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Identifying Pavement Failures and Effective Base Preparation

Purdue Road School

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NATIONAL SECURITY



ENERGY & ENVIRONMENT



INFRASTRUCTURE



HEALTH SOLUTIONS

Report on Infrastructure

2017 Infrastructure Grades

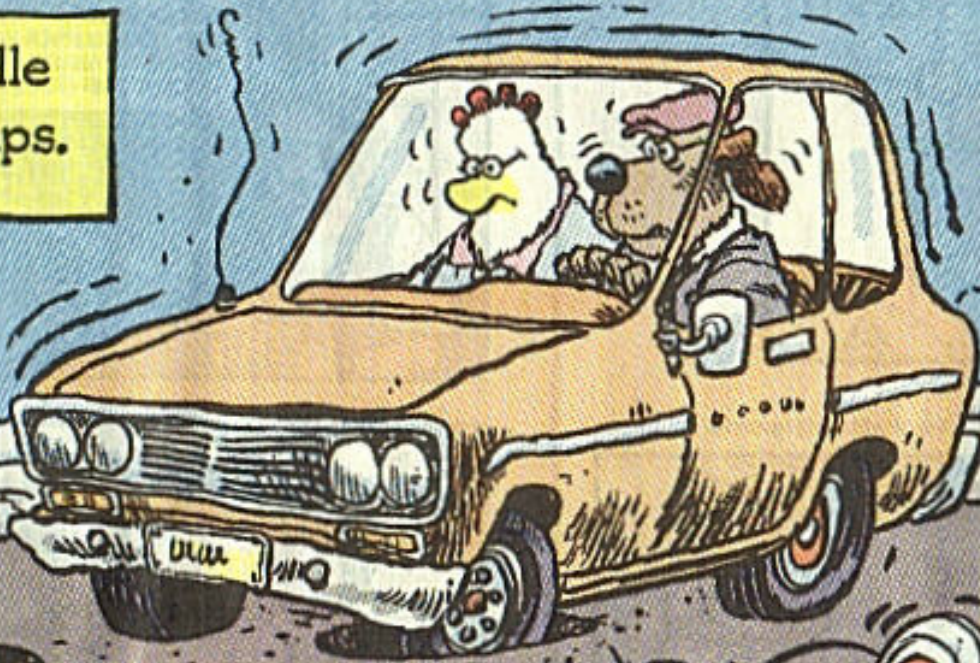
 AVIATION	D	 PARKS AND RECREATION	↓ D+
 BRIDGES	C+	 PORTS	↑ C+
 DAMS	D	 RAIL	↑ B
 DRINKING WATER	D	 ROADS	D
 ENERGY	D+	 SCHOOLS	↑ D+
 HAZARDOUS WASTE	↑ D+	 SOLID WASTE	↓ C+
 INLAND WATERWAYS	↑ D	 TRANSIT	↓ D-
 LEVEES	↑ D	 WASTEWATER	↑ D+

America's
Cumulative
Infrastructure
Grade



A	EXCEPTIONAL
B	GOOD
C	MEDIOCRE
D	POOR
F	FAILING

Pluggerville
speed bumps.

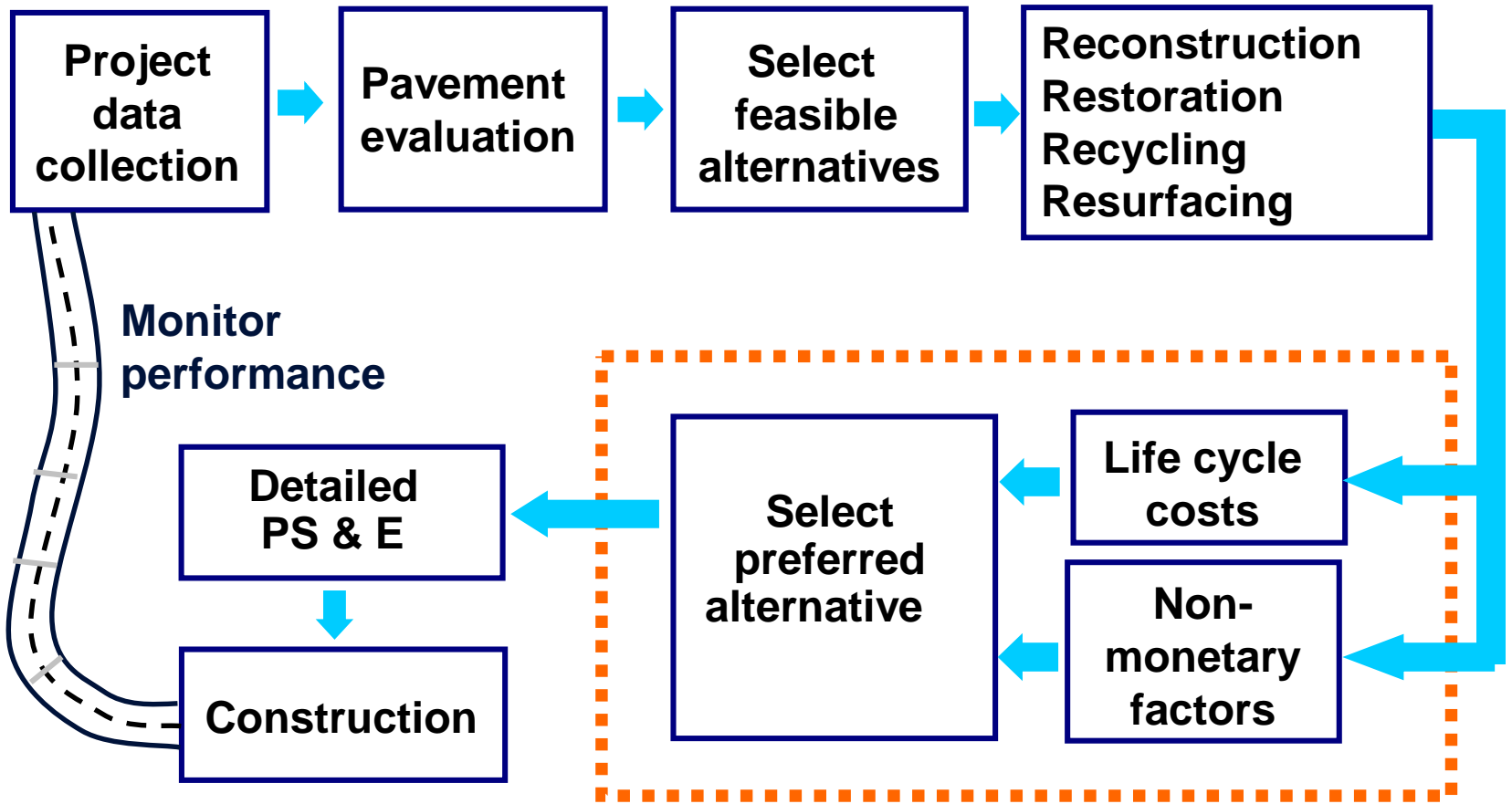


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So you have roads, now what?

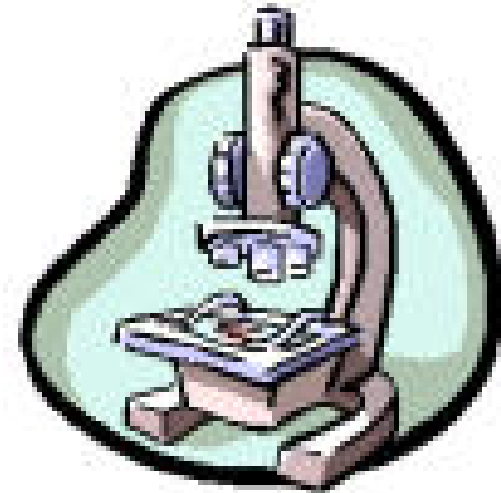
- New roads are great!
- Roads don't last forever
- Planning to fix roads is a must
- Knowing how to fix them is key
- Putting it all together makes you the expert!

Pavement Planning Life Cycle



Benefits of Pavement Evaluation

- Provides qualitative information to:
 - Determine causes of deterioration
 - Develop appropriate alternatives
- Provides quantitative information for:
 - Quantity estimates
 - Assessment of deterioration rates
 - Performing life cycle cost analyses



Goals of Pavement Evaluation

- Overall goal of rehabilitation design is to provide cost-effective solution that:
 - Addresses pavement deficiencies
 - Satisfies constraints

- Thorough pavement evaluation required to achieve this goal
 - Less chance of premature failure
 - Better chance of achieving intended design life
 - Better use of available funds and lower overall cost in the future

Data Required for Pavement Evaluation

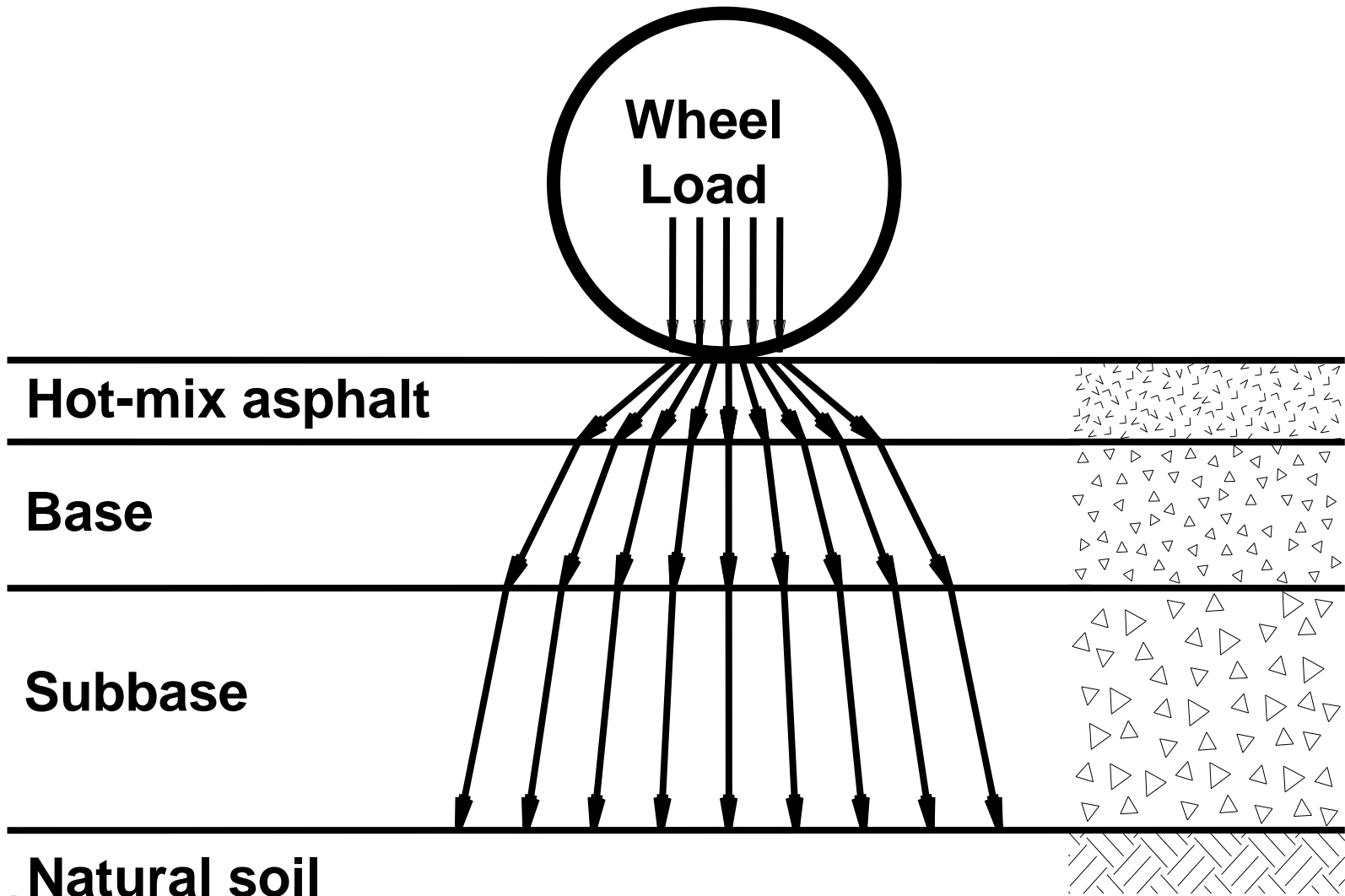
- Pavement and shoulder condition
- Pavement design
- Materials and soil properties
- Traffic volumes and loadings
- Climatic conditions
- Drainage conditions
- Geometric factors
- Safety aspects
- Other factors



Impact factors for pavement performance

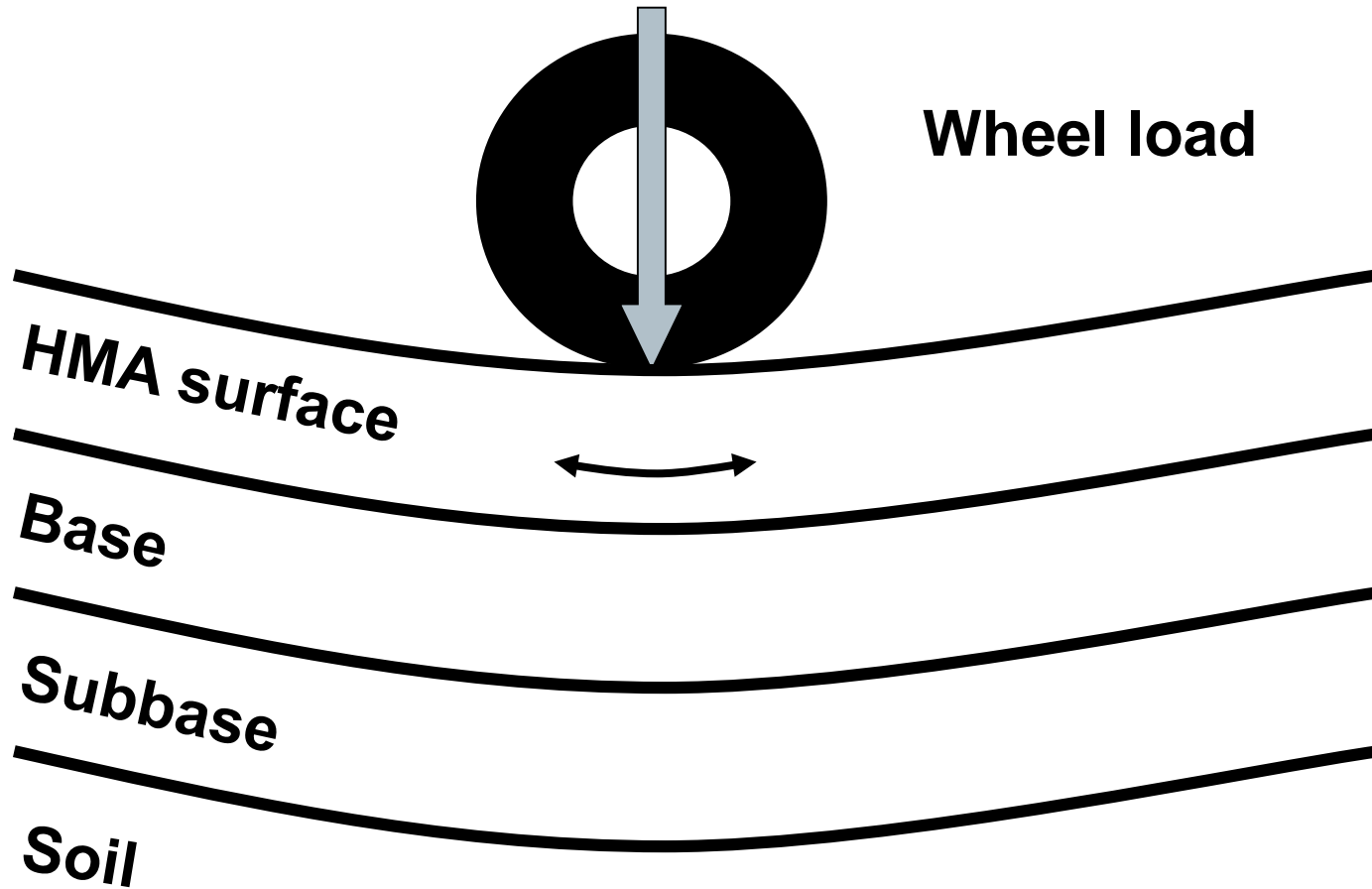
- Traffic
- Subgrade soil support
- Materials of construction
- Structural characteristics
- Construction and maintenance variation
- Moisture
- Maintenance / rehabilitation programs

Pavement layers distribute load

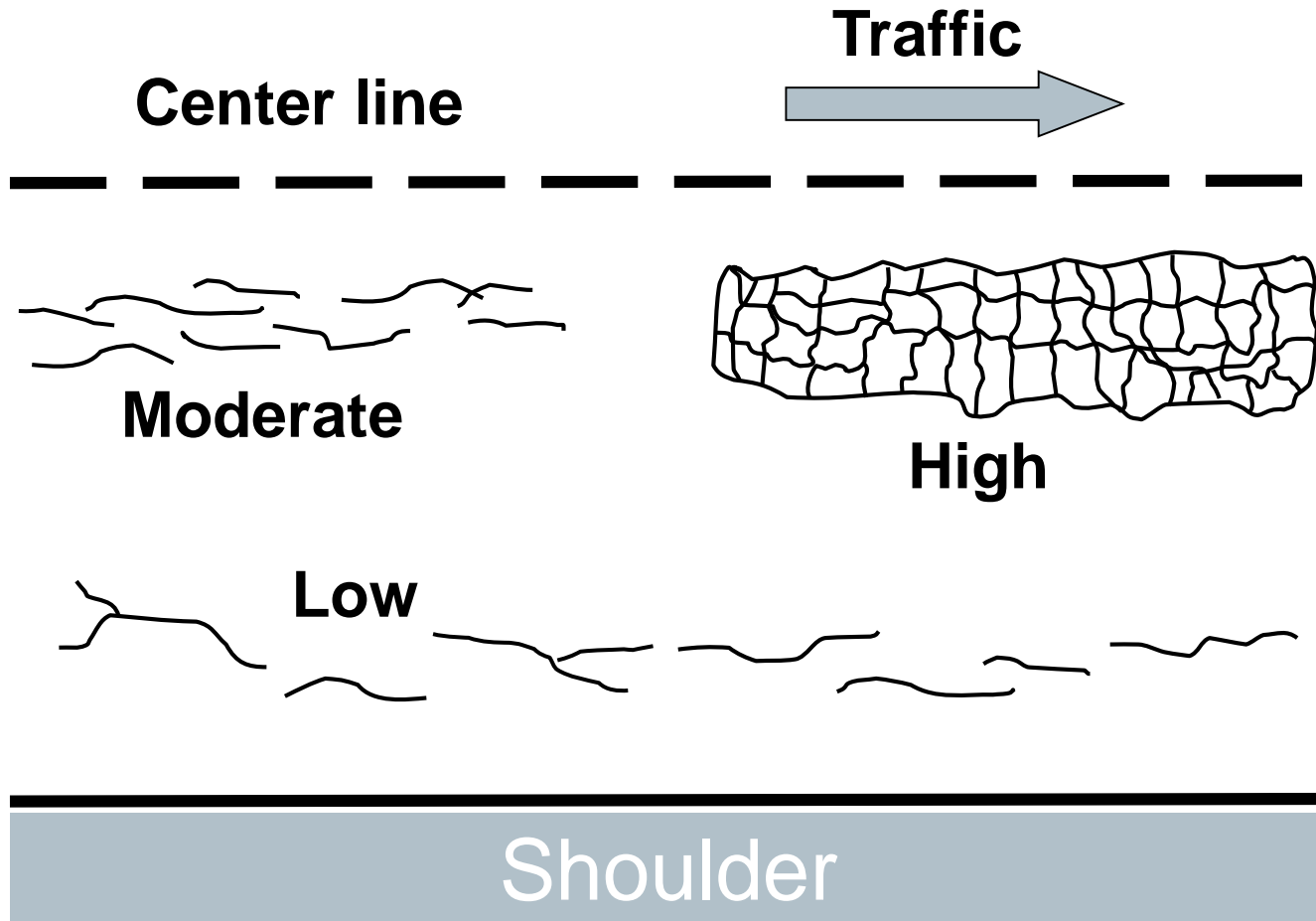




Fatigue cracking is load related



Fatigue cracking is in the wheel path



Early Stage of Fatigue Cracking



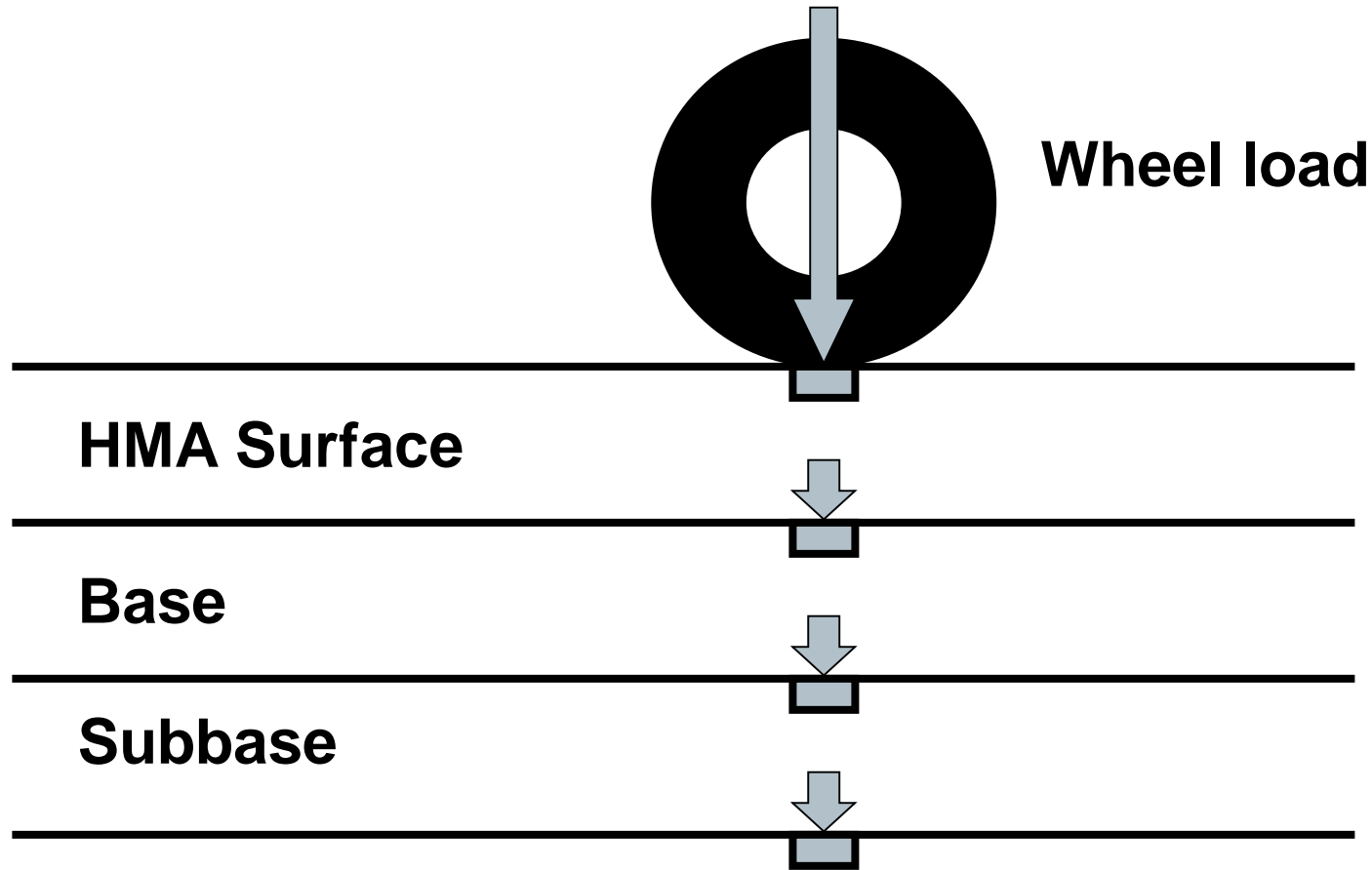
Intermediate Stage of Fatigue Cracking



Advanced Stage of Fatigue Cracking



Rutting can be load related



Minor Rutting



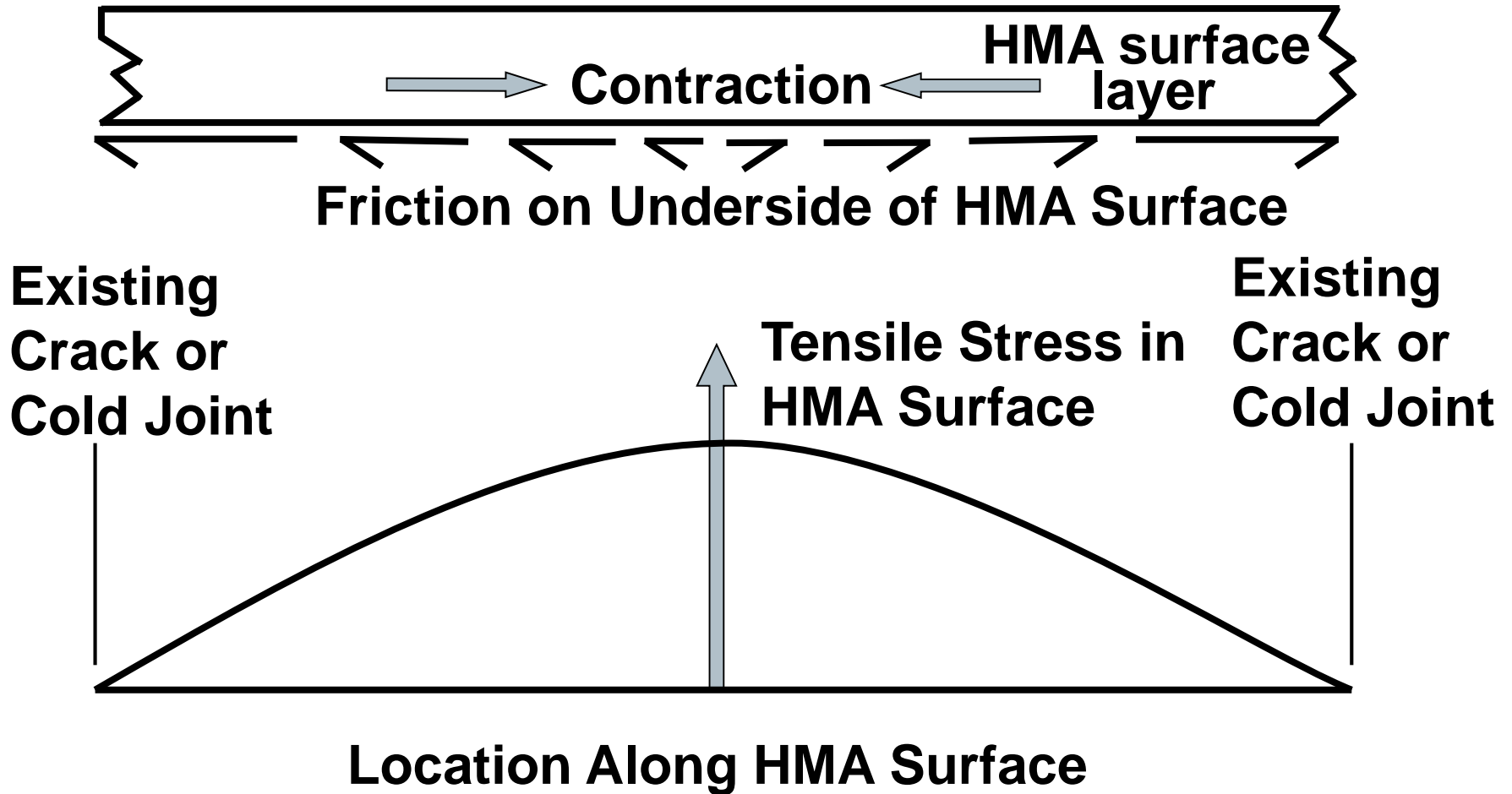
Severe Rutting



Rutting confined to HMA Layer



Thermal cracking is environmental



Thermal Cracking



Thermal cracking

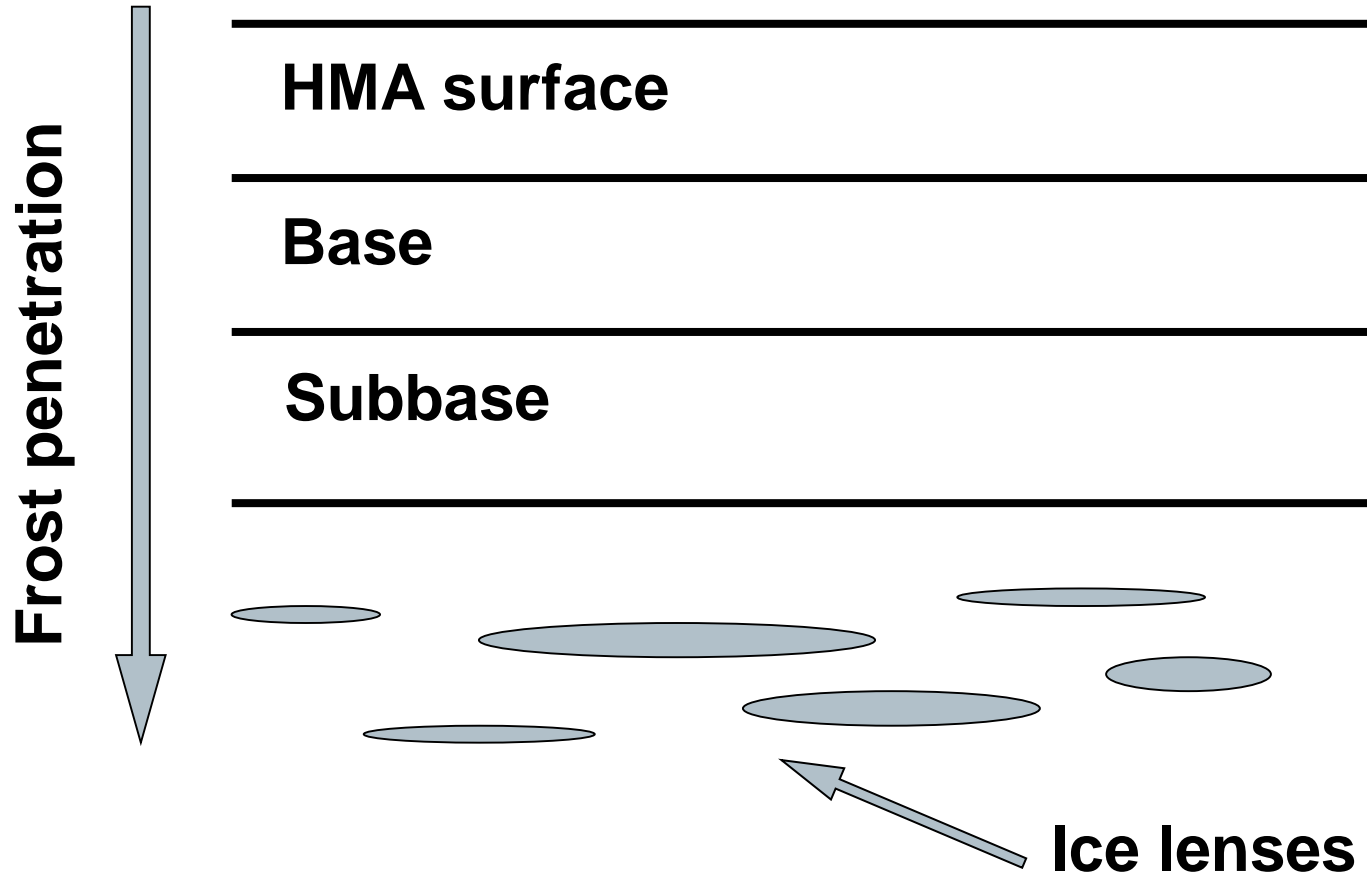


Wide thermal crack





Frost heave: temperature-related



Moisture related strength loss



Oxidized Surface Layer



Potholes



Flushing





Some problems that we regularly see



Construction Joints at Low Area



Poor Patching/No Sealing



Soft Subgrade During Paving



Poor Construction Joint



Poor Pavement Transition



Poor Pavement Transition



Insufficient Pavement Structure



Insufficient Pavement Structure



Insufficient Pavement Structure



Patch Needs Crack Sealing



Poor Compaction at Utility



Poor Utility Trench Compaction



Patch Didn't Solve the Problem



In Fact, it made it Worse



Poor Patching and ... No Crack Sealing



Utility Trench Settlement - CB



Low Point – Water Issues



Poor Drainage



Poor Drainage



Result of Trapped Water



Result of Trapped Water

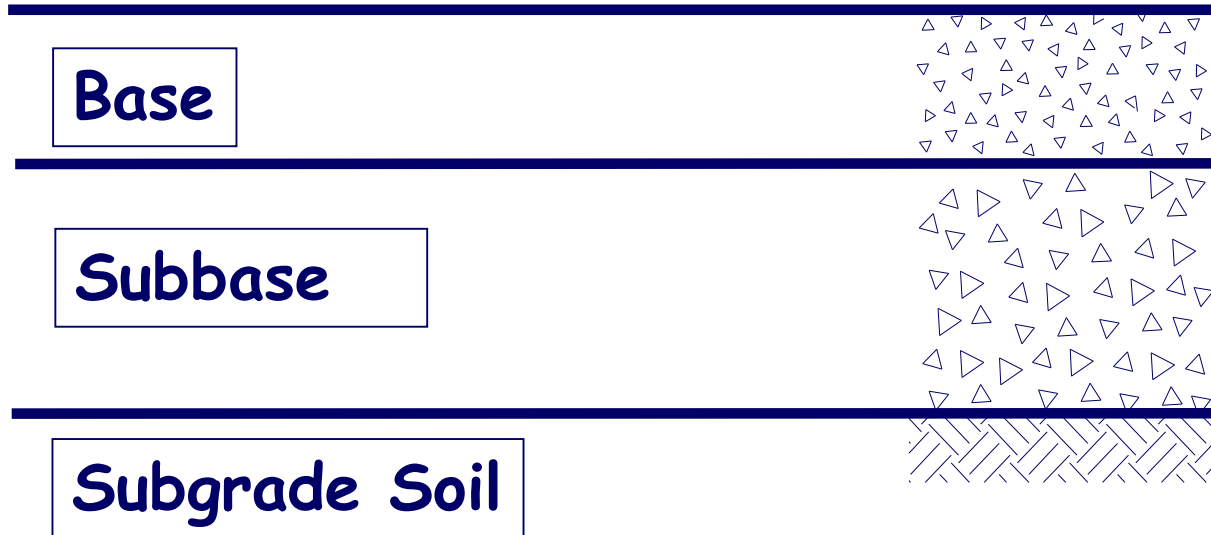




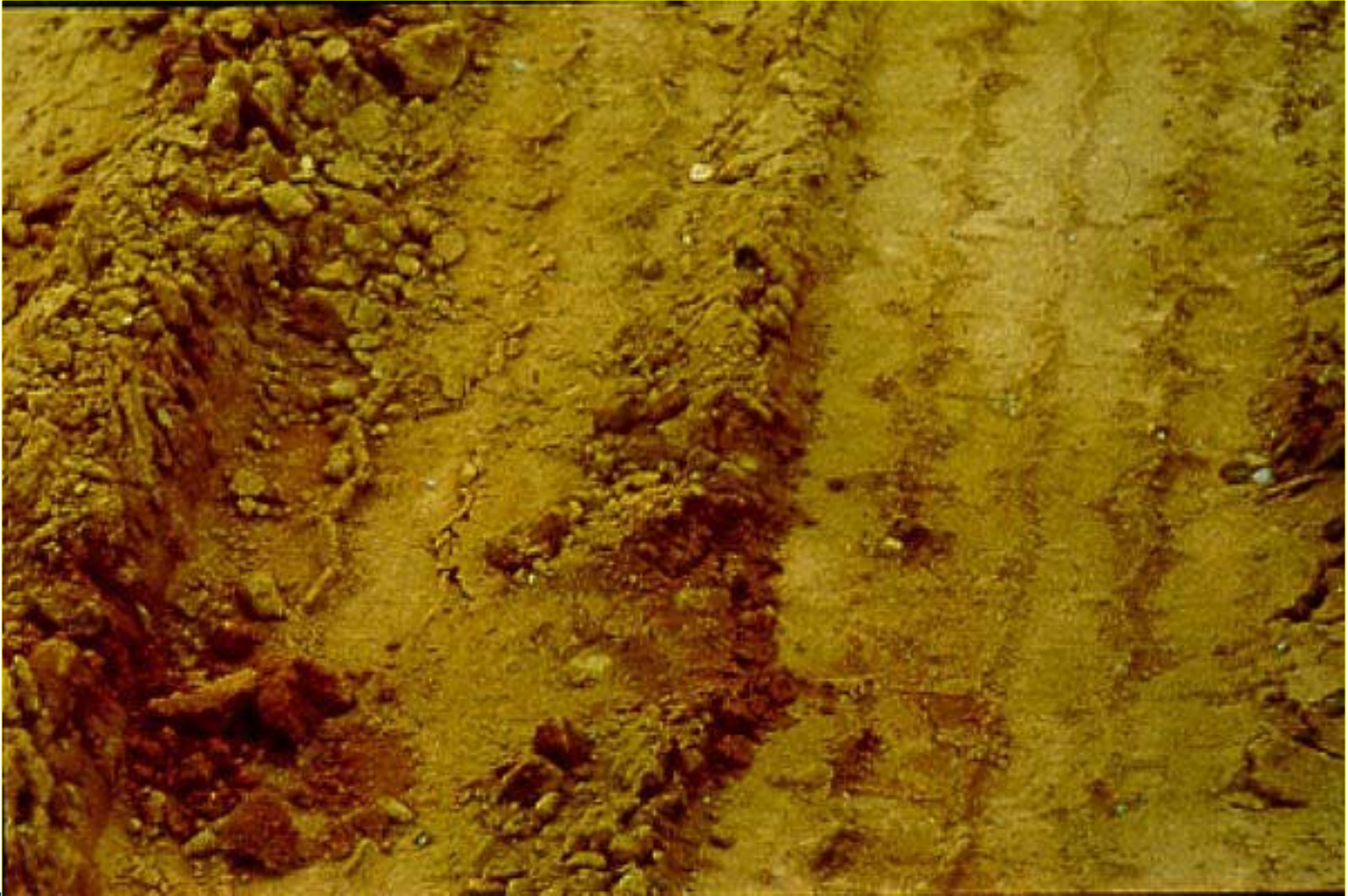
Preparation of the Subsurface Layers for a New Pavement



What materials and construction factors do we strive to control?



Is this subgrade ready?



Proof Rolling

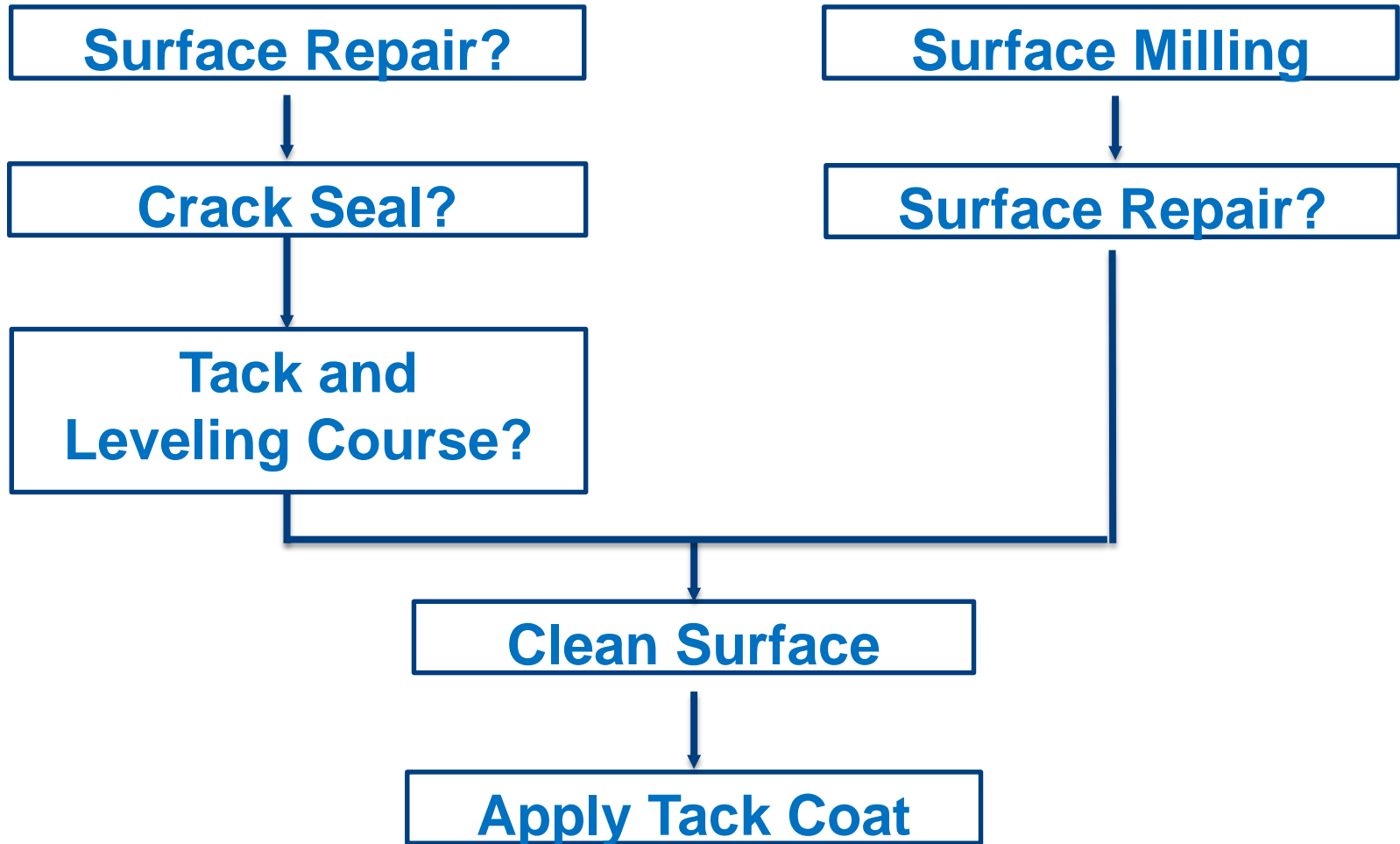


Re-Work Weak Areas





HMA Surface Preparation



Pavement Surface Repairs Must

- Address the distress mechanism (as well as symptom)
- Employ proper materials and construction procedures

Is this old patch okay?



Patch Construction

- Mark patch boundaries
- Cut boundaries
- Remove HMA and weak materials
- Repair foundation
- Apply tack coat
- Place HMA patch material
- Compact the patch

Mark Patch Boundaries



What's wrong with these?



Cut Boundaries



Small Patch

Medium to Large Patch



Remove HMA & Weak Materials



Back Hoe



Small Milling Machine

Address drainage problems



Repair Foundation *(Replace Base Material)*



Repair Foundation (Base Compaction)



Apply Tack Coat



Spray Application



Patch Area
After Tack

Place HMA Patch Material



Patch Compaction



Small Patches



Medium to Large Patches

HMA Patch Examples



Good



Poor

*The end product is a beautiful
long-lasting pavement*



Questions



Thank You!

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