

# The Great Impact of Geotechnical Features on System Performance



Scott A. Anderson, Ph.D., P.E.

FHWA Resource Center

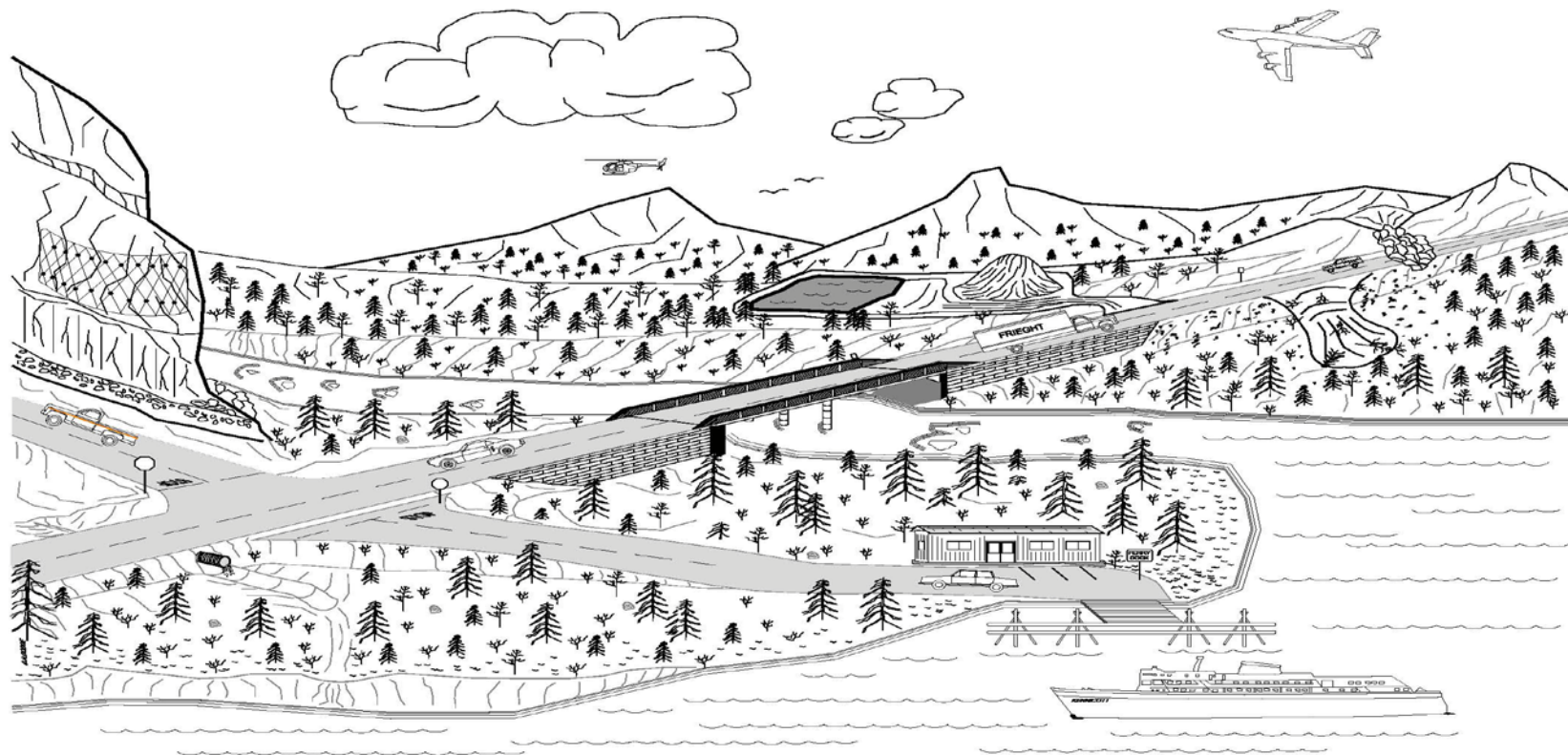
Geotechnical Engineering Technical Services Team Manager

# Thesis

- Corridors are the primary assets of a transportation agency. A transportation system will have multiple corridors.
- Geotechnical features such as embankments, slopes and retaining walls have a large influence on the performance of corridors.
- Performance (corridor or system) is the attribute agencies will be measuring and managing – and care most about.



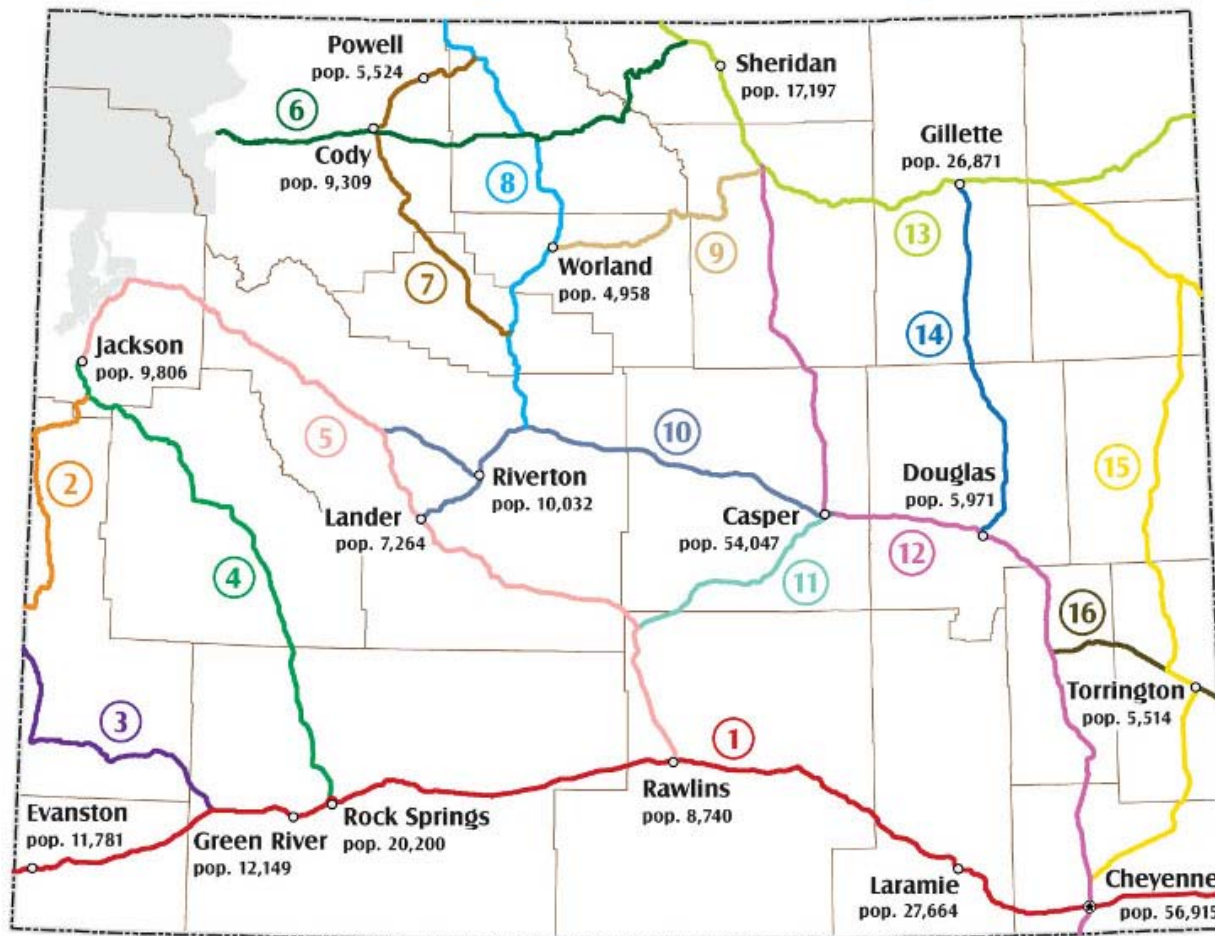
# What is a corridor?



U.S. Department of Transportation  
**Federal Highway  
Administration**

# Corridors in Wyoming

## The State Significant Corridor System



URS,  
WYDOT,  
2010



# What is a geotechnical feature?

- **A geotechnical asset: slopes, walls, and embankments are examples**
  - Performance is largely attributed to soil or rock performance
  - Does not include pits or quarries, or knowledge, such as a subsurface information database
    - These are assets that are not part of corridors
      - “Geotechnical Assets”

# What is “performance”?

- Many definitions concurrently
- Our ultimate objective(s)
- Something that can be measured
- Something that can be managed

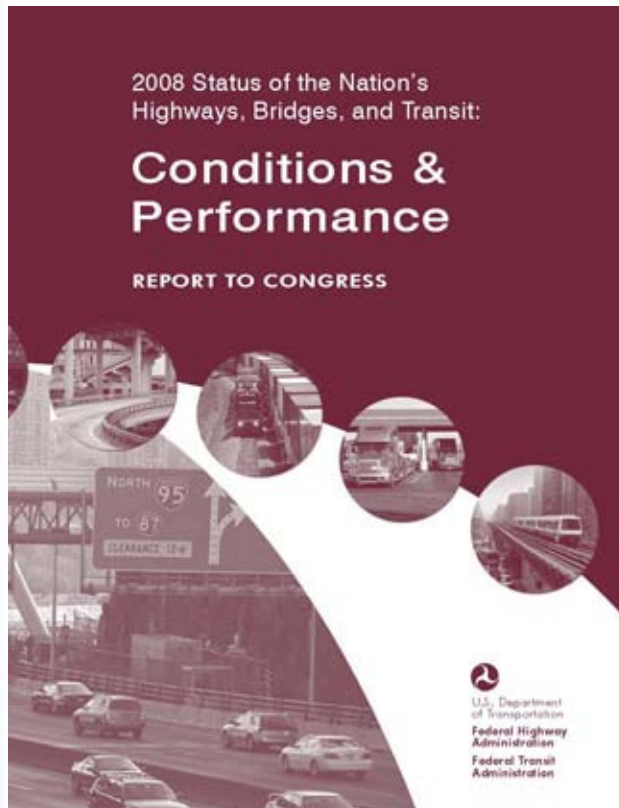


# USDOT Performance Report

Performance Measure	2004	2005	2006	2007	2008	2009	2010 Target	2010 Actual	Met / Not Met
Percentage of travel on the National Highway System (NHS) meeting pavement performance standards for "good" rated ride.	52	52	54	57	56	57	58	58*	Met
Percentage of deck area on National Highway System (NHS) bridges rated as deficient, adjusted for average daily traffic.	32.0	29.9	29.2	29.7	29.5	29.2	28.9	28.7	Met



# Condition Reporting



## Report to Congress

- System Conditions
- Operational Performance
- Safety
- Revenue and Expenditures
- Investment Analysis

Difficult to associate performance  
with federal investments



# What is “system performance”?

FHWA’s System Performance Goal:

The Nation’s highway system provides safe, reliable, effective and sustainable mobility for all users.

FHWA is now going farther...

# Performance Management in the Future

Performance Management of the Federal Highway Program is a systematic approach to making investment and strategic decisions using information about the condition and performance of the system and developing an approach to achieve a desired set of national goals



# Performance Management Success

## Utah Example

- **Strategic Direction identifies ‘final four’ of goals that guide performance management and planning**
  - Take Care of What We Have
  - Make the System Work Better
  - Improve Safety
  - Increase Capacity

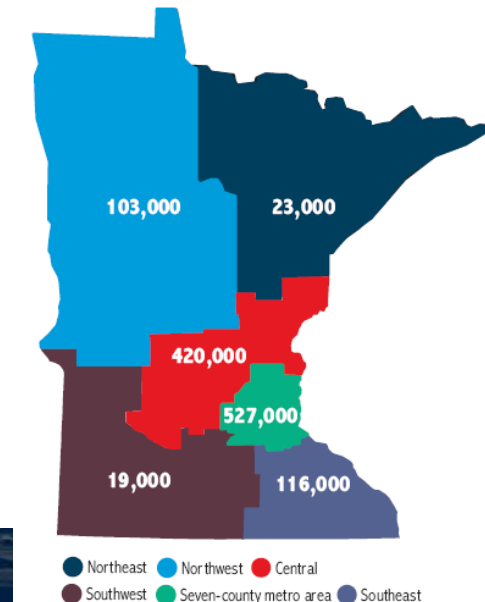


# Performance Based Planning at Mn/DOT

- **Policy Plan**

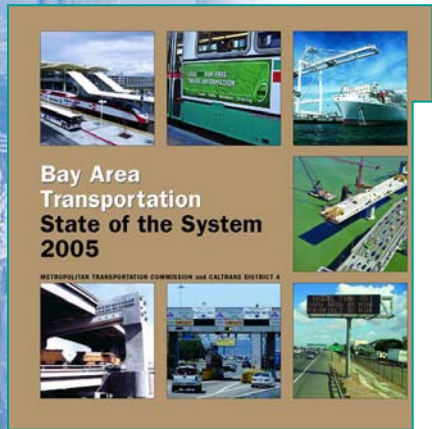
- *Vision: A Safe, Efficient and Sustainable Transportation System*
- Emerged from discussions with stakeholders
- Identified challenges and opportunities
- Defined policies to guide decisions

Safety	Twin Cities Mobility
Infrastructure Preservation	Greater Minnesota Metropolitan and Regional Mobility
Maintenance & Security	Community Development and Transportation
National and Global Connections	Energy and the Environment
Statewide Connections	Accountability and Transparency



# Performance Management Elements

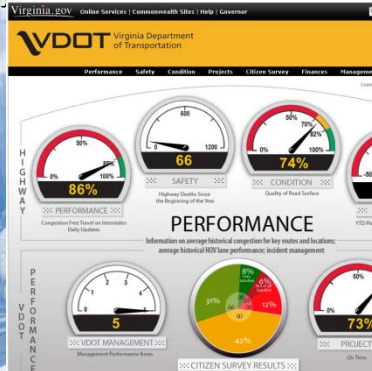
## Reporting Examples



*Business Plan 2004 & 2005*  
Ohio Department of Transportation

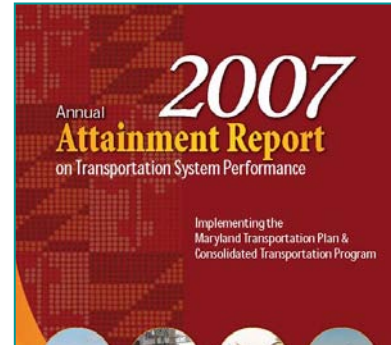


*State of the System 2005*  
Bay Area Transportation

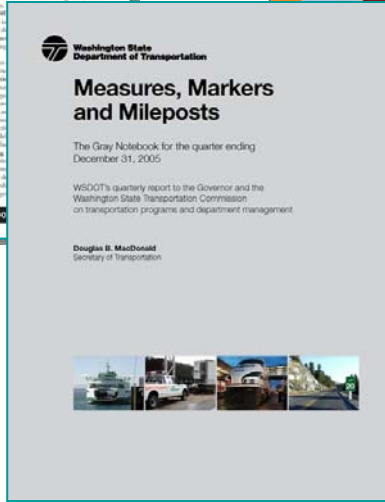
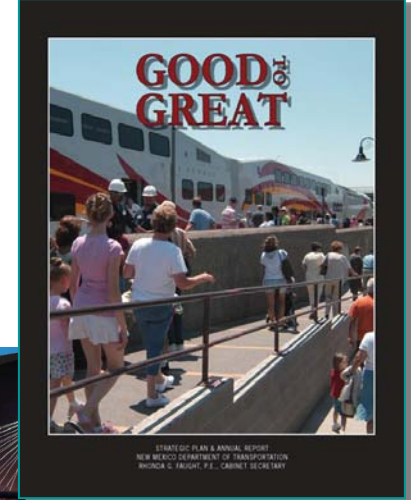


*Dashboard*  
Virginia Department of Transportation

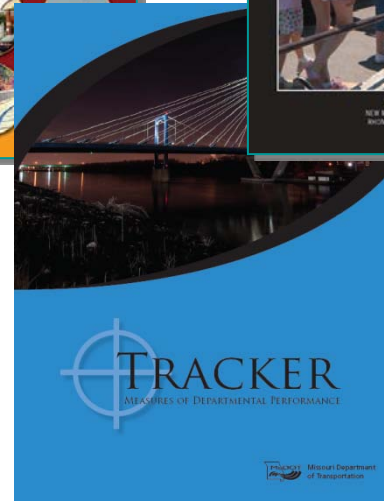
*2007 Annual Attainment Report*  
Maryland DOT



*Good to Great*  
Strategic Plan and Annual Report  
New Mexico DOT



*Measures, Markers and Mileposts*  
Washington State Department of Transportation



*Tracker*  
Missouri Department of Transportation



# Performance Management in the Future

Keywords for Performance are:

- System
- Mobility, Capacity
- Efficiency, Reliability
- Safety





**For a system to perform well, its corridors must perform well and deliver mobility, capacity, efficiency, reliability and safety**

**One broken link can change all of that**



# Geotechnical Message

- **Consider 200 slopes, 10 walls and 50 embankment culverts identified as 'in need' by separate inventory and assessment methods**
  - Measure: reduce number
  - Target: 10% reduction
- **Consider 10 corridors of primary significance**
  - Measure: safety, efficiency, mobility
  - Target 10% improvement





# Geotechnical Message

- It is important to be developing tools and practices for data collection and decision making





# Geotechnical Message

- It is also important to be looking beyond – to how that contributes to improved performance of a system through performance of a corridor
  - Bridges
  - Pavement
  - Walls
  - Signs
  - Slopes
  - Embankments
  - Tunnels
  - Etc.



U.S. Department of Transportation  
**Federal Highway  
Administration**

# Recent U.S. examples

- **Embankment on I-75 in TN**

- March 8, 2011
- Both SB lanes still closed
- Built in 1970s
- 150 ft high embankment
- CMP culvert
  - Deterioration
  - Separation
  - Saturation
  - Weakening
  - Failure





# Recent U.S. examples

- **Rockslide on I-40 in NC**

- October 2009
- 6 month closure
- 25,000 ADT
- \$10 m repair\*
- \$ 65 m travel time costs\*
- \$57 m operating costs\*
- \$44 m congestion costs\*
- \$10 m other costs\*

\*HDR, 2010



US-64 in TN, November 2009, \$22 m



# Recent U.S. examples

- **Rockfall on I-70 in CO**

- March 2010
- Repeat from Nov. 2004
- 4 days full closure
- 200 mile detour
- 2 months partial closure
- \$1.6 m repair



## Culvert failure on same corridor

- June 2003
- Similar closures
- \$4.2 m repair



# Final Thoughts

- Focus on features can lead to stovepipes
- Focus on corridors requires integration
- Geotechnical features are not 'solid as rock' – there are ownership responsibilities
- System performance is limited by the weakest link, which may be geotechnical

