Joint Deterioration Findings to Date

National Concrete Pavement Technology Center

Tech Center

Iowa State University

Institute for Transportation

The problem?

- Some joints are deteriorating faster than we would like

What Does it Look Like?

- Mechanical

What Does it Look Like?

- Mechanical

What Does it Look Like?

- Shadowing

What Does it Look Like?

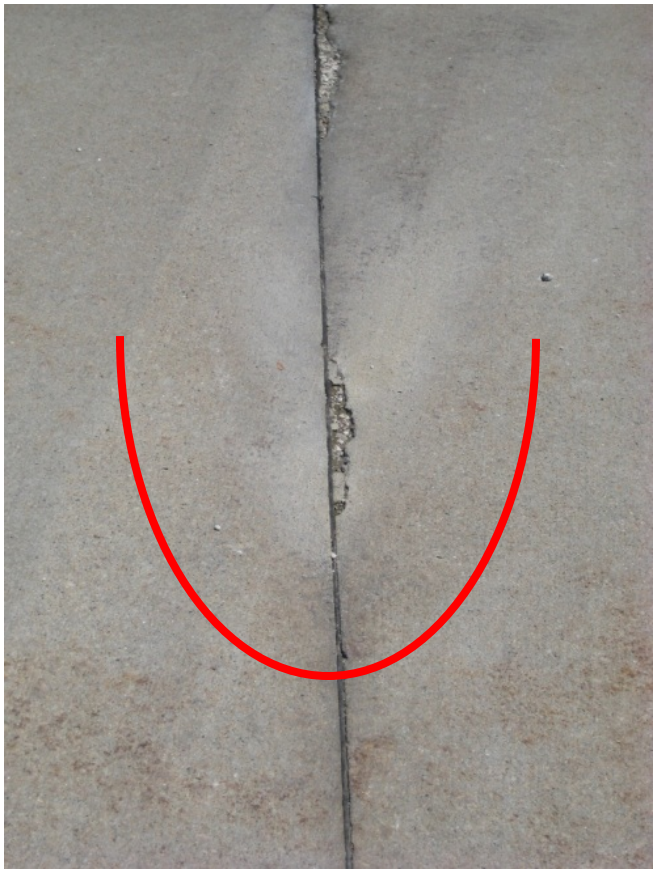
- Incremental Cracking

What Does it Look Like?

- Incremental Cracking

What Does it Look Like?

- Bottom Up Moisture



What Does it Look Like?

- Bottom Up Moisture

What Does it Look Like?

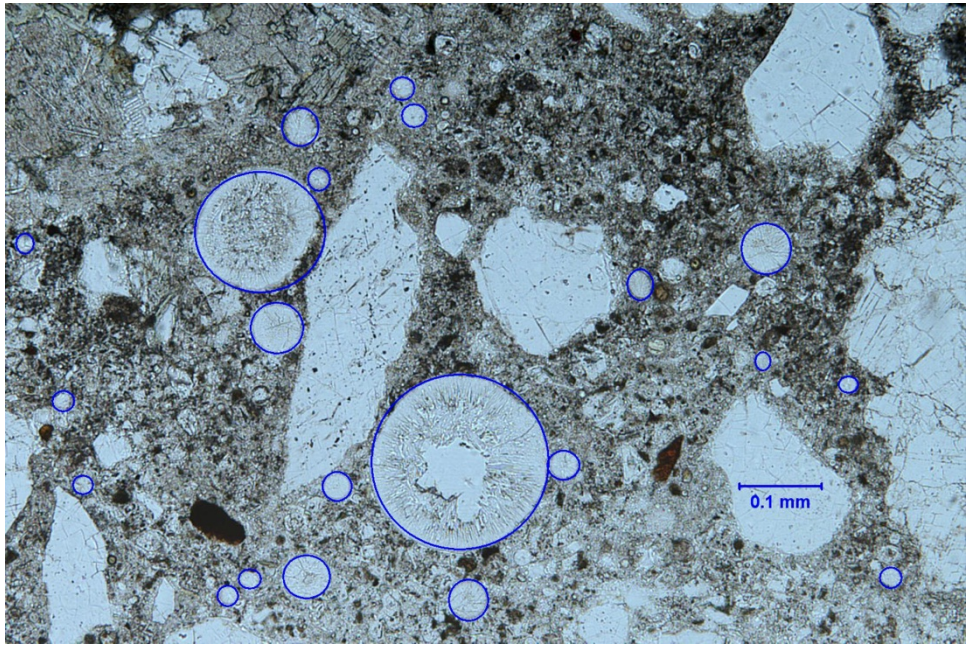
- Trapped Moisture

What Does it Look Like?

- Common Observations

What Does it Look Like?

- Common Observations



What Does it Look Like?

- Common Observations

What can be causing it?

- Chemical
- Mechanical
- Frost

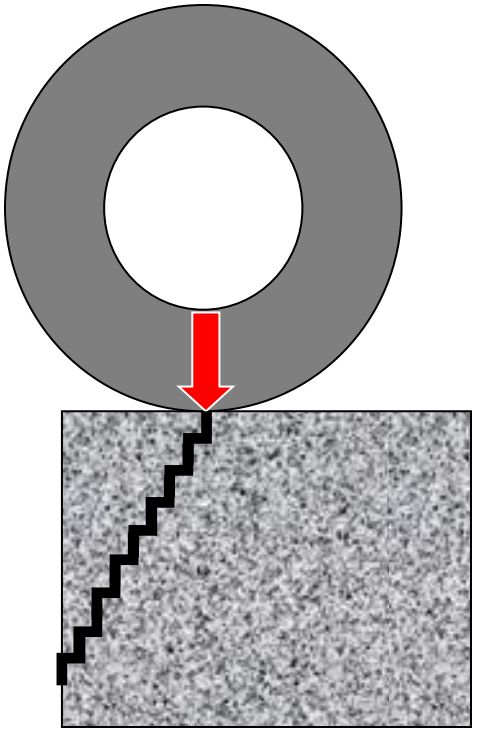
Chemical?

- ASR
- Sulfate

- Doubt it

Mechanical?

- Traffic
  - Unlikely – stress is ~50psi



Mechanical?

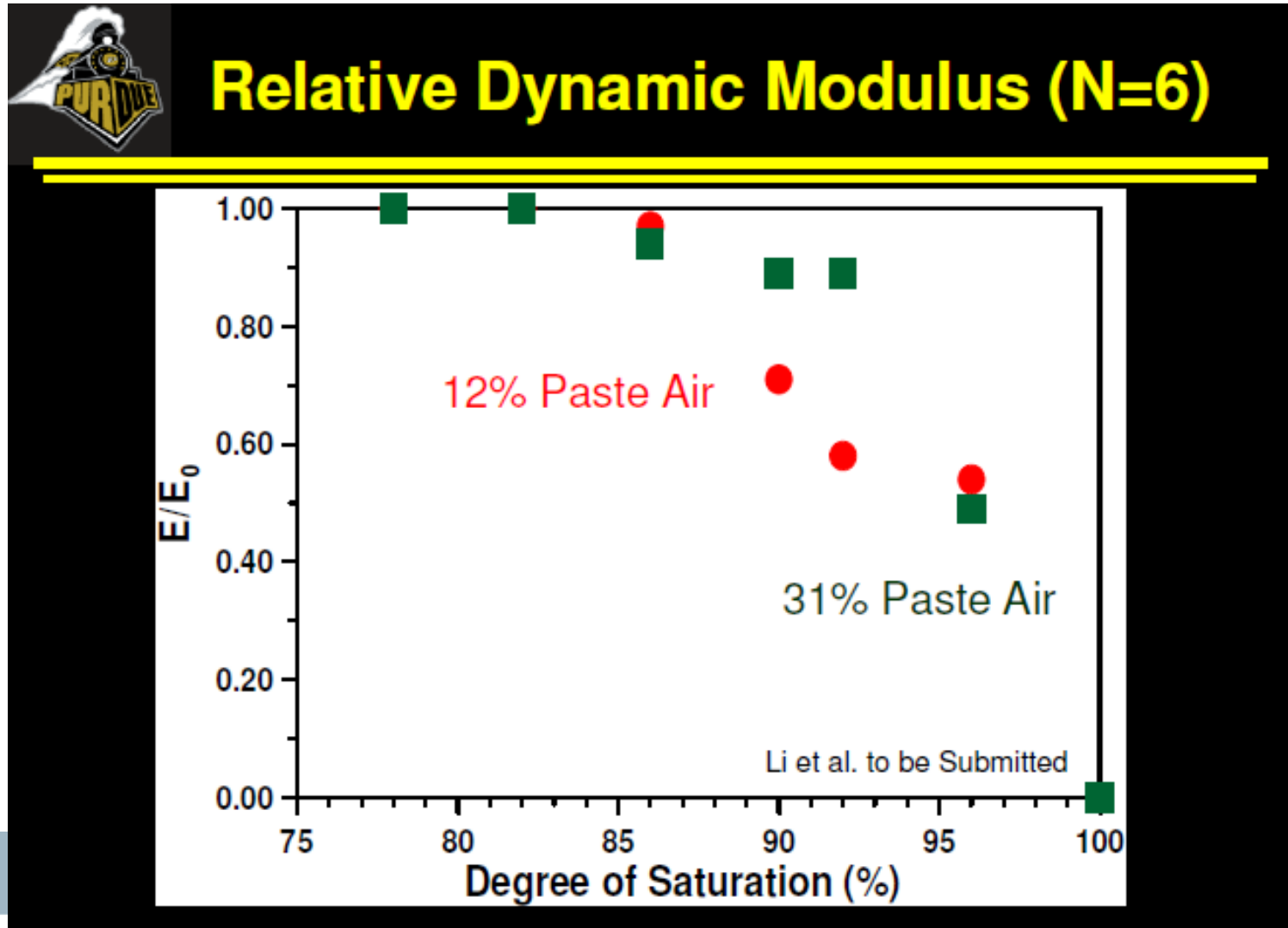
- Sawing
  - Maybe

Frost?

- Common features
  - Marginal air
  - Abundant water
  - Deposits in air voids
  - Cold weather

Purdue Work

- Damage depends on saturation



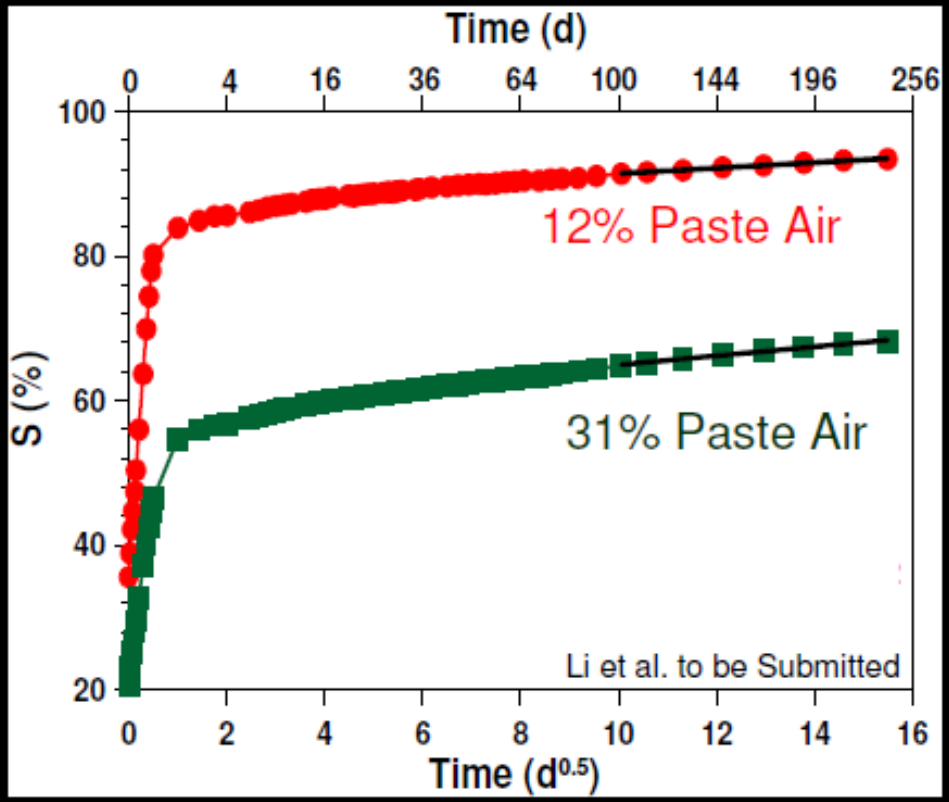
Jason Weiss

Purdue Work

- Saturation rate influenced by air and w/c

Experimental Procedures

- Degree of Saturation is more Important (Castro et al Submitted)



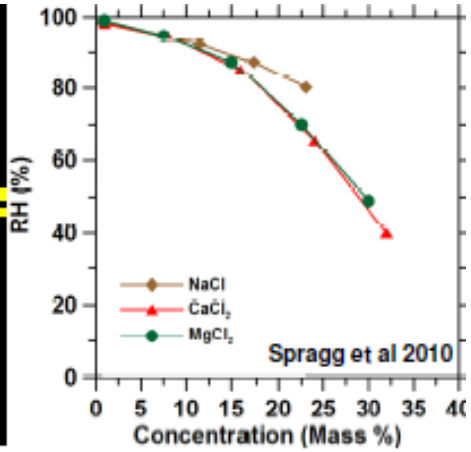
Jason Weiss

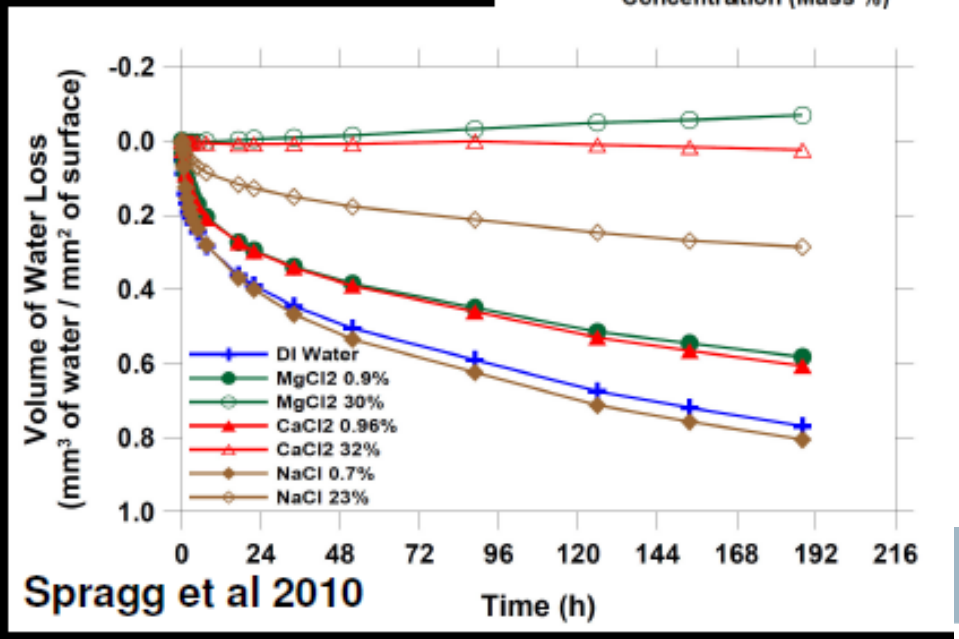
Purdue Work

- Some salts prevent drying

Drying of Concrete With Salt Solutions

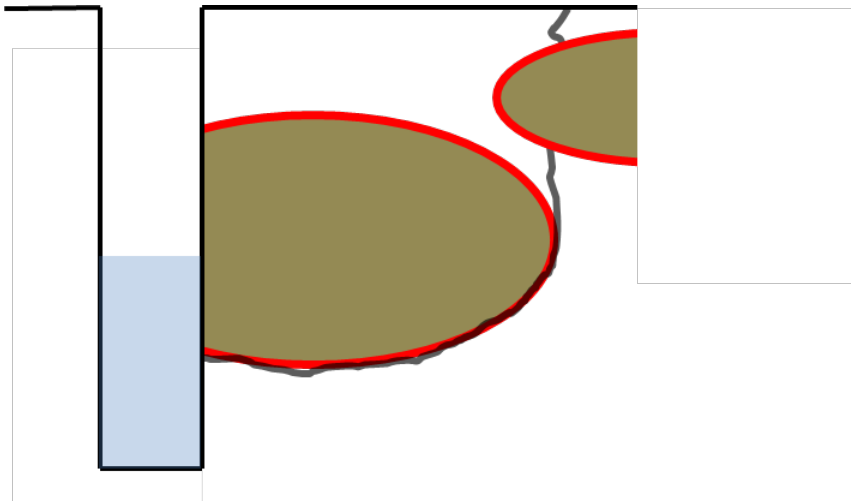
- One-sided condition,50 +/- 2% RH, 23 +/- 1°C
- Lower or no water loss or gain with higher salt concentrations
- Drying behavior explained by differences in solution and environmental RH





Jason Weiss

Interfacial Zone?



Questions

- Why only at joints?
  - Trapped water
  - Trapped salts
  - Sawing damage
- Why in some joints
  - Batch variability
  - Drainage
- Why now?
  - Marginal air
  - Marginal w/cm
  - Salting

So

- Water has to be prevented from saturating the concrete
  - Prevent water from ponding in the joint
  - Prevent water from penetrating from the base
- Permeability of the concrete should be as low as practically feasible
- The air void system in the in-place concrete must be adequate

Prevention

- New concrete
  - Ensure the system can dry out
  - Don’t push the envelope on air
  - Watch the w/cm

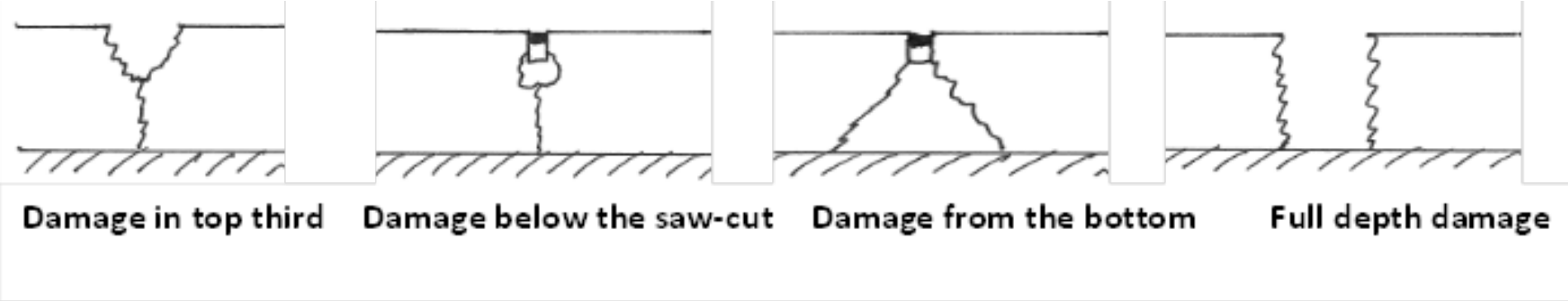
  - Monitor saw condition
  - Choose salts carefully

Prevention

- New concrete
  - Avoid joint details with reservoirs

Repairs / Prevention

- Existing Concrete
  - Sealants
  - Partial depth
  - Full depth
  - Overlay



Future Tasks

Work in collaboration with Purdue and Michigan Tech

- Sampling and testing from field
- In-situ sub-base permeability
- Tests on Sealants

- Effect of gradation on stress at corner
- Interfacial Transition Zone
- Capillary size and suction

Future Tasks

Work by John Kevern, MO

- Vary sawing parameters
- Monitor temperatures
- Core and look for bruising

- At ISU – vary saw condition

The aim…

- A long lasting joint