# Minnesota's Preventive Maintenance Study


National Pavement Management Conference
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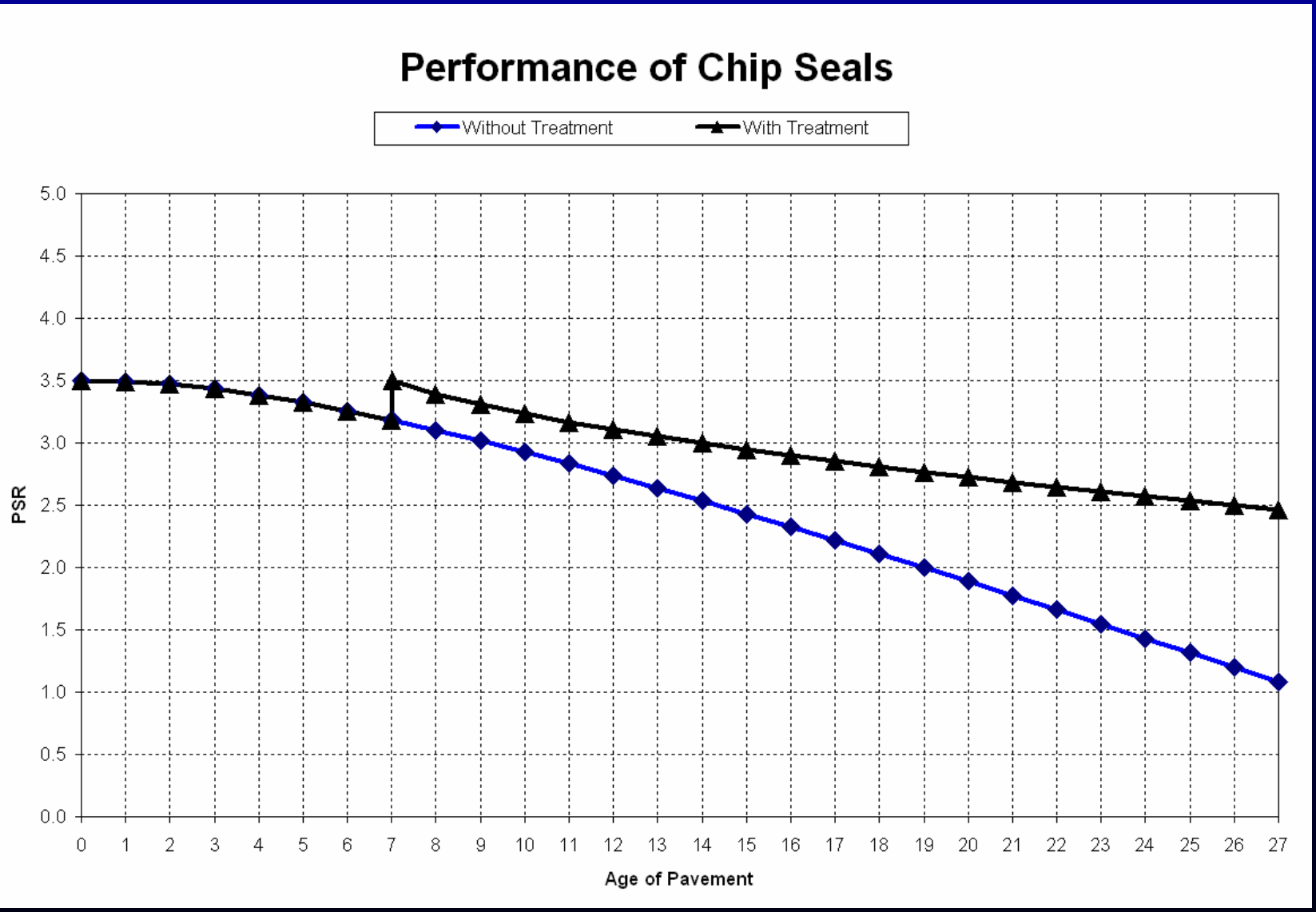
# The BIG Question…

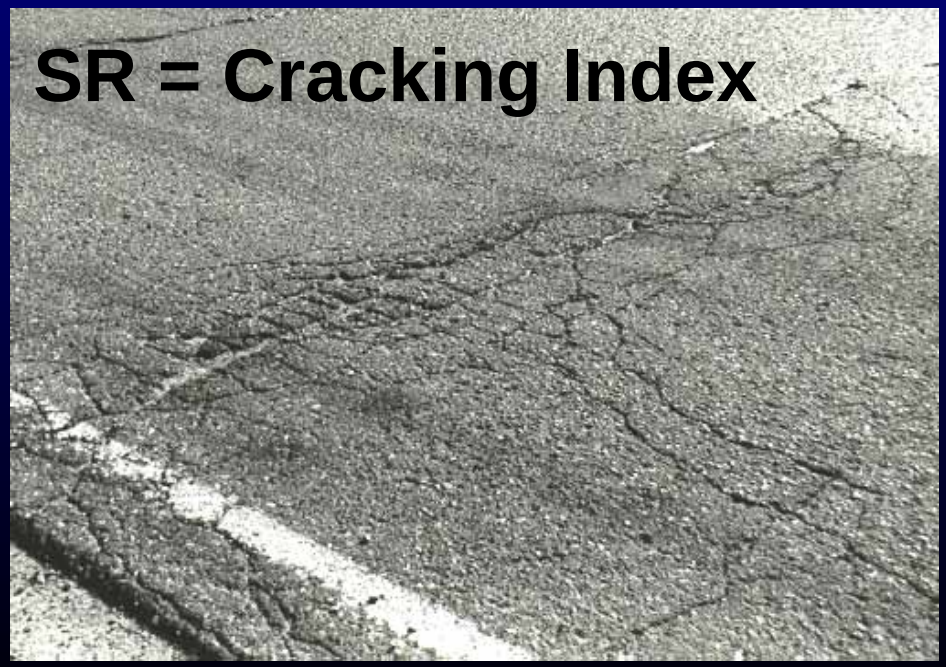
How effective are preventive maintenance treatments at extending pavement life ?

# Simple enough…



…Or is it ?

# Pathway Services© Digital Inspection Vehicle


# Mn/DOT Pavement Indices

- RQI
- SR
- PQI

## Overall Index

$$PQI = \sqrt{(RQI)(SR)}$$

# Pavement Defects

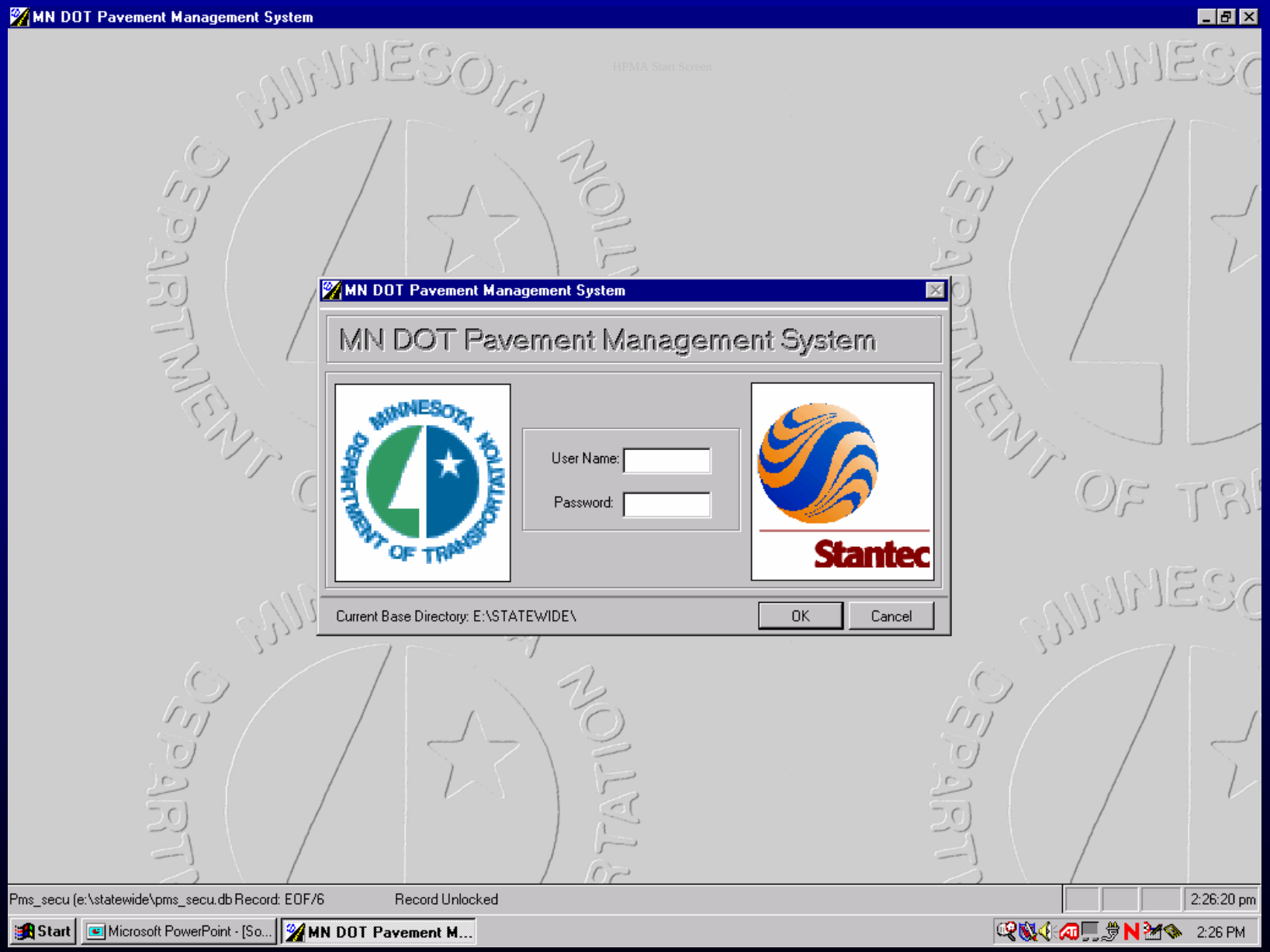
## Bituminous Defects

- Transverse Cr. (L,M,H)
- Longitudinal Cr. (L,M,H)
- Longitudinal Joint (L,M,H)
- Multiple Cr.
- Alligator Cr.
- Rutting
- Raveling/Weathering
- Patching

## Concrete Defects

- Spalled Joints (L & H)
- Faulting
- Cracked Panels
- Broken Panels
- 100% Overlaid Panels
- Patches over 5 sq.ft.
- D-Cracked Panels

# Highway Pavement Management Application (HPMA)

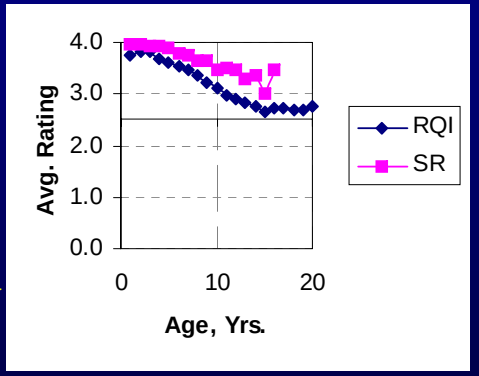


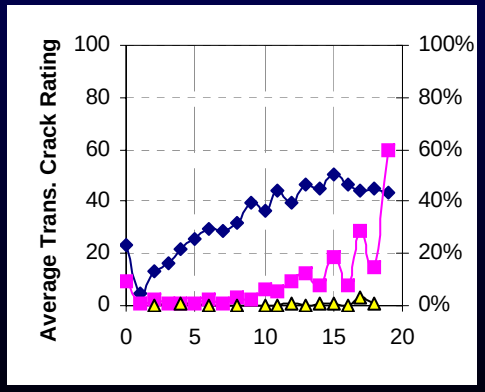
# Performance Analysis Topics

- Forecasting Future Performance
- Performance Comparisons
  - By Rehabilitation
  - Preventive Maintenance Strategies
- Modes of Deterioration
  - Ride
  - Dominate Distresses

# Forecasting: Analysis Steps Used

- Query Data to Sub-categories by:
  - Pavement Type
  - Last Rehab Type
  - Preventive maintenance received
- Fit Trends
  - Index Trends
  - Distress Growth Trends
- Compare Trends



# Does Maintenance Extend Life?

- Dataset: All Bituminous over Aggregate Base in the Minnesota Trunk Highway System

- Sub-Categories
  - Sections without any maintenance
  - Sections with maintenance

# Ride Trends

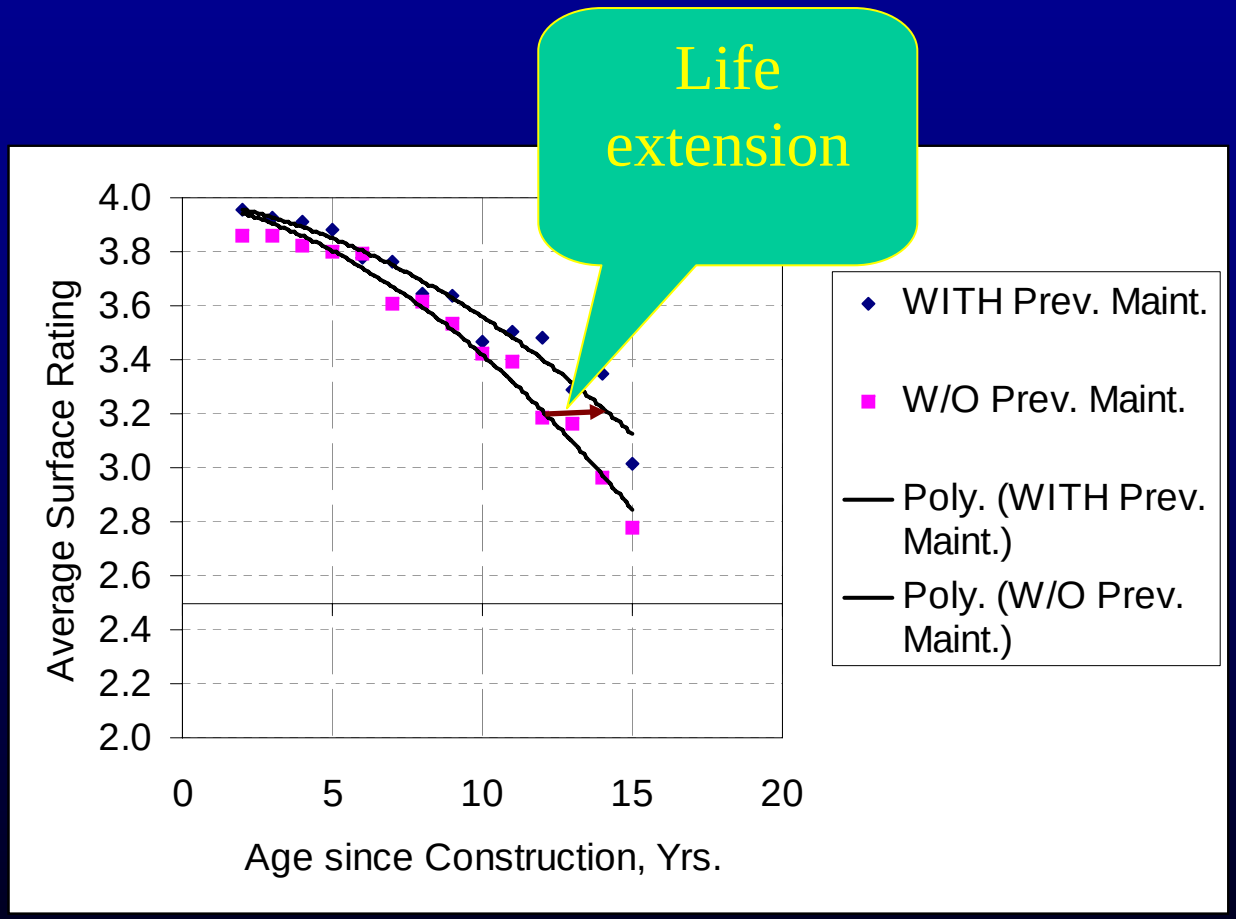
Initial Conclusion:

Sections with preventive maintenance have higher RQI and last longer.

# Surface Rating Trends

Initial Conclusion:

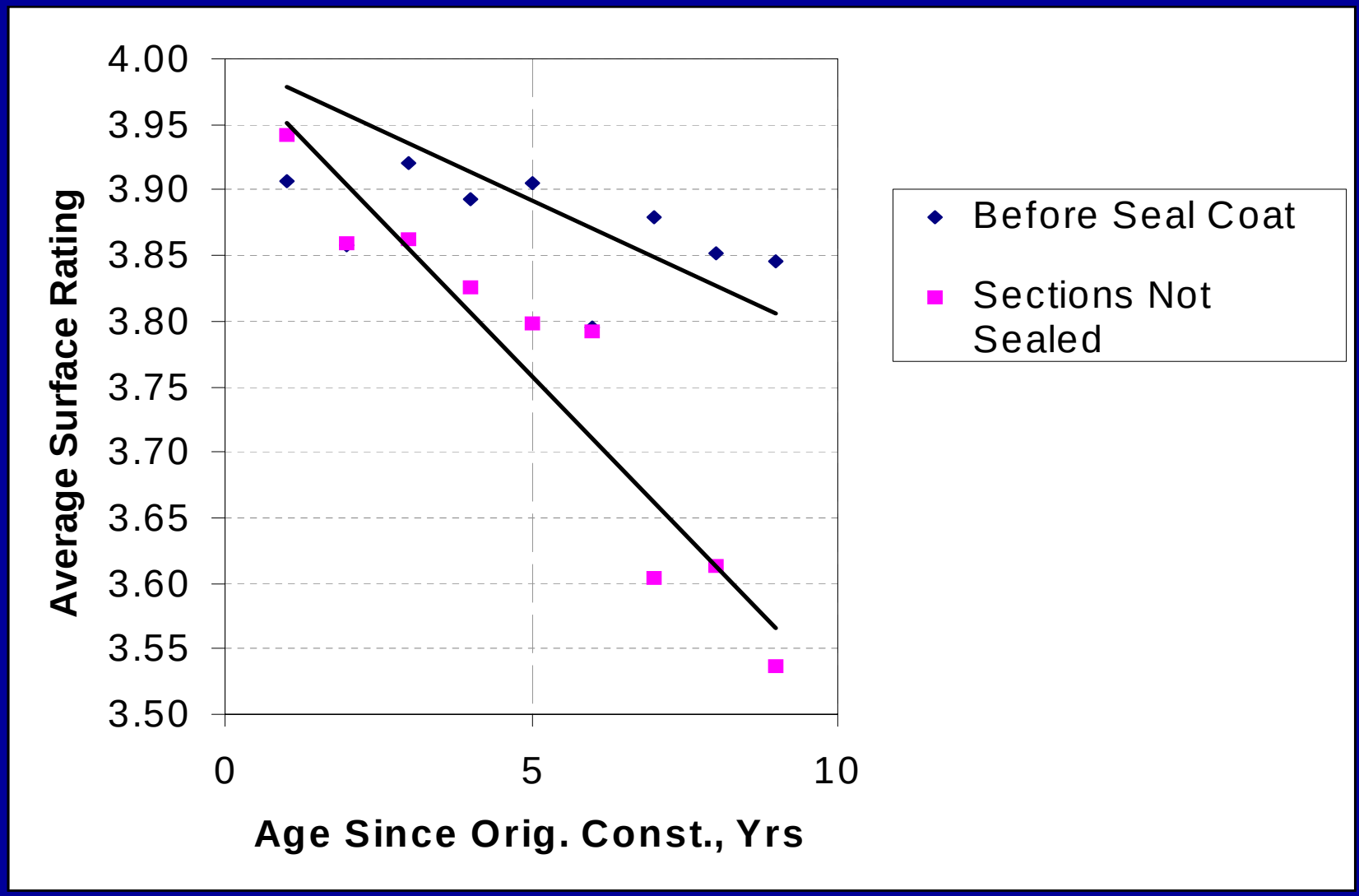
Sections with preventive maintenance have higher SR and take a couple years longer to deteriorate.



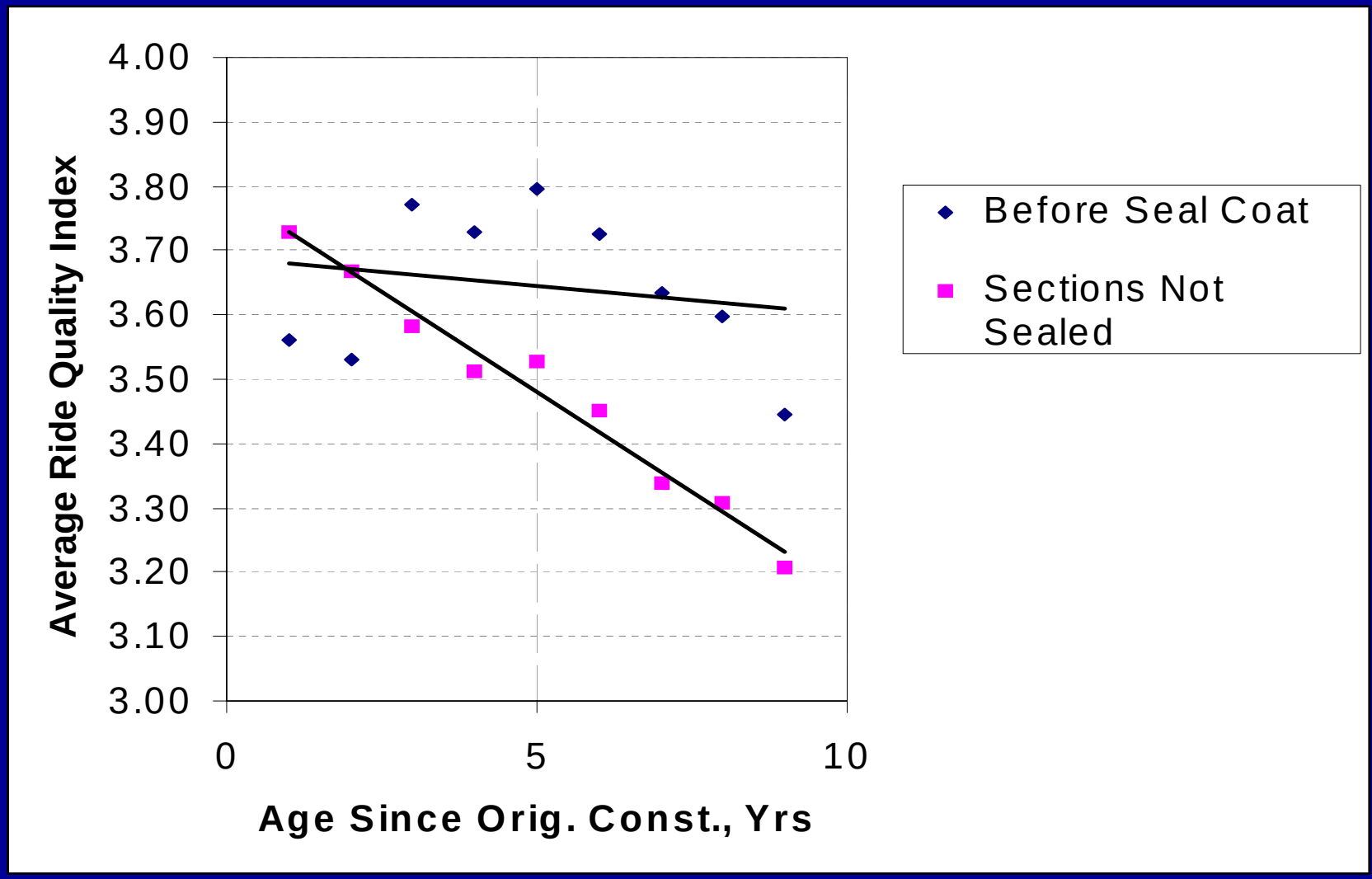
# Pre-Existing Conditions

- Are sections selected for preventive maintenance typical of all sections?
- Do pre-existing conditions, if different, effect future performance?
- Is Pavement Performance influenced by Agency Practice?

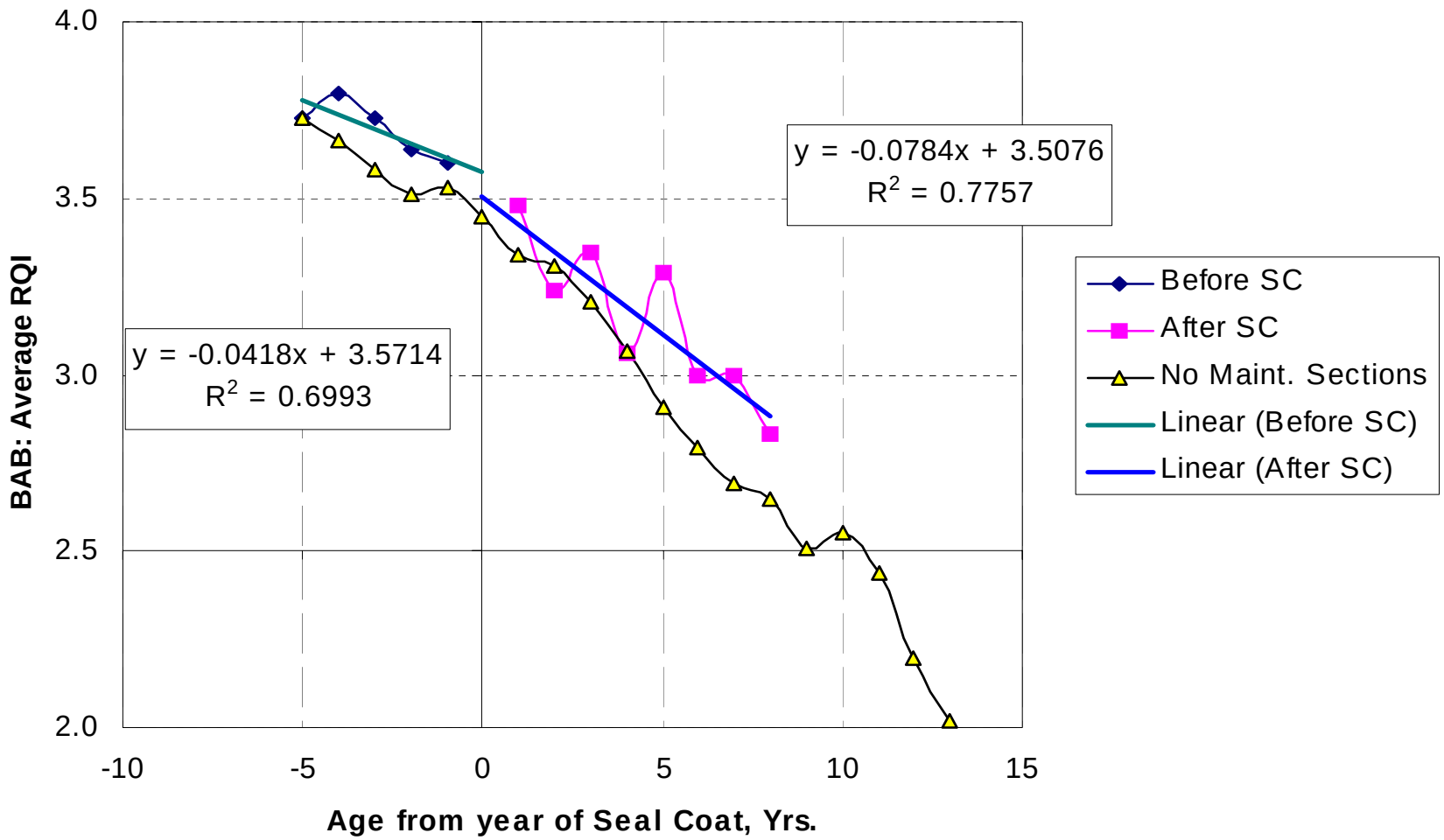
# Selection Bias for Seal Coats: SR



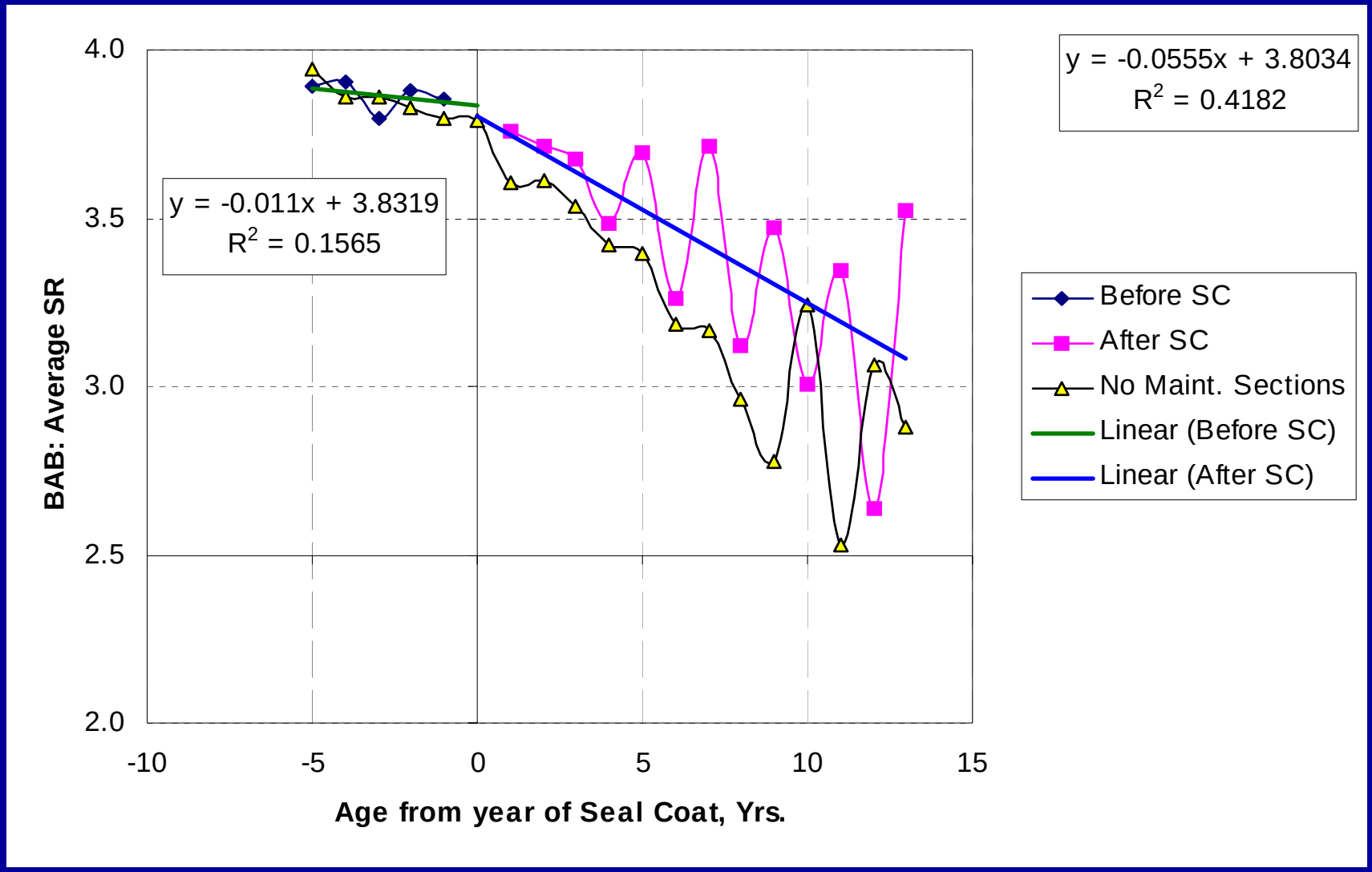
# Selection Bias for Seal Coats: RQI



# RQI Carryover Effect?



# SR Carryover Effect?



# Seal Coat: Selection Effect

- Conclude:
  - Pavements that are selected for seal coating are in slightly better condition
  - Pre-existing condition might serve to make seal coated sections appear to last longer
    - How can we find out?
      - Control Sections

# Control (“Do Nothing”) Section

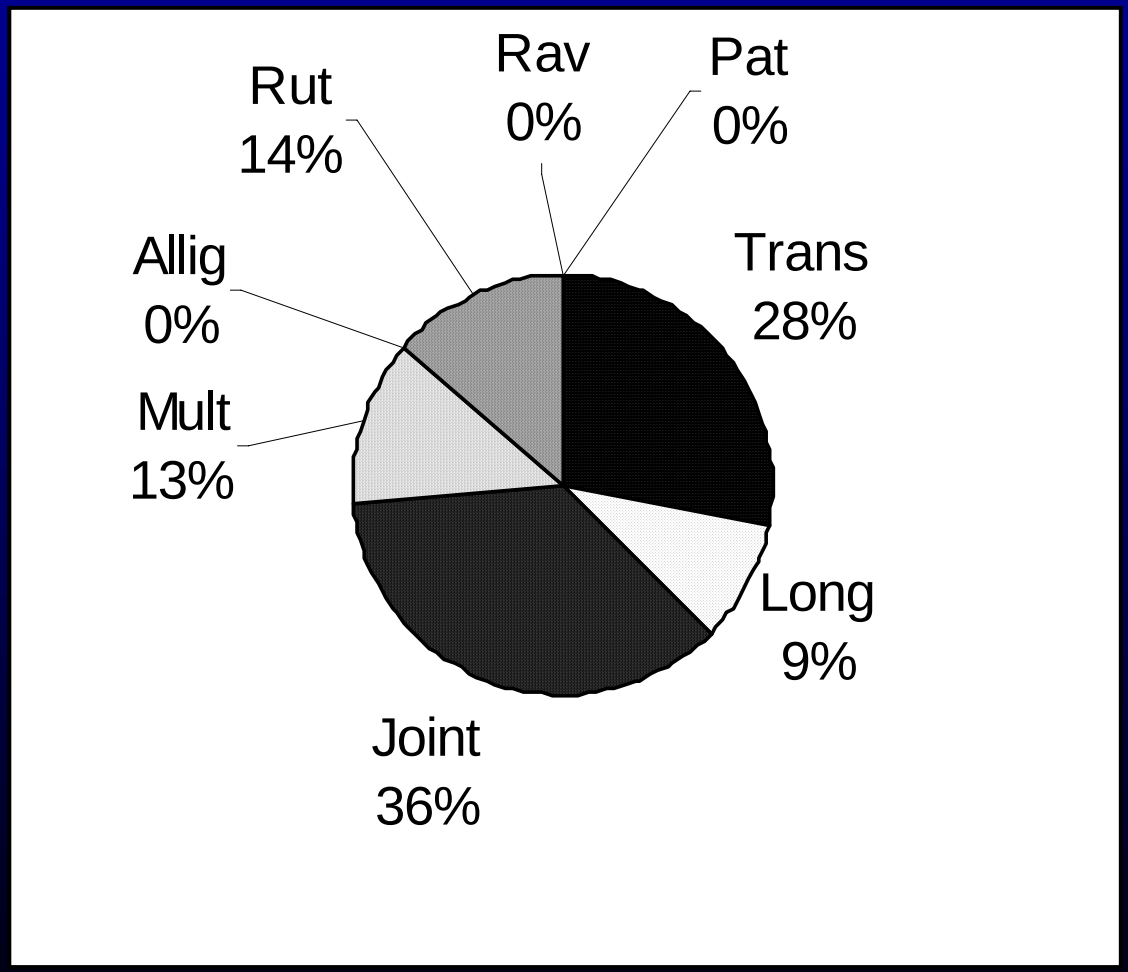
- Incorporate into PM Rating Process
- Pair with similar Treated Section
- Monitor Annually
- Need more than Several per Treatment

# Mode of Deterioration

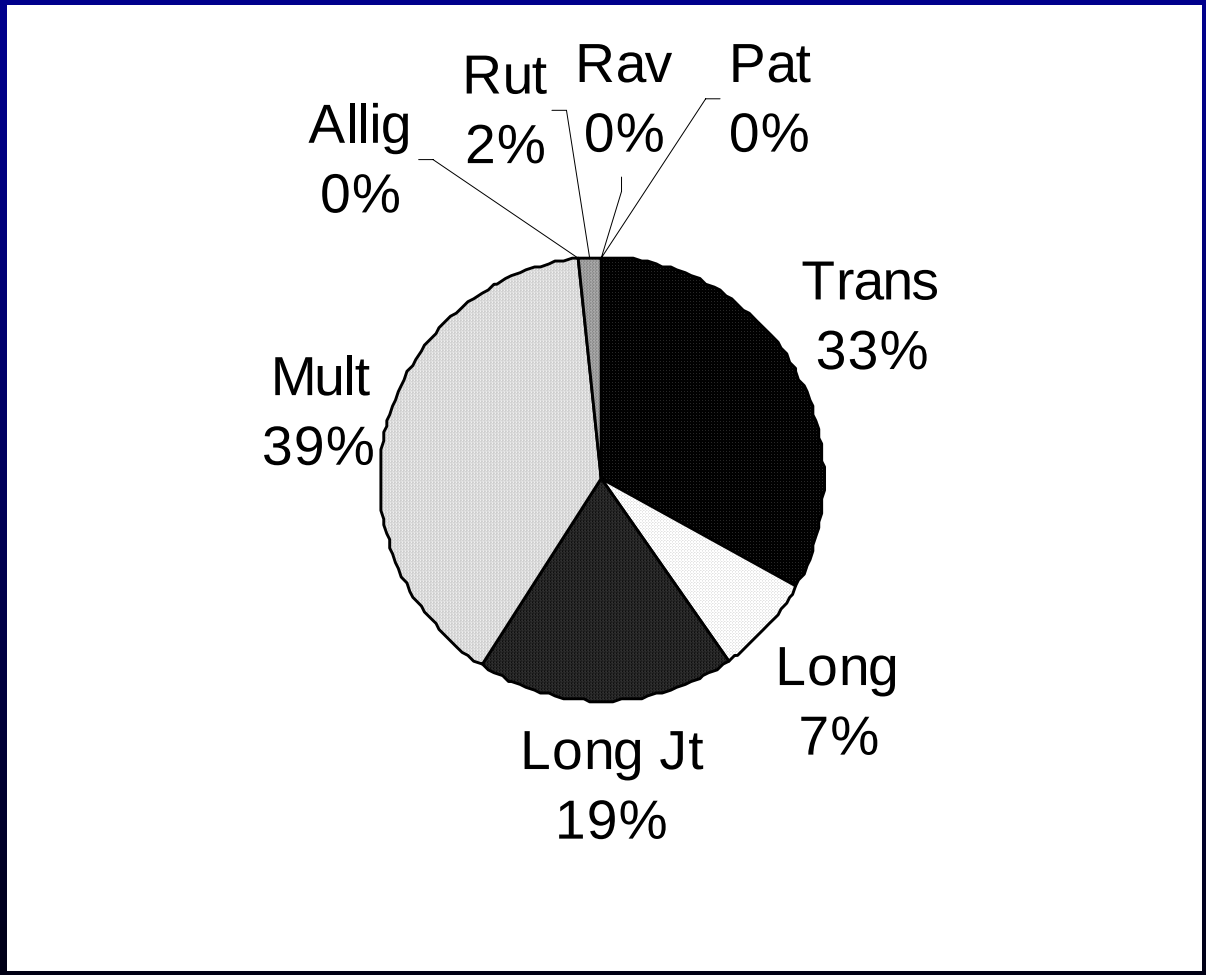
## Which Distresses Rule?

- Transverse Cr. (L,M,H)
- Longitudinal Cr (L,M,H)
- Longitudinal Joint Deterioration (L,M,H)
- Multiple Cr.
- Alligator Cr.
- Rutting
- Raveling/Weathering
- Patching

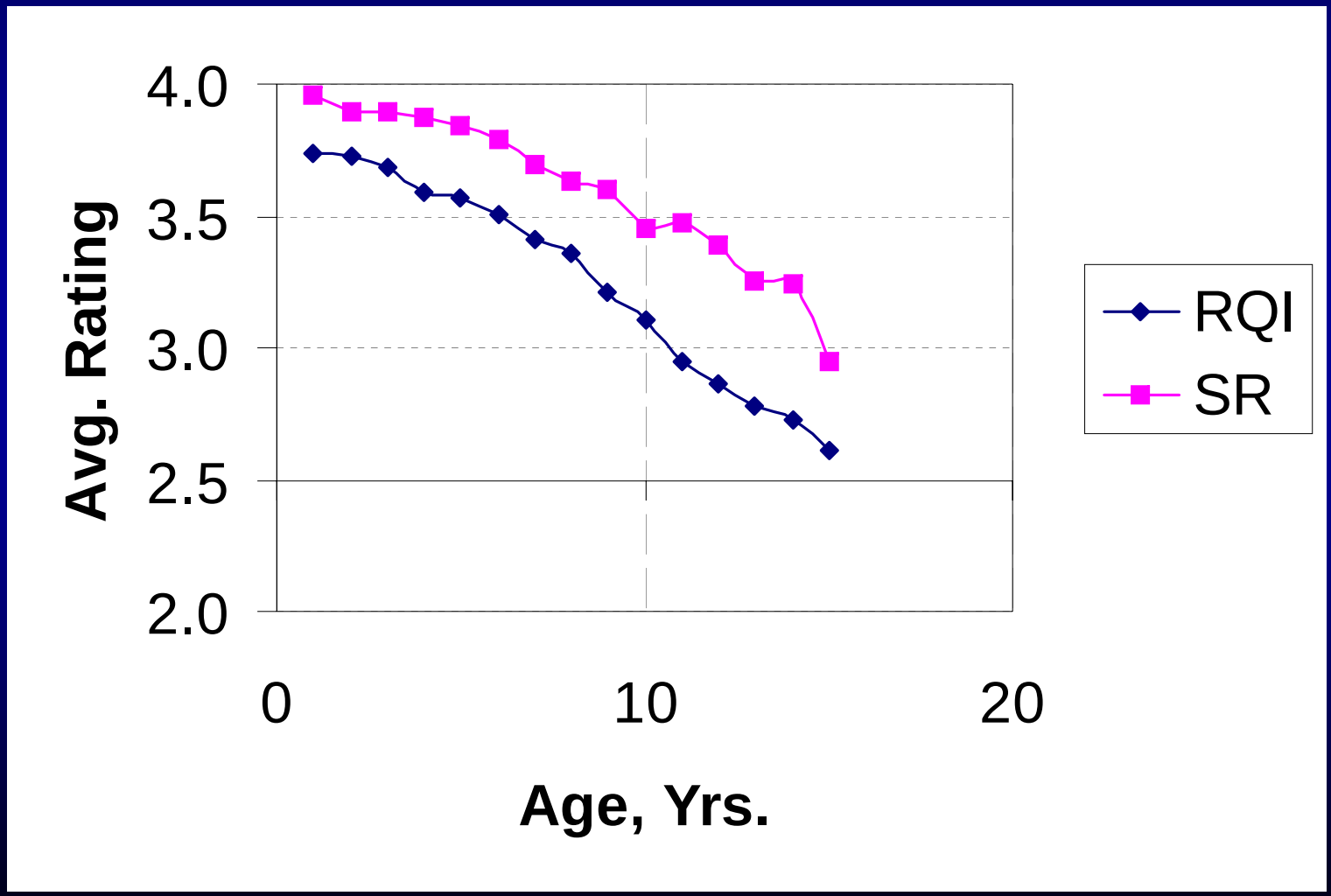
# Mode of Deterioration
## 1st Generation Flexible Pavements



# Mode of Deterioration
## (BOB Sections – Thin Overlay)



# Ride:
## Our Most Critical Distress on Bituminous



# Summary

- Bias Topics
- Situations that can Bias Trends
  - Performance reflects practice
  - Influence of previous condition history
  - Critical Modes of Deterioration
- Deterioration Modes
  - Deterioration of pavement along linear distresses
  - Ride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