Construction Factors Influencing Durability

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Missouri Asphalt Conference
December 8, 2009

Primary Causes of Poor Durability

Cause	Result
Low Binder Content	Ravelling
Binder Aging	Brittleness Cracking
High Voids Content	Early asphalt hardening Cracking Disintegration/ravelling

Understand the causes
so we can prevent the results.

Ravelling

- Insufficient binder
- Insufficient fine aggregate
- Lack of compaction
- High dust to binder ratio
- Water sensitivity
- “Dirty” aggregates

- *Mix design*
- *Changes during production*
- *Inadequate compaction*

Cracking

- Fatigue
  - Pavement thickness
  - Low binder content
  - Moisture sensitivity
  - Stiff binder
- Thermal
  - Low binder content
  - Stiff binder
  - High dust to asphalt

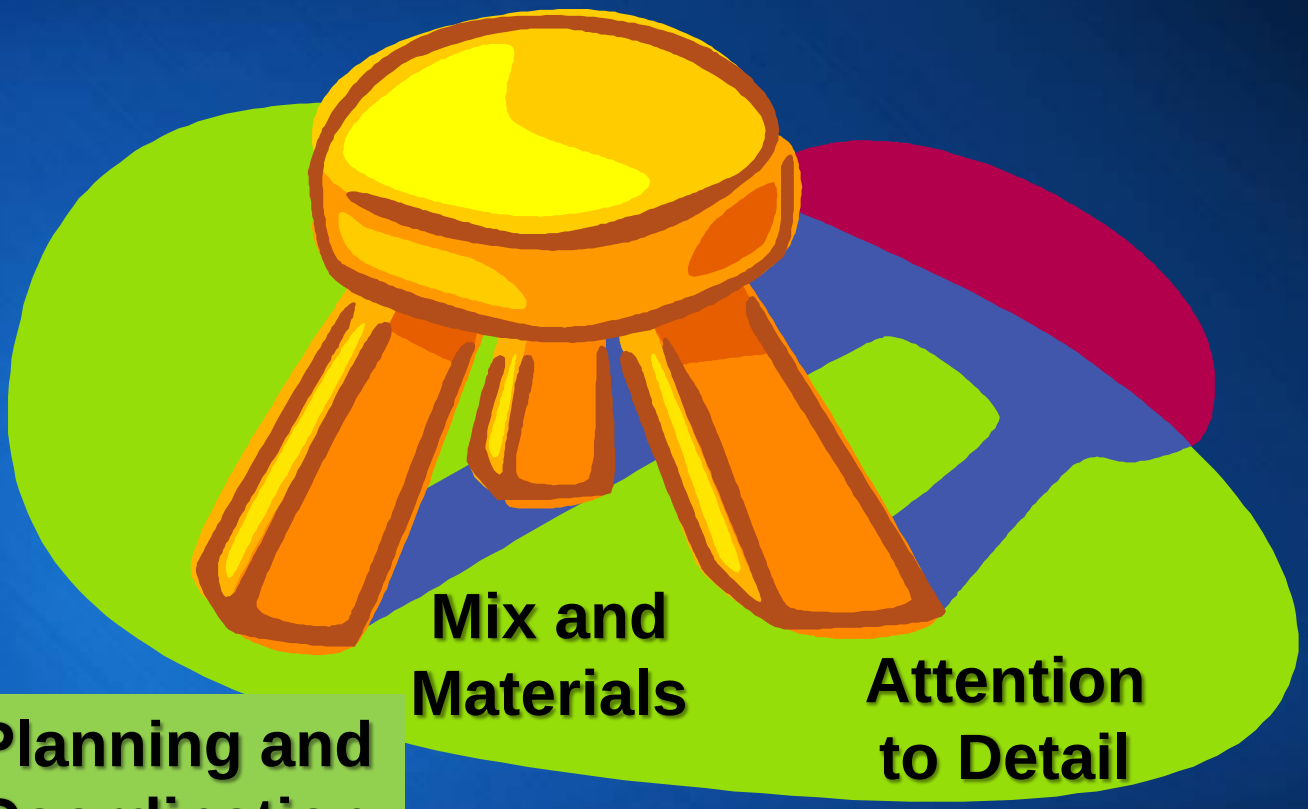
- *Pavement design*
- *Mix design/material selection*
- *Changes during production*
- *Inadequate compaction*

Binder Aging

- Oxygen reacts with binder
- Leads to hardening of binder

- *Material Selection*
- *Overheating*
- *Poor compaction*

Ensuring Durability Depends On:



Let's look at primary causes and prevention.

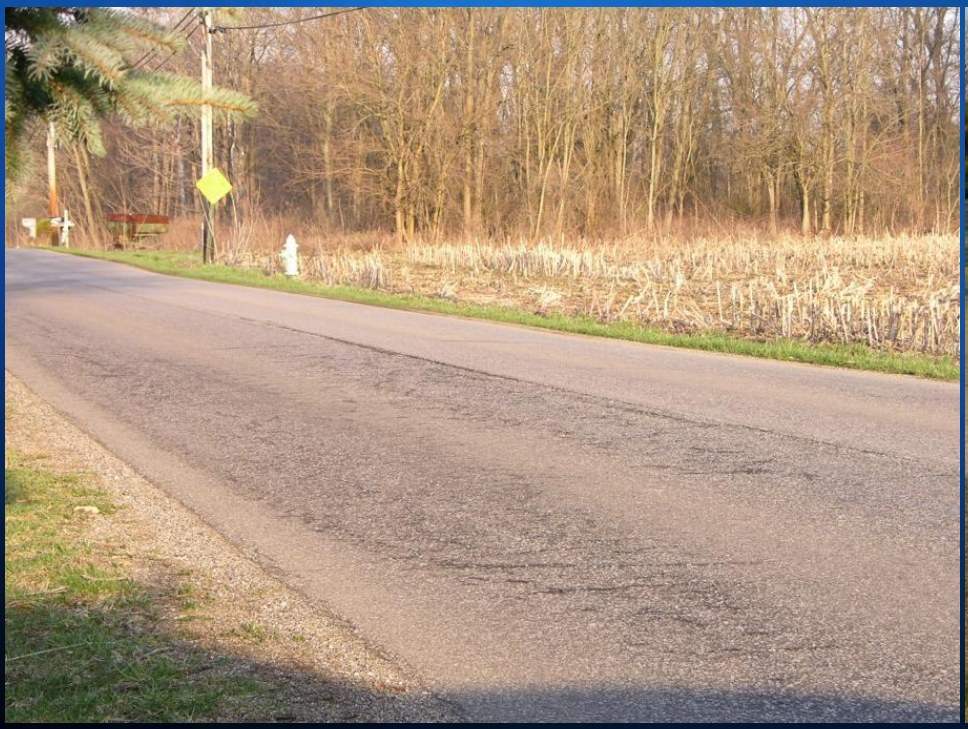
Binder Content

Too Low

- Durability Problems

Too High

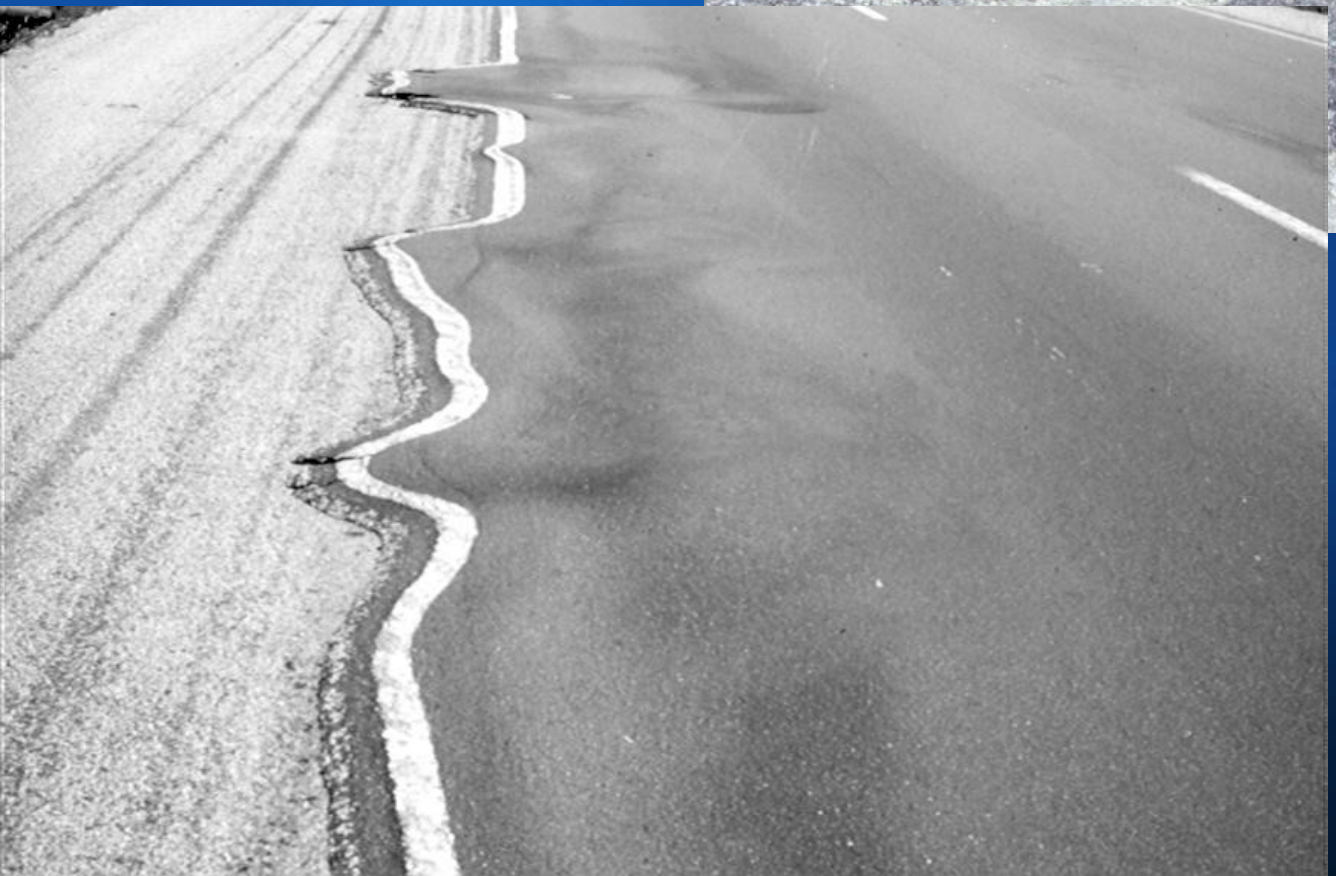
- Stability Problems



Factors Affecting Binder Content

- Inaccurate scales
- Improperly calibrated meters
- Leaking asphalt valve
- Incorrect moisture correction factor
- Segregation

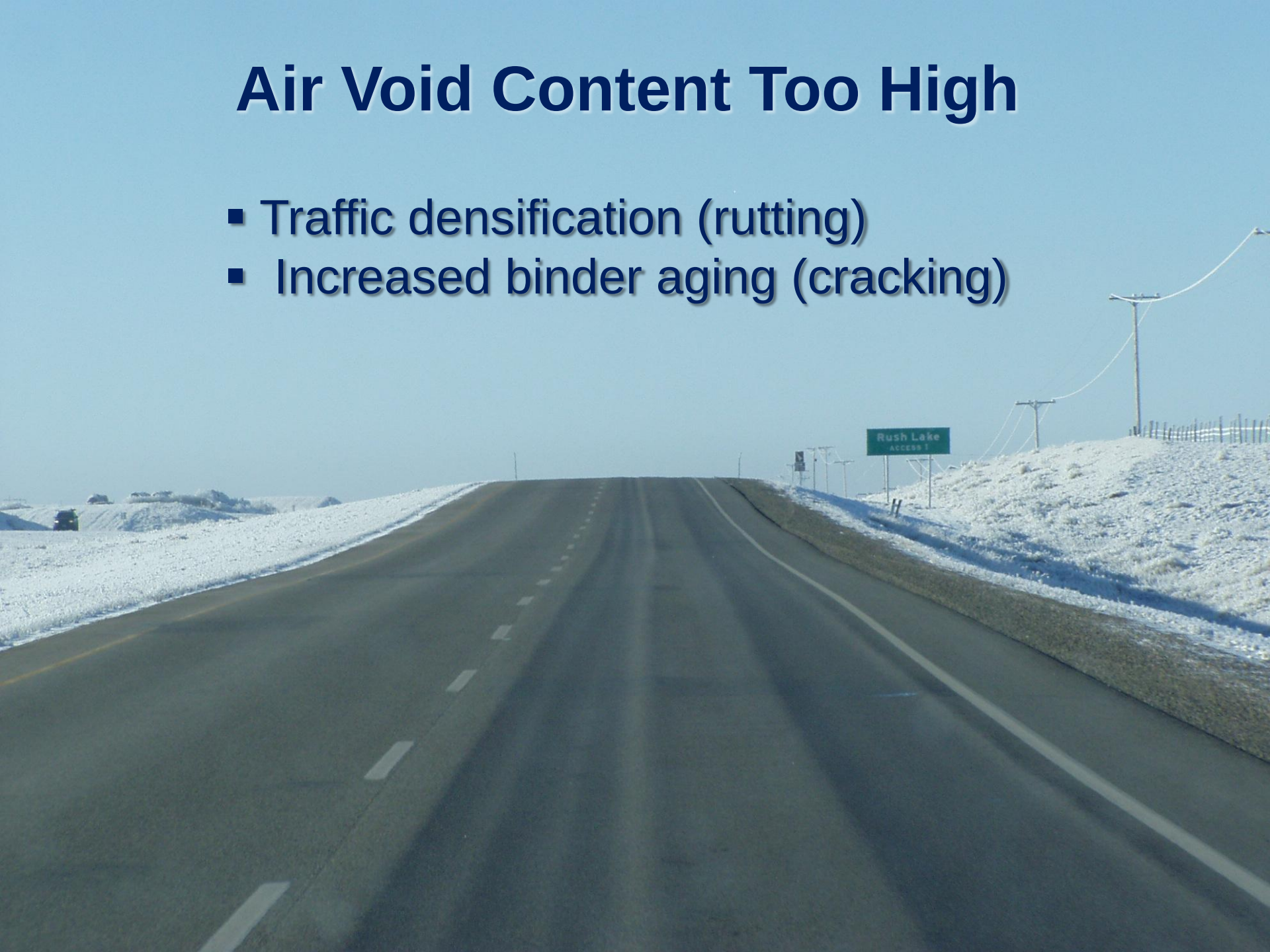
Air Voids Too Low



1.5% air

Air Void Content Too High

- Traffic densification (rutting)
- Increased binder aging (cracking)



Impact of High Voids

Ravelling increases as air content increases.

Service life reduced about 10% for each 1% air voids over 7%!

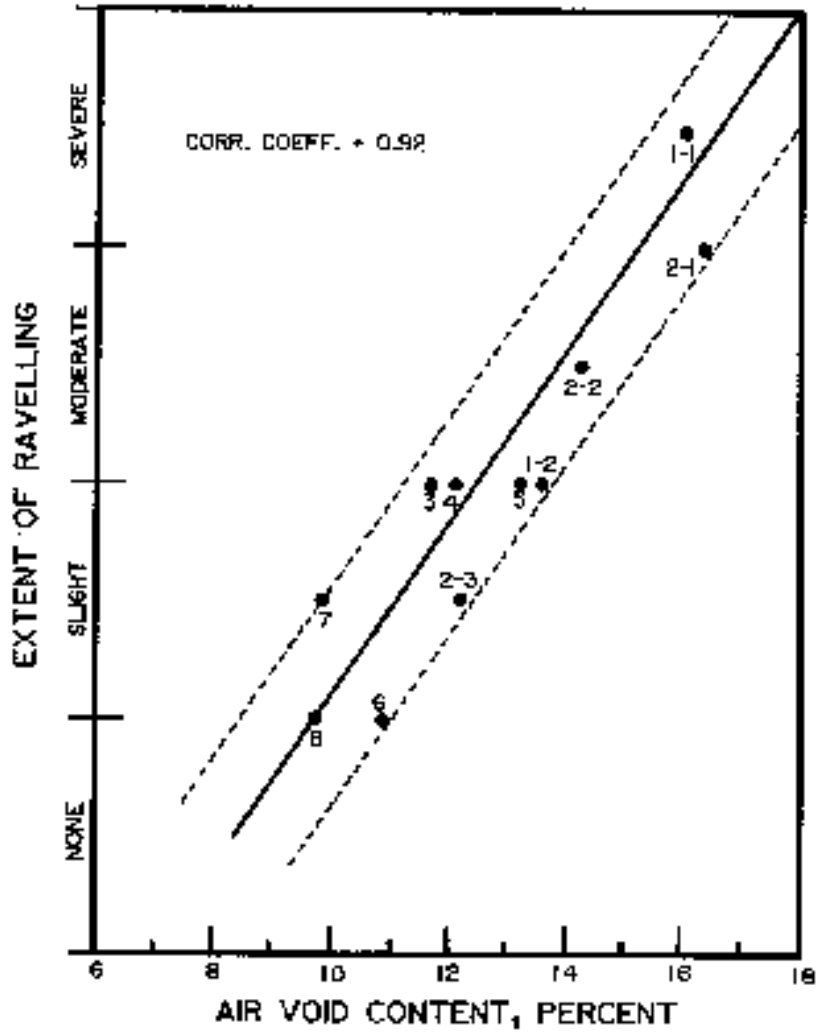
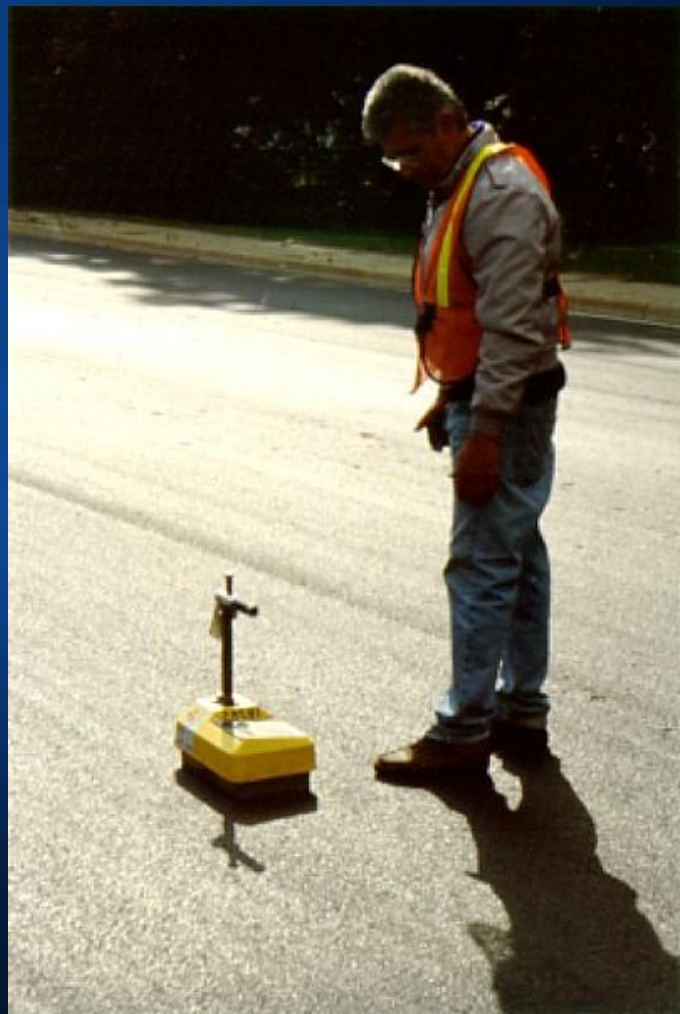


Figure 2–34. Air Void Content Versus Extent of Ravelling (after Kandhal, 43)

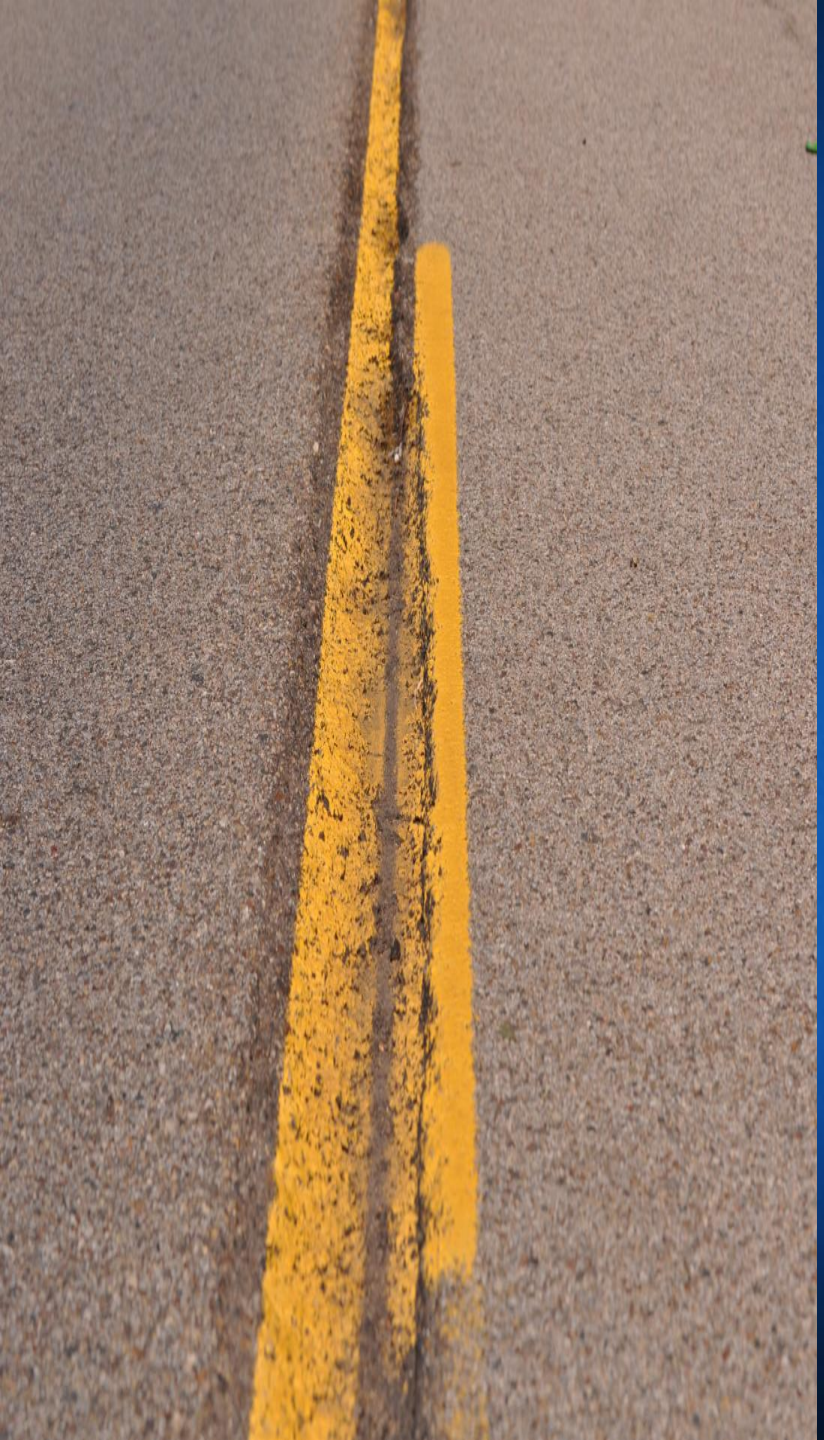
Factors Affecting Compaction

- Mix Properties
  - Aggregate gradation, shape and texture
  - Binder stiffness and content
  - Mix temperature
- Environmental Conditions
  - Air and surface temperature
  - Wind
  - Humidity



Factors Affecting Compaction

- Layer Thickness
- Joints
- Segregation
- Equipment
  - Enough
  - Speed
  - Type



Joint Compaction

- Weakest link
- Allow water and air penetration
  - Stripping
  - Delaminations
  - Hardening/Cracking
- Avoid if possible!
- Many approaches
- Attention to detail

Control segregation at edge of mat


Drive a straight line!

Compact the Unconfined Edge

1. Overhang first pass.
2. Hold back from edge; overhang on second pass.

Keep pneumatics away from edge.


Maintain proper overlap.
Allow for roll down.


Bump the joint, don’t rake.

Scattering Causes Low Joint Density

Confined Edge – Pinch the Joint or Overhang It

First pass from cold side not recommended.

Low Density at Joint (Age 1 yr)

Segregation

- Aggravates other problems
  - Low binder content
  - High air void content
  - Binder aging
  - Moisture

- Can occur at any point in the process from stockpiles to laydown

Manage Your Stockpiles

Consistent Plant Operations

Load Trucks Properly!

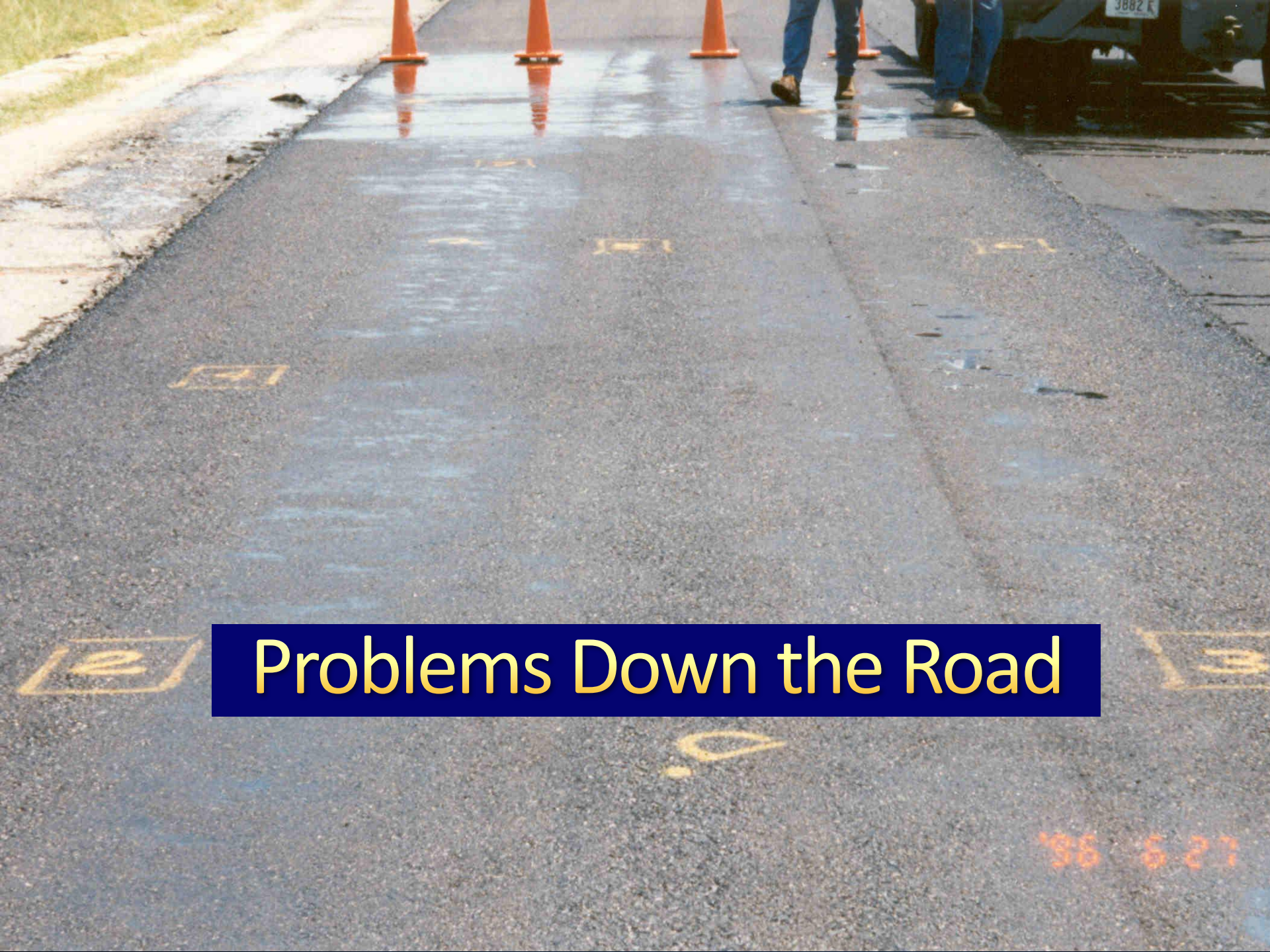

Don’t Flap Your Wings!


Segregation from Dumping

Truck Load to Truck Load Segregation

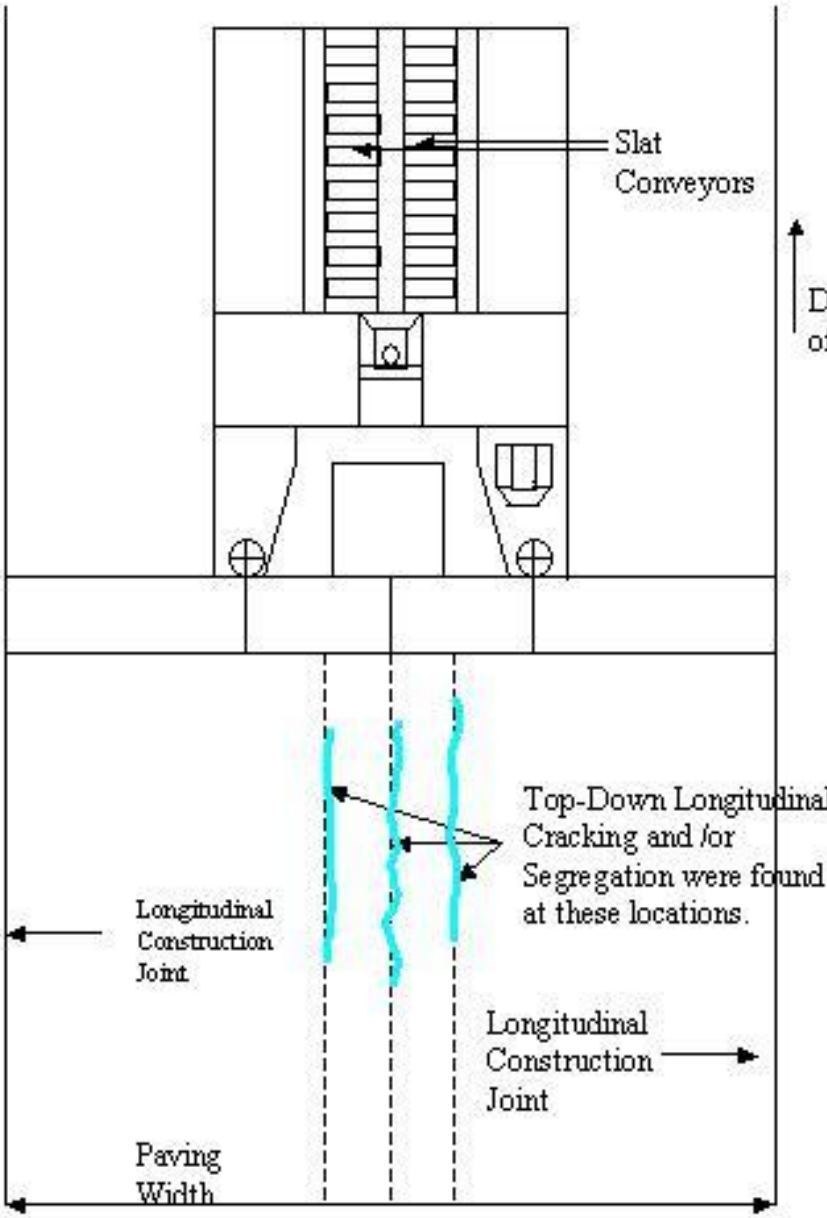

Leads to Potholes


Longitudinal Segregation


Problems Down the Road


Colorado I-25
OVERSIZE LOAD


Paver Segregation


Slat
Conveyors
Direction
of Paving
Top-Down Longitudinal
Cracking and /or
Segregation were found
at these locations.
Longitudinal
Construction
Joint
Longitudinal
Construction
Joint
Paving
Width


37"
36"

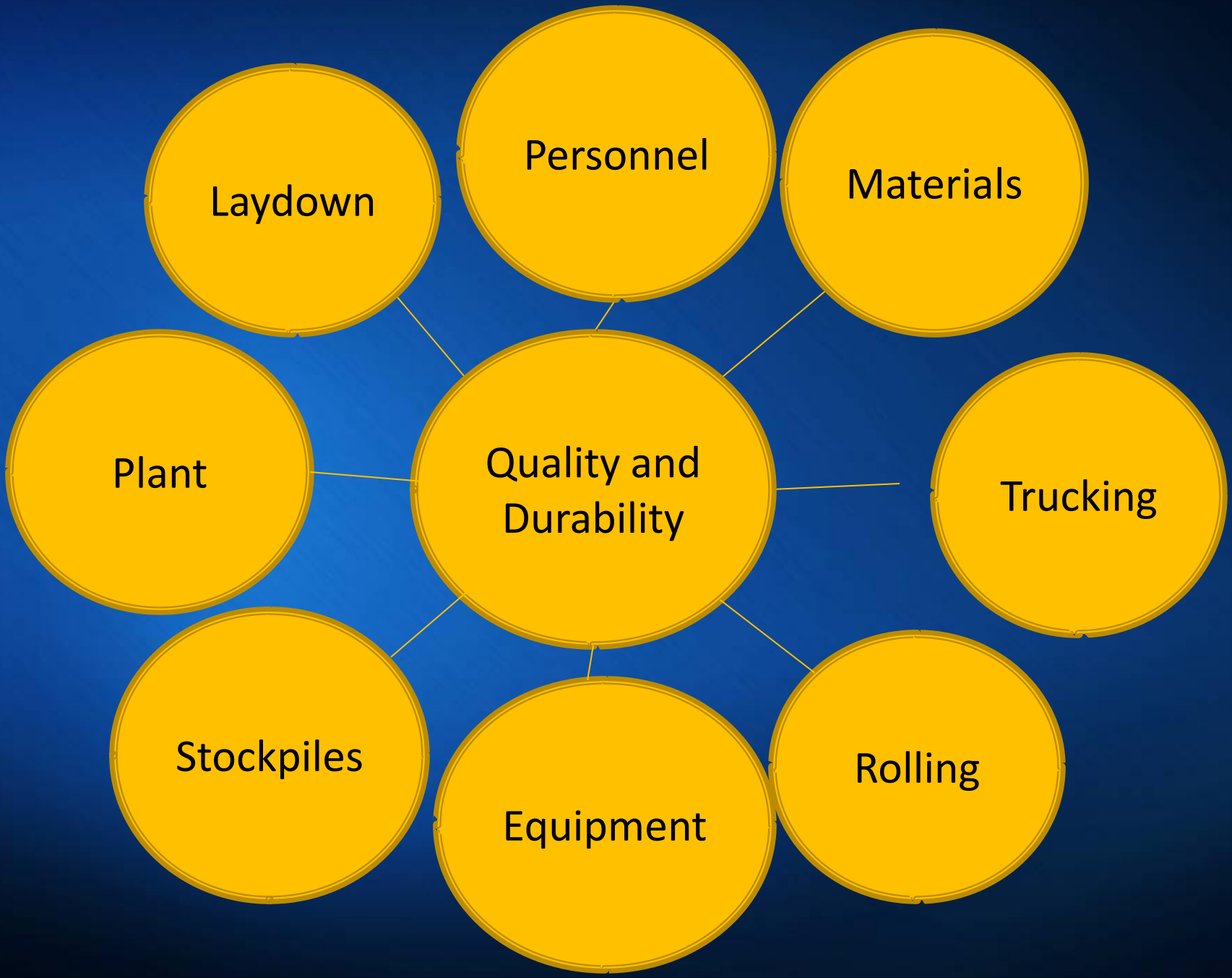

Details,
Details,
Details

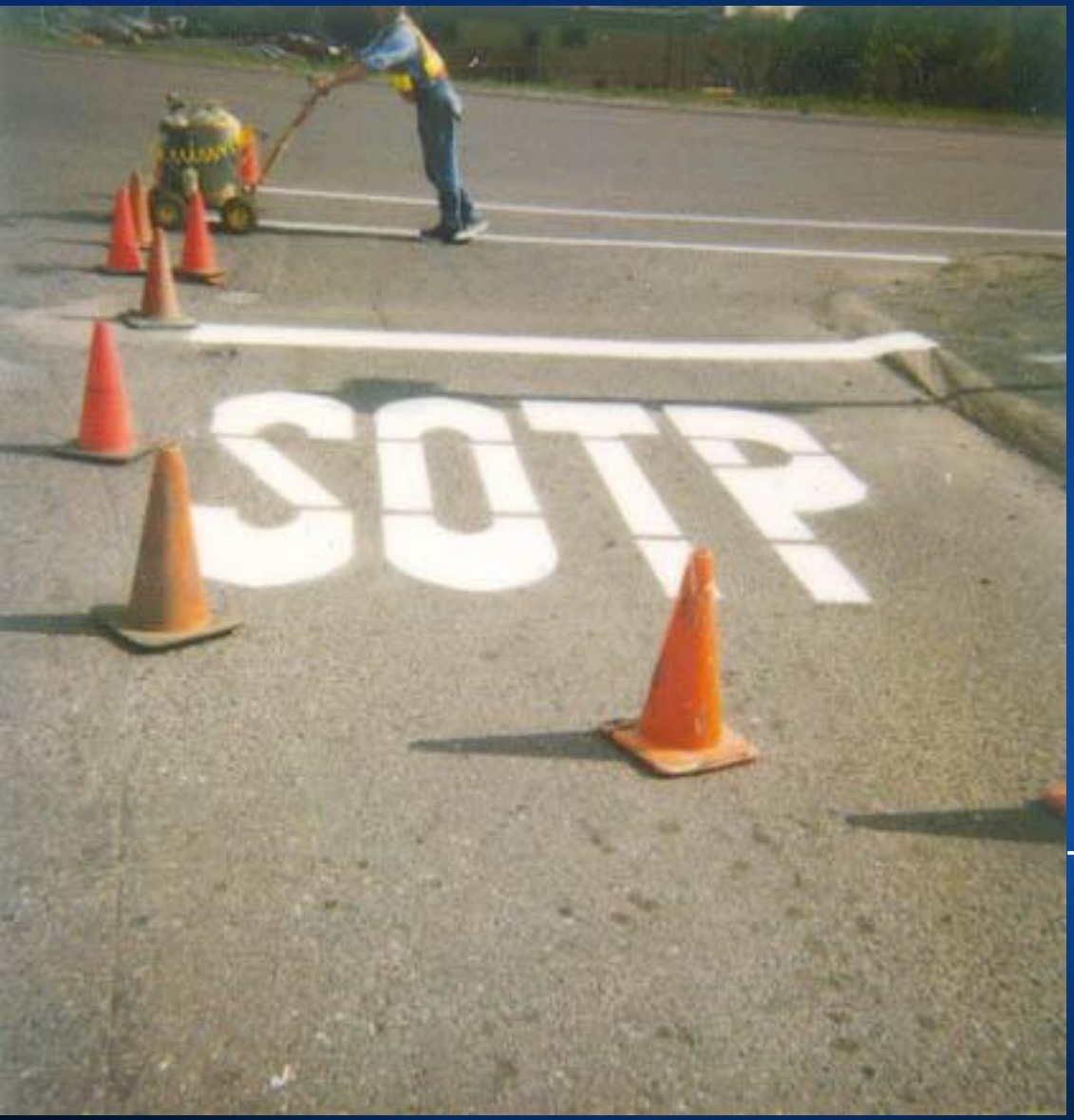
Prevention

Planning is Key!

OLLEGE OF ARCHITECTURE AND *BAD* PLANNING?

Attention to Details


Laydown
Personnel
Materials
Plant
Quality and Durability
Trucking
Stockpiles
Equipment
Rolling



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Thanks to Heritage Research Group, Gerry Huber, Dudley Bonte, Doug Hanson, Chuck Deahl and Libby Burley for photos and ideas.