

# Quantifying the Effects of Preservation Treatments on Pavement Performance

AASHTO SCOM Meeting – Providence, RI  
August 1, 2017

James M. Bryce, Ph.D.





# Agenda

---

## 1. Project background

- ▶ Objective and scope

## 2. Project Findings

- ▶ Effects of preservation
- ▶ Analysis of performance measures
- ▶ Analysis of State & LTPP data
  - ▶ Effect of thin overlay on performance

## 3. Summary

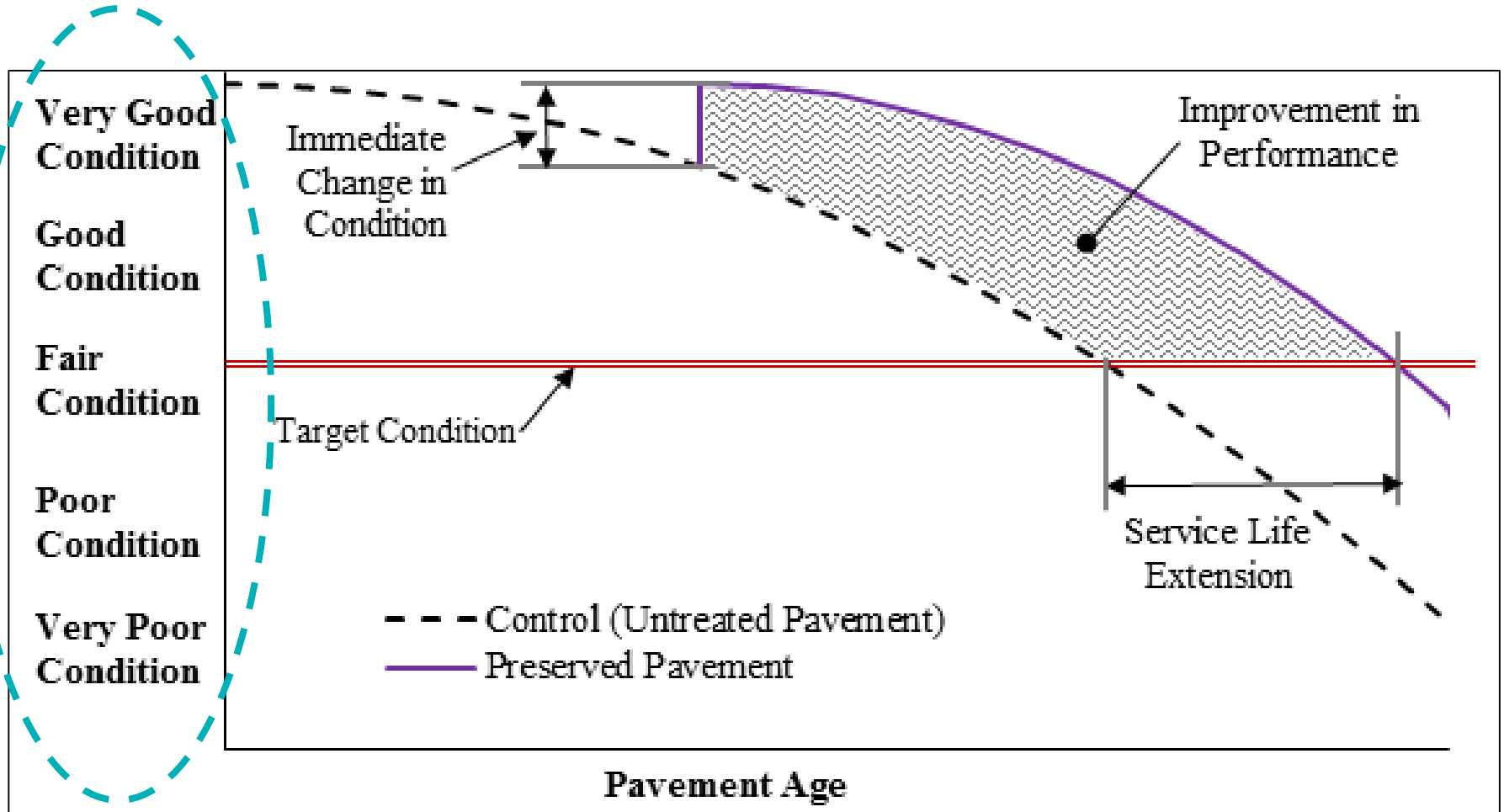


# Project Background





# Pavement Preservation & Performance



# Background

---

- **Research conducted under NCHRP Project 14-33 to:**
    - ▶ Identify and/or develop pavement performance measures that consider contributions of preservation to performance, service life, and life-cycle costs
    - ▶ Prepare guide document to facilitate implementation of measures by highway agencies
  - **Many performance measures evaluated**
  - **Recommended measures and approach to evaluate effect of preservation**
-

# Phase I Outcomes

---

## Identify information on performance measures and preservation treatment use

- **Literature review identified numerous potential performance measures:**
    - ▶ Individual distress/condition
    - ▶ Composite pavement measures
    - ▶ Cost-based measures
    - ▶ Other measures (e.g., noise, RSI, VOC, etc.)
  - **Performance measures reflect strategic objectives of agency**
-

# Phase I Outcomes

---

- **Defining performance measures**
    - ▶ Metrics that quantify degree of achieving specific goals pertaining to performance.
      - ▶ Evaluate current condition
      - ▶ Forecast effect of certain actions
  - **Selected performance measures**
    - ▶ Many candidate measures evaluated
    - ▶ Recommended individual distress measurements
      - ▶ Drive maintenance decisions and collected by ~every agency
-

# Modelling the Effect of Preservation

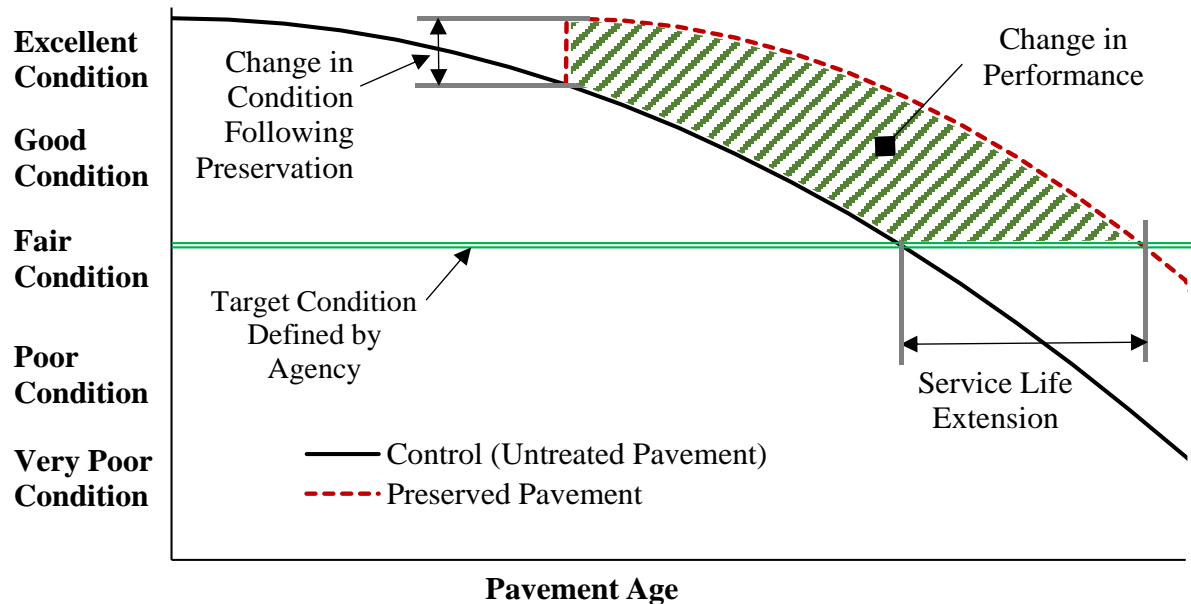






# Data Gathering

- **Data gathered from 8 agencies + LTPP**
  - ▶ 6 AC preservation treatments
  - ▶ 2 PCC preservation treatments

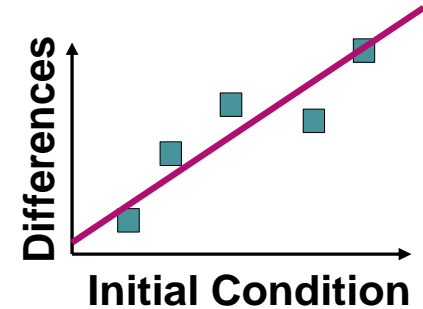
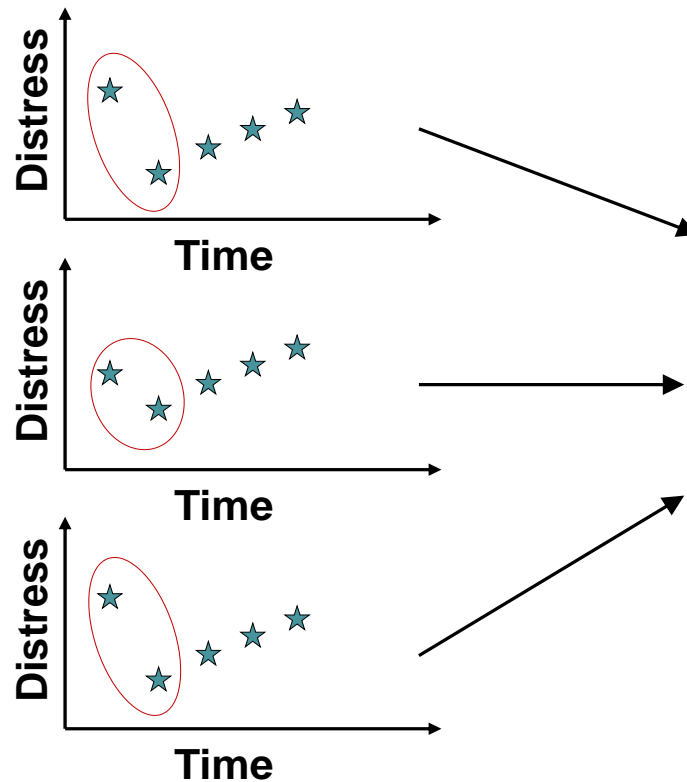


- **Examples: effects of thin overlay on IRI & Rutting**



# Calculating initial change in condition

- **Difference in two measurements**
- **Errors in initial condition and change in condition**



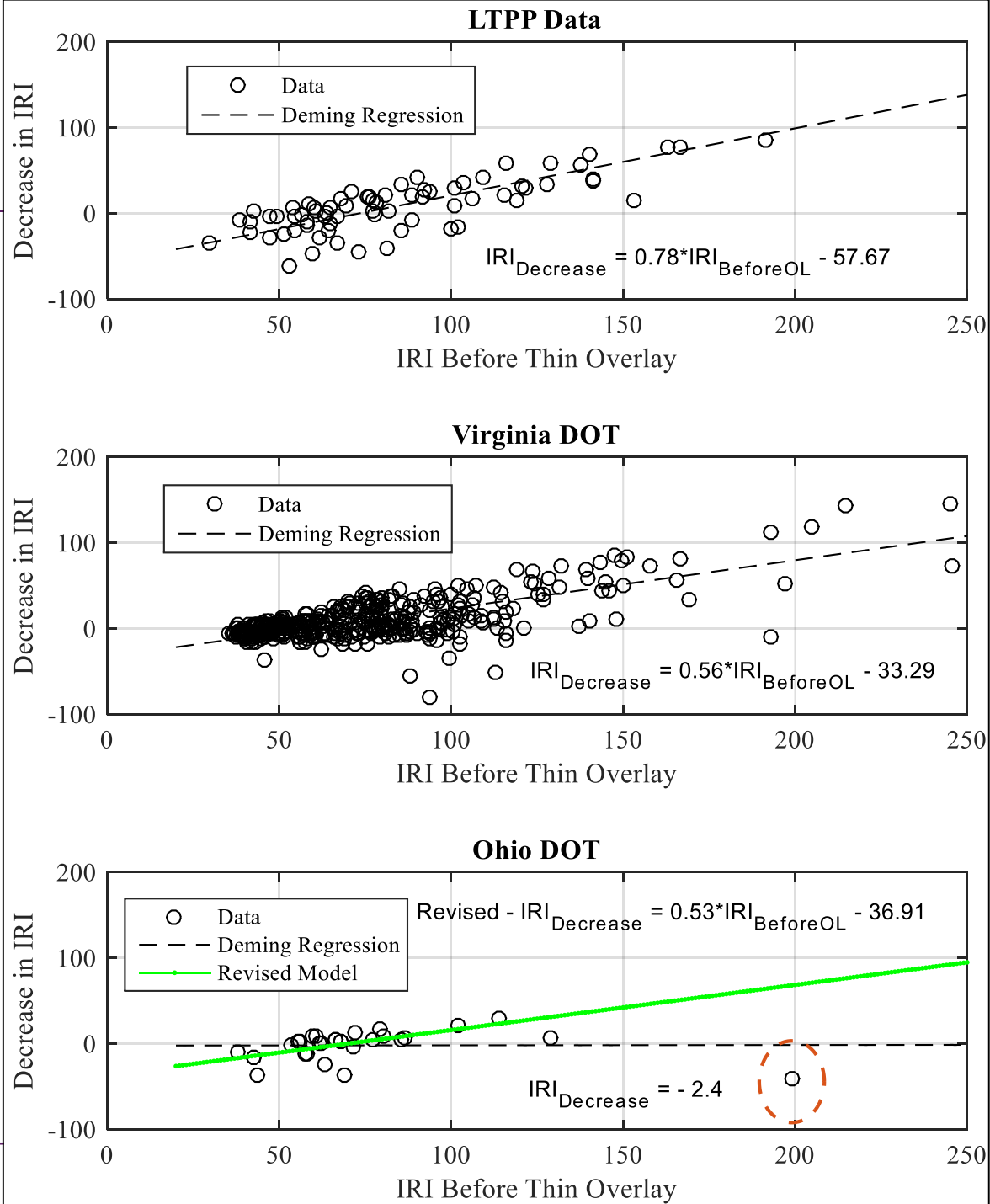
# Initial Change

- **Data from**

- ▶ LTPP SPS-3
- ▶ Virginia DOT (2007-2014)
- ▶ Ohio DOT (2011-2014)

- **Significant variables**

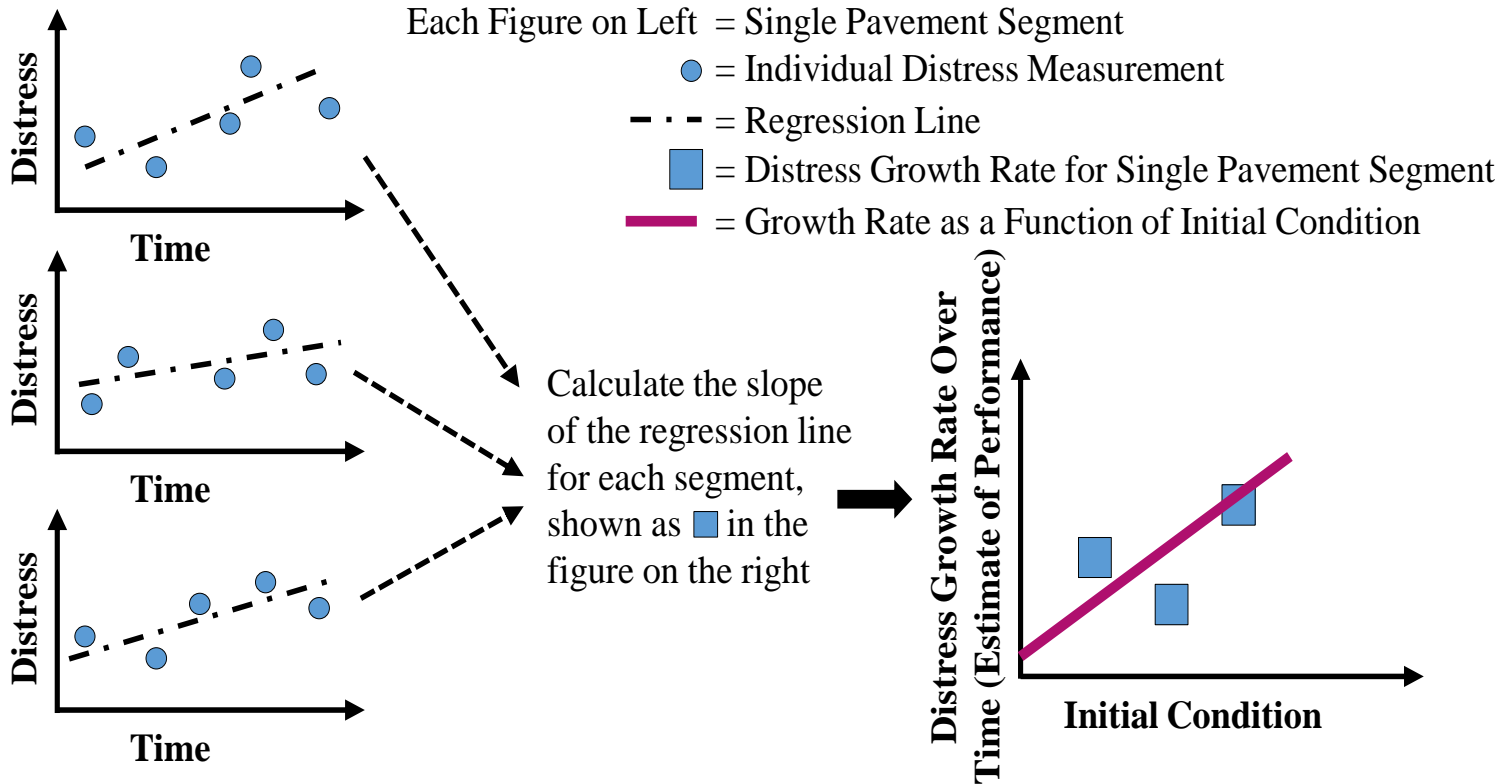
- ▶ Initial condition
- ▶ Pavement type
- ▶ Treatment type





# Calculating change in performance

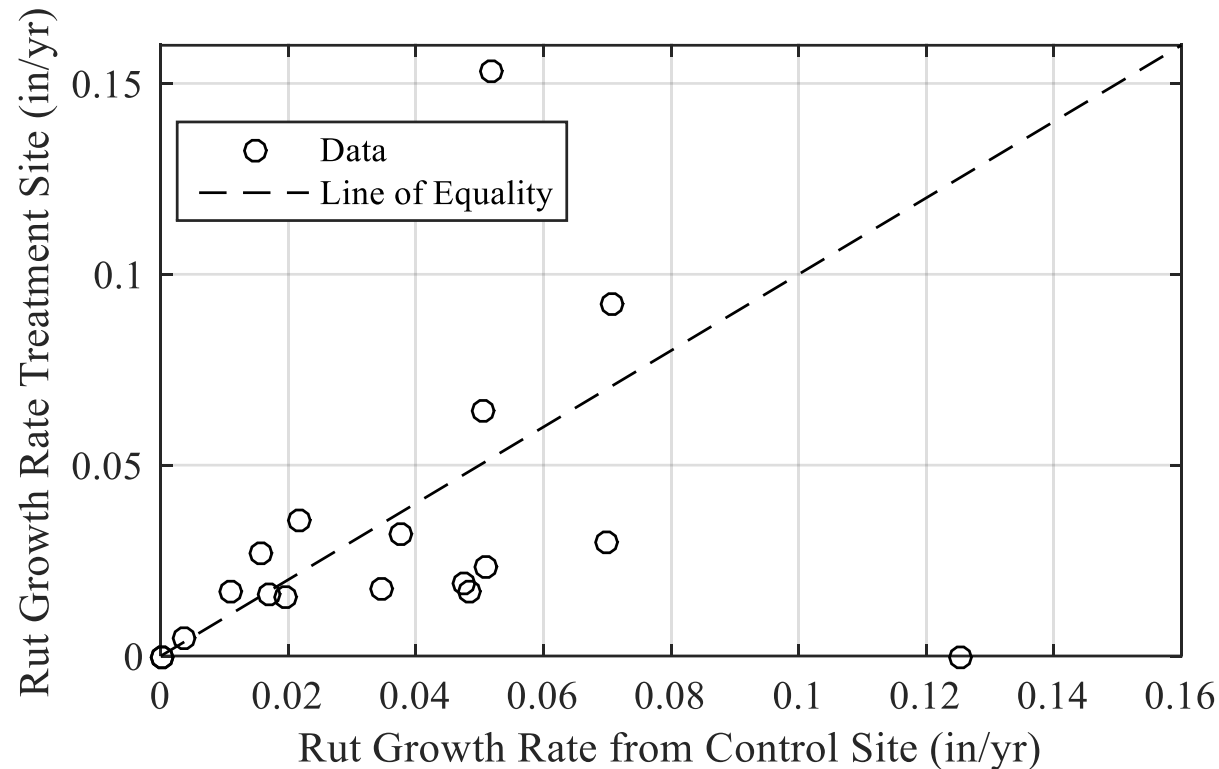
- **Growth rates modeled using robust linear regression**





# Change in performance

- **Relative Rutting comparison using LTPP data**
  - ▶ Relative comparison – does control section grow more rapidly than overlay section?
  - ▶ Overlay rutting growth  $\sim 0.031$  in./mile/year
  - ▶ Control rutting growth  $\sim 0.038$  in./mile/year

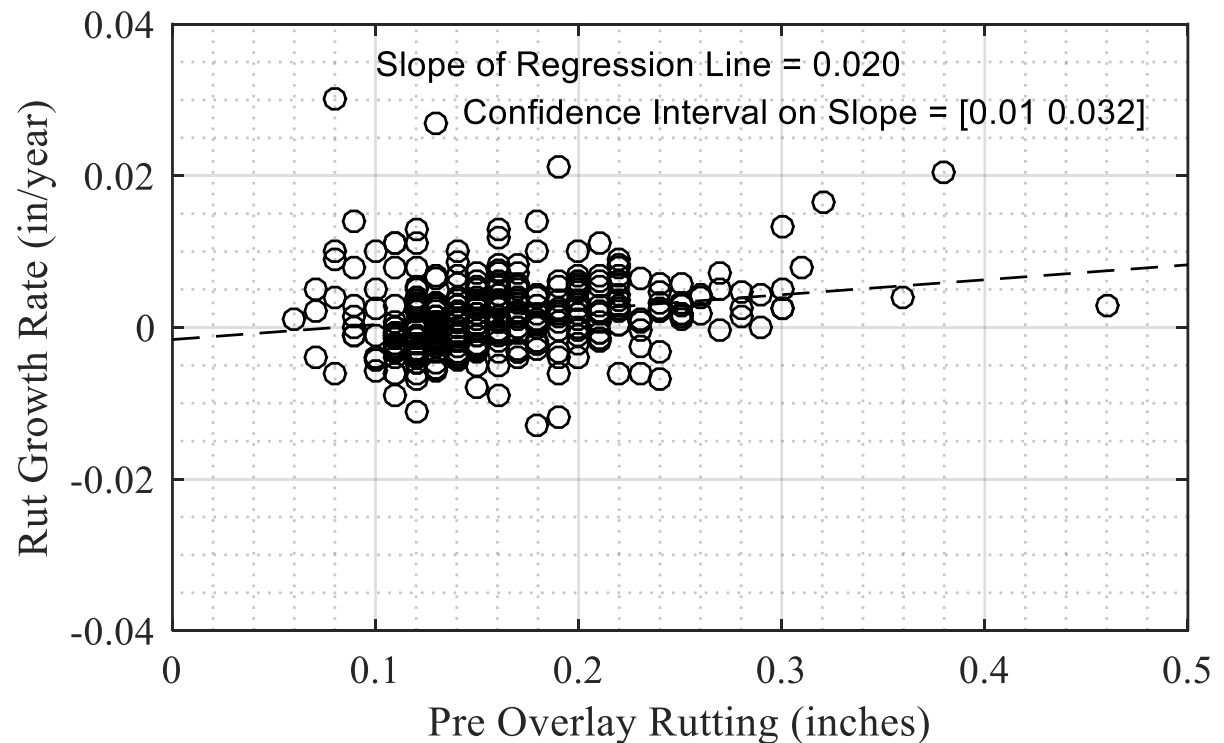




# Change in performance

- **Relative Rutting comparison using VA data**

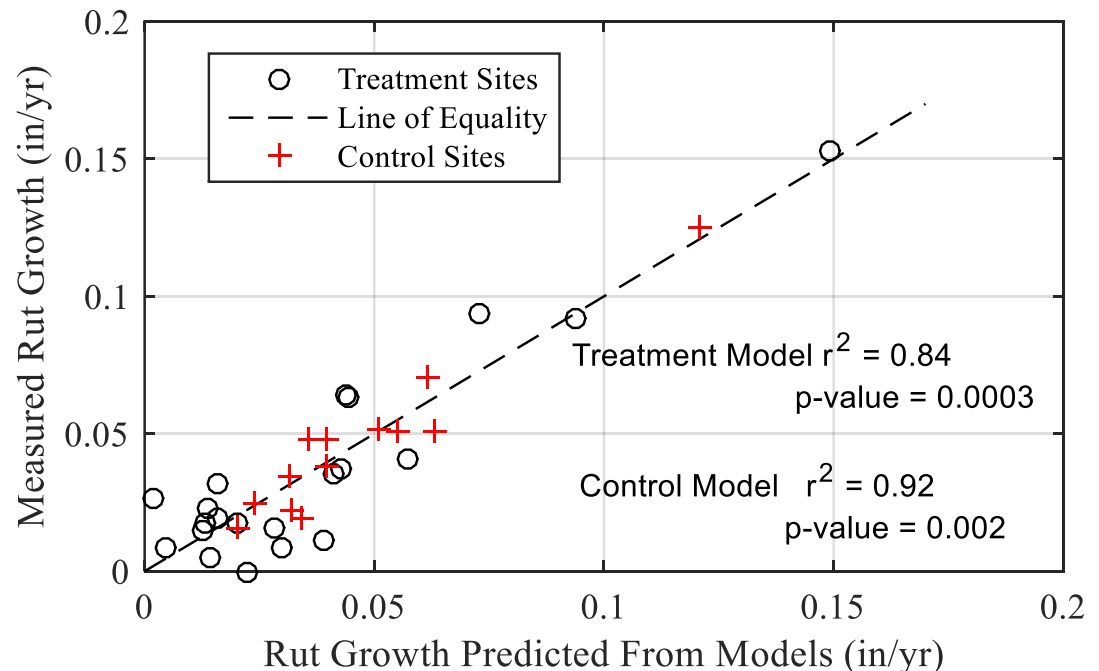
- ▶ Relative comparison – does rut growth rate following overlay relate to initial rutting?
- ▶ Simulation performed to identify ratio of variances



# Change in performance

## • Modelling rutting performance

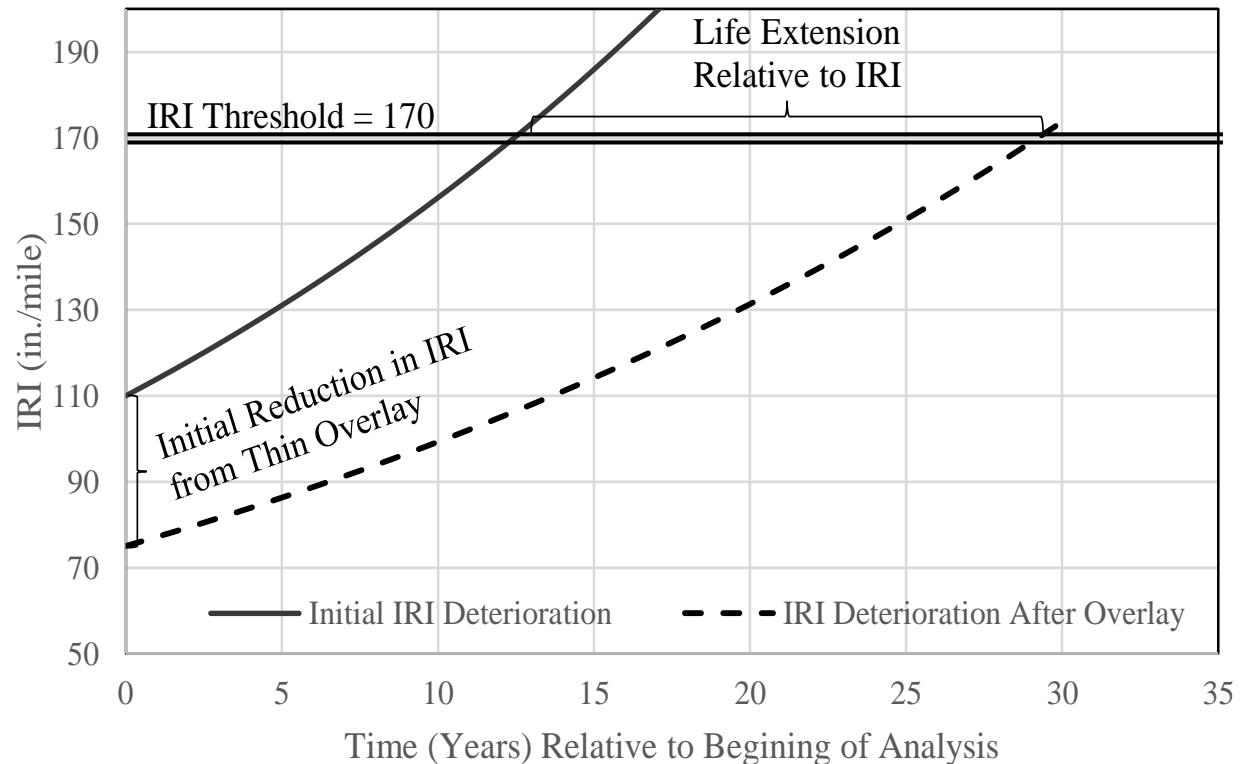
- ▶ Many control sites had better rutting performance
  - ▶ Can independent variables be used to predict rut growth?
  - ▶ Do the same variables show similar significance to the model?
- ▶ Following variable showed as significant
  - ▶ Rainfall
  - ▶ Freeze-thaw cycles
  - ▶ Temperature
  - ▶ Structural number
  - ▶ Traffic (AADT)



# Implementation

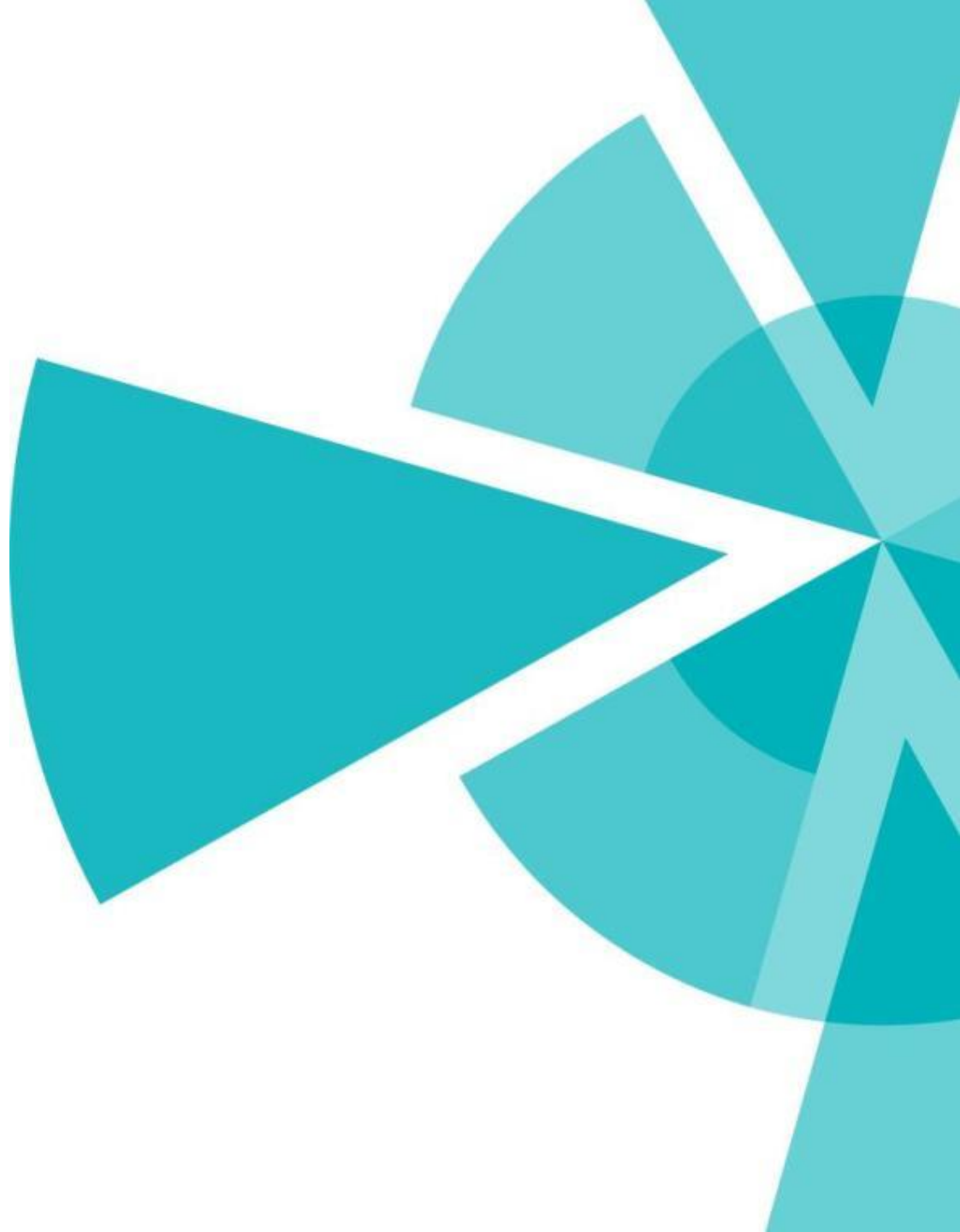
- **Change in condition and performance input into effectiveness evaluation**

- ▶ Life extension and changes in performance can be estimated
- ▶ Effect on LCC can be calculated
- ▶ Can be implemented in project selection or optimization





# Summary



# Project Report and Guide

---

- **NCHRP Report 858 currently in publication**
  - ▶ Report documents work performed on project
  
- **Includes guide as attachment**
  - ▶ Selecting performance measures
  - ▶ Evaluating effect of preservation using measures
    - ▶ Gathering and assessing required data
    - ▶ Developing models supporting performance measures
    - ▶ Implementing measures in PMS

## Select Project Conclusions

---

- **Data do exist for moving away from anecdotal evidence for demonstrating preservation effects**
  - ▶ Many agencies collect and store data required to assess effectiveness of preservation
  - ▶ Other sources of data (e.g., LTPP) can be used to supplement agency data
- **Analysis of condition data requires techniques not traditionally found in pavement literature**
  - ▶ e.g., robust or censored regression techniques, econometric techniques, etc.

# Questions and Discussion

---

# Thank You!

