

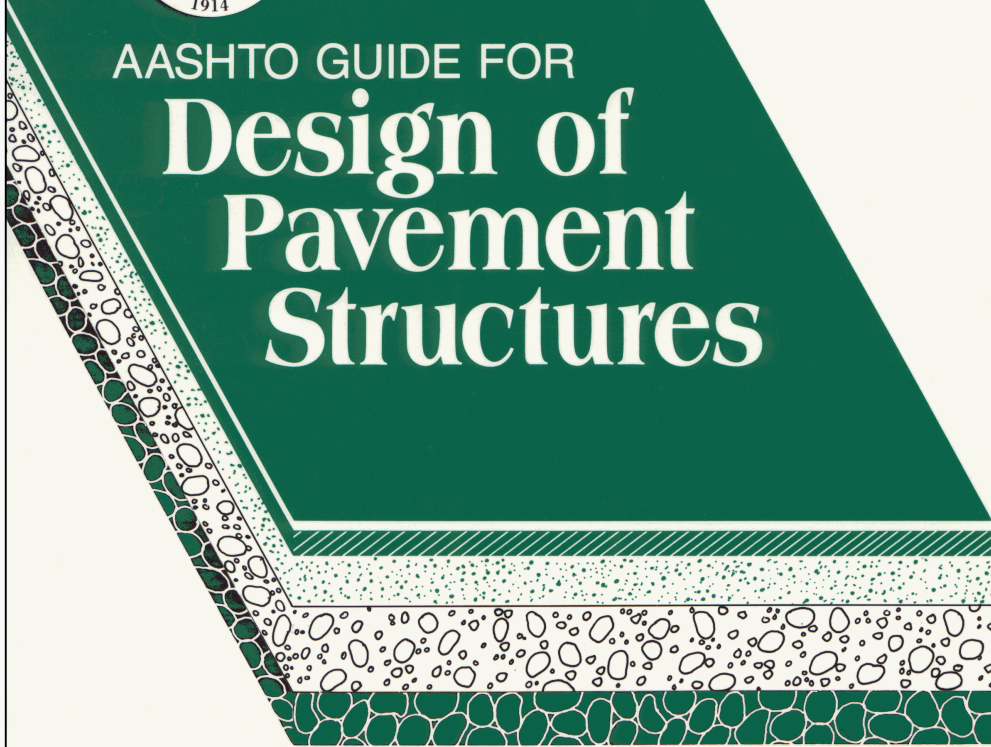
2002 Design Guide General Overview

2002 Southeastern Pavement
Management & Design Conference

June 24, 2002



AASHTO GUIDE FOR
**Design of
Pavement
Structures**

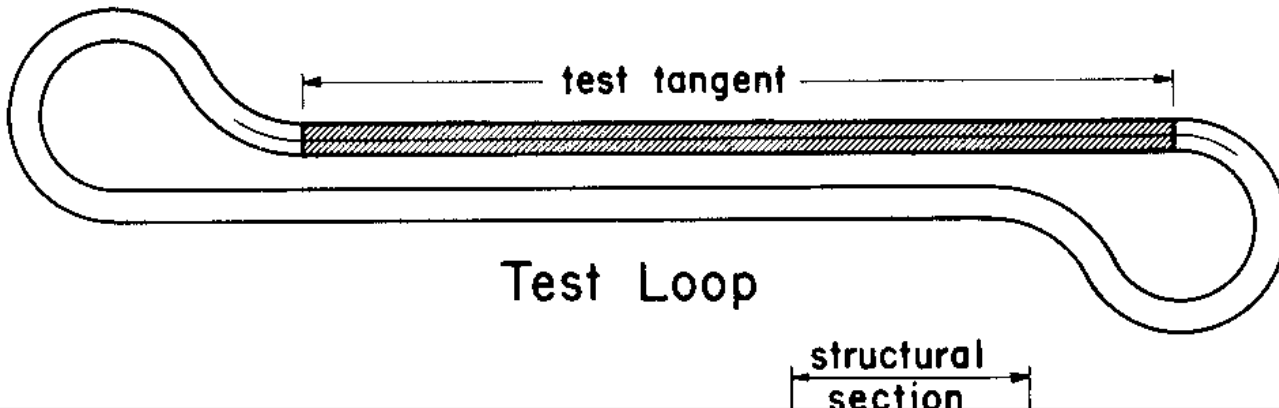
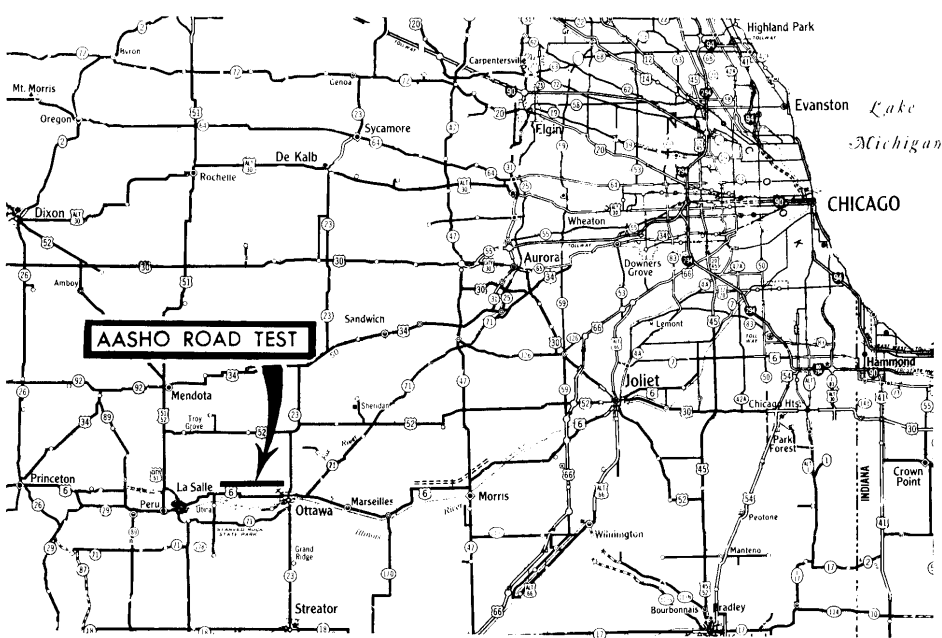


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Design Guide
NCHRP 1-37A

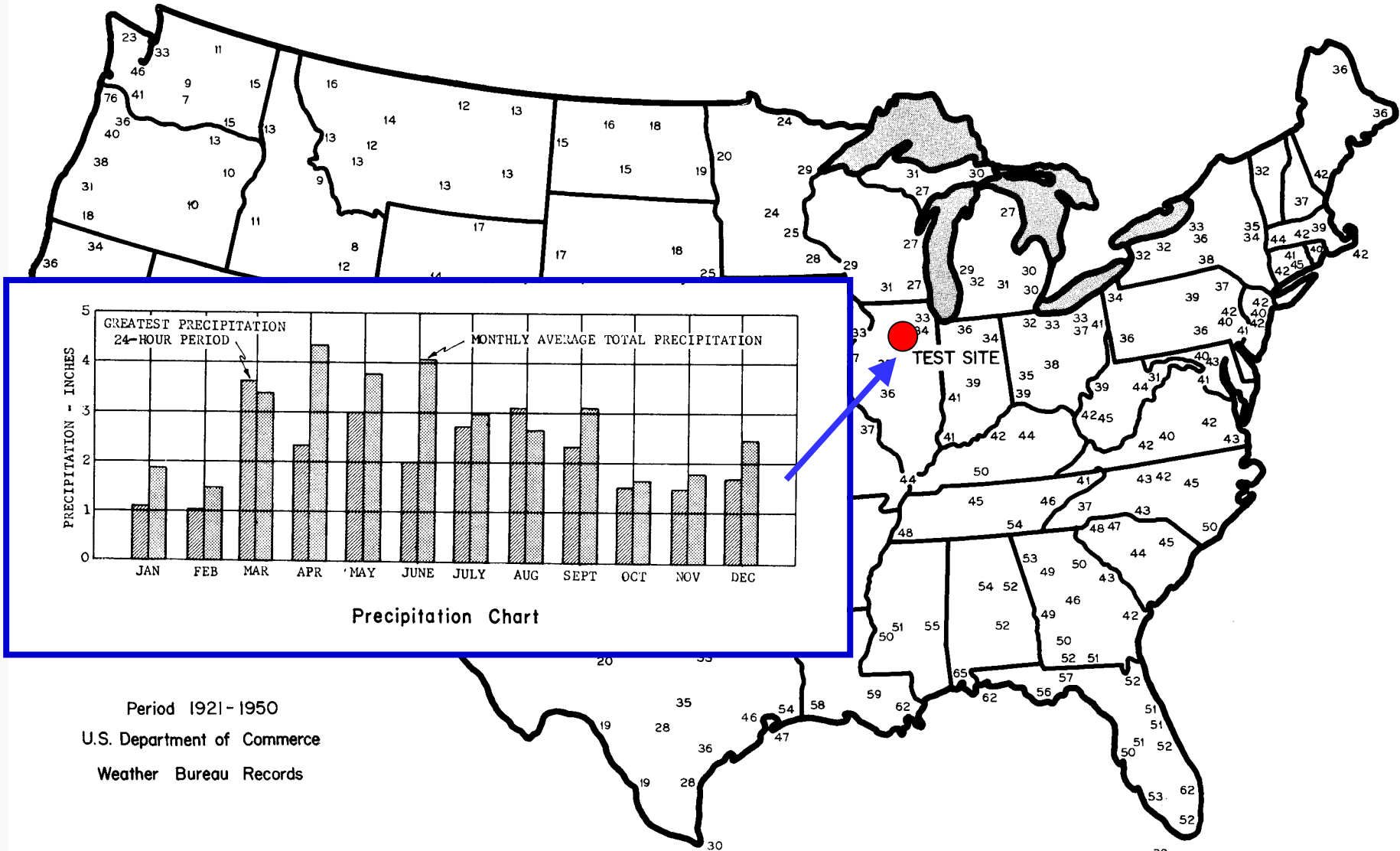
PUBLISHED BY THE
AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

1993 Version

AASHO Road Test (late 1950s)



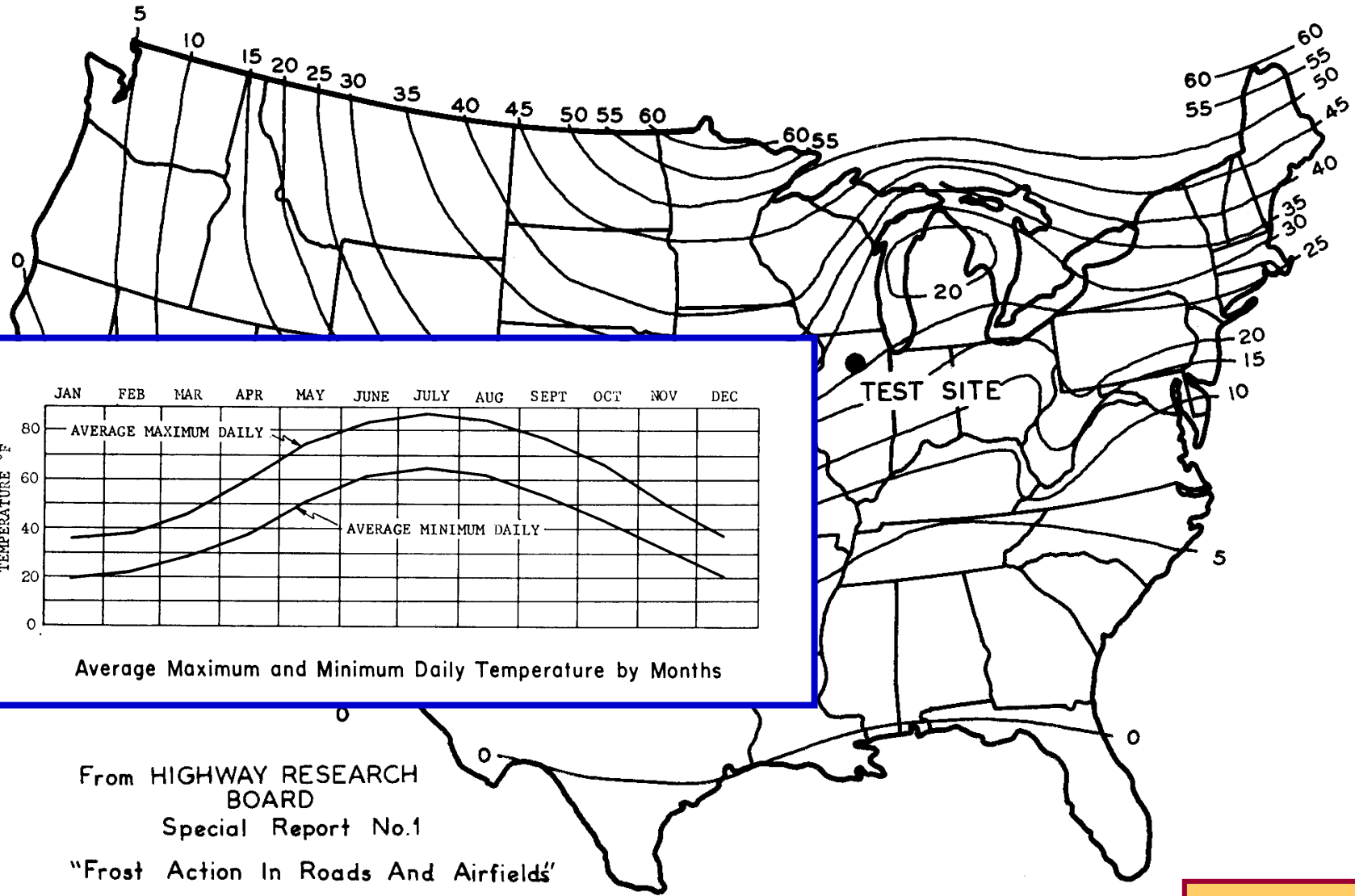
One Rainfall Zone...



Period 1921-1950
 U.S. Department of Commerce
 Weather Bureau Records

Figure 9. Average annual precipitation, in inches.

One Temperature Zone...



From HIGHWAY RESEARCH BOARD
Special Report No.1

"Frost Action In Roads And Airfields"

Figure 10. Average annual frost penetration, in inches.

(AASHO, 1961)

One Subgrade...



**A-6 / A-7-6 (Clay)
Poor Drainage**

Figure 16. Embankment construction, loop 1, using rotary speed mixers to process and adjust moisture content of soil

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(AASHTO, 1961)

Limited Set of Materials...

- One asphalt concrete
 - 3/4" surface course
 - 1" binder course
- One portland cement concrete (3500 psi @ 14 days)
- Four base materials
 - Well-graded crushed limestone (main experiment)
 - Well-graded uncrushed gravel (special studies)
 - Bituminous-treated base (special studies)
 - Cement-treated base (special studies)
- One uniform sand/gravel subbase

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Design Guide

NCHRP 1-37A

1950s Construction Methods...



Figure 57. Compacting subbase.



Figure 29. Bituminous concrete construction.

2002

Design Guide

(AASHTO, 1961) 7A

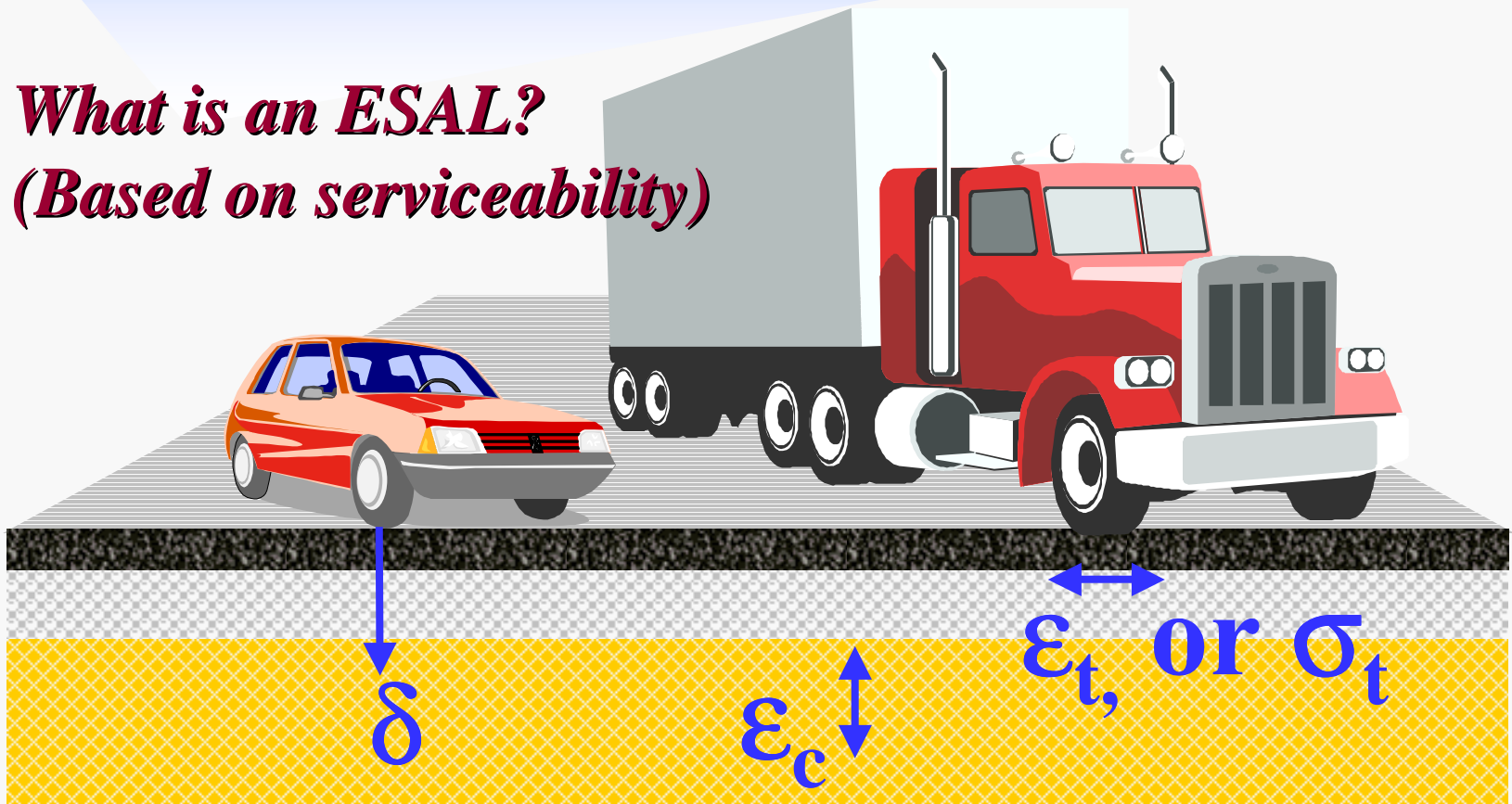
1950s Vehicle Loads...



Figure 23. Test vehicles, showing typical axle arrangements and loadings.

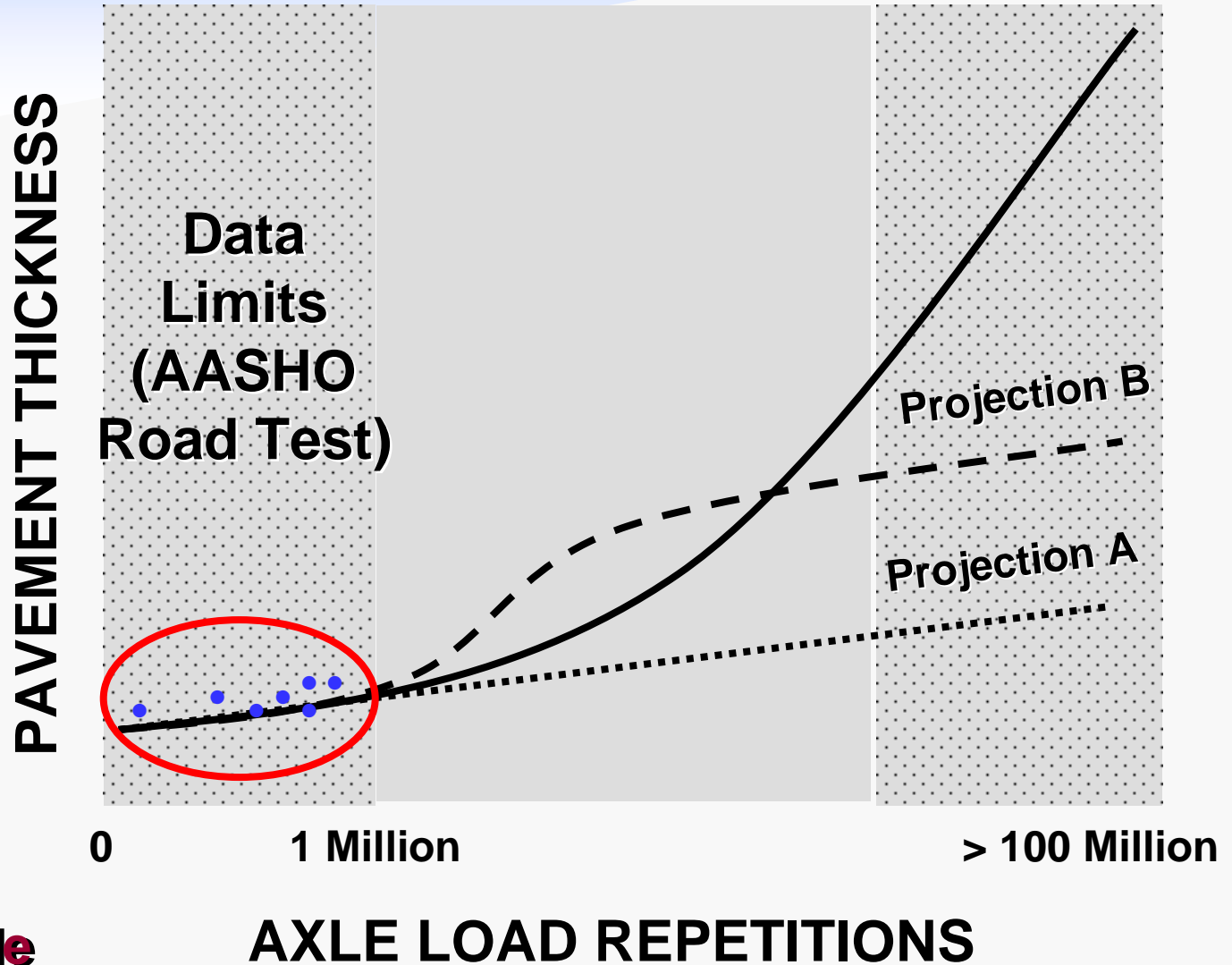
Traffic Input - ESALs

*What is an ESAL?
(Based on serviceability)*



*Which criterion?
(They don't all give the same result!)*

Limited Traffic Applications



1950s Data Analysis... (Empirical)



Figure 27. IBM tape-to-card printing punch.



Figure 26. Chart reader used with longitudinal profilometer to transcribe information to punched paper tape.



Figure 28. Bendix G 15-D computer at project.

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(AASHO, 1961)

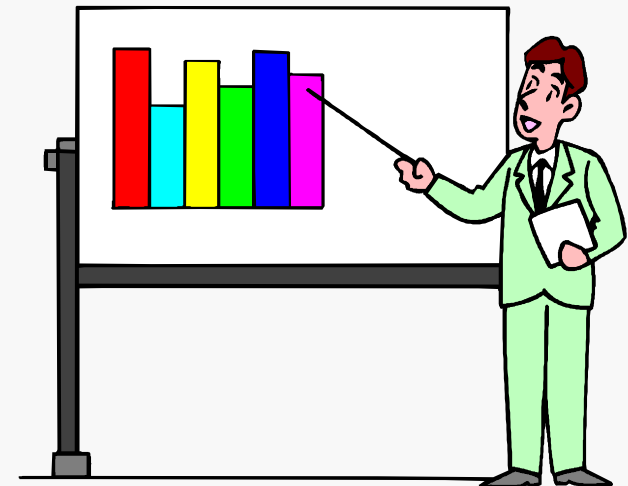
Field Performance - The LTPP Study



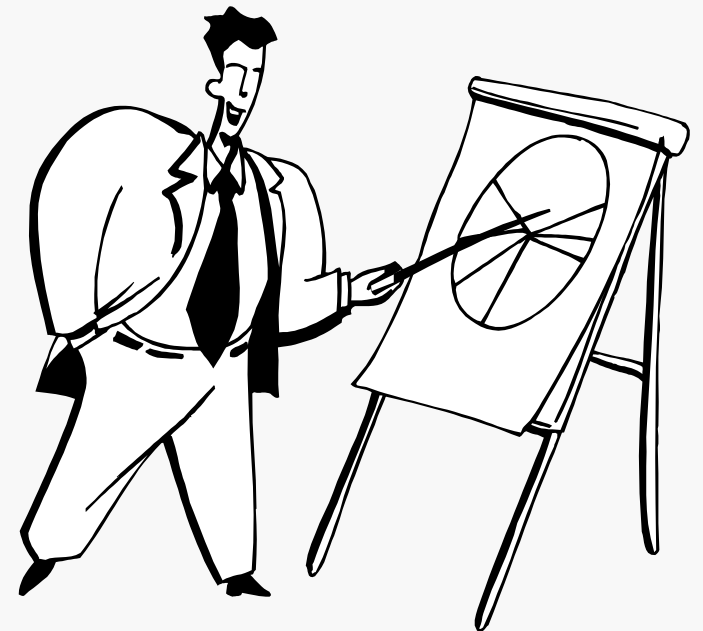
2002 Design Guide

1-37A Presentation Overview

- Status
- Flexible Pavements
- Rigid Pavements
- Rehabilitation
- Software Overview



The technical presentations on
model details and software
are on Tuesday.



NCHRP Project 1-37A

Development of the 2002
Guide for the Design of New
and Rehabilitated Pavements

Responsible NCHRP Staff Officer

Dr. Amir N. Hanna

Senior Program Officer



1-37A Project Team



Principal Investigator
John P. Hallin

Co-PI (Implementation)
Kenneth McGhee

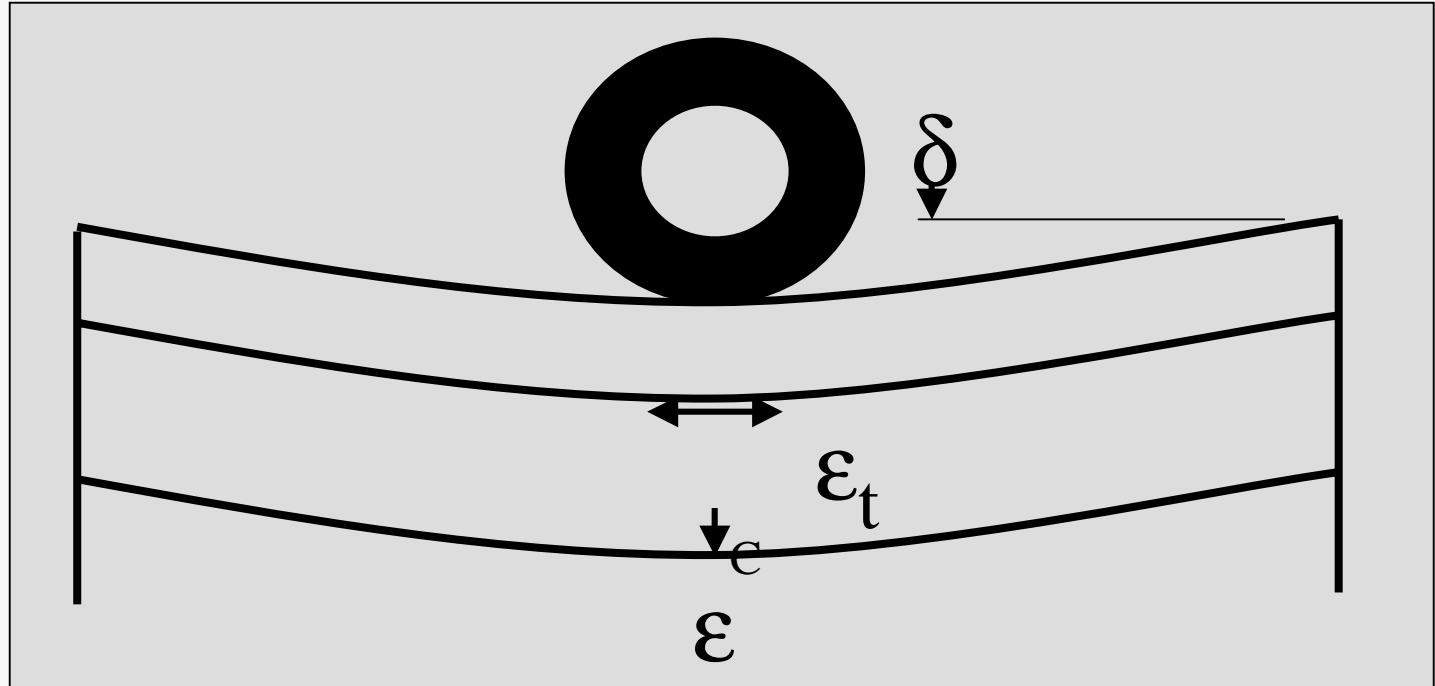
Flexible Pavement
Matthew W. Witczak

Rigid Pavement
Michael I. Darter

Resource Pool:
ERES-ARA; ASU; UMd;
Fugro-BRE; Consultants

Objective:

Develop the 2002 Guide for design of new and rehabilitated pavement structures based on M-E techniques.



Study Requirements

- Application/enhancement of existing state-of-the-art technology.
- Common design parameters across pavement types:
 - Materials & soils characterization
 - Climate parameters
 - Traffic characterization
 - Reliability

**Asphalt & PCC
Pavements Treated
Alike As Far As
Possible!**

1. Structural response models
2. Materials characterization
3. Traffic characterization
4. Climate modeling
5. Mechanistic distress models
6. Smoothness models
7. Calibration of models
8. Rehabilitation
9. Design reliability
10. 2002 Design Guide text
11. 2002 Software
12. Training-Implementation

2002



1997

Inputs important!
Many obstacles overcome to reduce number & complexity.

Asphalt & PCC Pavements Treated Alike As Far As Possible!



Soils & Materials
Climate
Traffic
Design Features

Design Inputs to aid implementation:

Hierarchical approach for determining design inputs to help implementation.

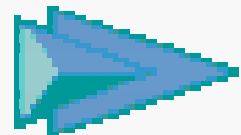
Input Level	Determination of Input Values	Knowledge of Input Parameter
1	Project/Segment Specific Measurements	Good
2	Correlations/Regression equations, Regional values	Fair
3	Defaults, Educated Guess	Poor

Products You Will See:

- Manuals
- Software



- Guidelines
- Test Procedures
- User's Manual
- Training Materials



Products You Will See:

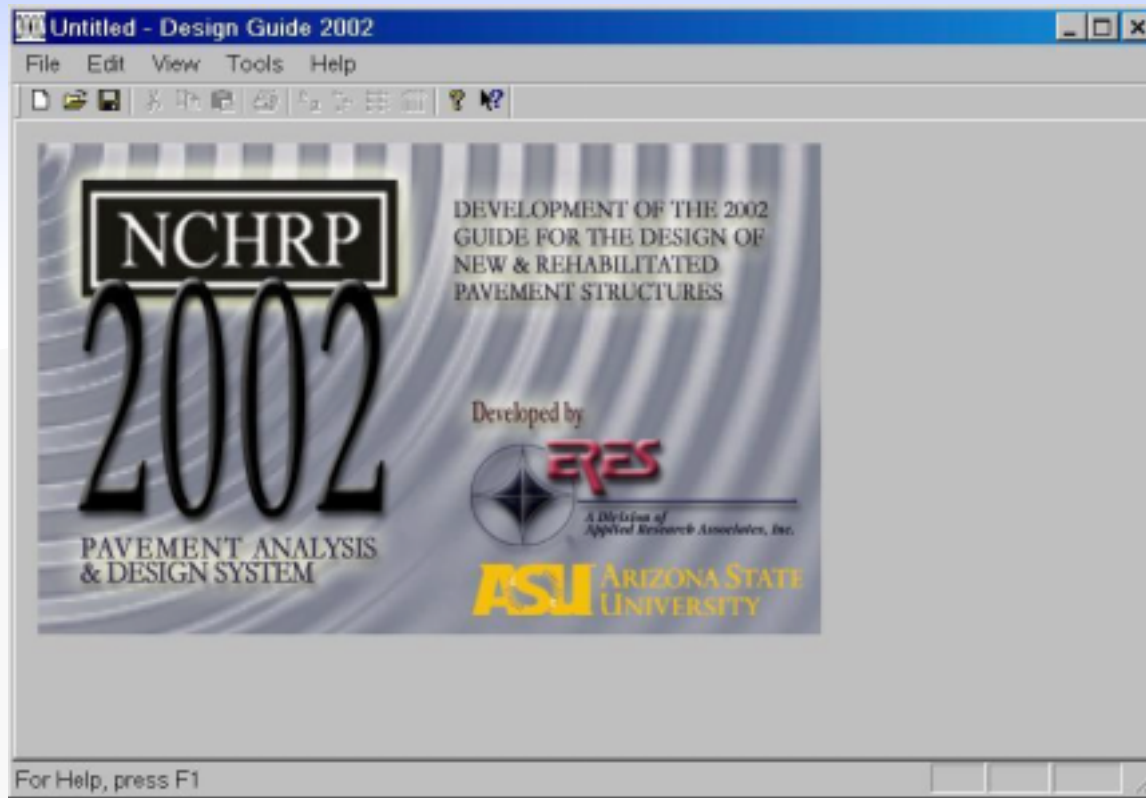


- ✓ Procedures for pavement, LCCA, traffic analysis
- ✓ Procedures for evaluating existing pavements
- ✓ Recommendations on rehabilitation treatments, subdrainage, and foundation improvements for problem soils

Products can be found on the
2002 Website:

www.2002designnguide.com

2002 DESIGN GUIDE SOFTWARE



2002
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NCHRP 1-37A

2002 Design Software Program

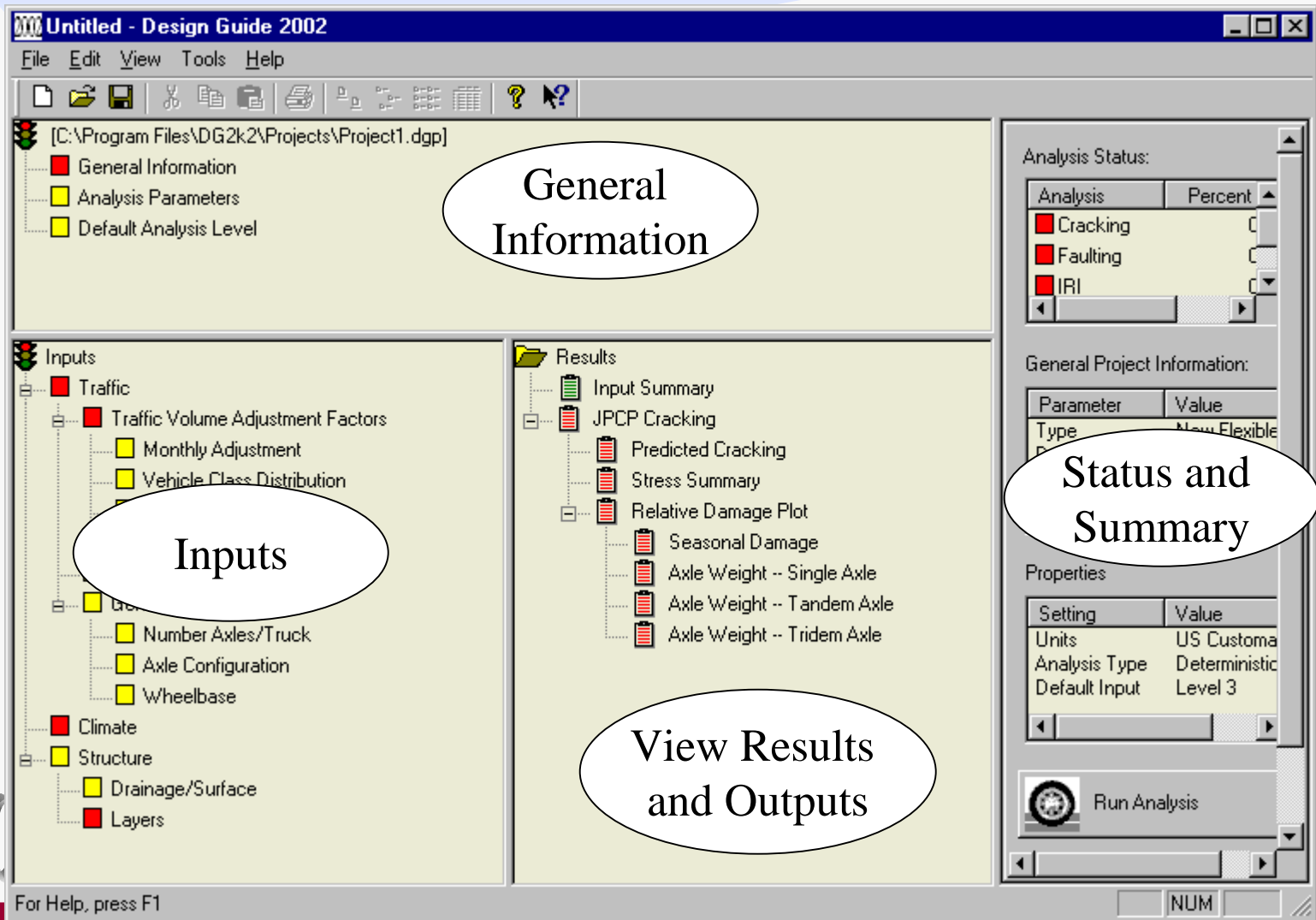
- Handles both U.S. Customary and SI units.
- User-friendly software with online/ on-screen help in two levels
 - Context sensitive help for all design inputs
 - Detail HTML help accessible from each screen
- Runs on Windows 98, 2000, NT, XP
- Hardcopy and electronic copy outputs (HTML and/or Excel Workbooks)

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Design Guide

NCHRP 1-37A

Program Layout



Color Coded Status Icons

The screenshot shows the Design Guide 2002 software interface. The left pane displays a tree view of project inputs, and the right pane shows analysis status and project information. Three callout boxes explain the color coding:

- Green:** Green to indicate completed inputs. This is shown for the 'General Information' and 'Default Analysis Level' items in the left pane.
- Yellow:** Yellow to indicate that default values will be used for the design. This is shown for items like 'Monthly Adjustment', 'Vehicle Class Distribution', 'Hourly Distribution', 'Axle Load Distribution Factors', 'General Traffic Inputs', 'Number Axles/Truck', 'Axle Configuration', and 'Wheelbase'.
- Red:** Red to indicate that these inputs are still needed for the design process. This is shown for 'Traffic', 'Traffic Volume Adjustment Factors', 'Traffic Growth Factor', 'Climate', 'Structure', and 'Layers'.

The right pane shows the 'Analysis Status' table:

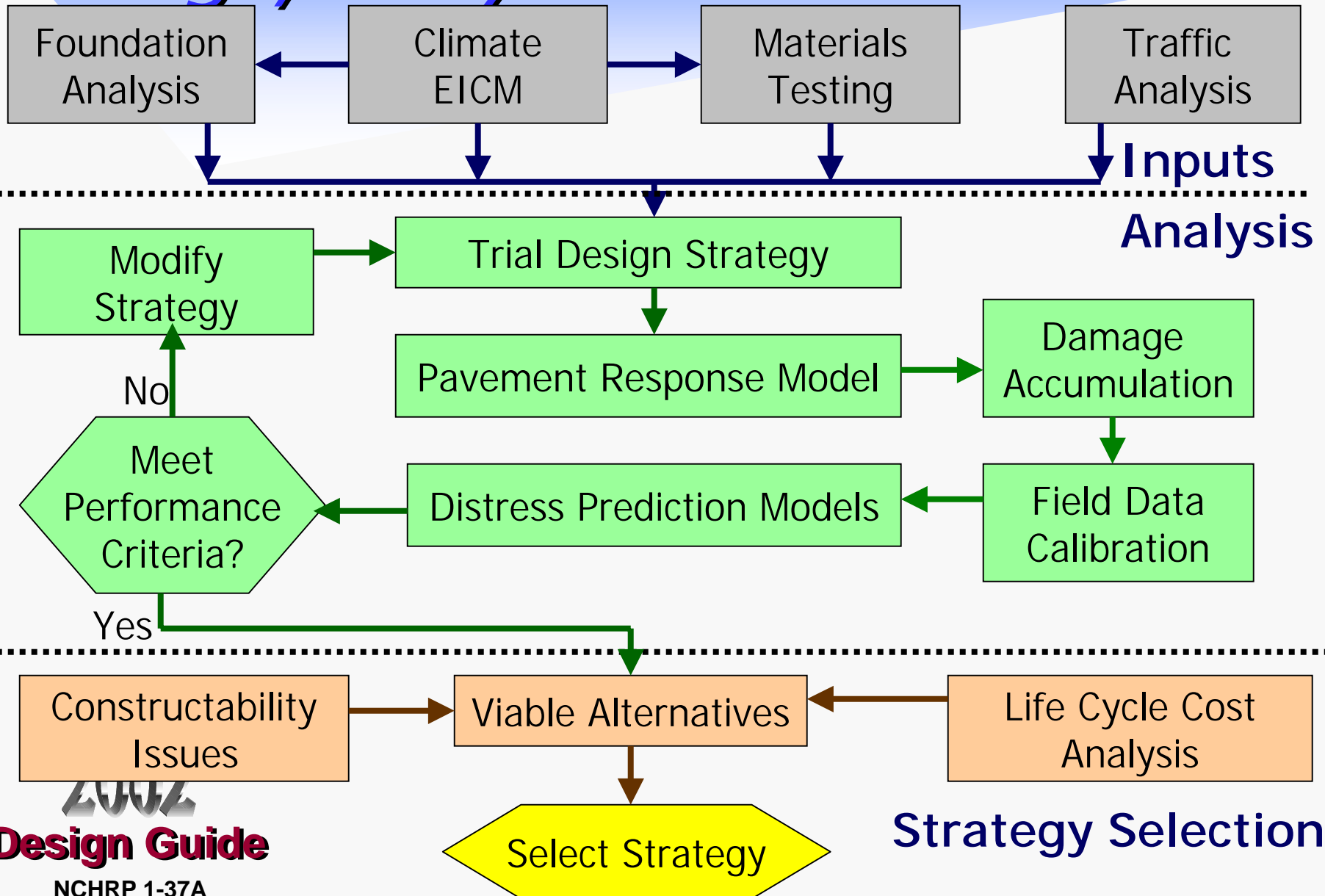
Analysis	Percent
Cracking	
Faulting	
IRI	

Below this is the 'General Project Information' table:

Parameter	Value
Type	New JPCP
Design Life	20 Years
Location	

At the bottom right, there is a 'Run Analysis' button and a 'NUM' button.

Design/Analysis Process



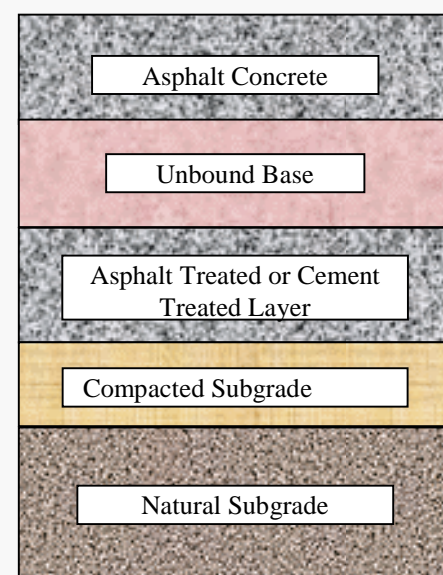
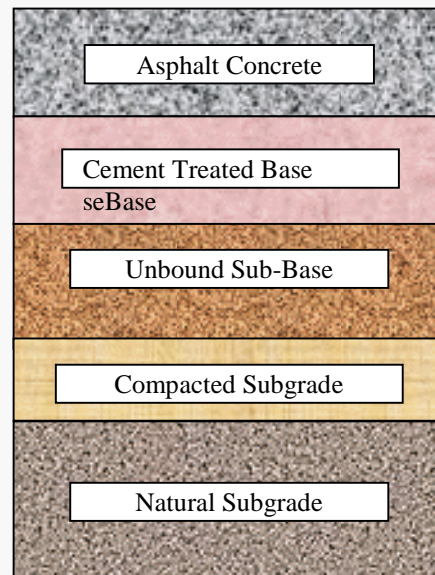
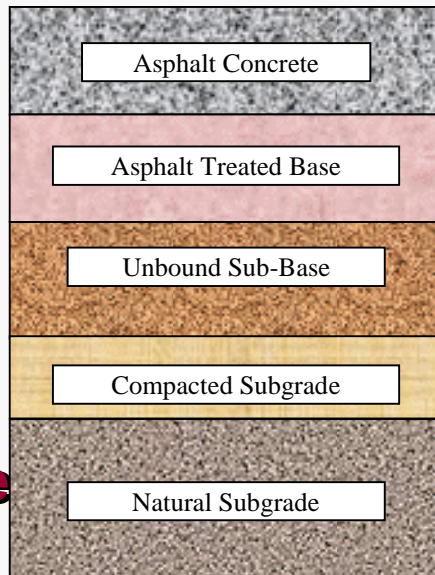
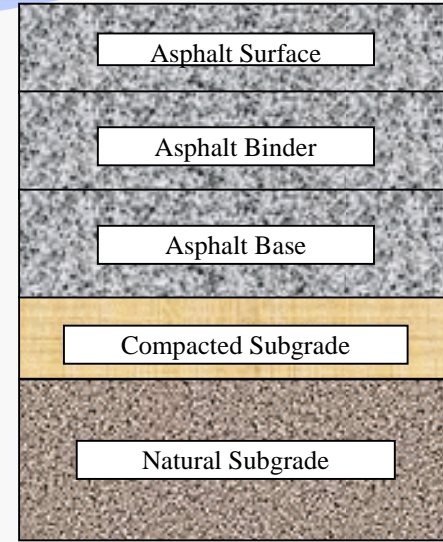
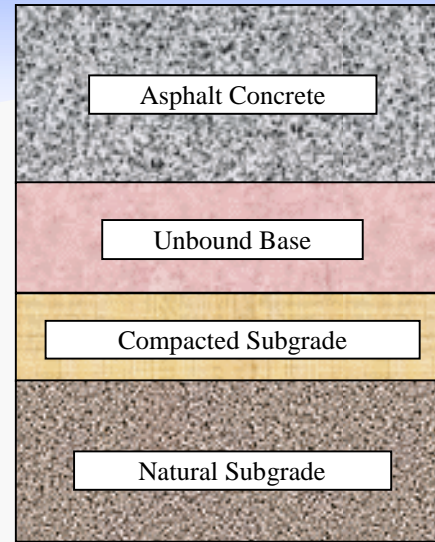
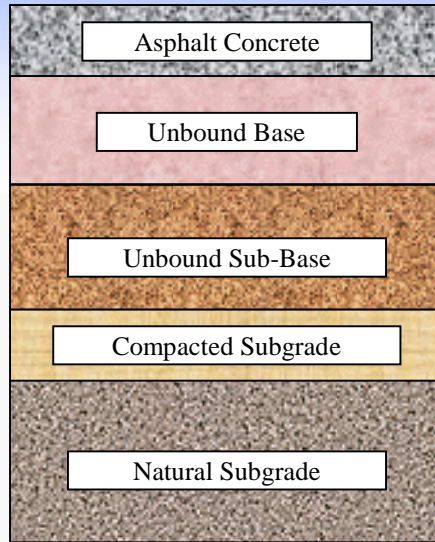


Traffic Inputs

2002 Design Guide Approach – Axle Load Spectra

- Axle load repetitions by
 - Vehicle class
 - Single axle
 - Tandem
 - Tridem
 - Quad
 - Special vehicles
 - Axle load group (load level)
 - Time
 - Monthly proportion
 - Hourly (PCC pavements) proportion
 - Annual growth

HMA Pavement Structures:



Predicted Distresses:

**Fatigue
Cracking**

**Longitudinal
Cracking**

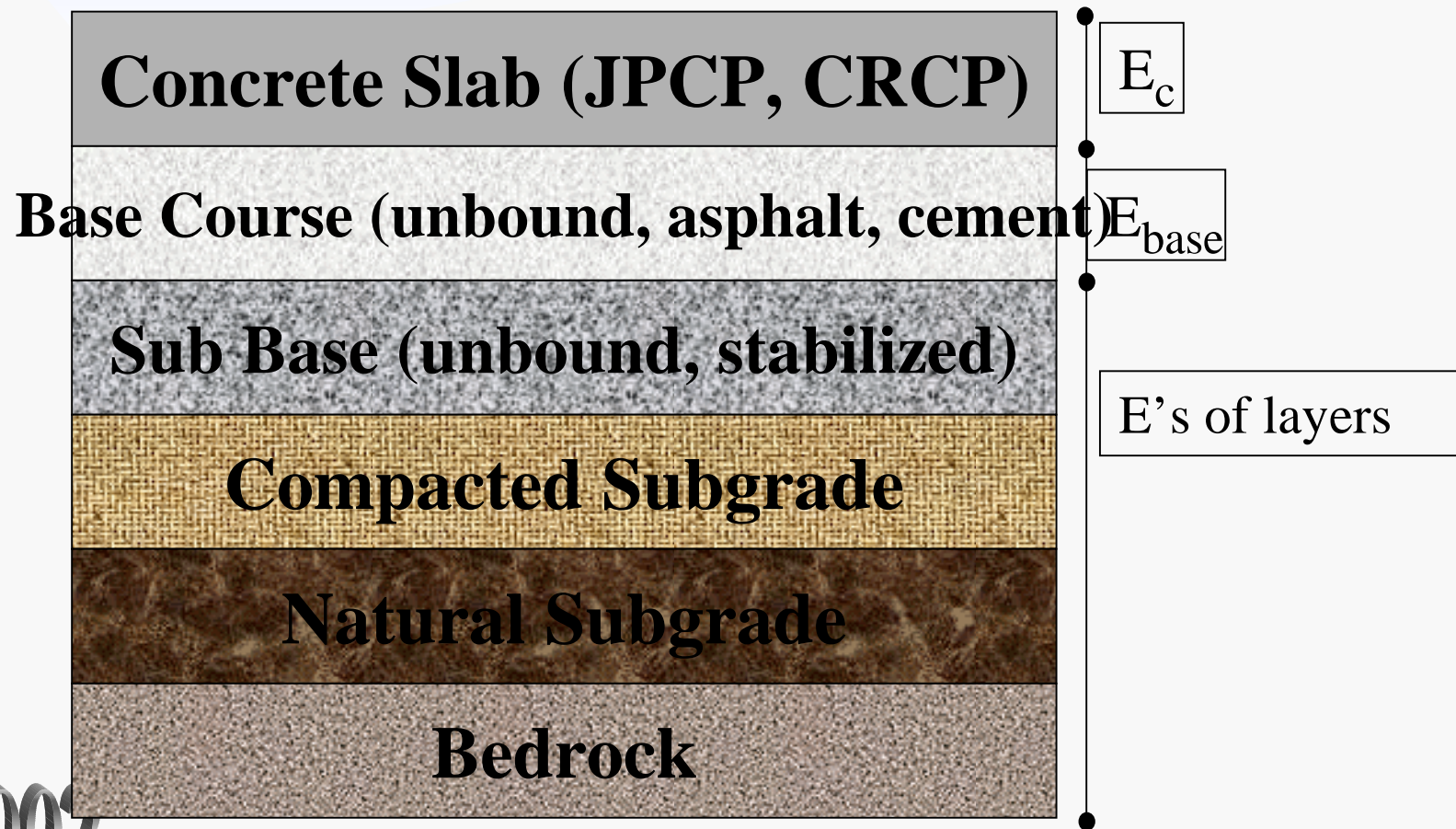
IRI

**Thermal
Cracking**

**Rut
Depths**



Concrete Pavement Structures



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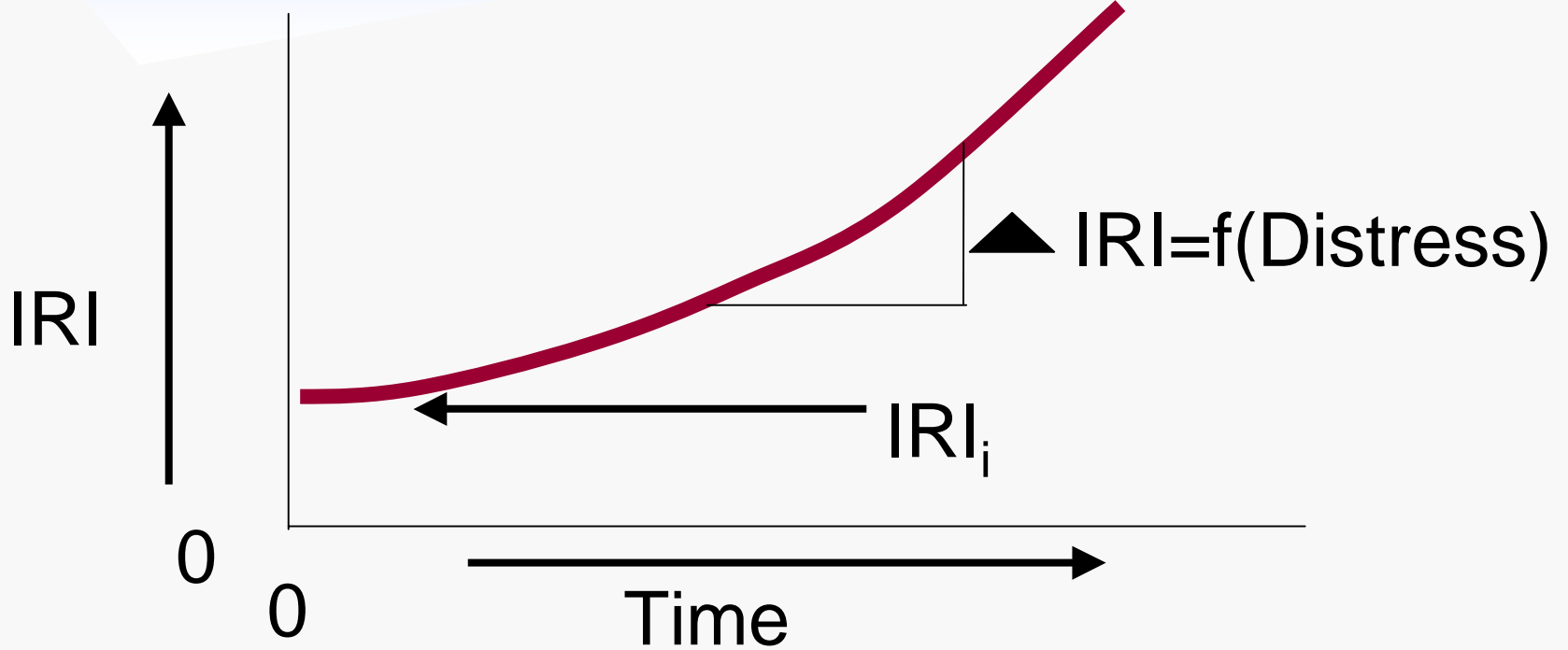


Joint Faulting



CRCP Punchout – Major Structural Distress





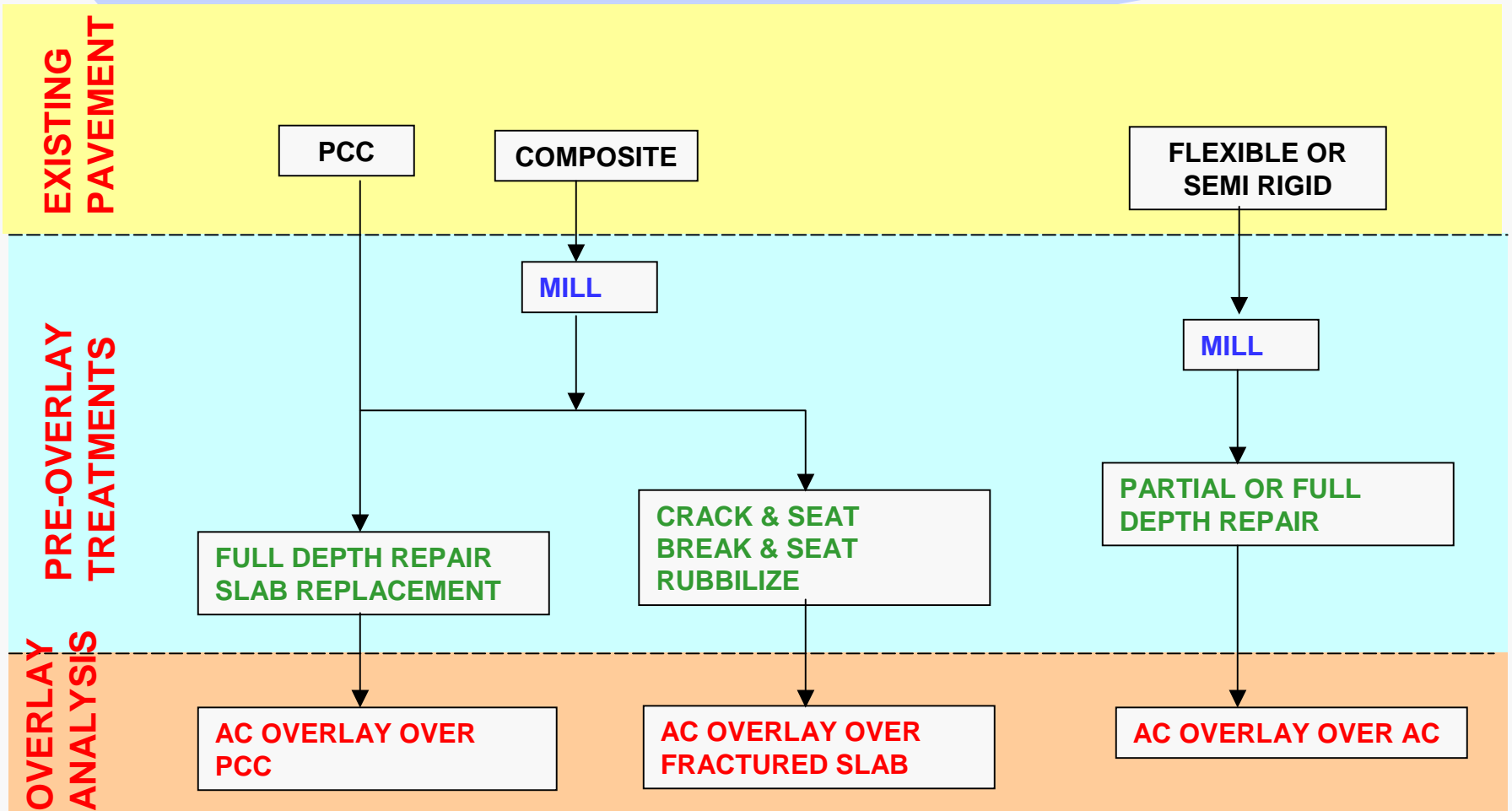
Rehabilitation

Part II—Chapter 5
Evaluation existing pavements
for rehabilitation

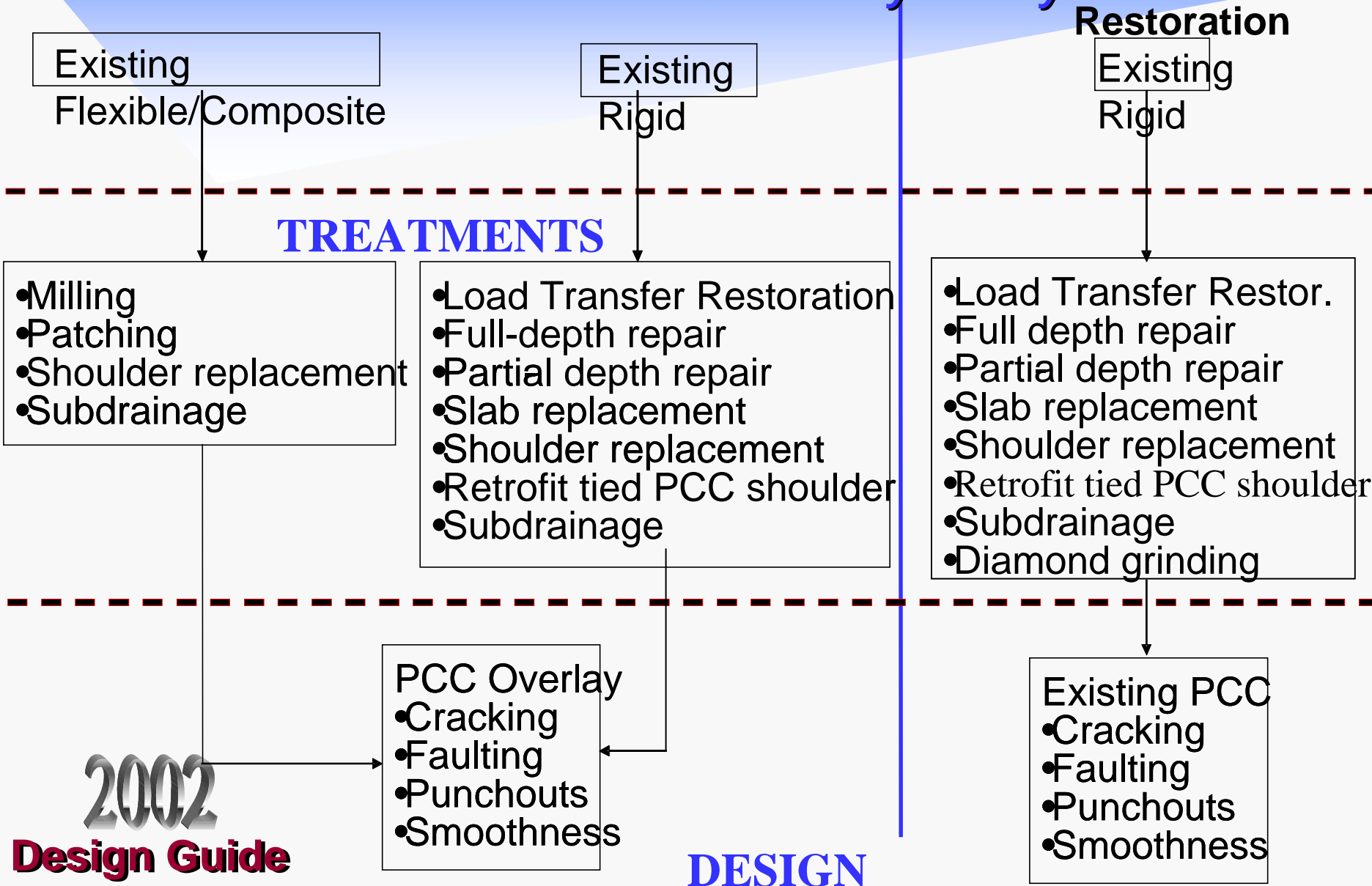
Part III—Chapter 5
Identification of feasible
rehabilitation strategies

Part III—Chapter 6, HMAC
rehabilitation of existing pavements
Part III—Chapter 7, PCC
rehabilitation of existing pavements

HMAC Overlay Analysis



PCC Restoration/Overlay Analysis



Implementation Issues

- Training on design procedure
- Establish database for design inputs
- Local validation and calibration of distress models
 - Establish database of sections in state
 - Input guidelines for local conditions and materials
 - Adjust performance models as needed

Communication and training are essential!

- Mechanistic principles
- Design-Analysis Process
- Traffic
- Climate
- Materials Characterization
- Prediction Models
- Pavement Evaluation



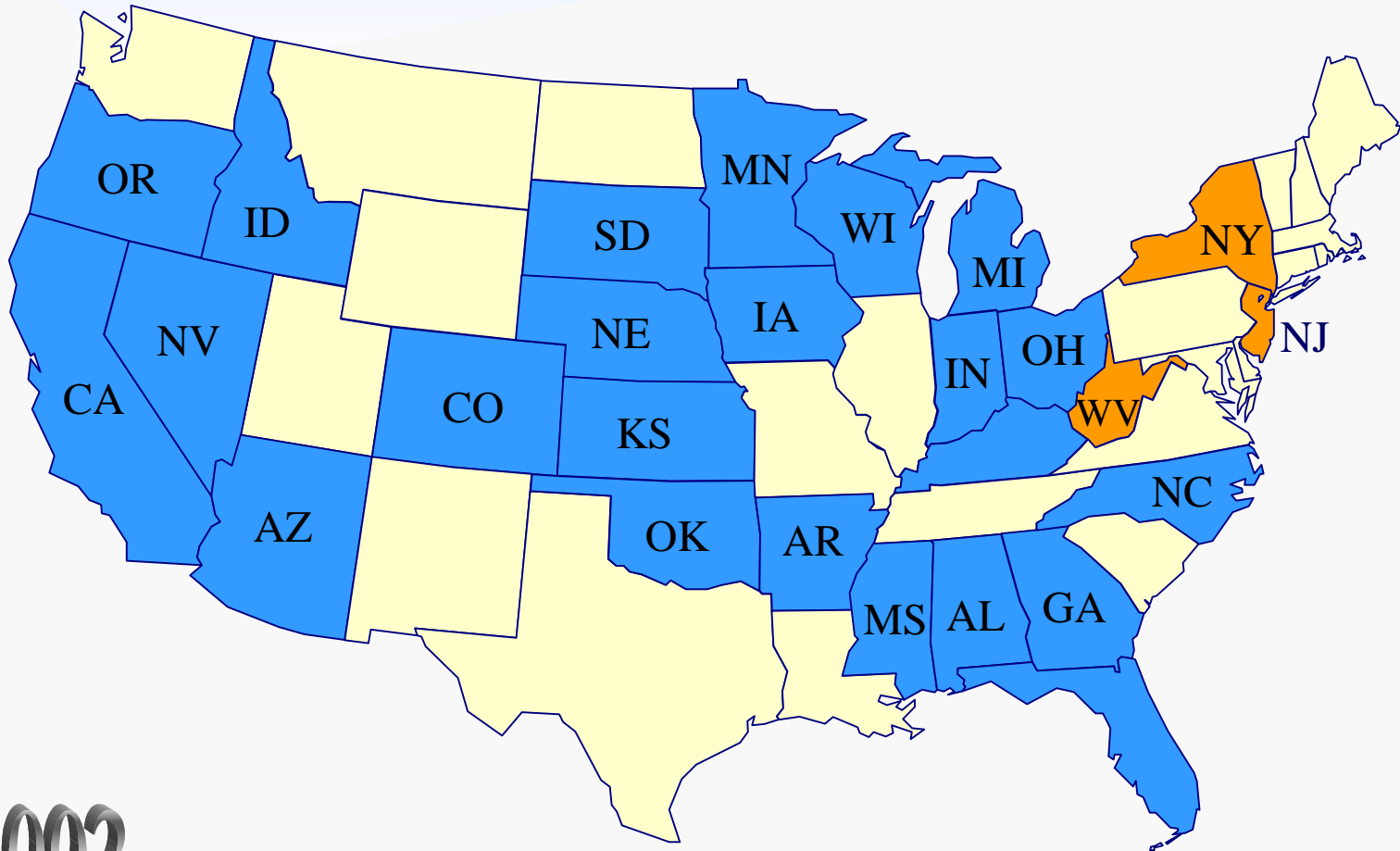
- ✓ Power Point Slides
- ✓ Video, CD
- ✓ Examples & Demos
- ✓ Manuals

2002

Design Guide

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JPCP Calibration States (LTTP Data from 23 States)



Local Calibration and Confirmation of Default Values



Inputs

- Review all inputs, procedures, defaults, ranges.
- Establish agency procedures for inputs.

Calibration

- Materials database
- Traffic database
- Performance database
- Rehabilitation database

So What's Left?

Nov 02

Finalizing 2002 Guide

Finalizing Training Materials
& Implementation

Integration & Debugging
Software

Completion of Calibration

Reliability Implementation



Jan. 02

Benefits from the 2002 Guide.

