

2005 Southeastern States Pavement  
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# Mechanistic-Empirical Pavement Design Guide *-Implementation-*

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**APPLIED  
RESEARCH  
ASSOCIATES, INC.**

An Employee-Owned Company

# *Focus of Presentation*

Regional & Individual Implementation  
Considerations or Issues to define  
inputs, defaults, and calibration  
values.

- ★ Similar activities & inputs between agencies
- ★ Operational & policy differences between agencies

# Common Implementation Questions & Issues

How do we determine the inputs?

How do we use the software?

Are the predictions accurate enough?

Are the default values applicable?

Are the calibration factors applicable?





# *Establish Similarities & Differences Between Agencies*

## ☀ Site Features

- Climate
- Foundation
- Traffic

## ☀ Design Features

## ☀ Materials & design procedures

## ☀ Design strategies

## ☀ Materials & construction specifications

## ☀ Acceptance policies

## ☀ Maintenance strategies

## ☀ Operational policies

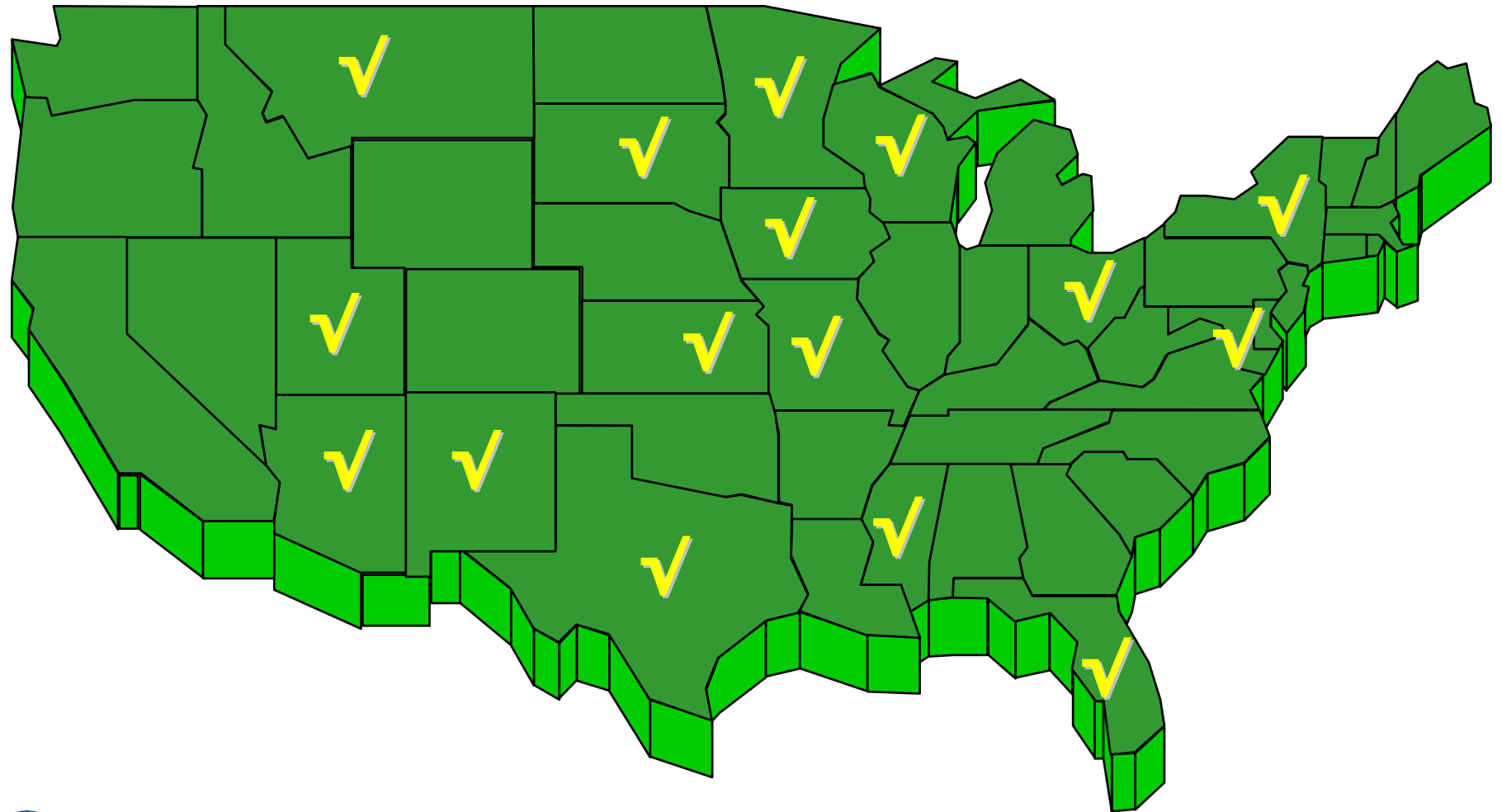
All will affect the experimental plan for implementation.

# *On-Going National Implementation Efforts*

- 1. NCHRP 9-30** – Experimental Plan for Calibration & Validation of HMA Performance Models for Mix & Structural Design.
- 2. NCHRP 1-40B** – Local Calibration for the M-E PDG for New & Rehabilitated Pavement Structures.

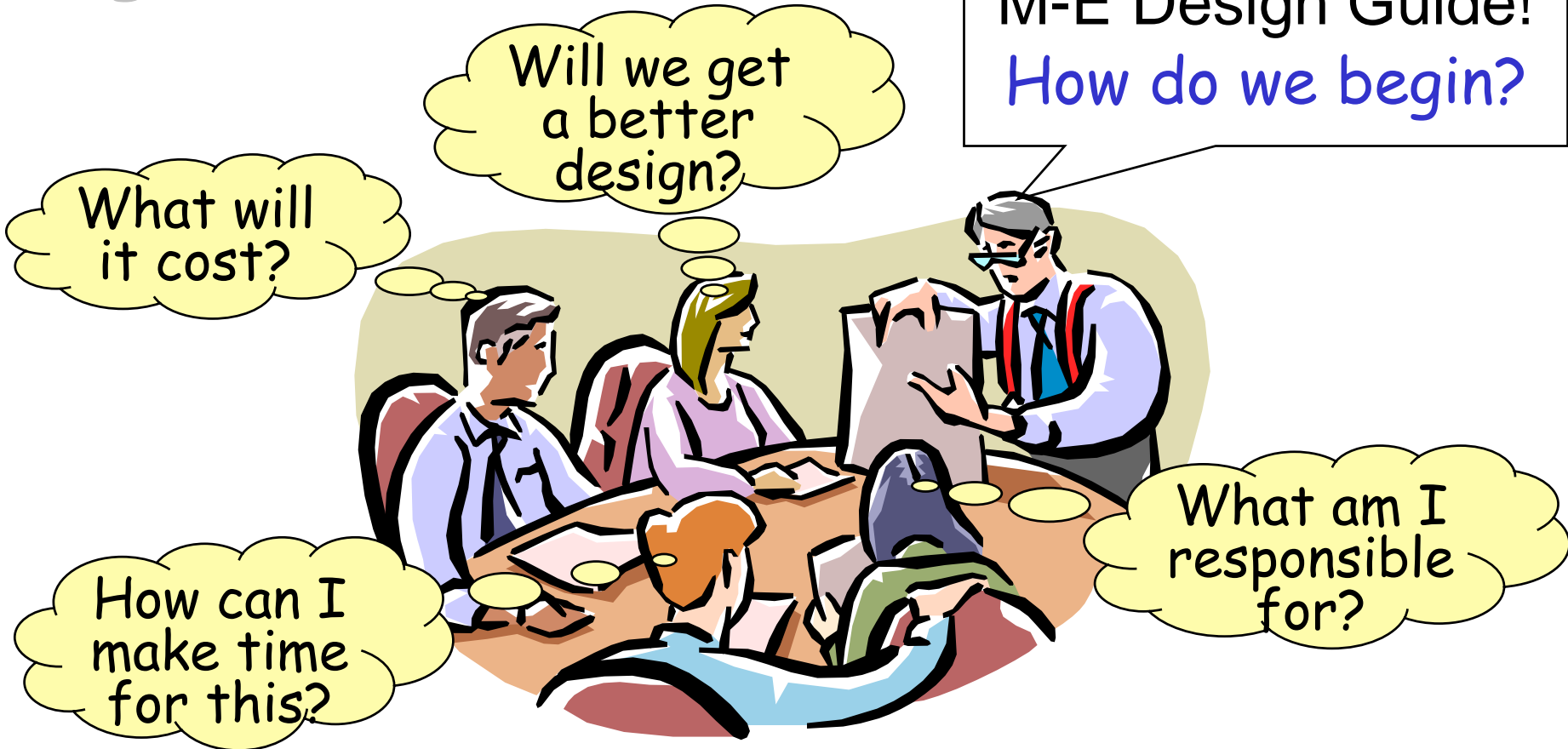


# On-Going Local Implementation Studies and Efforts



# Many similar questions & issues between agencies.

We have decided to implement the new M-E Design Guide!  
How do we begin?





# *Important Activities for Implementation*



## ☀ Training:

- Determining inputs & using software.

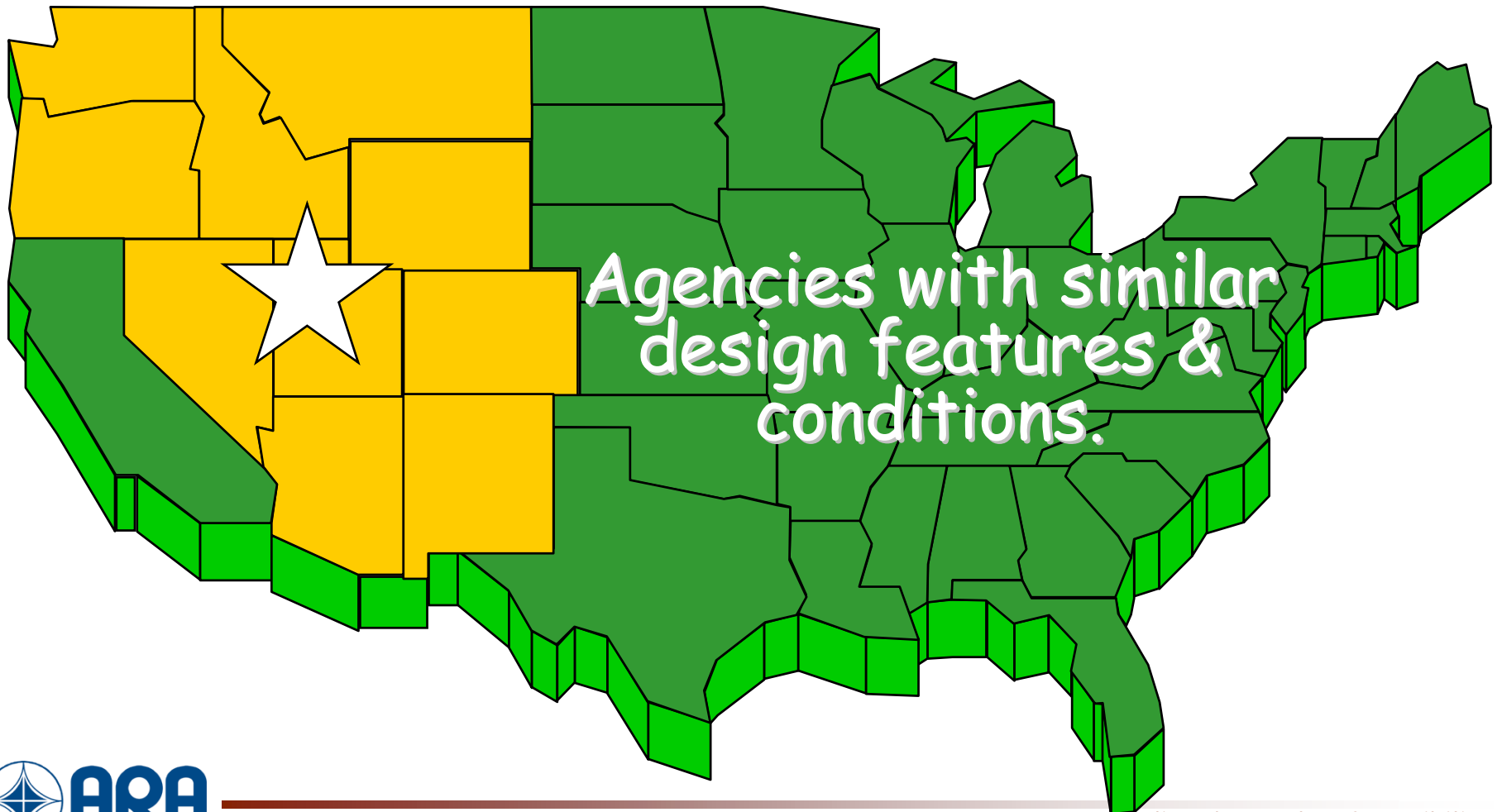
## ☀ Communication:

- Departments need to know what information is needed & how it is used.

☀ Establish sensitivity of inputs to distress

☀ Identify problem areas and solutions for software use

*Implementation Approach:  
Video conferencing to share successes,  
problems, & knowledge*



Agencies with similar  
design features &  
conditions.

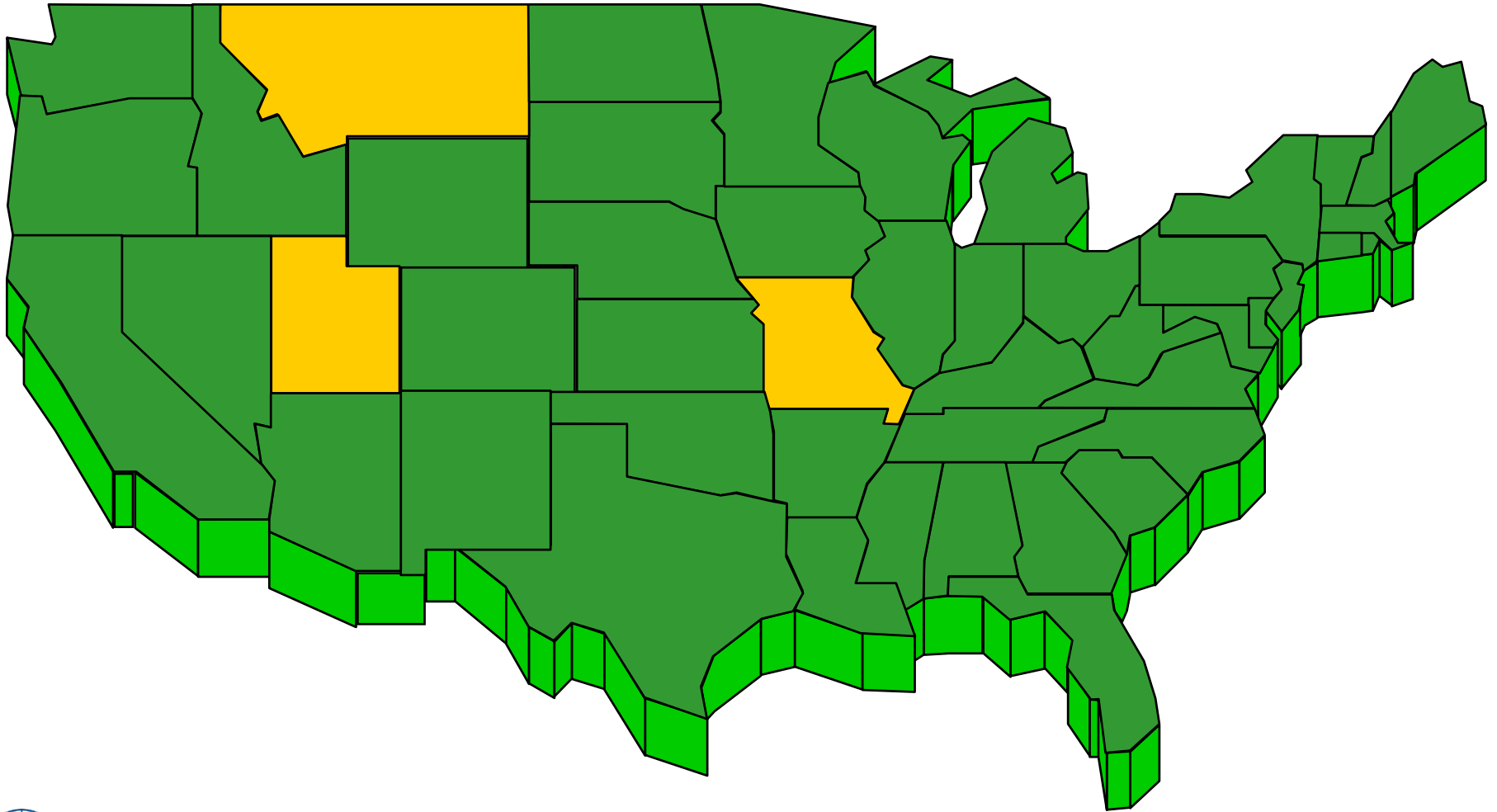
# *Implementation Areas & Technology Transfer*

Training & communications within & between departments

- ★ Traffic
- ★ Materials
- ★ Construction
- ★ Calibration



# *Implementation Issues: Highlights from 3 Agencies*



# *Traffic Characterization*

[Missouri, Montana, Utah Traffic Libraries]

- 
- ✪ **How many trucks?**
  - ✪ **What type of trucks?**
  - ✪ **How much do they weigh?**



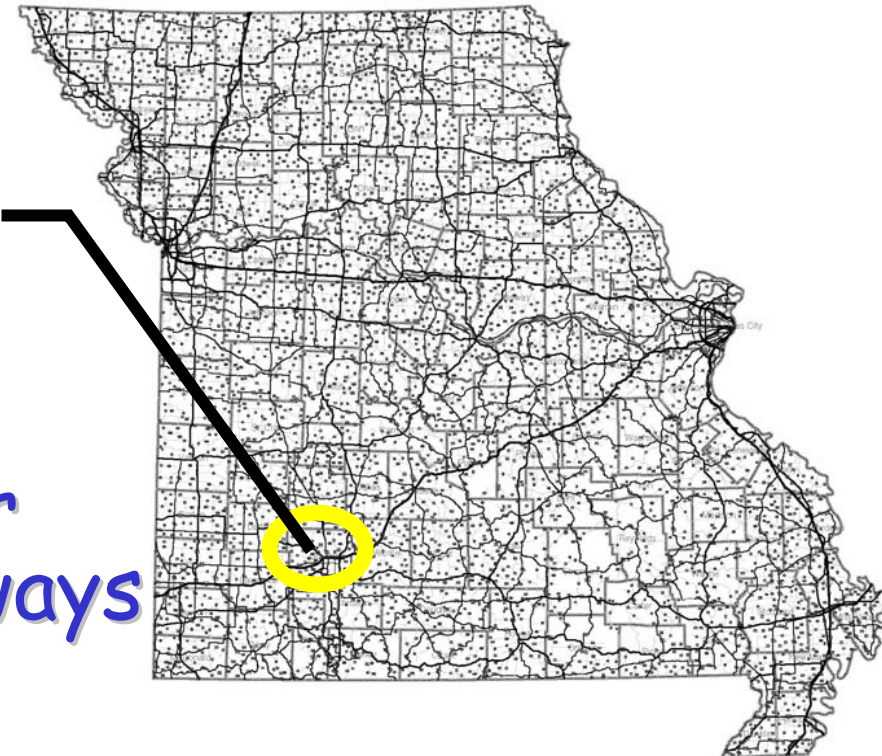
# Traffic Library Expectation

Missouri, Montana, & Utah:

Traffic volume & weight inputs for every state maintained roadway.

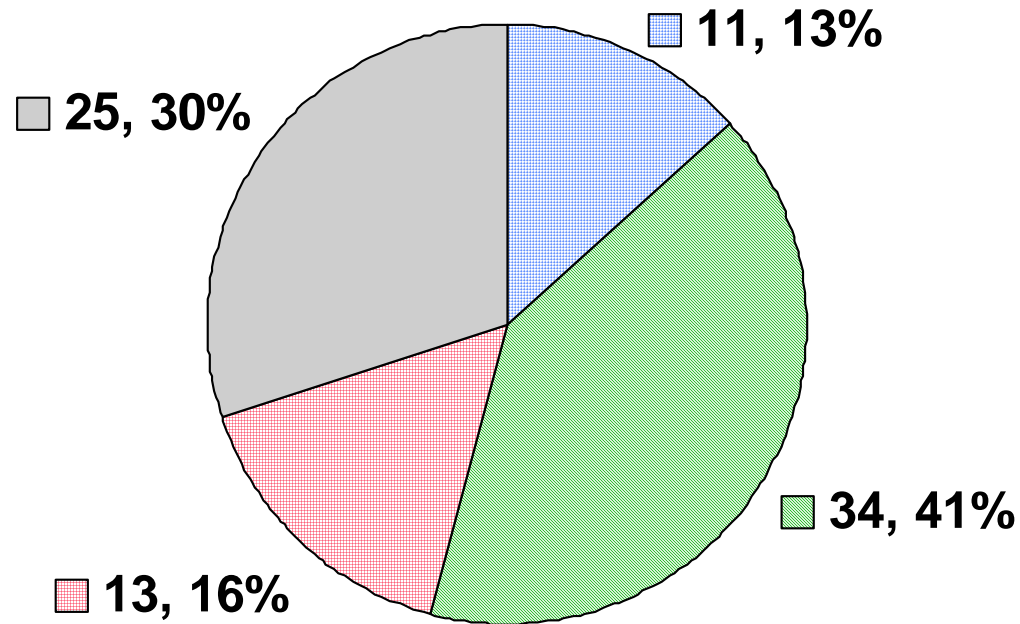
Overlay Project; traffic inputs obtained from library.

Share traffic data for primary arterial roadways





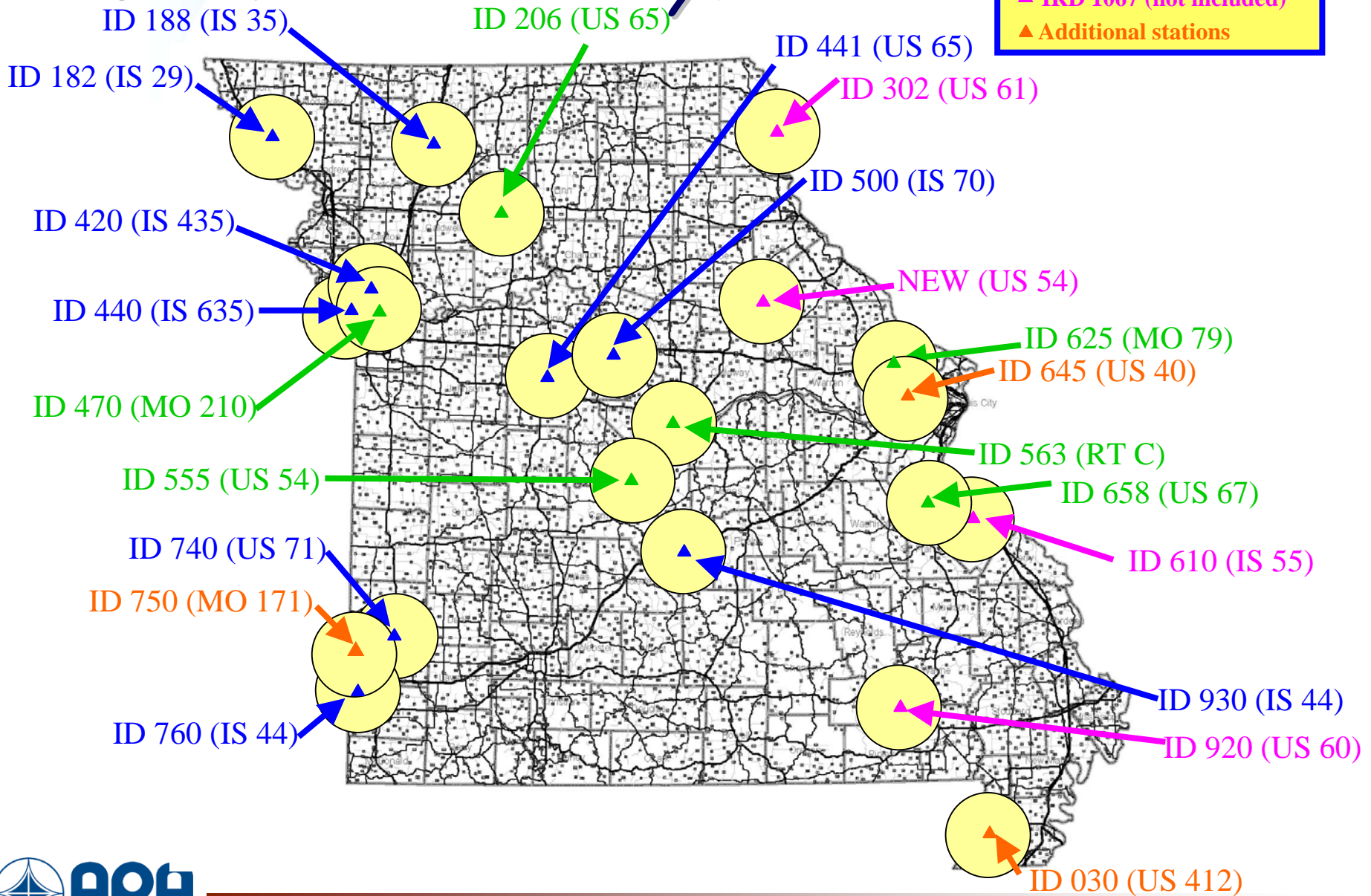
# Missouri DOT Traffic Data Collection Program



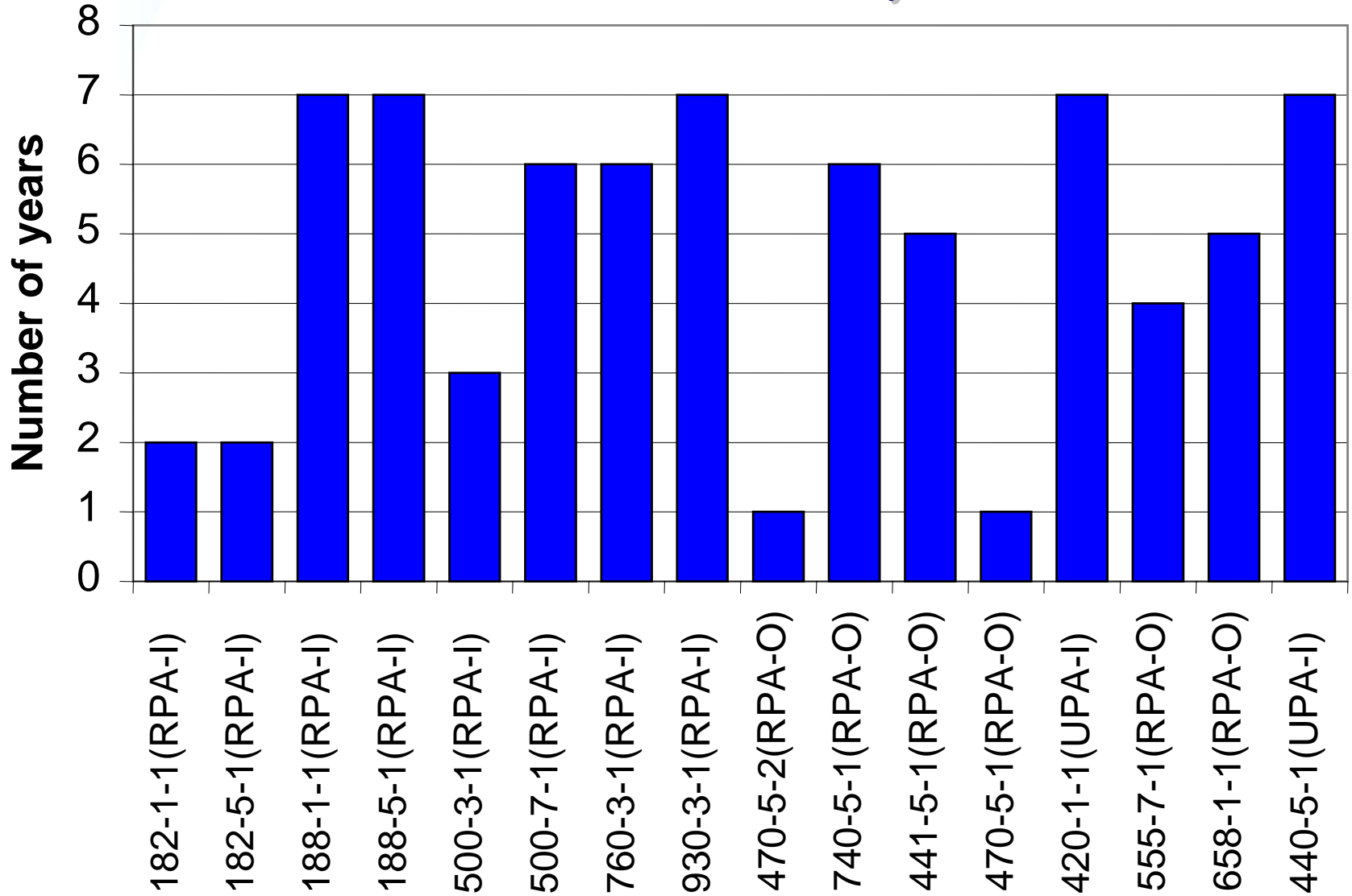
■ Count Sites ■ Class Sites ■ WIM (IRD 1067) ■ WIM (ADR 3000)

# WIM Sites Analyzed

- ▲ IRD 1067 WIM (included)
- ▲ ADR 3000 (included)
- ▲ IRD 1067 (not included)
- ▲ Additional stations

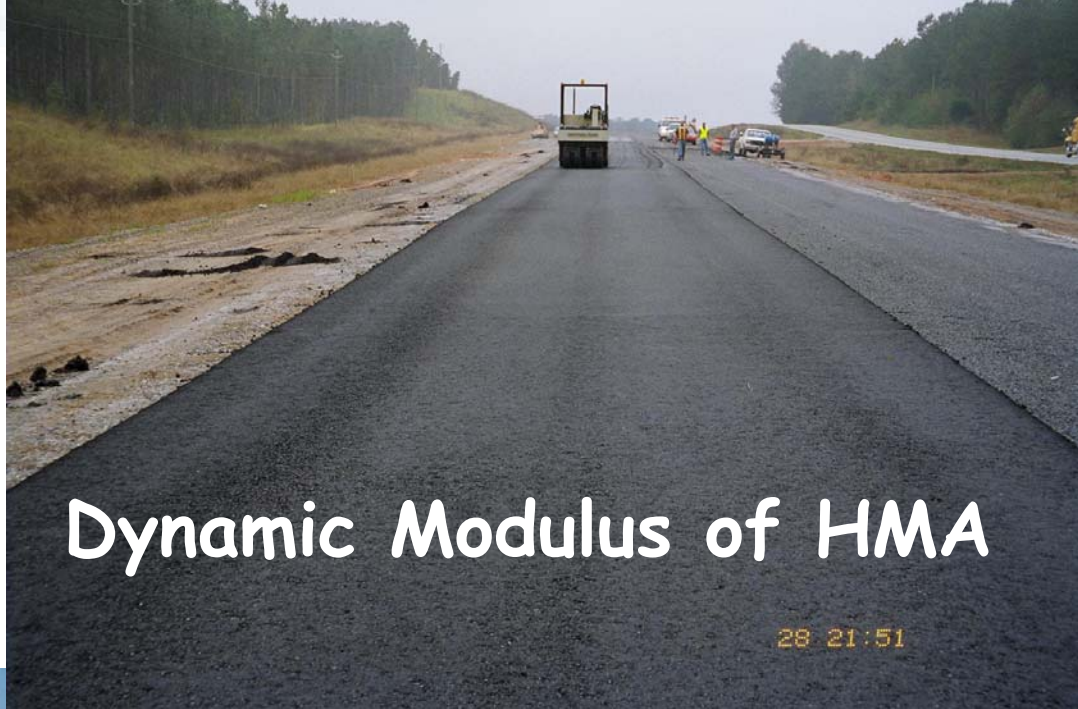


# WIM Data Availability - Years



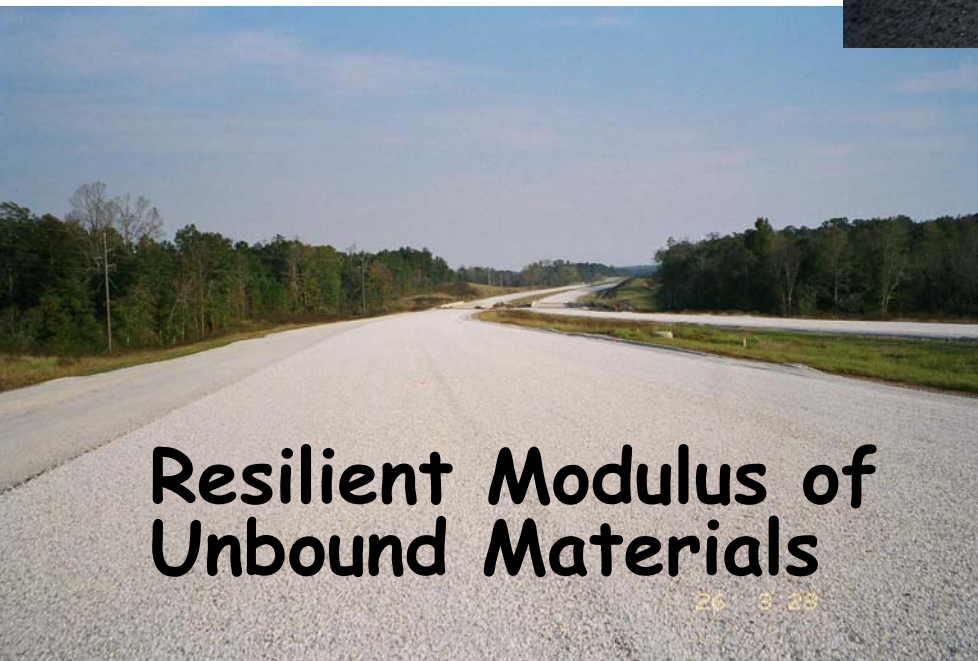
# Material Characterization

Material modulus is the key property.



Dynamic Modulus of HMA

28 21:51



Resilient Modulus of Unbound Materials

26 8:28



Static Modulus of concrete



# Material Testing - Equipment Purchased for Implementation

## Unbound Mtls.

- ✱ Montana - No
- ✱ Missouri - No
- ✱ Utah - Yes

## HMA

- ✱ Montana - No
- ✱ Missouri - Yes
- ✱ Utah - Yes

## PCC

Most agencies have equip.



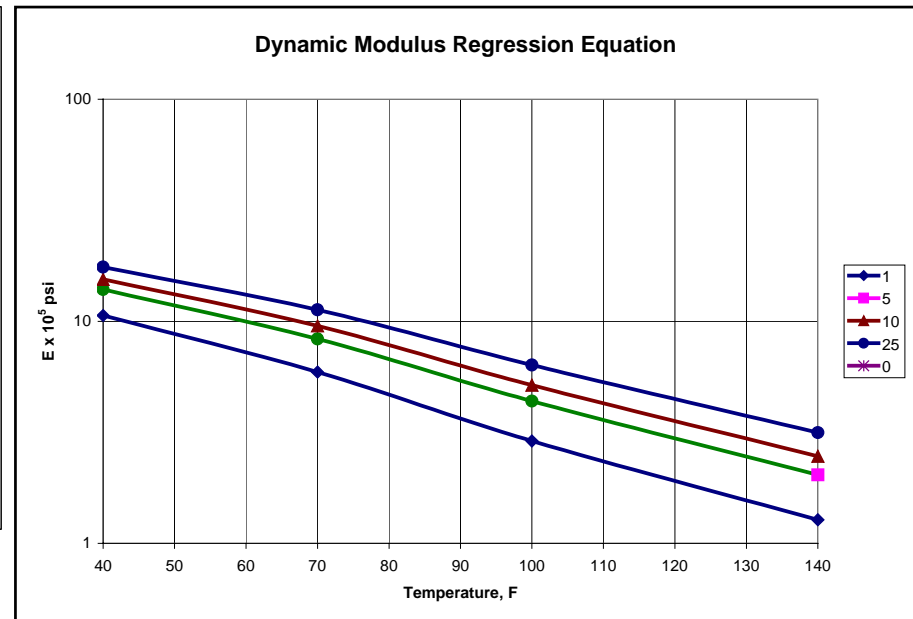
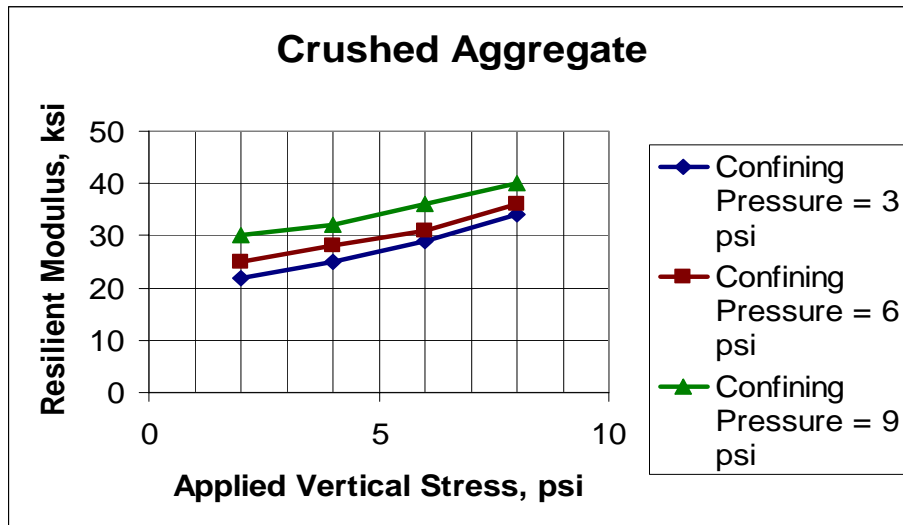
# Material Property Library

Resilient modulus for standard materials

- ✿ Laboratory testing
- ✿ DCP or FWD testing

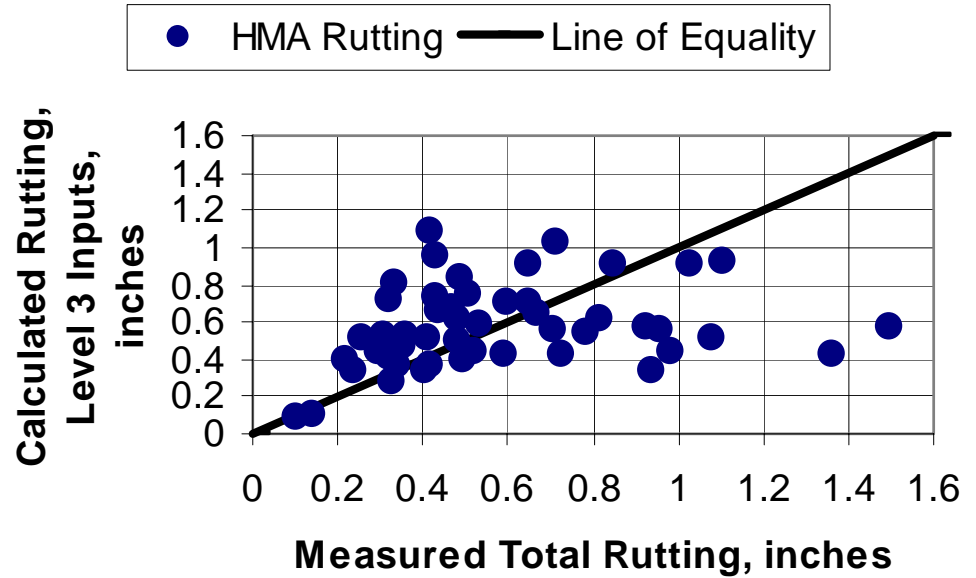
Master curve for typical HMA mixtures

- ✿ Laboratory testing
- ✿ Volumetric properties





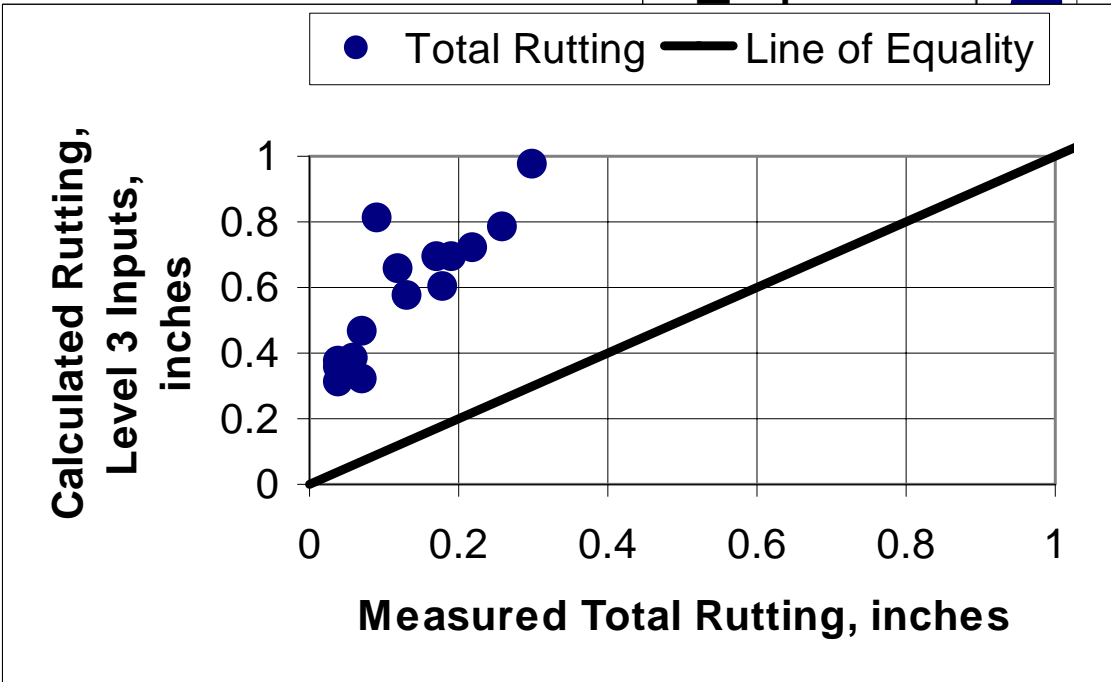
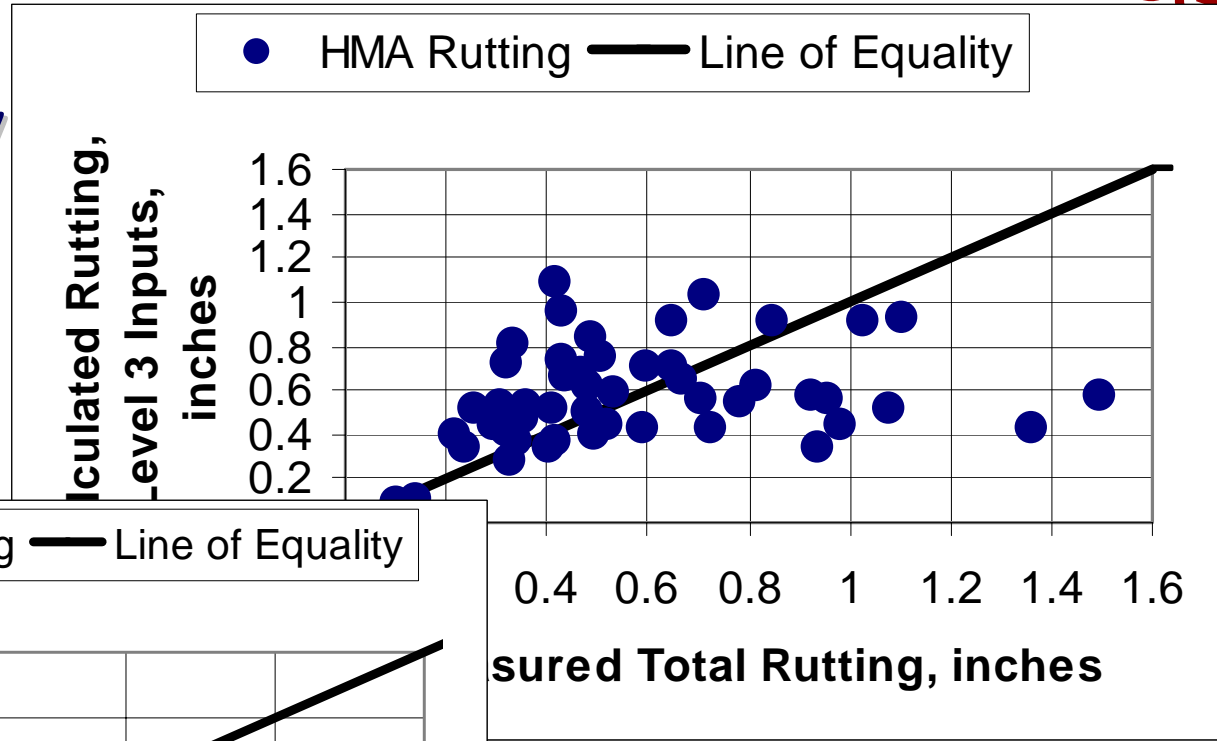
# Local Calibration



A difficult & costly issue to resolve!

6/13/2000 8:28am

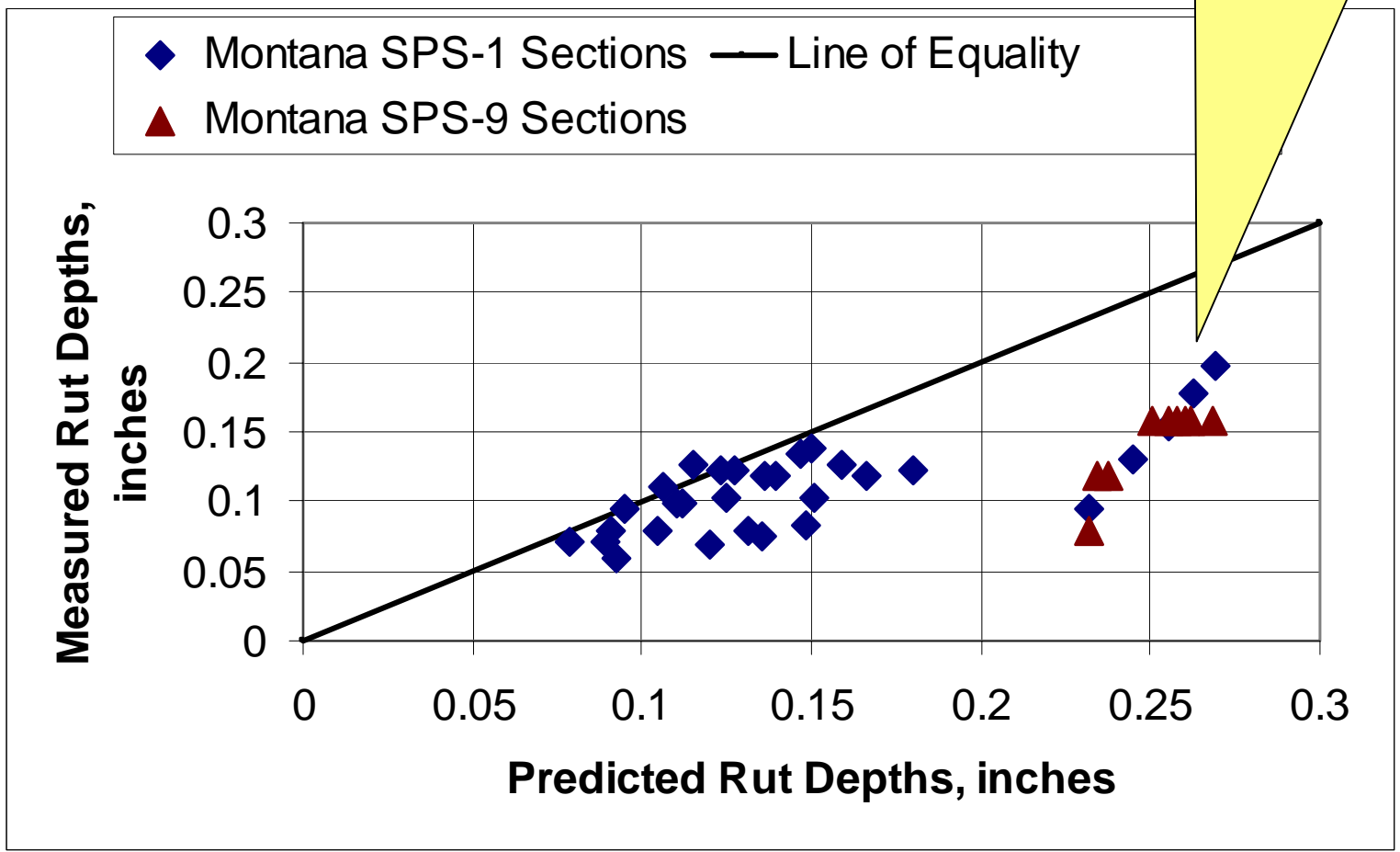
# Comparison of Predicted & Measured Rutting



# Predicted & Measured Distress

M-E PDG

Why are these so different?

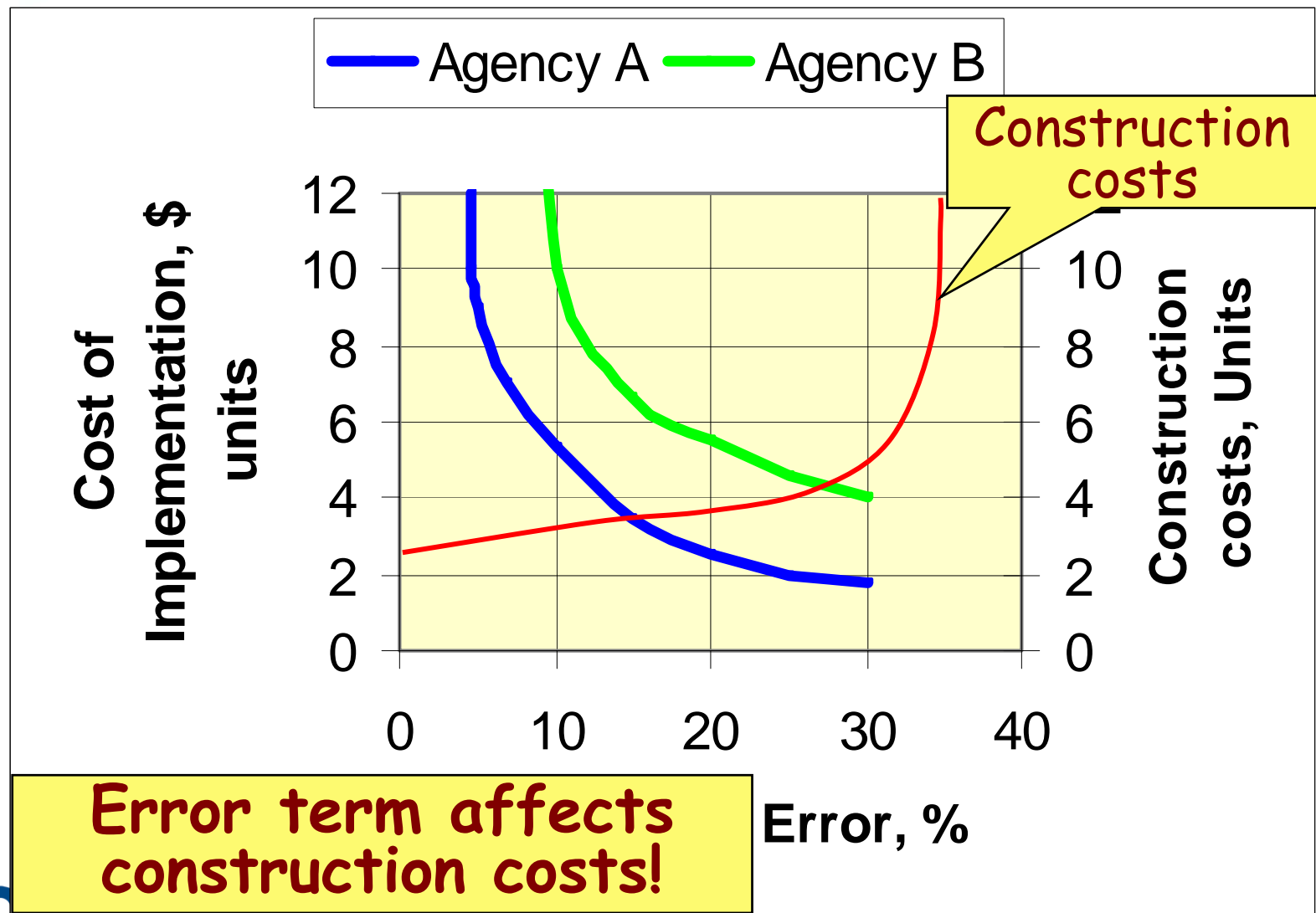


# Local Calibration Effort

- ✳ How close is close enough?
- ✳ Calibration costs exponentially increase with a reduction in error term!

Missouri	Rigid & Flexible	Correlate calibration factors to material parameters
Montana	Flexible & Semi-Rigid	Determine calibration factors for semi-rigid; develop correlations
Utah	Rigid & Flexible	Calibration – A future activity

# Accuracy of Designs & Costs

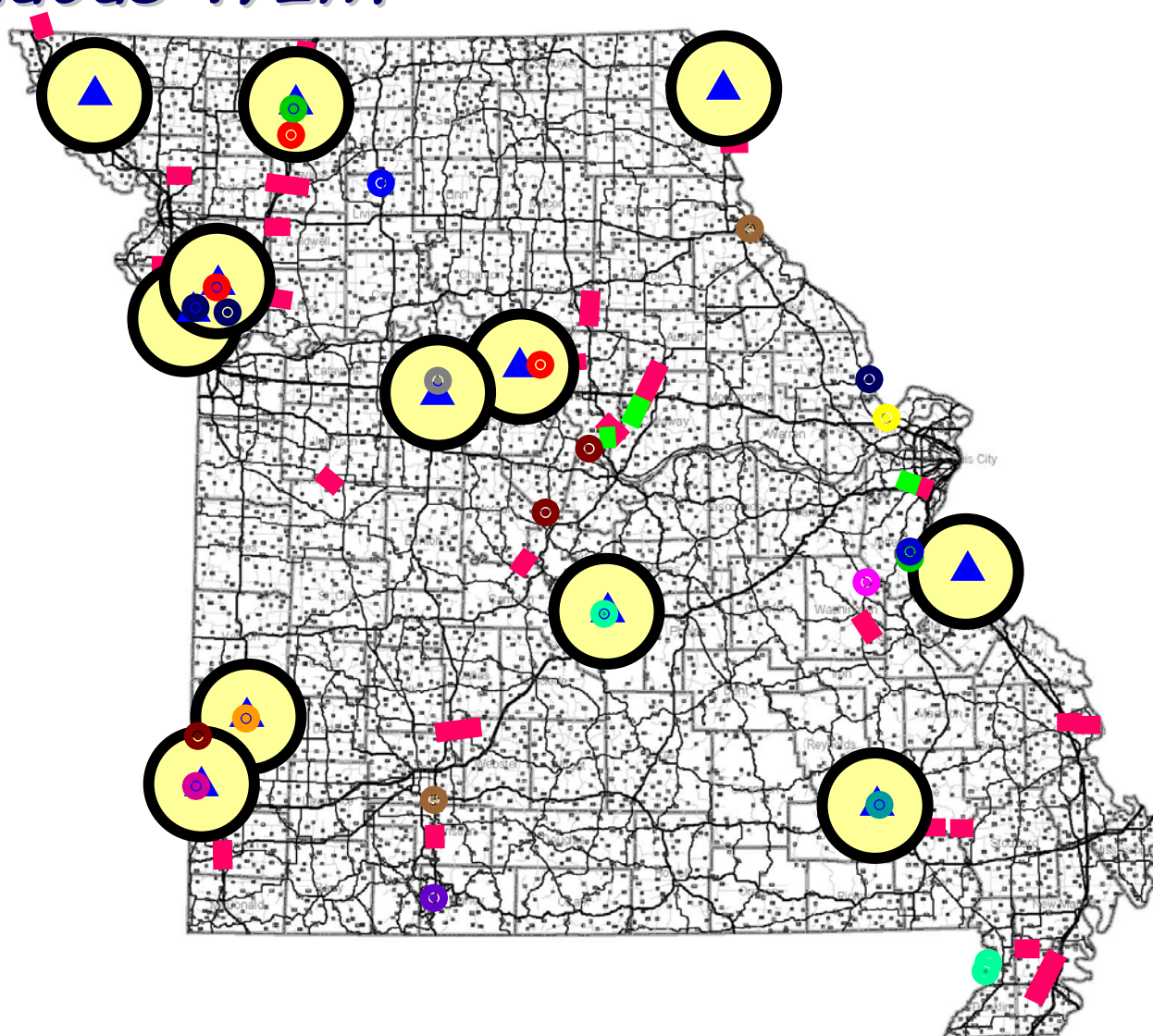


## *Local Calibration - Number of Sites*

<b>Agency</b>	<b>Type of Sites</b>	<b>Number</b>
Missouri	LTPP & Non-LTPP	HMA – 50+ PCC – 30+
Montana	LTPP & Non-LTPP	HMA – 40+ PCC – 0
Utah	LTPP & Non-LTPP	Limited



# Coverage - Local Calibration Sections & <sup>M-E PDG</sup> Continuous WIM



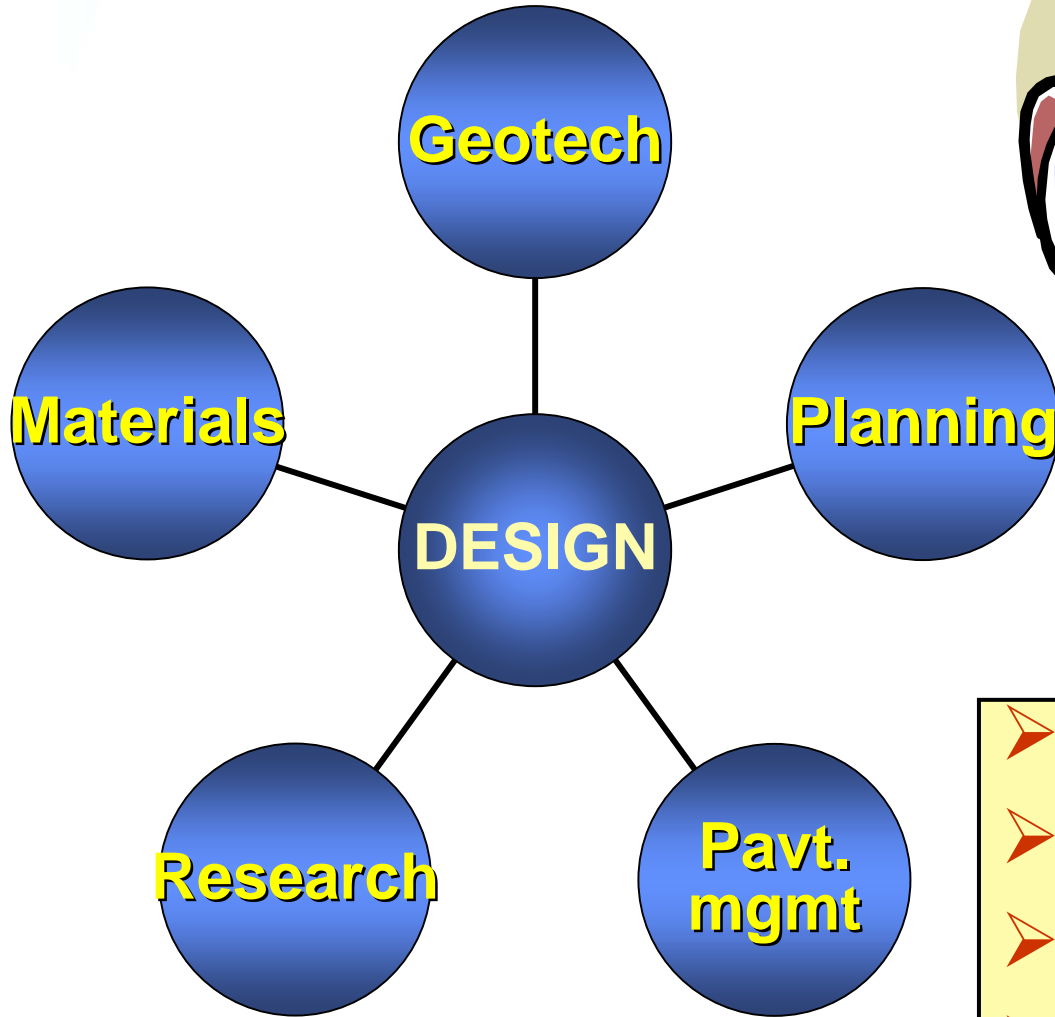
- ⊙ GPS 1/SPS 3
- ⊙ GPS 4
- ⊙ GPS 4/SPS 4
- ⊙ GPS 5
- ⊙ GPS 6A
- ⊙ GPS 6B
- ⊙ GPS 7A/7S
- ⊙ GPS 7B
- ⊙ SPS 5
- ⊙ SPS 6
- ⊙ SPS A600
- ⊙ SPS 7
- ⊙ SPS 8
- ⊙ SPS 9A

# *Successful Implementation Plan*

M-E PDG

1. Top management and stakeholder support
2. Form a steering committee
3. Develop step-by-step action plan
  - ★ Methodical execution
  - ★ Use all available resources & existing data.
    - LTPP
    - Experimental Sections
    - Etc.

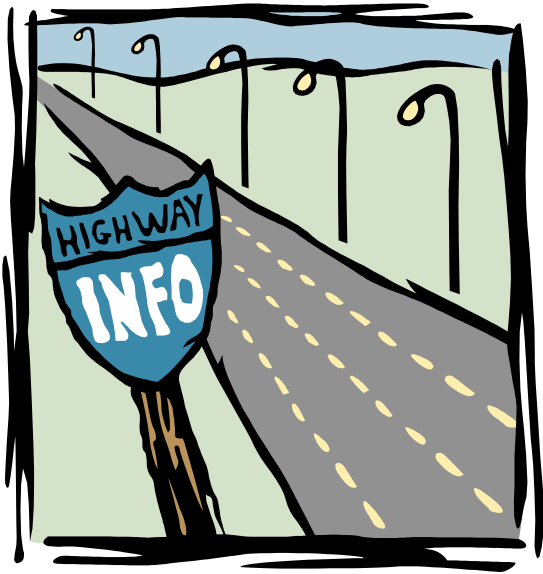
# Steering Committee



- Management
- Central office
- District offices
- Industry

# Action Plan

**Phase I -  
Assess needs and  
prepare work plan**



**Phase II -  
Execution of work plan**

**Phase III -  
Pilot project and future plans**

# *Technology Transfer & Implementation Products*

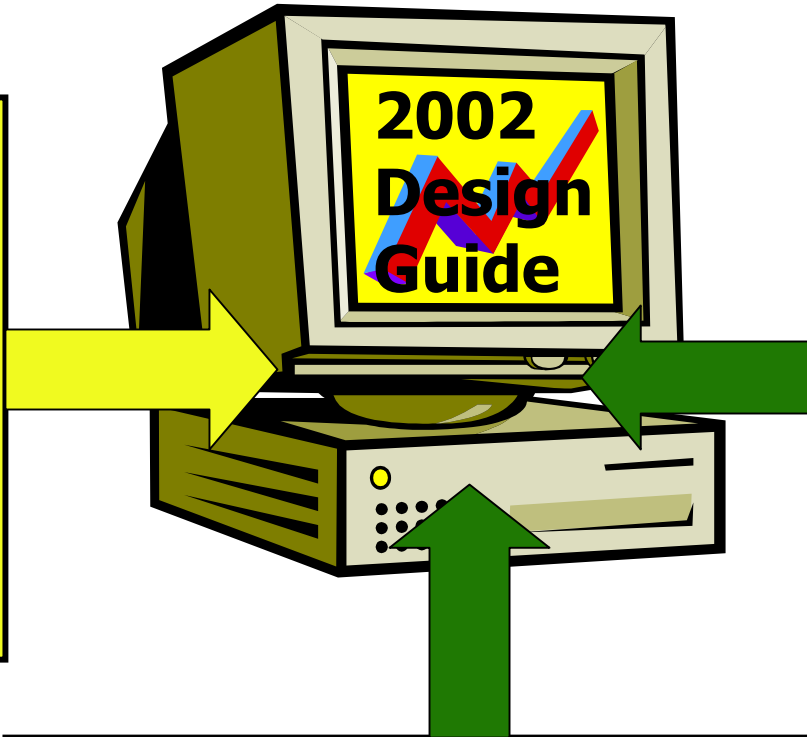
## **Available Products:**

- ✿ Management video
- ✿ Interactive CD for software
- ✿ Implementation notes
- ✿ Training course
- ✿ Guide text & appendices.
- ✿ User's Manual in support of software.



# Future Improvements

**NCHRP 9-30**  
Experimental Plan  
for Calibration &  
Validation of HMA  
Performance  
Models for Mix &  
Structural Design



**NCHRP 1-42**  
Top-Down  
Cracking of  
HMA Layers

**NCHRP 1-41**  
Selection of a Reflection  
Cracking Model for HMA Layers

# Summary

- ✿ Implementation will require a coordinated effort.
- ✿ Implementation should be completed through technology transfer:
  - Within departments of an agency
  - Between departments
  - Between agencies



# *Coordinated Effort Between Agencies*

## Similarities

- ✱ Share examples, experiences, data
- ✱ Populate database
- ✱ Materials testing

## Differences

- ✱ Material & construction specifications
- ✱ Maintenance strategies
- ✱ Policies

*Thank you for your  
attention.*



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