

# Joint Design Optimization

## IRISE ANNUAL MEETING

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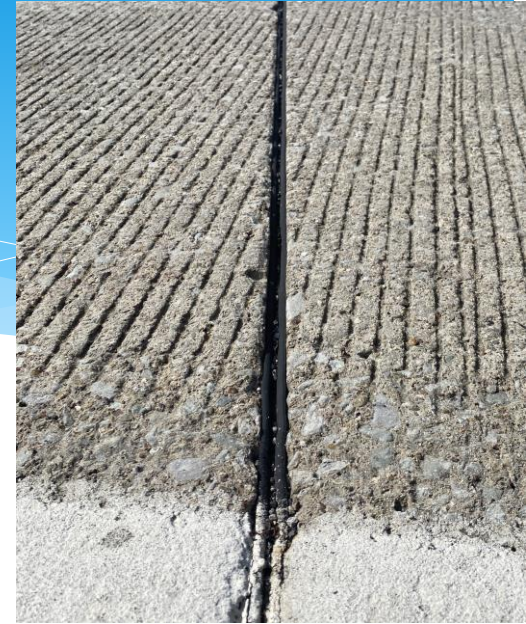
Charles Donnelly



# The Problem

## Premature joint sealant failure

- ❑ Incompressibles:
  - ❑ Spalling
  - ❑ Blow-ups
- ❑ Moisture:
  - ❑ Accelerated dowel corrosion
  - ❑ Faulting



# Project Objectives

## ❑ Evaluate current

1. sealant types,
2. reservoir designs, and
3. construction practices

.... to identify opportunities for improvement

## ❑ Develop guidelines to optimize joint reservoir design

accounting for key design and material parameters

# Schedule/Status

- Task A: Literature review on joint sealants
- Task B: Performance data review
- Task C: Joint reservoir design – to be submitted soon
- Task E: Development of joint design strategies
- Task F: Draft final report
- Task G: Final report

# Task B: Performance in the field

## Data

- PennDOT database size: **28,582 datapoints**
- Turnpike database size: **1,638 datapoints**

## Distresses evaluated

- Spalling
- Faulting
- Blow-ups not considered*

## Factors considered

- Construction year
- Number of years in service (age)
- Sealant type (Type II, Type IV)
- Location
- Joint spacing

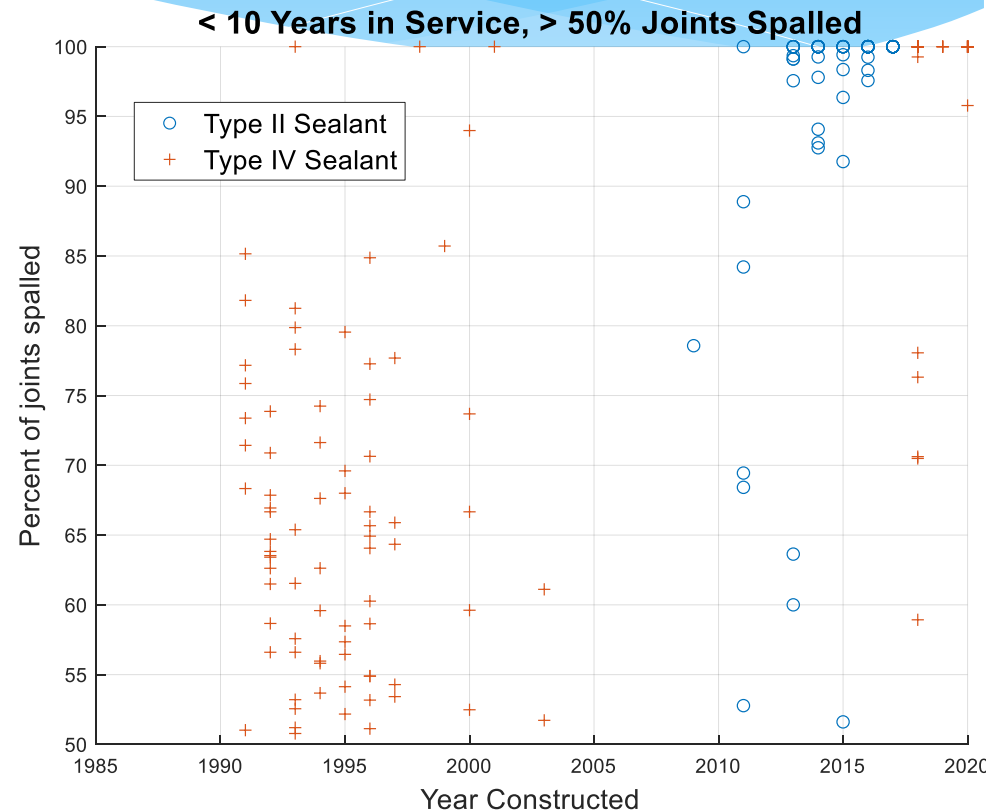
# Task B: Performance in the field

## ❑ Spalling

- ❑ 94% of sections had less than 10% joints spalled (< 10 yrs old)
- ❑ Type II sealants (2008 – 2018) were prone to spalling
- ❑ Spalling occurred as a result of Installation of reflective taping on Turnpike

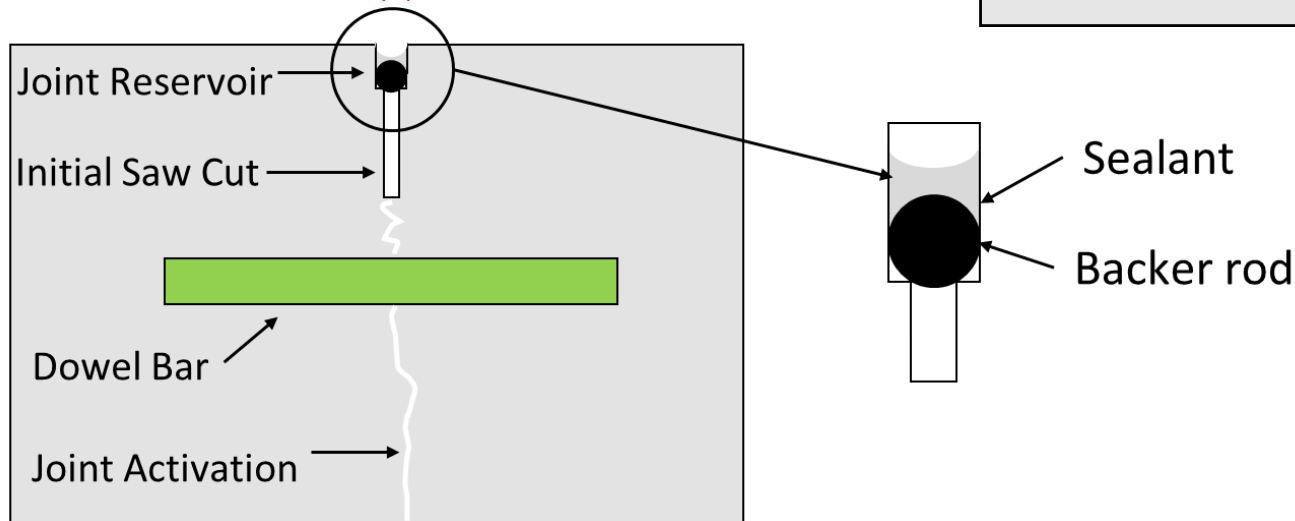
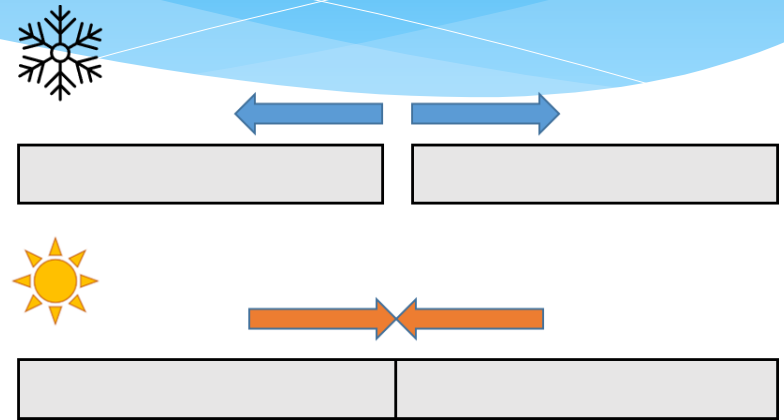
## ❑ Faulting

- ❑ Does not have precision needed



# Task C: Joint reservoir design

- ❑ Evaluate reservoir design method
- ❑ Jt. open/closing
  - ❑ Ambient temp & RH
  - ❑ Concrete material prop. =  $F(\text{RH} \ \& \ \text{restraint})$
  - ❑ Slab length
  - ❑ Friction factor (?)



# SR-22 in Murrysville, PA

## District 12

- ❑ 18-year-old heavily instrumented
- ❑ 4-lane urban major arterial



Static Strain Gages



Static Pressure Cell



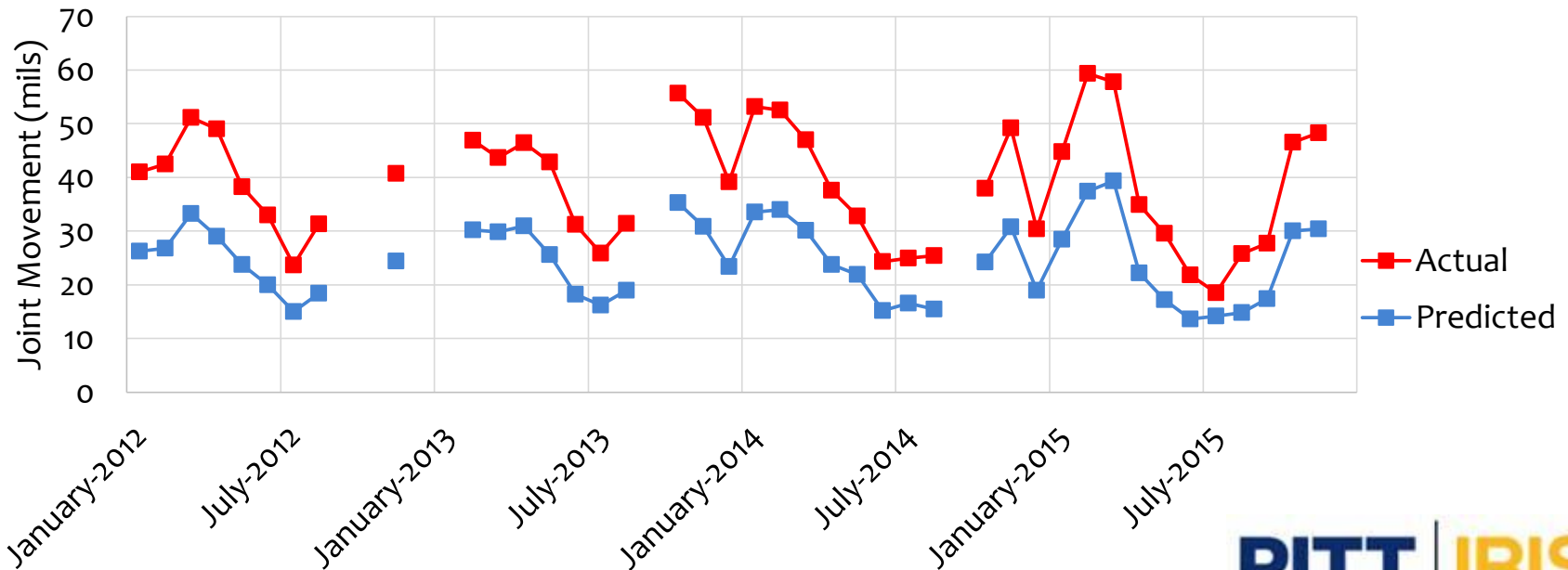
Dowel and tie bars in restrained section



# Jt Opening and Closing

## Findings from Smart Pavement:

- ❑ Not resealed in 20 plus years and still performing well
- ❑ Joint closing restrictions occurred as early at 3 to 5 years
- ❑ CTE in lab similar to CTE in the field
- ❑ Underestimate joint movement with current friction factor by 65%



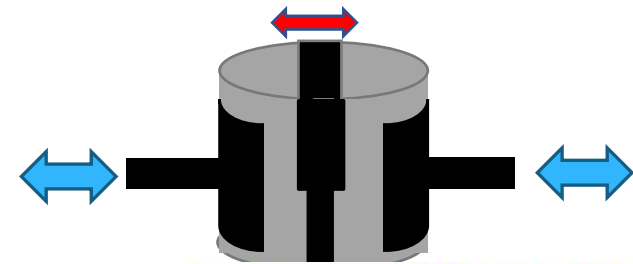
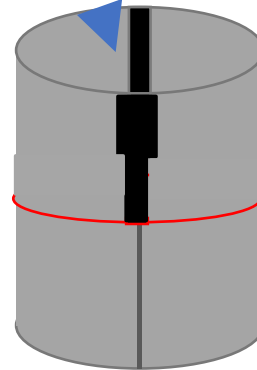
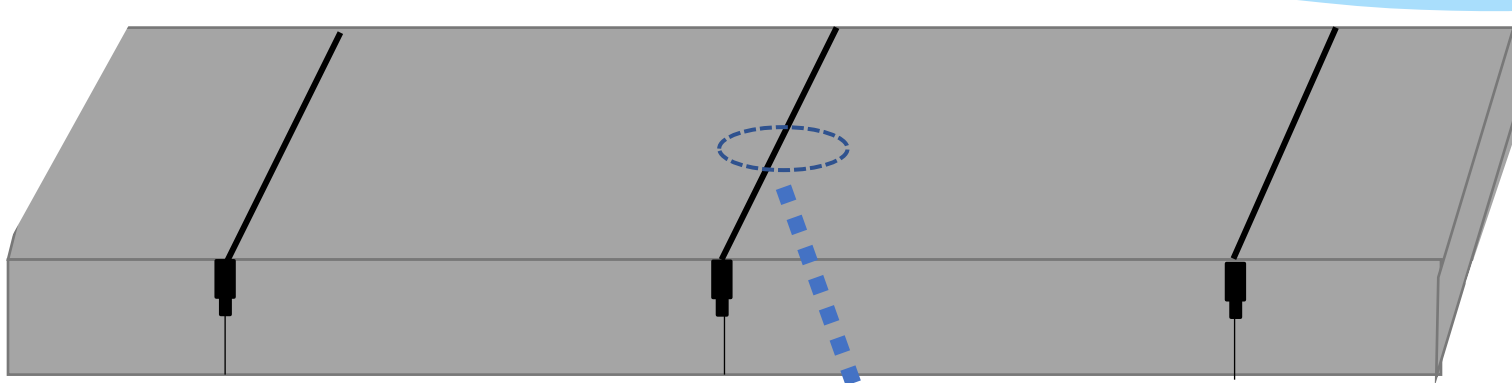
# Laboratory testing

## Factors to be considered:

- Sealant type
- Joint movement
- Reservoir design
- Environmental exposure
- Construction

**Results will be used to inform design guidelines**

# Laboratory testing



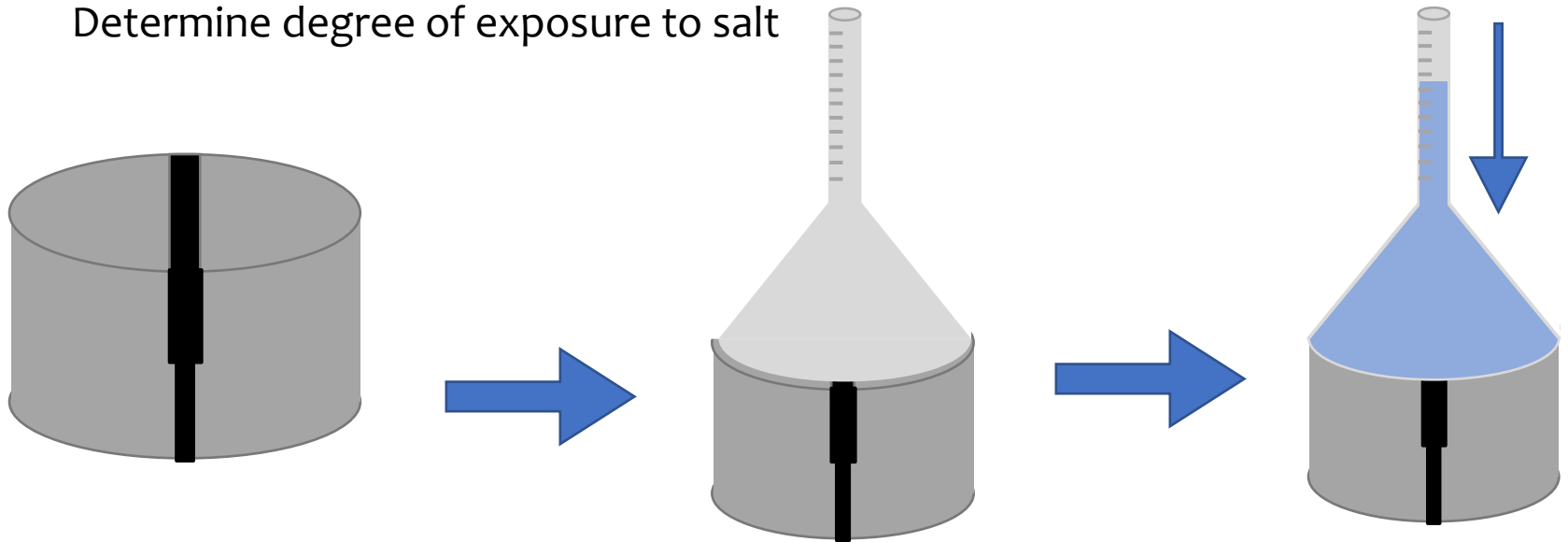
## Key Parameters:

- ❑ Sealant type (II, IV, silicone, neoprene)
- ❑ Reservoir design
- ❑ Joint activation
- ❑ Construction

# Laboratory testing

## Modified permeability test

Quantify rate of water entry  
Determine degree of exposure to salt



# Acknowledgements

## Project Panel

**Chuck Niederriter**, Golden Triangle Construction

**Lydia Peddicord**, PennDOT

**Yathi Yatheepan**, FHWA

**Matthew Blough**, PA Turnpike

**Charles Buchanan**, PA Turnpike

**Jason Molinero**, Allegheny County



## Questions?