road Upgrade Program

# Background—Gravel Road Upgrades

- Washington County has been constructing GRUs for 20 yrs
  - Typically a triple shot chip seal
  - Possibly HMA
- Funded primarily by “benefiting parties” or through separate funding sources.
- Some “premature” failures developed in GRU projects constructed after 2008
  - Raveling
  - Cracking
  - Rutting



# Possible “Culprits”

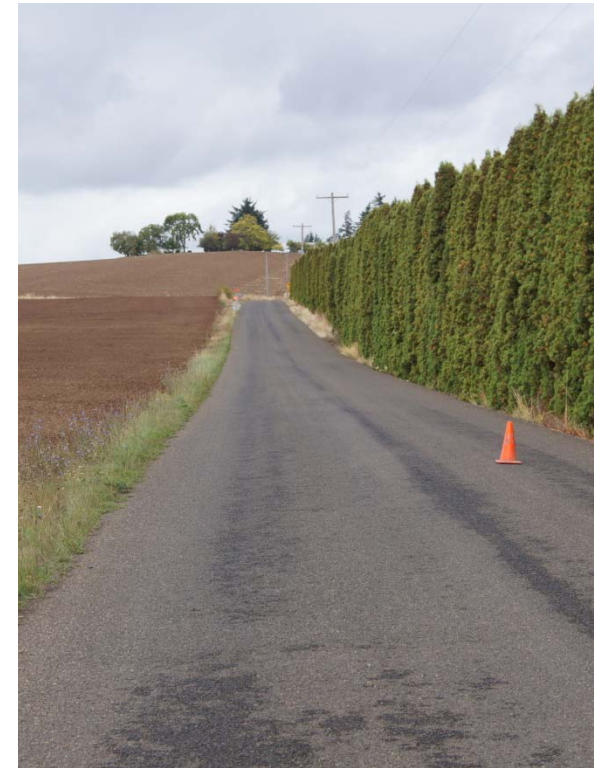
- New type of oil
  - Older roads used MC-250 prime coat
  - Switched to HFMS-2SP prime coat in ~2008
- Aggregate Gradation
- Excessive Traffic
- Inadequate base thickness
- Poor drainage
- Construction timing





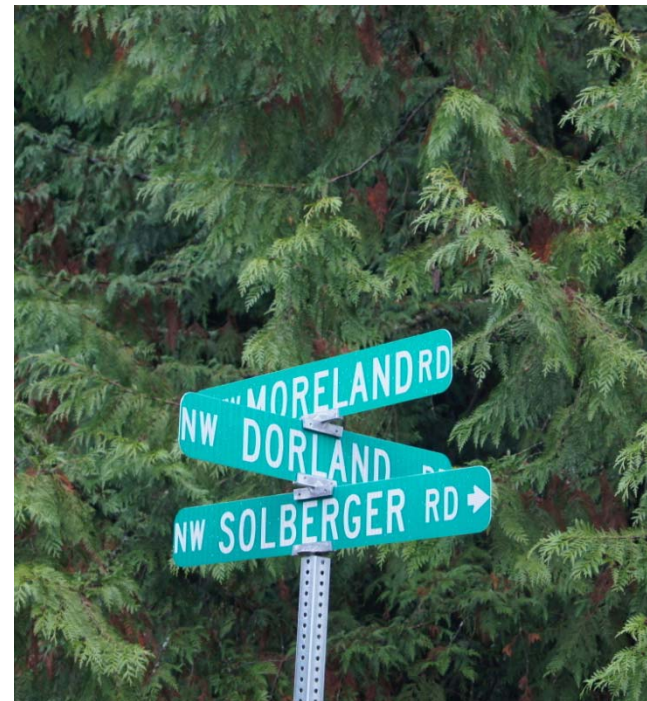
# Areas of Investigation

- **Material Characteristics**
  - Chip Seal Binder
  - Chip Size and Texture
  - Chip Gradation/P200
  - Base Aggregate Gradation/P200
- **Structural Capacity**
  - Base Aggregate Thickness
  - Subgrade Strength
- **Construction Practices**
  - Review



# Field Investigation/Data Gathering

- Visual Survey
  - Identified Failed Roads
  - Identified Good Roads
  - Selected Core/Test Locations
- Traffic Volume
  - ADT
  - FHWA Truck Classifications
- Construction Date
- Maintenance/Cost History
- Material Sources
  - Chip Seal Binder
  - Chip and Base Aggregates



# Field Investigation/Data Gathering

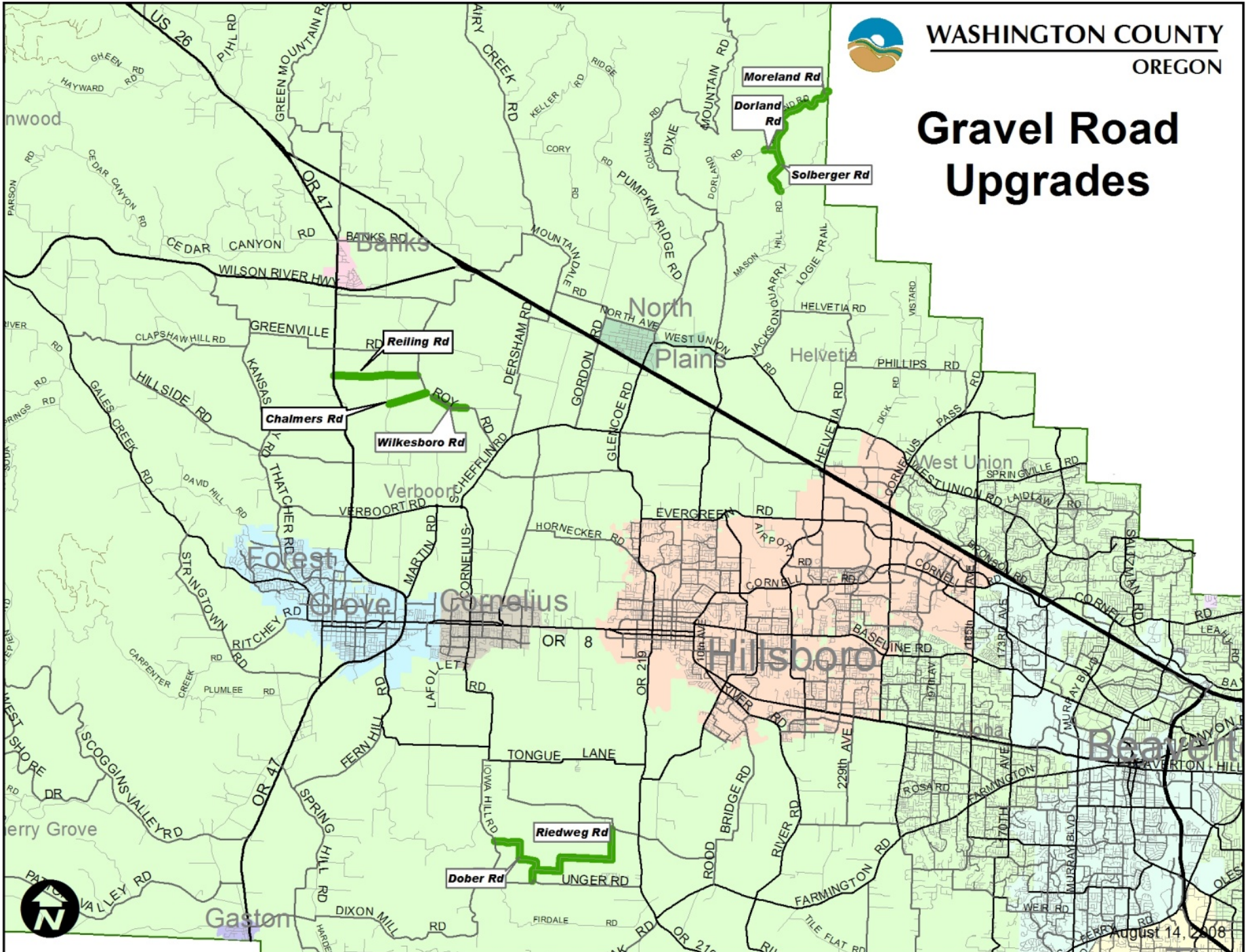
- Eight Roads
- Photos and GIS location
- Rut measurements
- Sand Patch Test
- Material Samples
  - Bituminous Surface Treatment
  - Base Aggregate
  - Subgrade Soil
- Dynamic Cone Penetrometer







# Gravel Road Upgrades





# Field Investigation







Sand Patch Test



# Results

- Material Characteristics
- Structural Capacity
- Construction Practices



**Final Report**  
**Chip Seal Performance Review**  
Washington County, Oregon

January 6, 2012

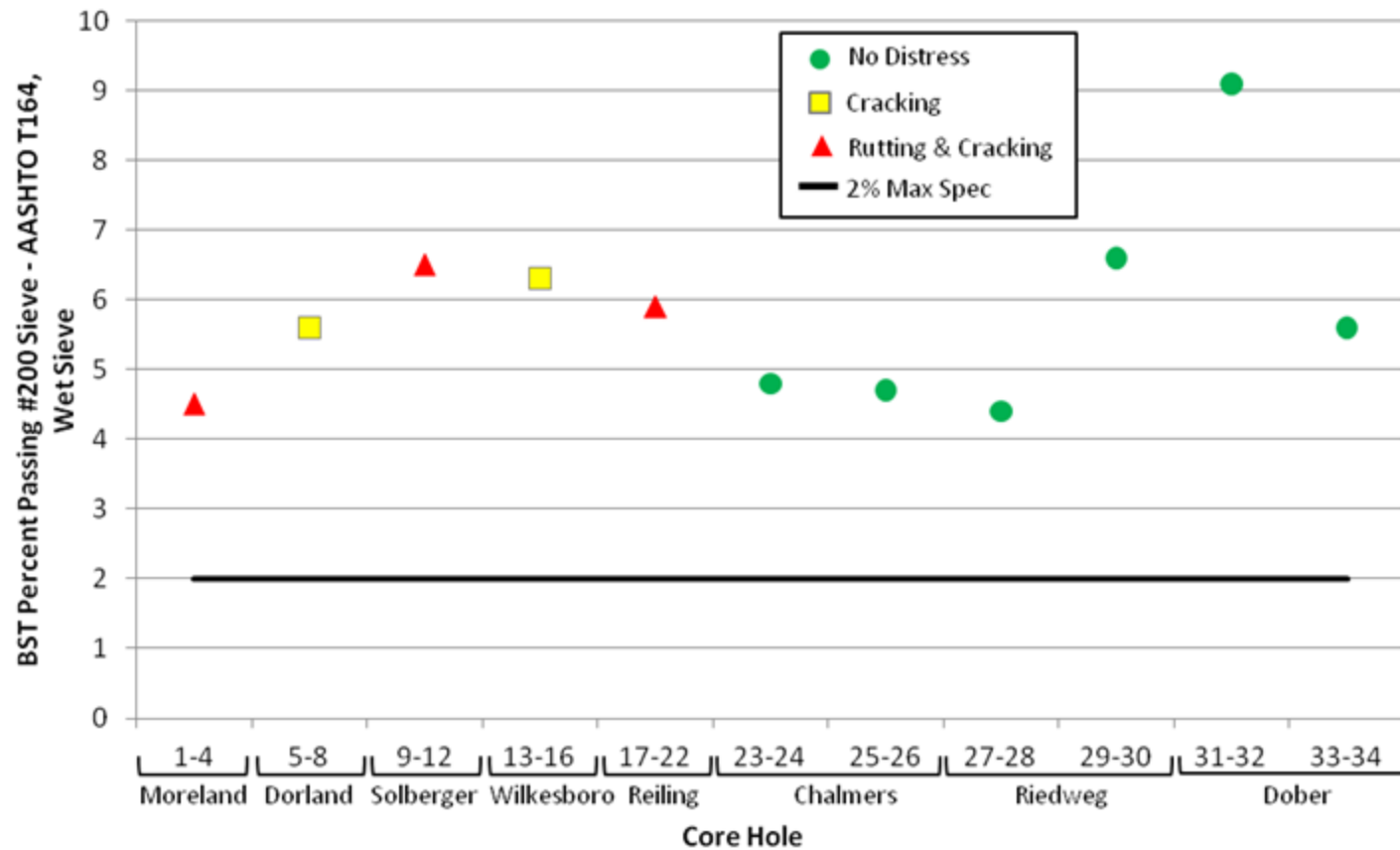




# Bituminous Surface Treatment

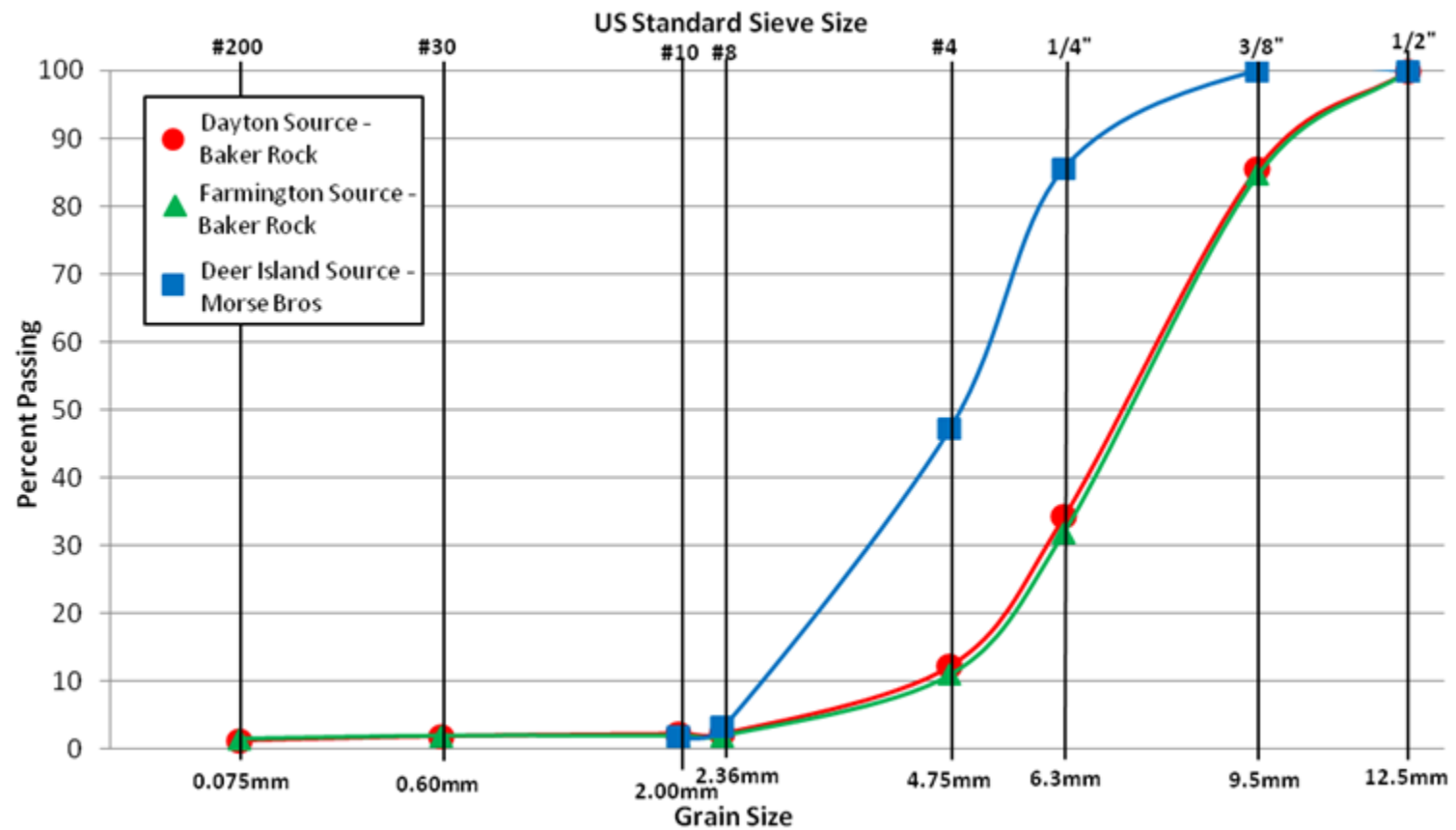


# Results - % P200 in BST

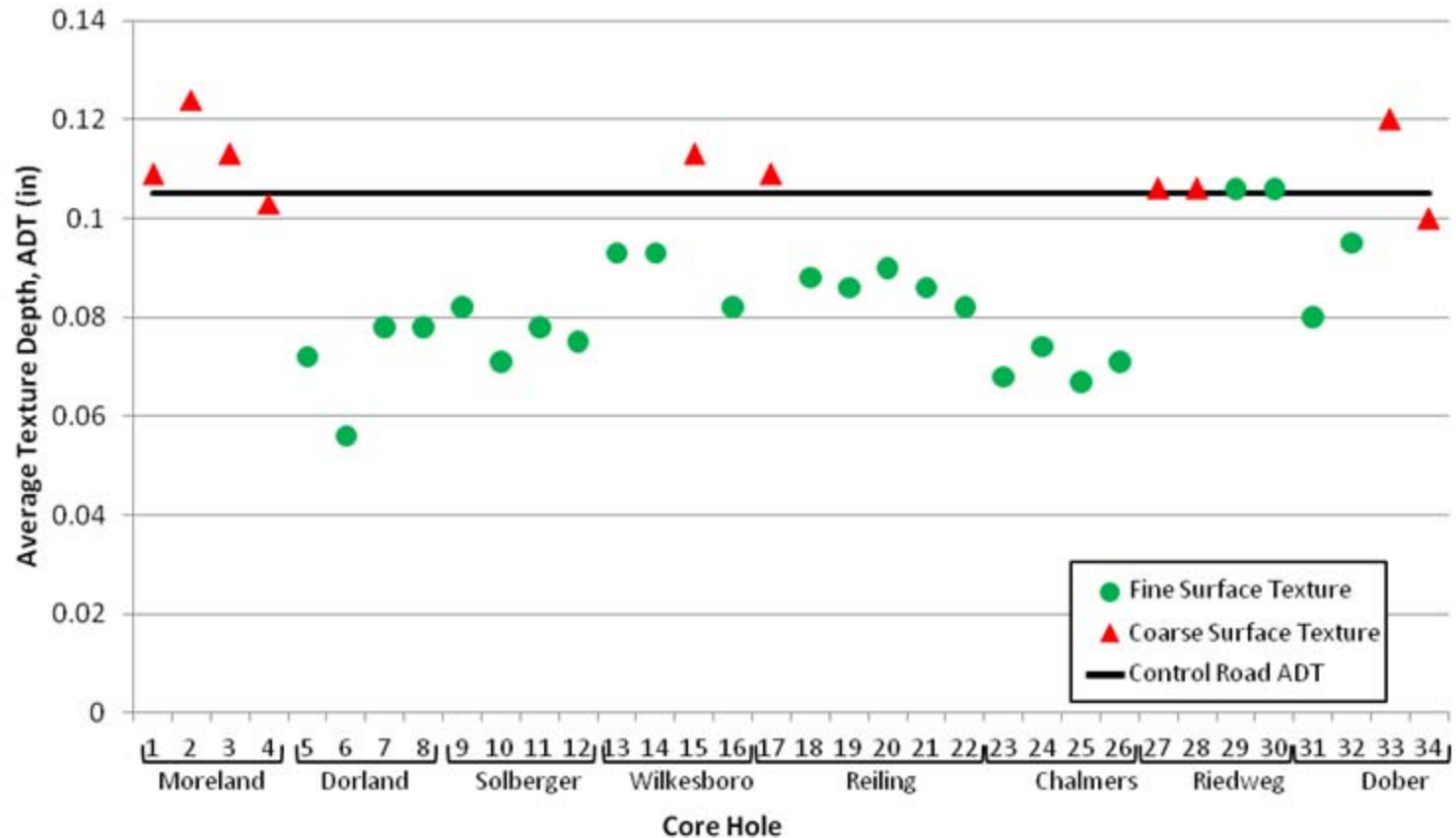




# Results - BST Gradation

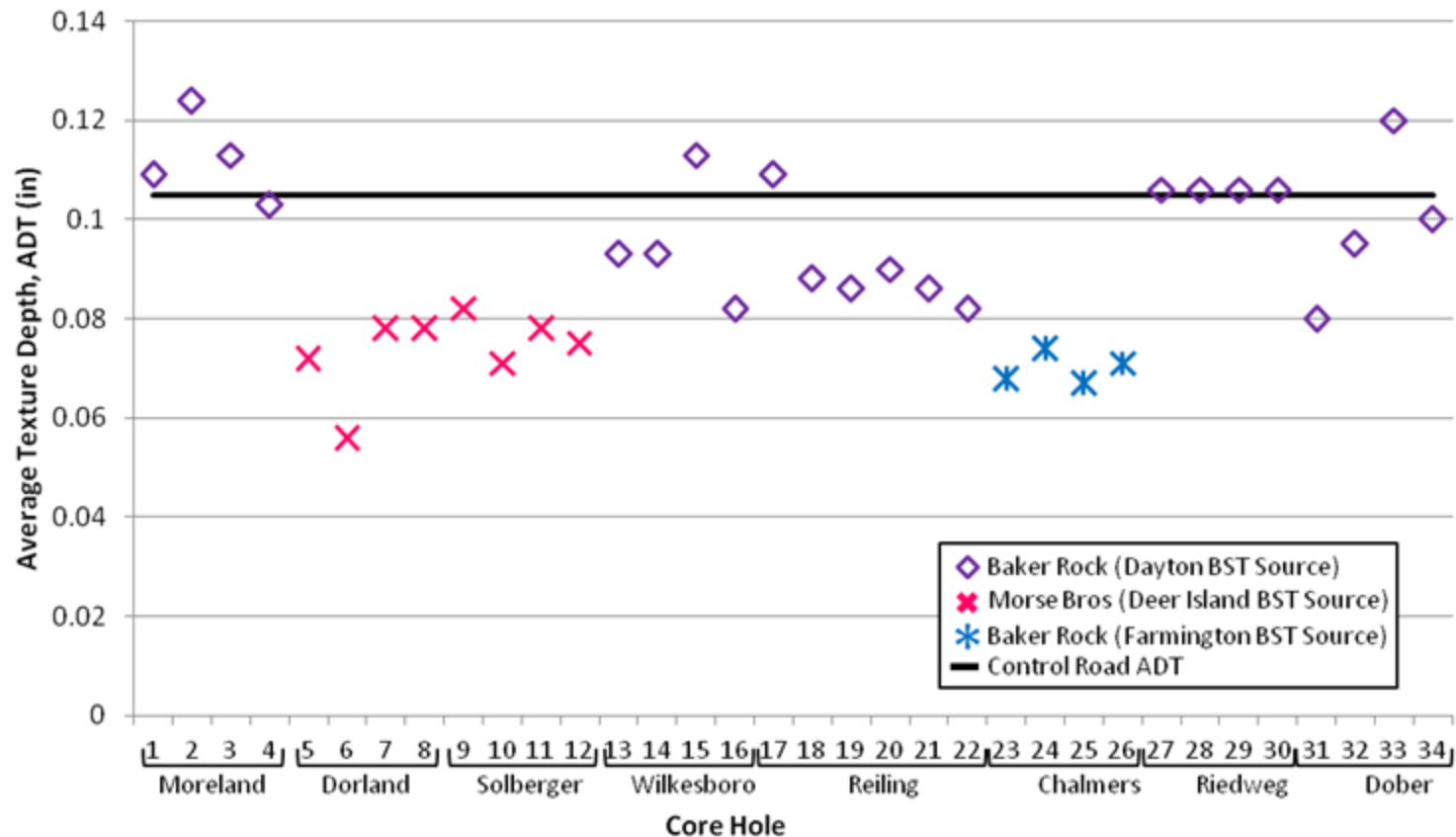


# Results - BST Texture





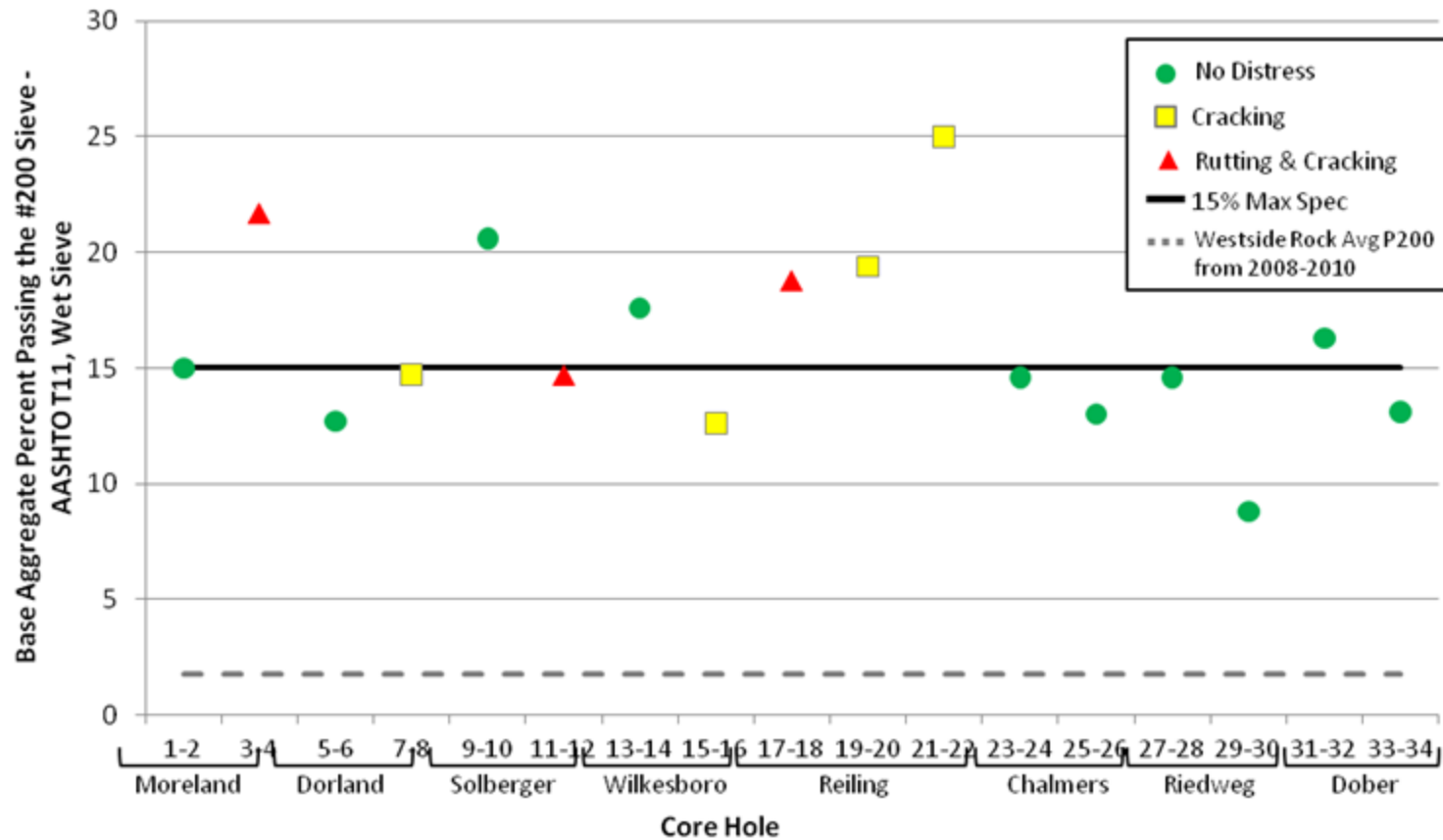
# Results - BST Texture / Source





Base Aggregate

# Results - P200 in Base Rock

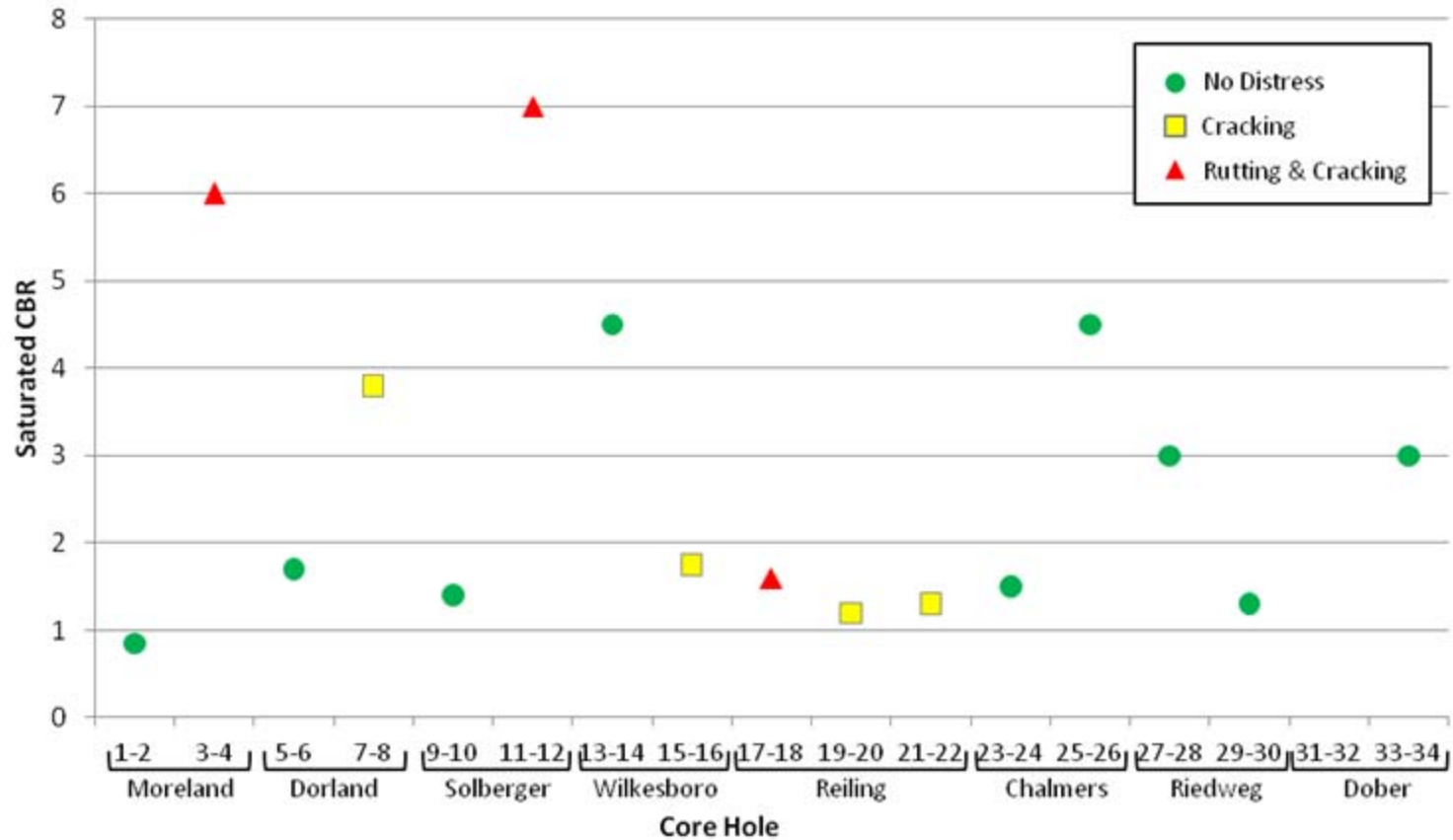




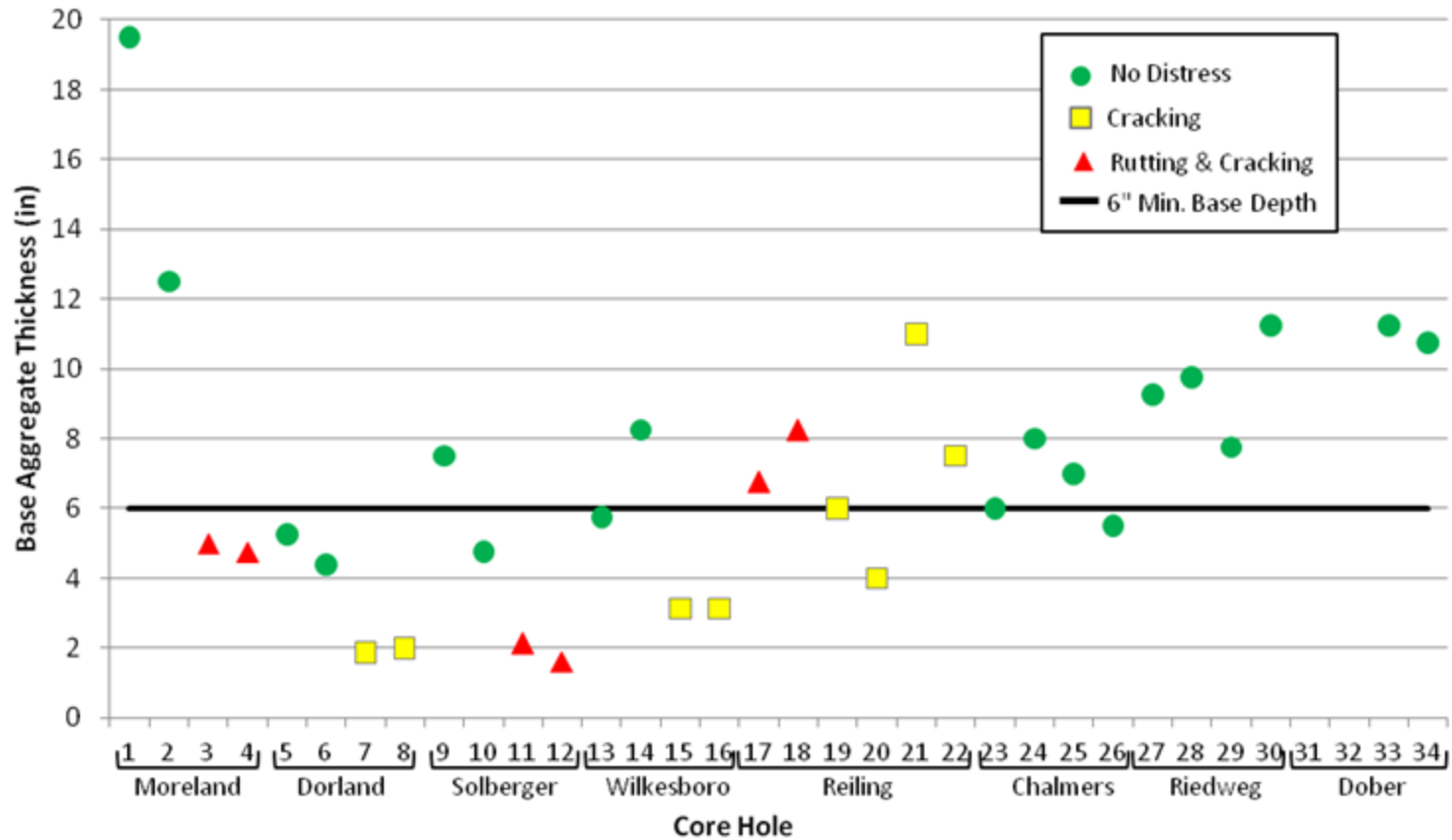
# Structural Capacity



# Results - CBR

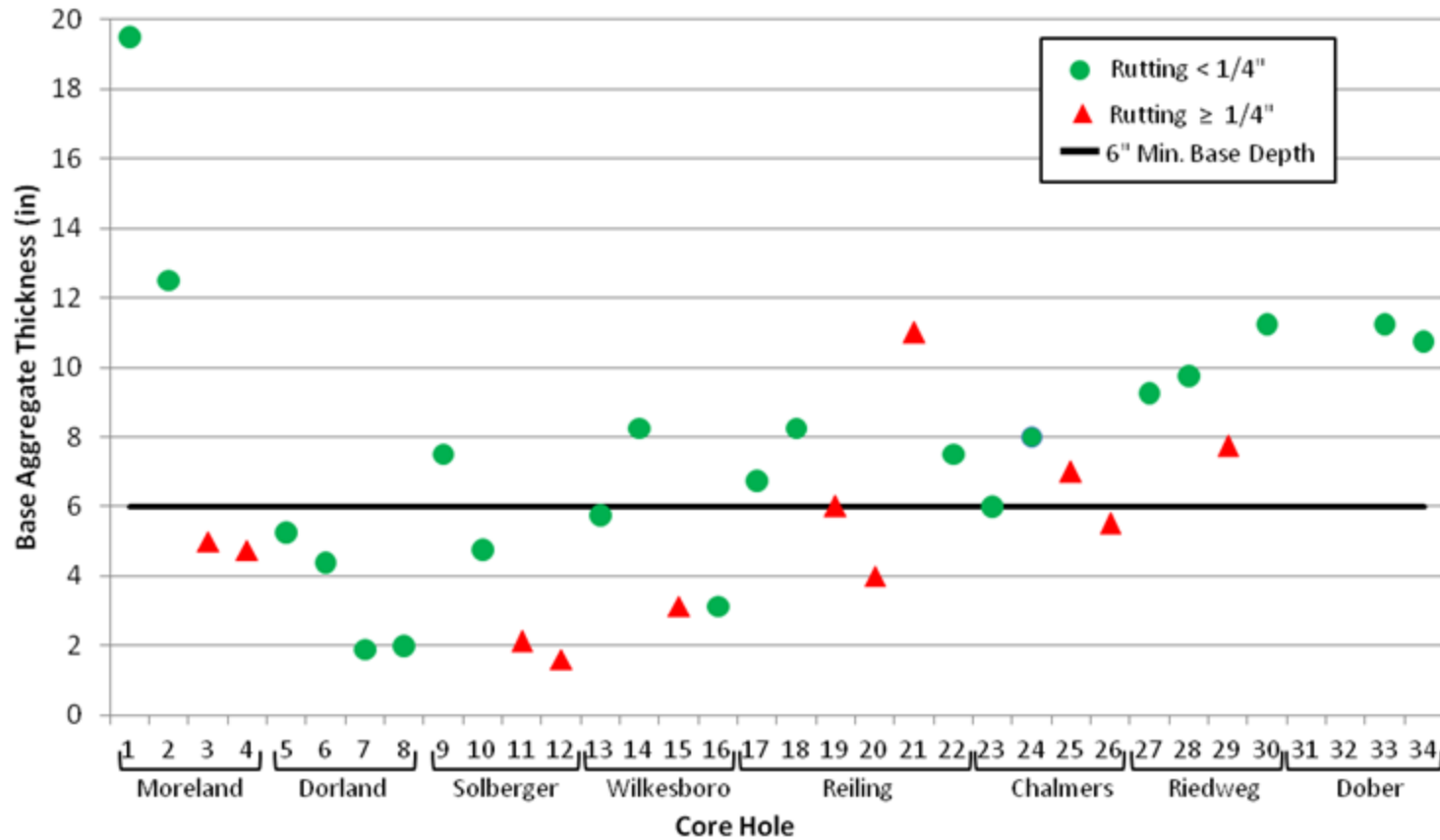


# Results - Base Thickness

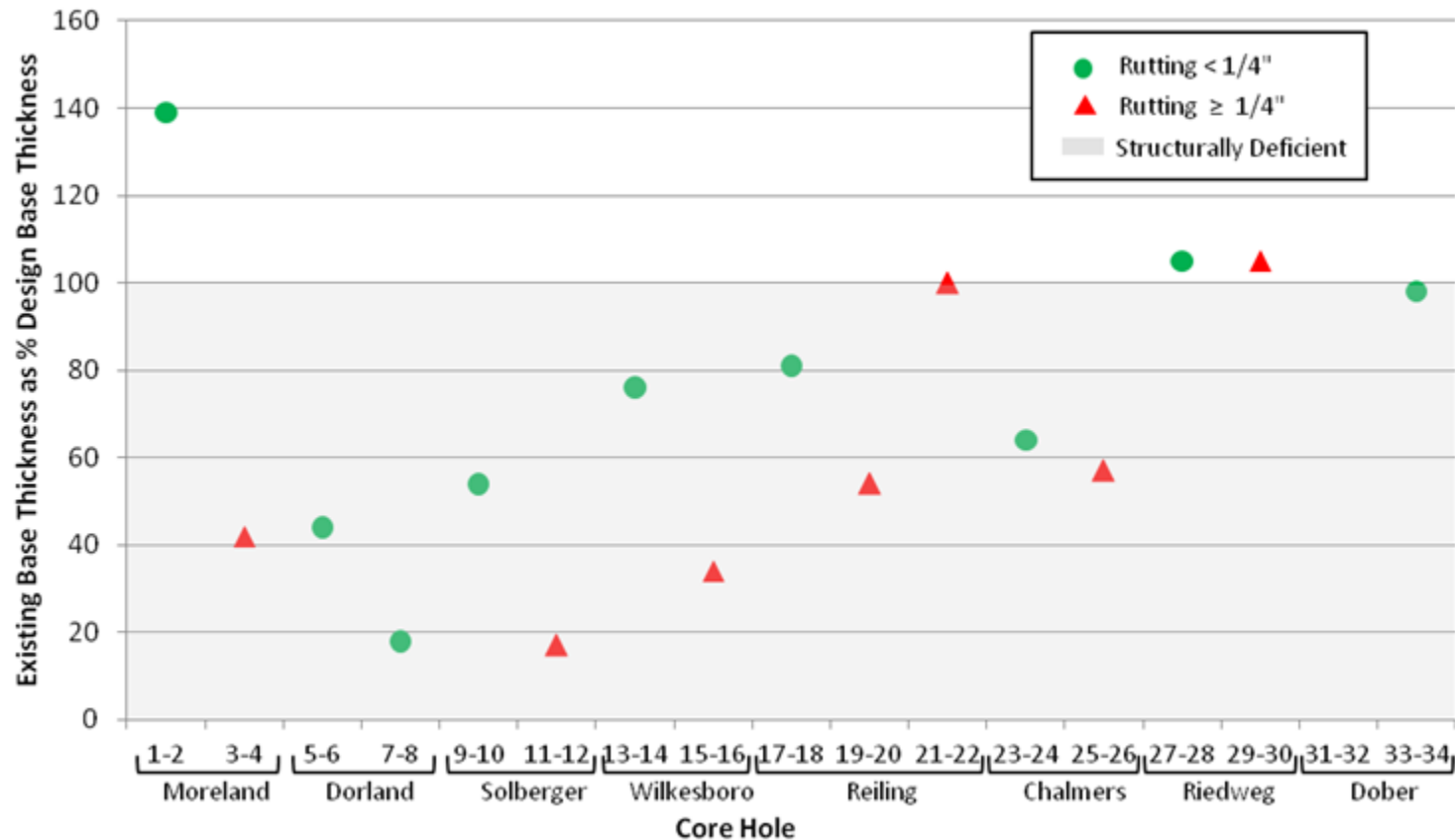




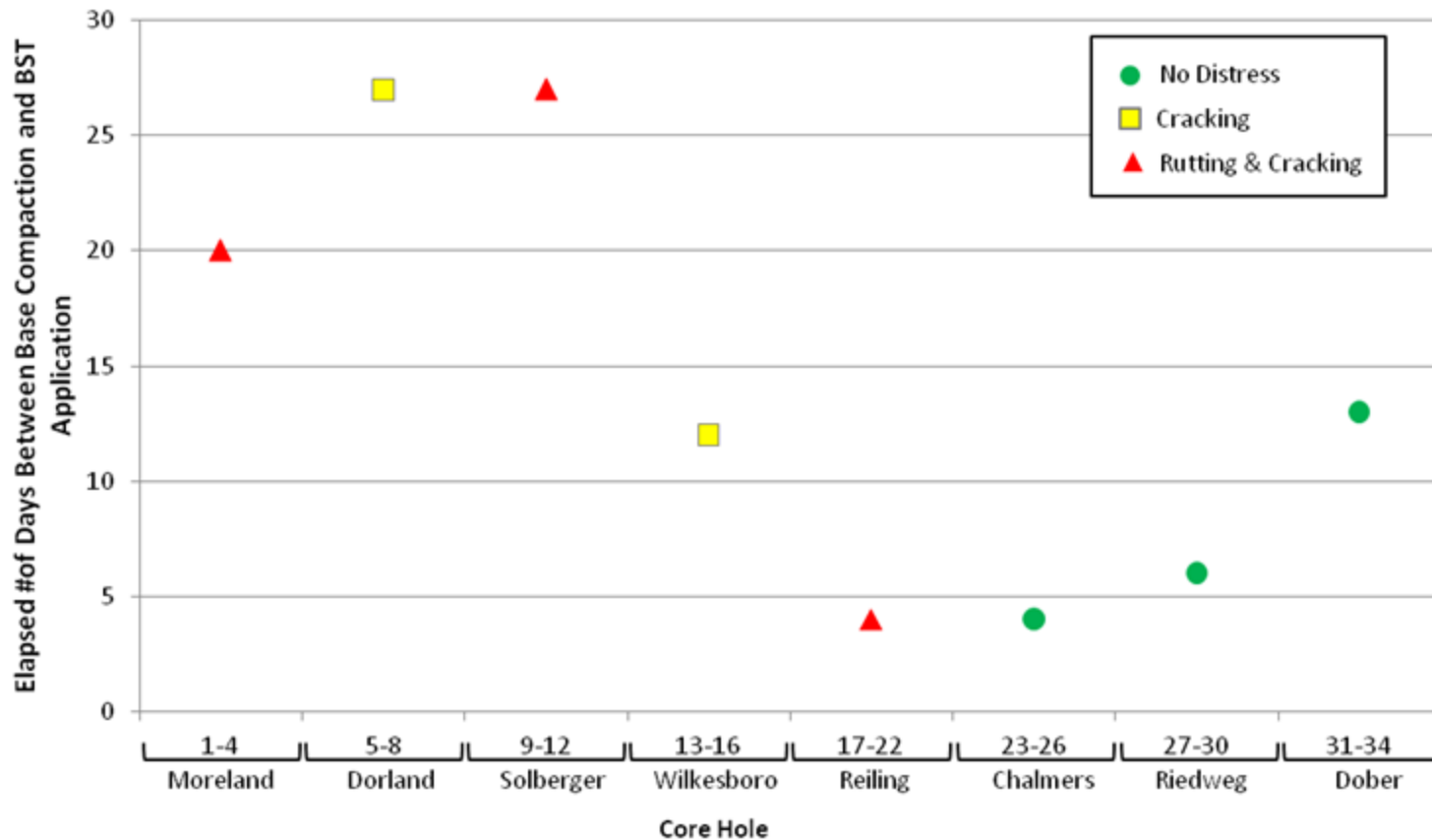
# Results - Base Thickness



# Results - % Design Thickness



# Results - BST Lag Time





# Conclusions

- **Materials**
  - BST Surface Texture related to source
  - BST Surface Texture adequate
- **Structural Capacity**
  - Failures due to inadequate base thickness
- **Construction Processes were generally acceptable**
  - Better performance when lag time between base rock placement and BST application < 10 days

# Recommendations

- **Materials**
  - BST Aggregate Size—use 5/8”—1/2”—3/8”
  - Finish with a fog seal
    - Better lane delineation
    - Better chip retention
  - Institute Quality Assurance program
- **Structural Capacity**
  - Structural evaluation of GRU Candidates



# Questions?

Washington County, Oregon  
Gravel Road Upgrade Program

**Thank You!**

**DUVAL ENGINEERING LLC**  
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