SPS-2 What Have We Learned-- Sorta…..

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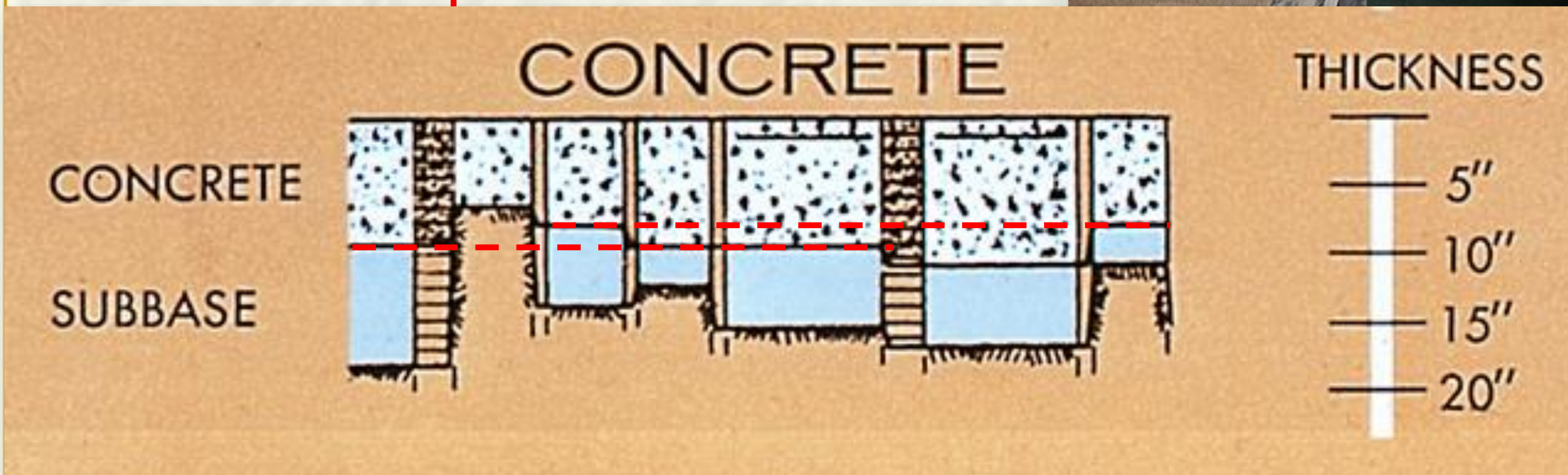
Presentation Outline

- My Message Is: Its Time to Do it Again
- Its been about a ¼ Century
- What People Were Thinking Before the Development of the LTPP SPS-2
- Concrete Pavements Perform Differently

AASHO Road Test Findings

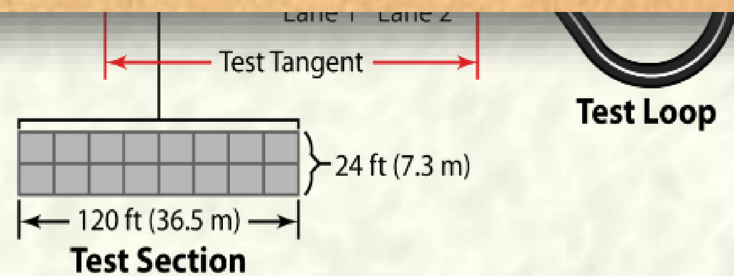
Conditions:

- One location, one soil type, one environment
- 368 Concrete pavement test

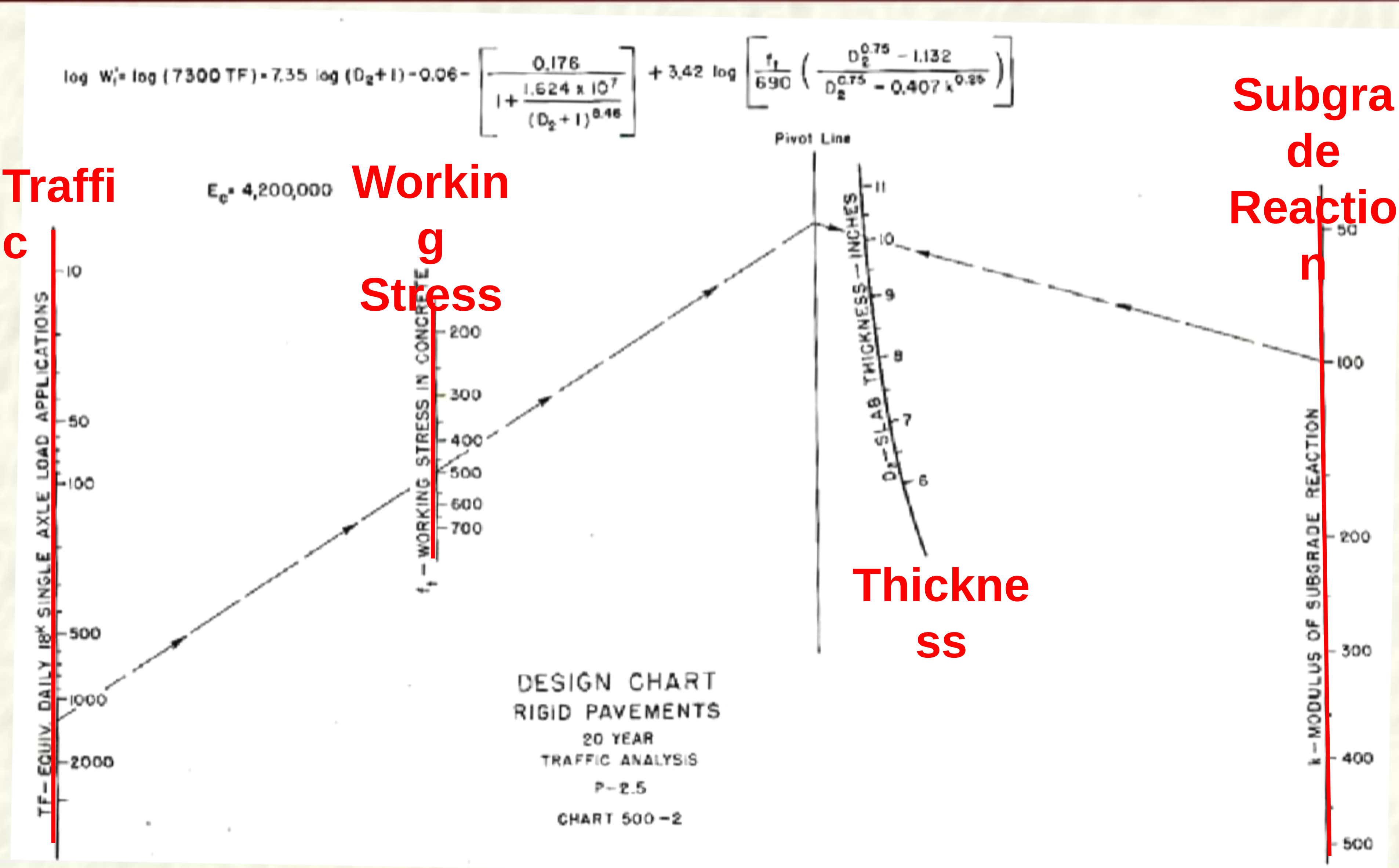


from 3 to 9 in. was found

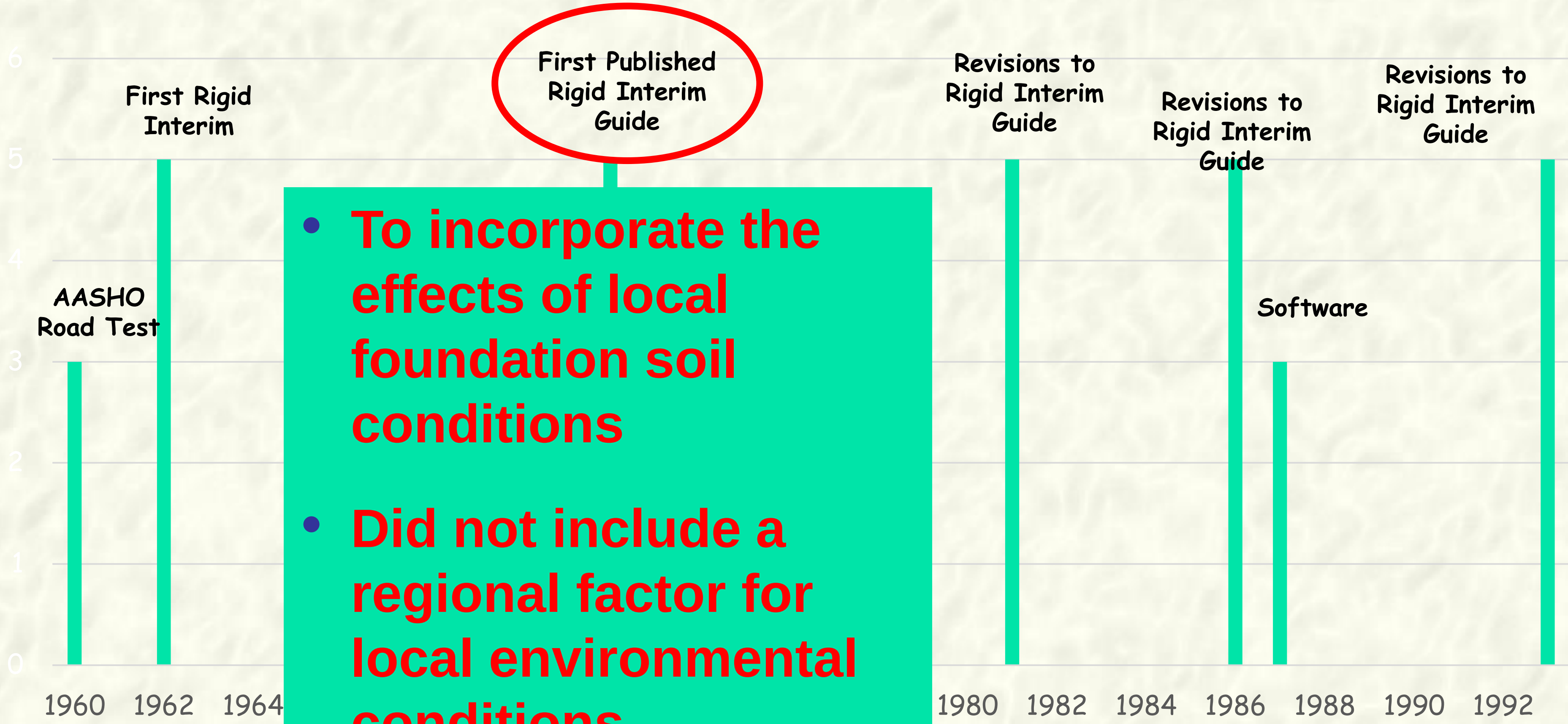
- No increase in life resulted from use of paved shoulders



AASHO Rigid Pavement Design Nomograph



Time Line of AASHO Design Guide



- To incorporate the effects of local foundation soil conditions
- Did not include a regional factor for local environmental conditions

SPS-2 Development

1972 Changes to AASHO Rigid Desig

1961 Rigid Pavement Design Equation

$$\log W_{18} = 7.35 \log(D+1) - 0.06 + \frac{\log[(4.5 - p_t)/(4.5 - 1.5)]}{1 + 1.624 \times 10^7/(D+1)^{8.46}}$$

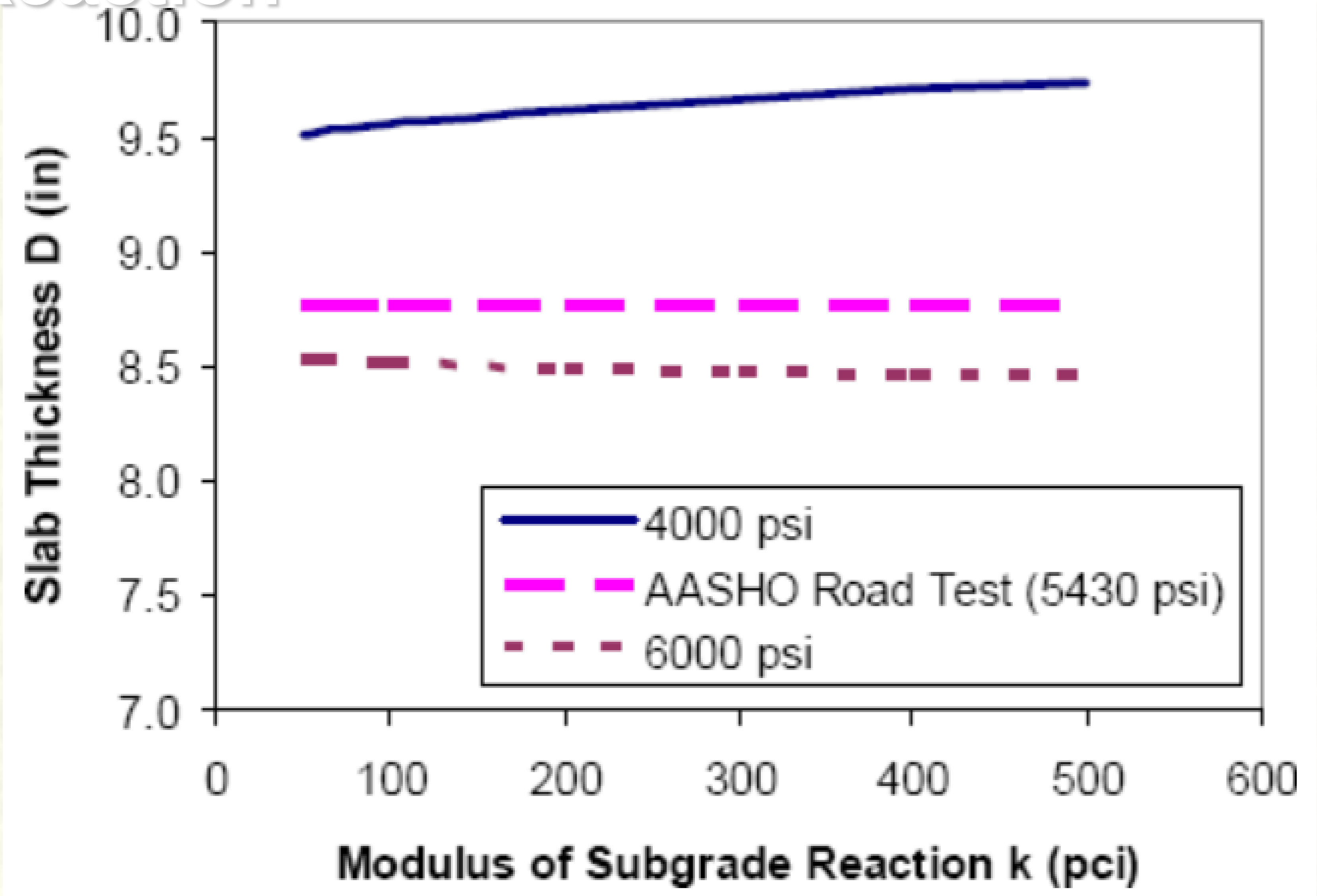
1972 Rigid Pavement Design Equation

$$\log W_{18} = 7.3 \log(D+1) - 0.06 + \frac{\log[(4.5 - p_t)/(4.5 - 1.5)]}{1 + 1.624 \times 10^7/(D+1)^{8.46}}$$

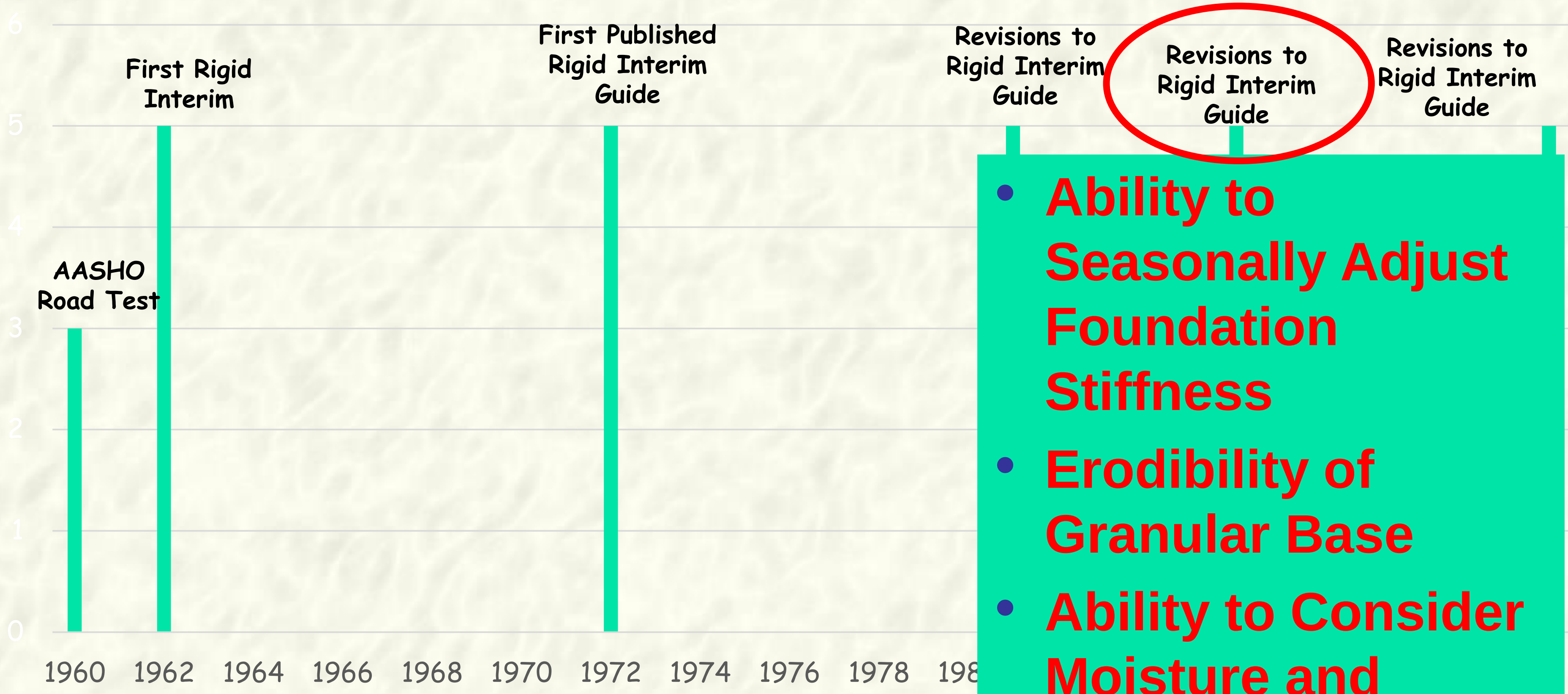
$$+ (4.22 - 0.32\, p_t)\left[\log\left(\frac{S_c}{215.63\, J}\right)\left(\frac{D^{0.75} - 1.132}{D^{0.75} - 18.42/(E_c/k)^{0.25}}\right)\right]$$

in which S_c is the modulus of rupture and E_c is the modulus of elasticity for the concrete (psi), *J* is an empirical joint load transfer coefficient, *k* is the modulus of subgrade reaction (pci)

Sensitivity to Modulus of Subgrade Reaction

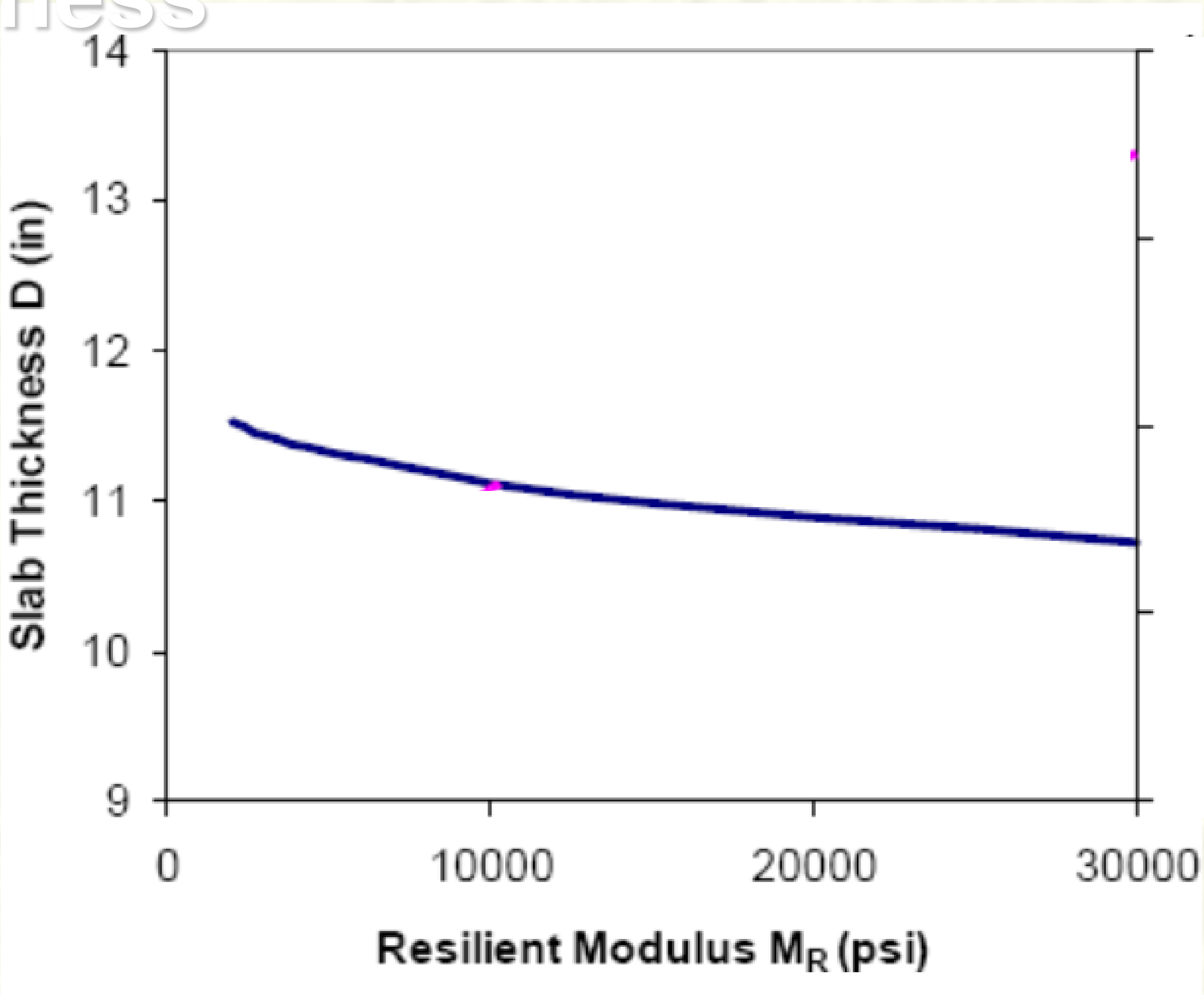


Time Line of AASHO Design Guide

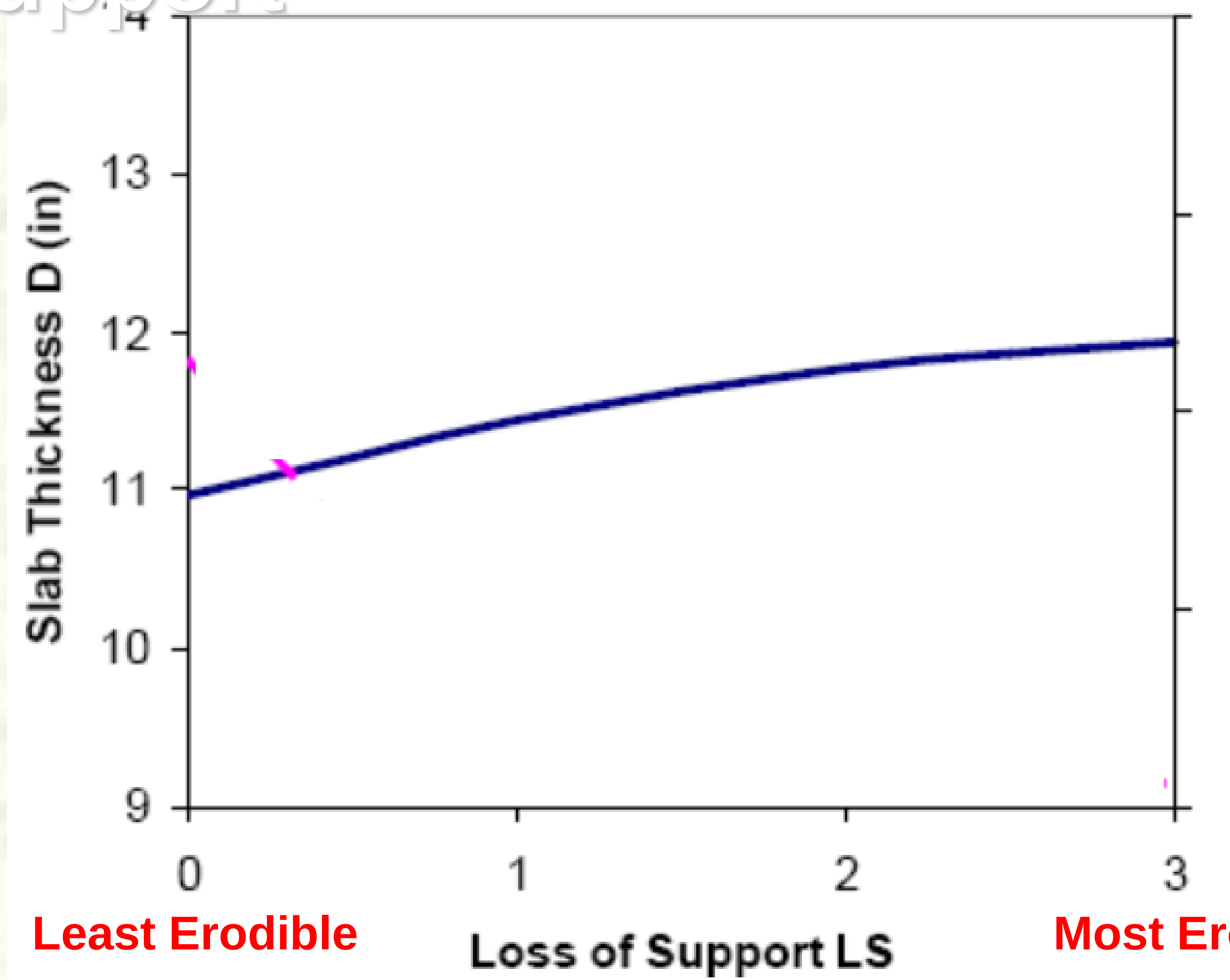


- Ability to Seasonally Adjust Foundation Stiffness
- Erodibility of Granular Base
- Ability to Consider Moisture and Drainage

Thickness Sensitivity to Subgrade Stiffness

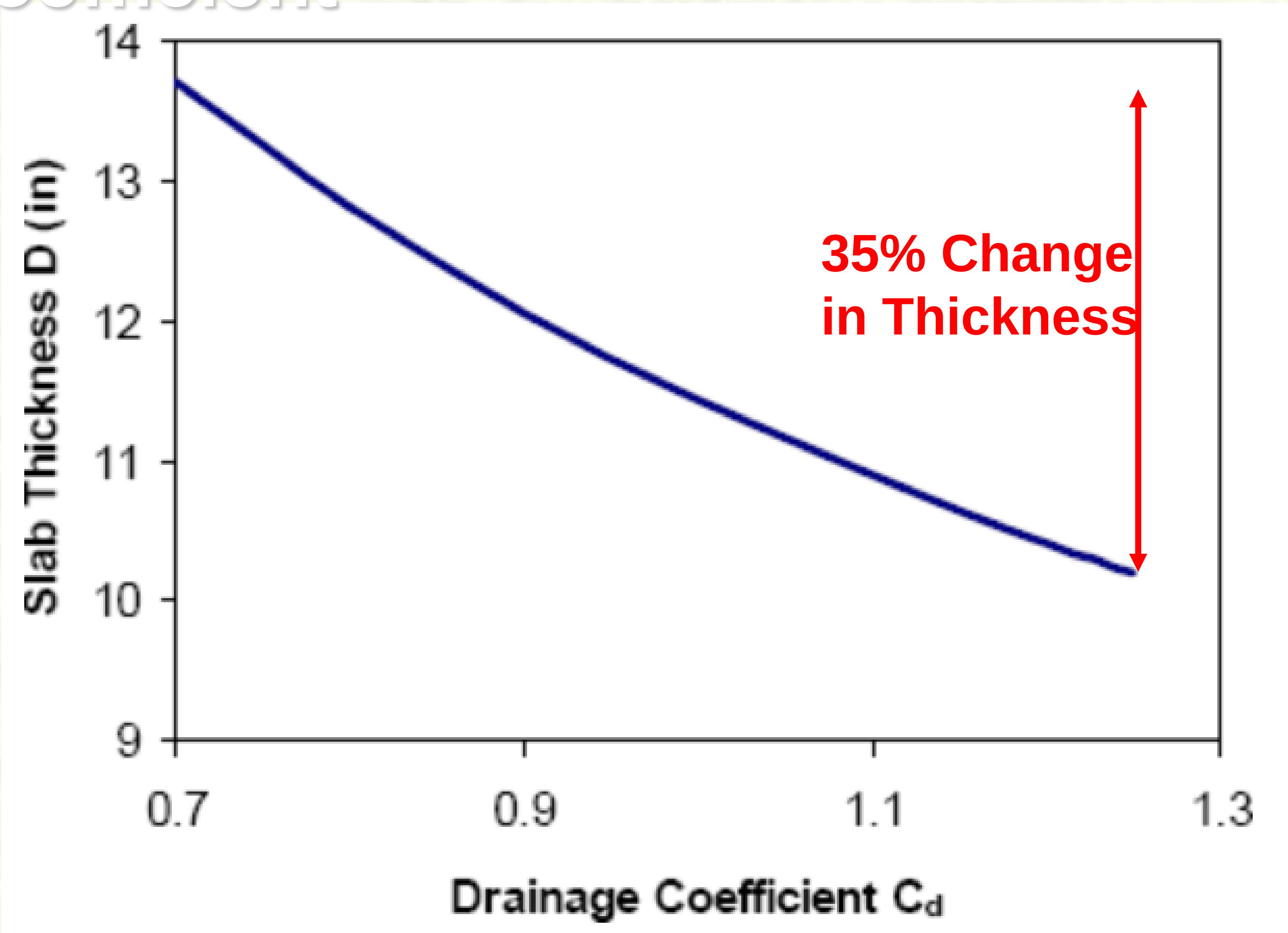


Thickness Sensitivity to Loss of Support



Least Erodible **Most Erodible**

Thickness Sensitivity to Drainage Coefficient

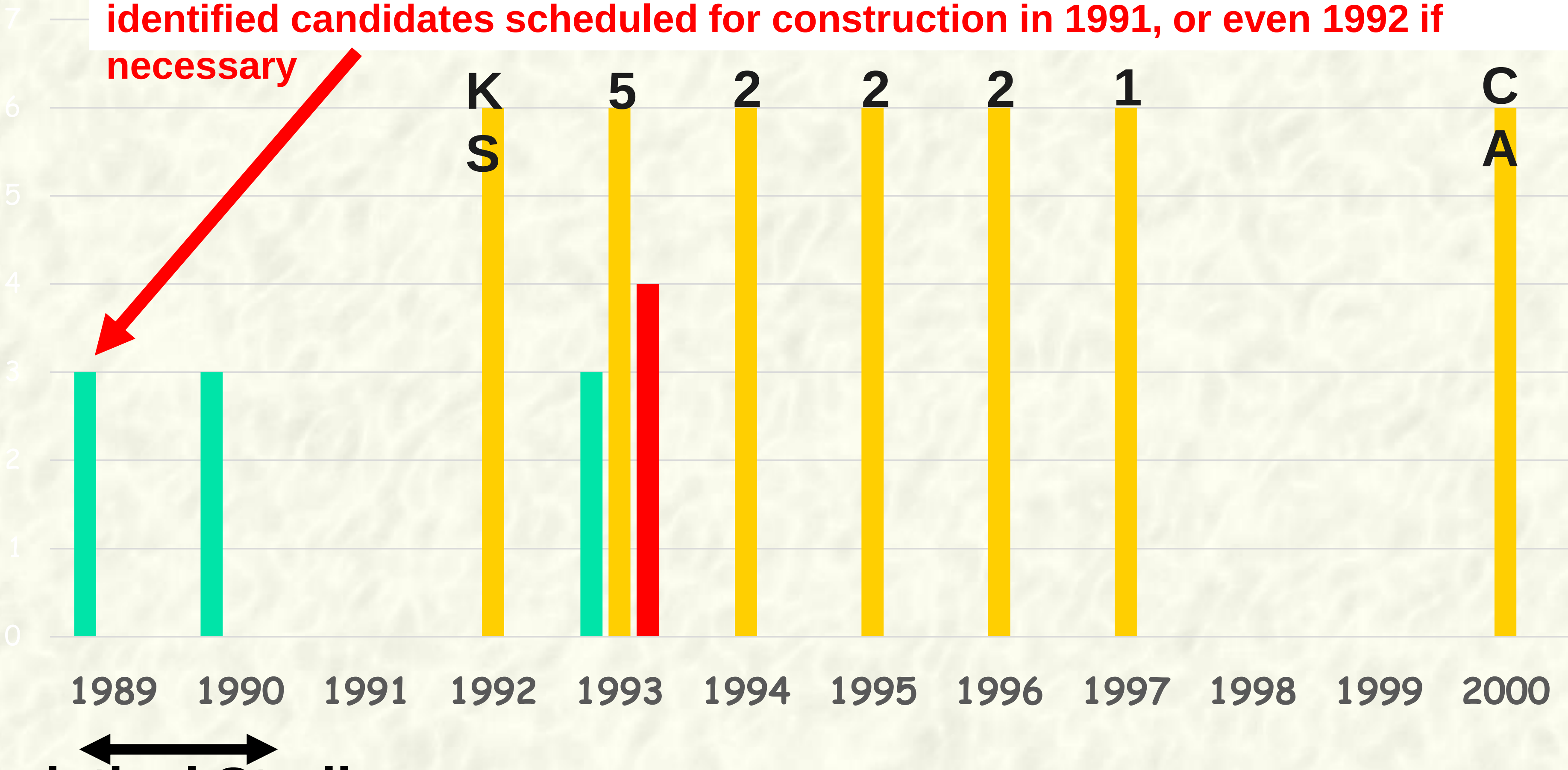


Reasons To Create SPS-2

- **"At present, highway agencies lack sufficient information on the influence of concrete strength and pavement drainage on the performance of Portland cement concrete (PCC) pavements. "**
- **"Although these factors appear in the AASHTO Guide for Design of Pavement Structures, they were incorporated into the equations through rational engineering considerations and not as the direct result of a structured field experiment."**

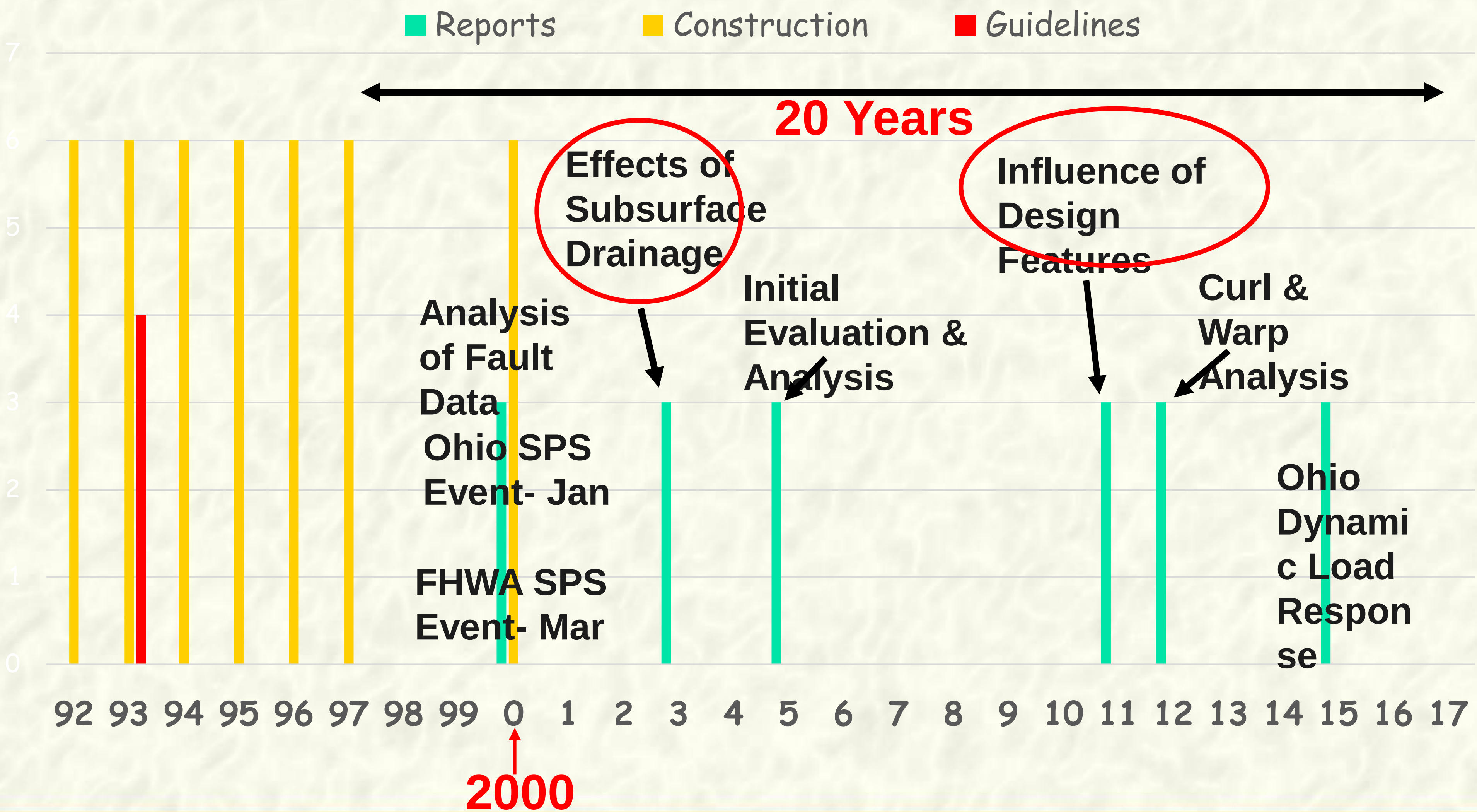
Time Line of SPS-2 Experiment

It is anticipated that only a few SPS-2 projects will be built during the 1990 construction season. The remaining test sites will be selected from the identified candidates scheduled for construction in 1991, or even 1992 if necessary

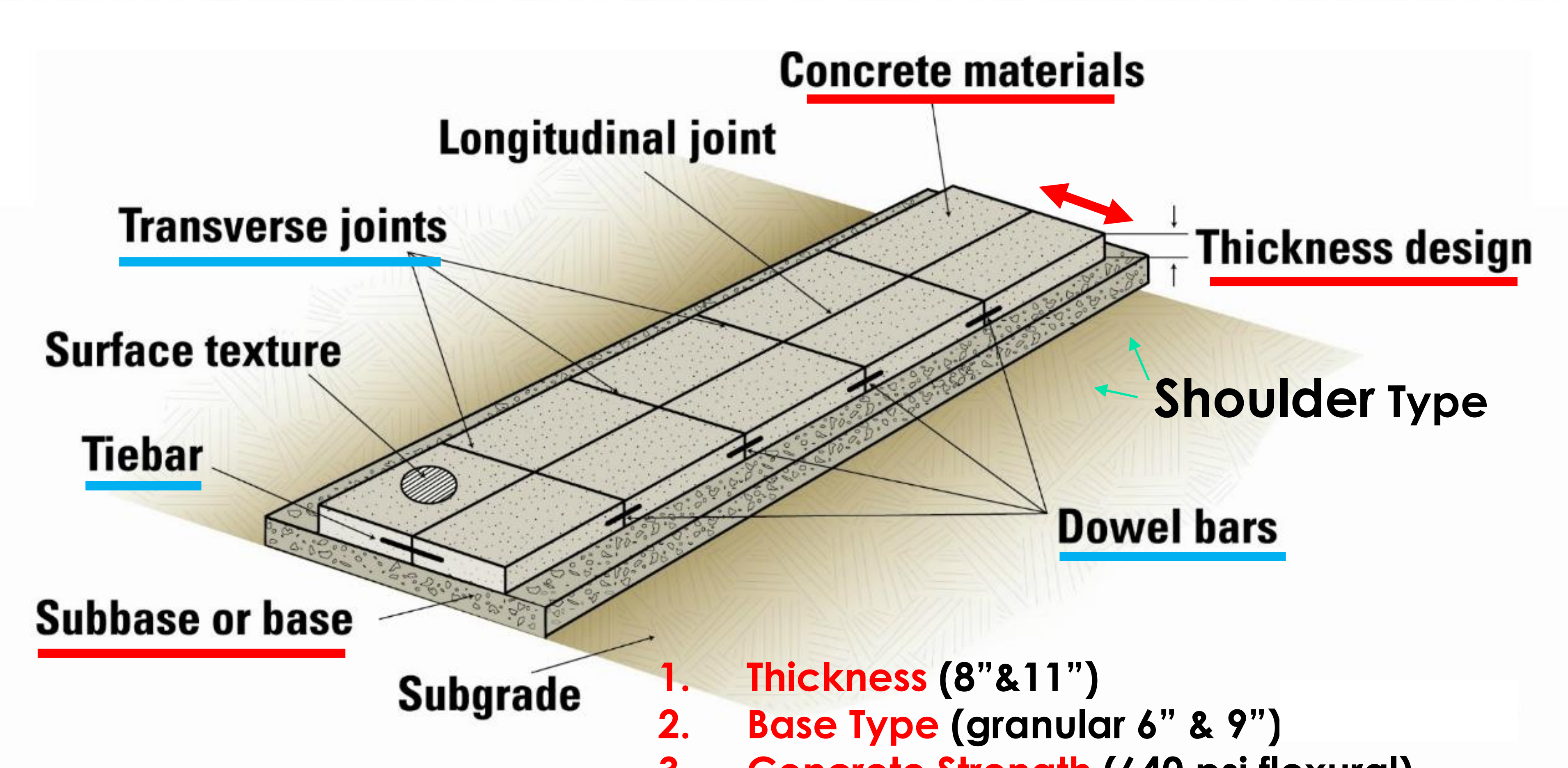


Analytical Studies Conducted

Time Line of SPS-2 Experiment



Largest Concrete Pavement Research Project in the World



1. Thickness (8"&11")
2. Base Type (granular 6" & 9")
3. Concrete Strength (640 psi flexural)
4. Lane Width (12 ft)
5. Drainage (none)

SPS-2 Experimental Design

Pavement Structure				
		PCCP		
Drainage	Base Type	Thickness (inches)	Flexural Strength 14-D (psi)	Lane Width (ft)
No	DGAB	8	550	12
				14
			900	12
				14
		11	550	12
				14
			900	12
				14
No	LCB	8	550	12
				14
			900	12
				14
		11	550	12
				14
			900	12
				14
Yes	PATB	8	550	12
				14
			900	12
				14
		11	550	12
				14
			900	12
				14

Climatic Zones, Subgrade			
WET		DRY	
FREEZE	NO FREEZE	FREEZE	NO FREEZE

Subgrade

Locatio
n

192 Test Section

Recommendations

Perform a series of satellite road studies

Pavement Structure					Climatic Zones, Subgrade
		PCCP			
Drainage	Base Type	Thickness (inches)	Flexural Strength 14-D (psi)	Lane Width (ft)	
No	DGAB	8	550	12	
				14	
			900	12	
				14	
		11	550	12	
				14	
			900	12	
				14	
No	LCB	8	550	12	
				14	
			900	12	
				14	
		11	550	12	
				14	
			900	12	
				14	
Yes	PATB	8	550	12	
				14	
			900	12	
				14	
		11	550	12	
				14	
			900	12	
				14	

Climate

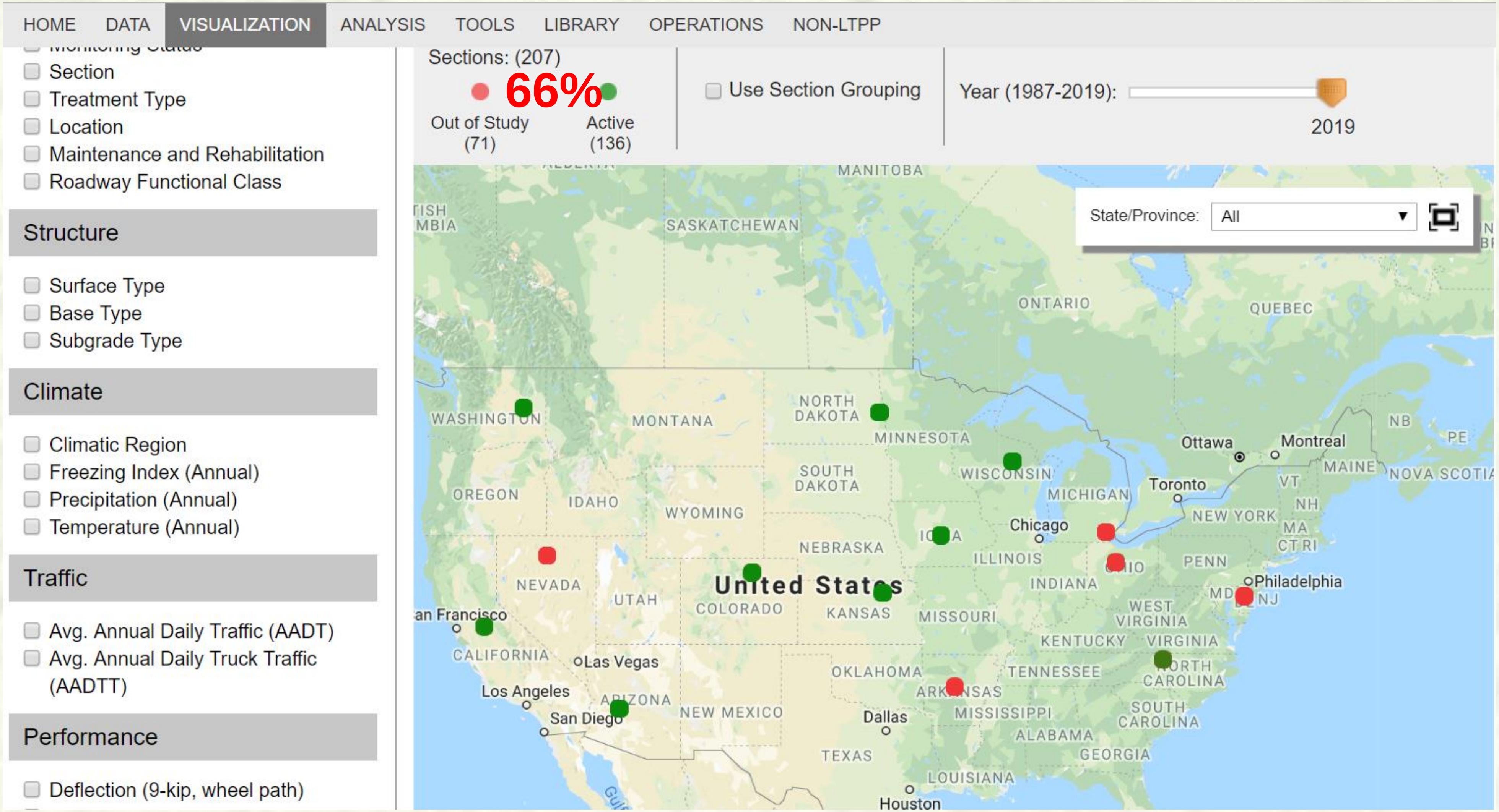
Soil

Location

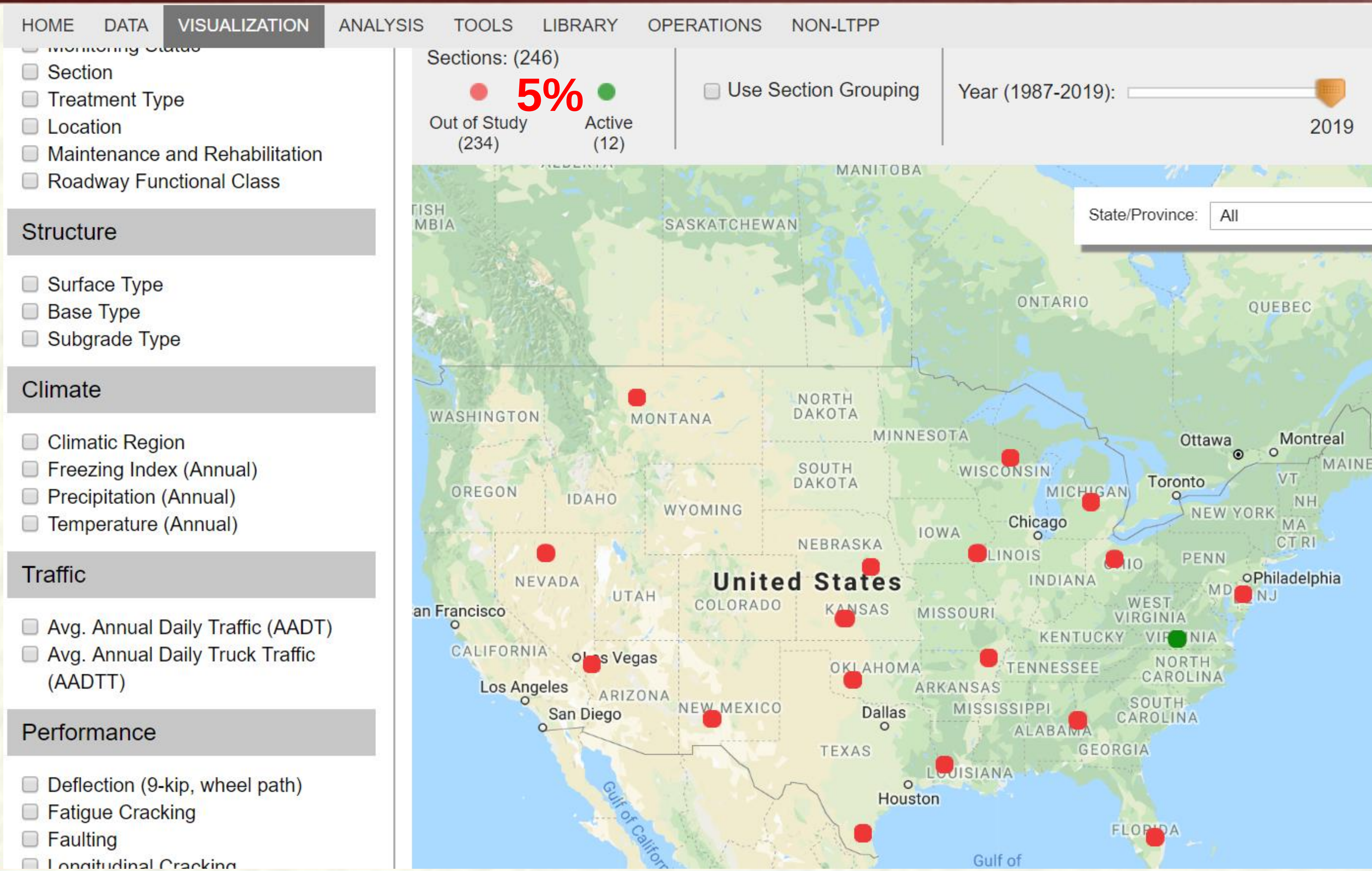
192 Test Sections

So What Have We Learned After 27 Years

SPS-2 Site Survival

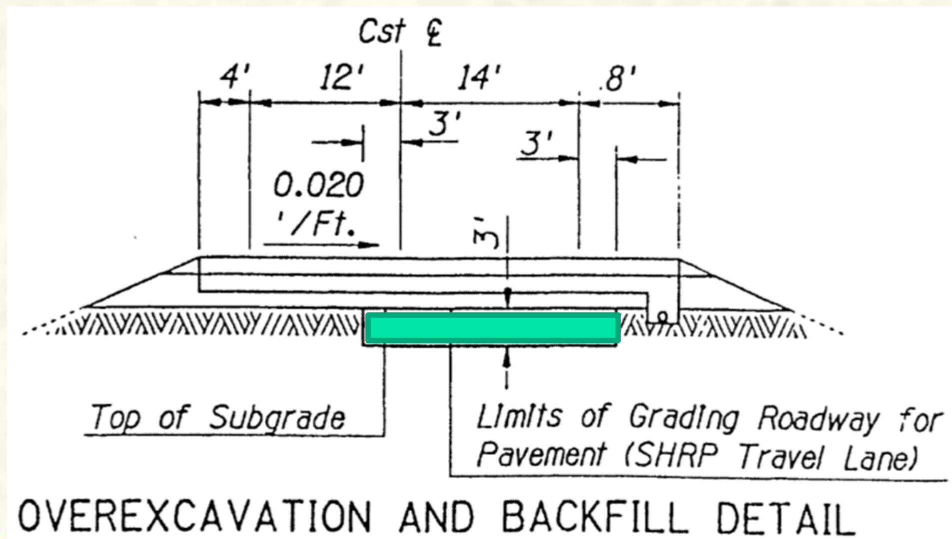


SPS-1 Site Survival



Subgrade Construction

Subgrade Preparation



Subgrade Construction

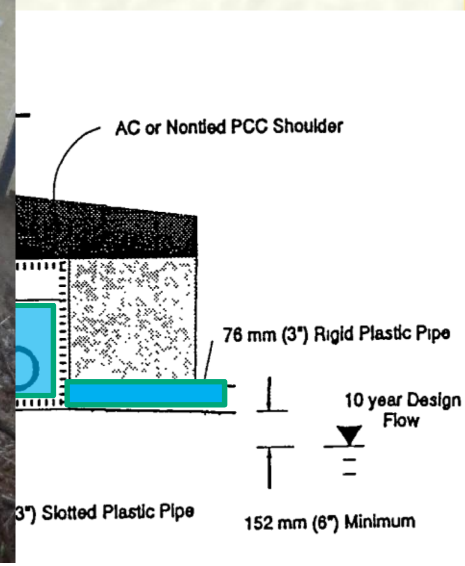
Shoulder

Travel Lane

Draine
Undr


Arkansas
SPS-2
2


Slots


AC or Nontied PCC Shoulder
76 mm (3") Rigid Plastic Pipe
10 year Design Flow
3") Slotted Plastic Pipe
152 mm (6") Minimum

Base Construction

Base Type

Concrete Strength

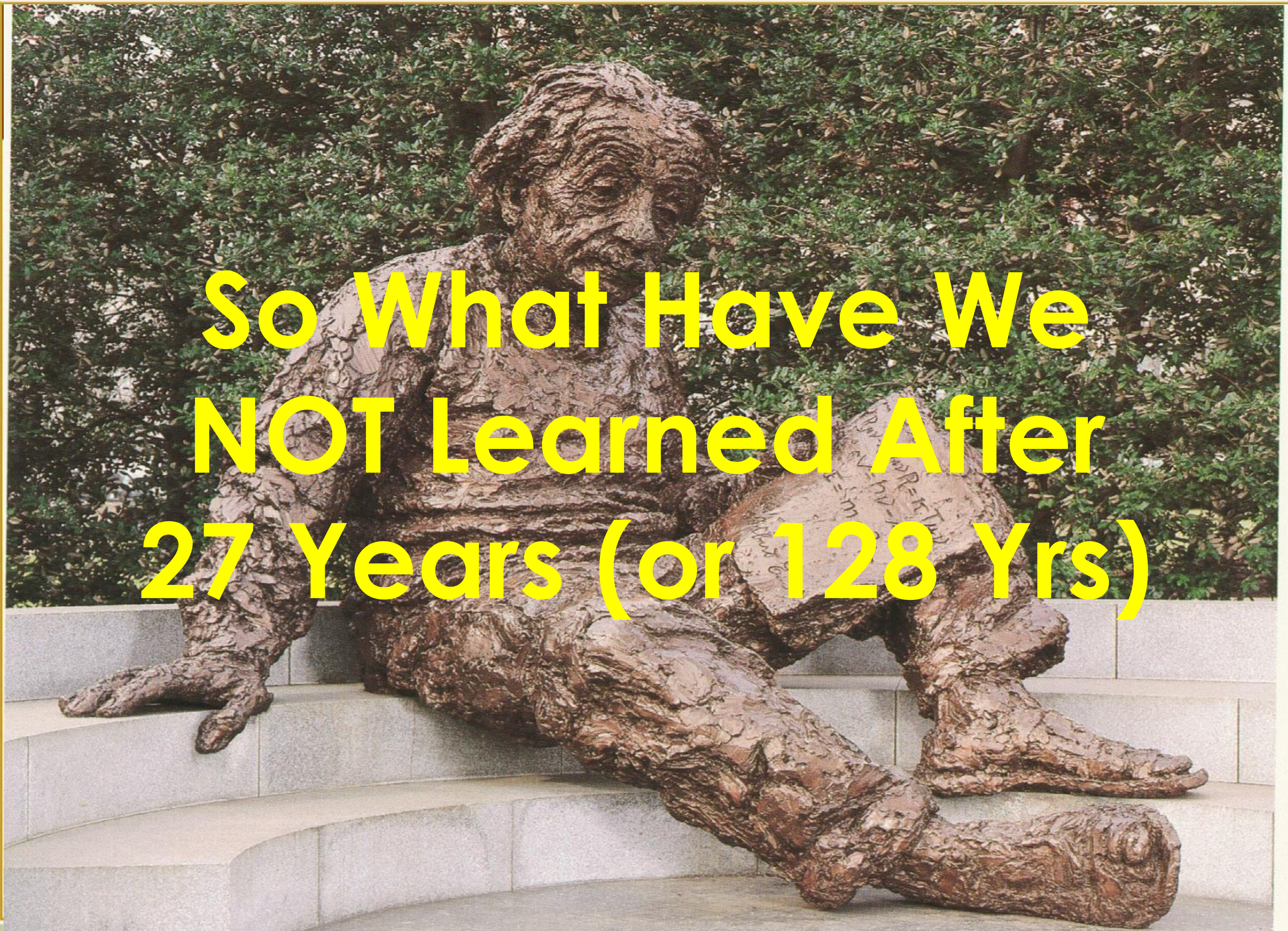
Lane Width

Cracking Over Dowels

8" PCCP

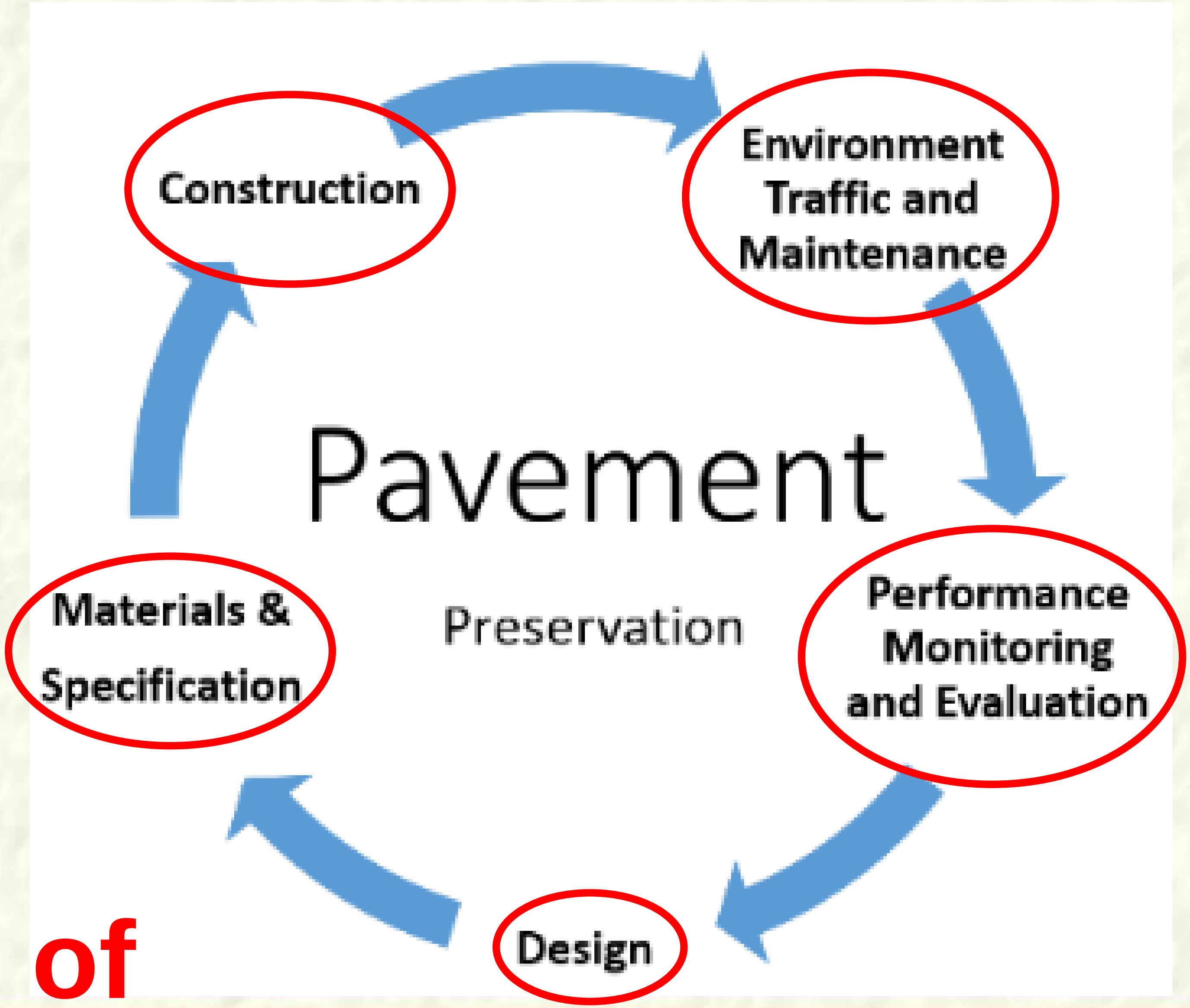
Next

Shoulder Type


So What Have We
NOT Learned After
27 Years (or 128 Yrs)

Can We Establish Intervention Thresholds for Preservation Using SPS-2

Quality on Performance -- How About Design

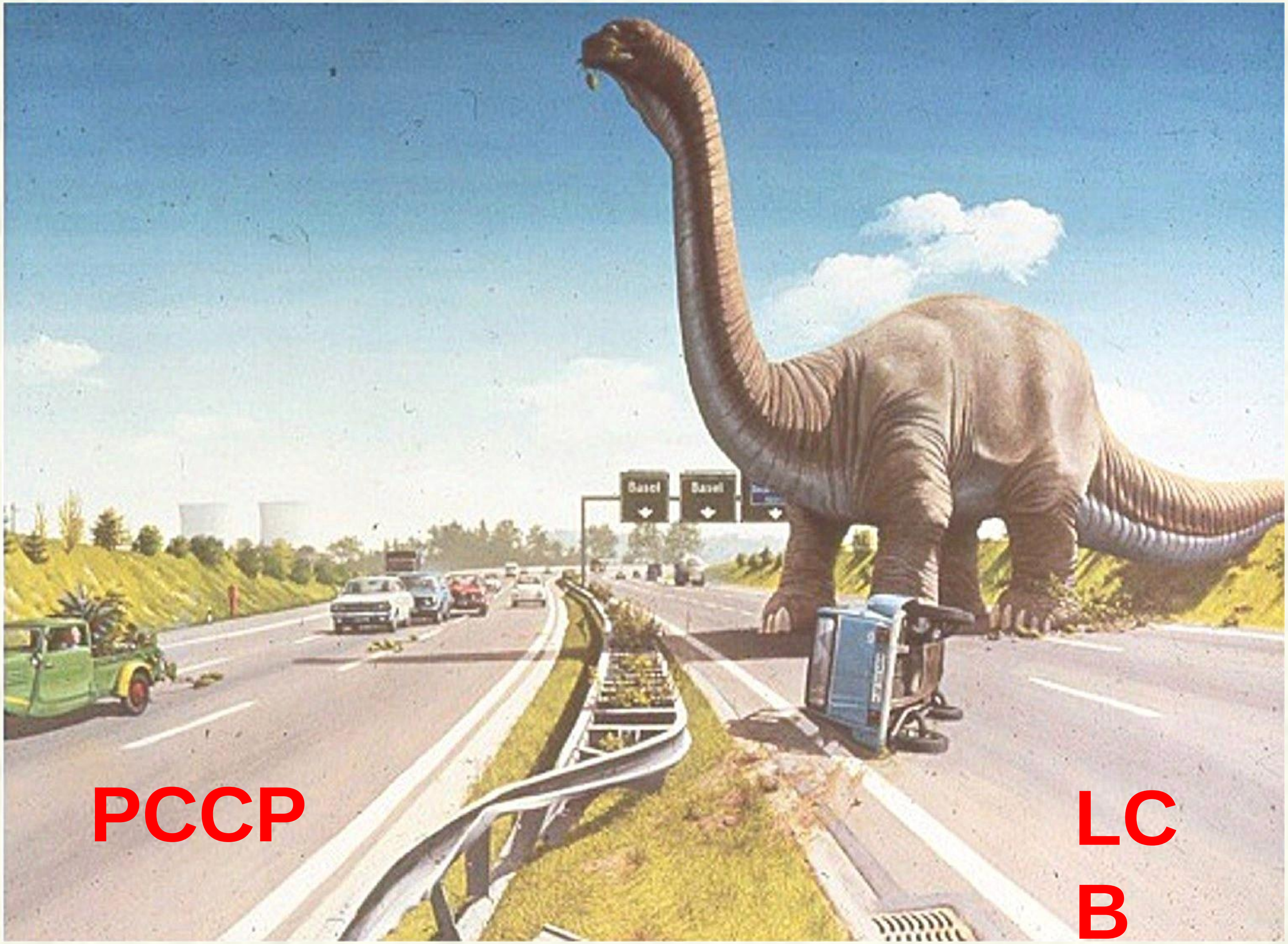


Circle of

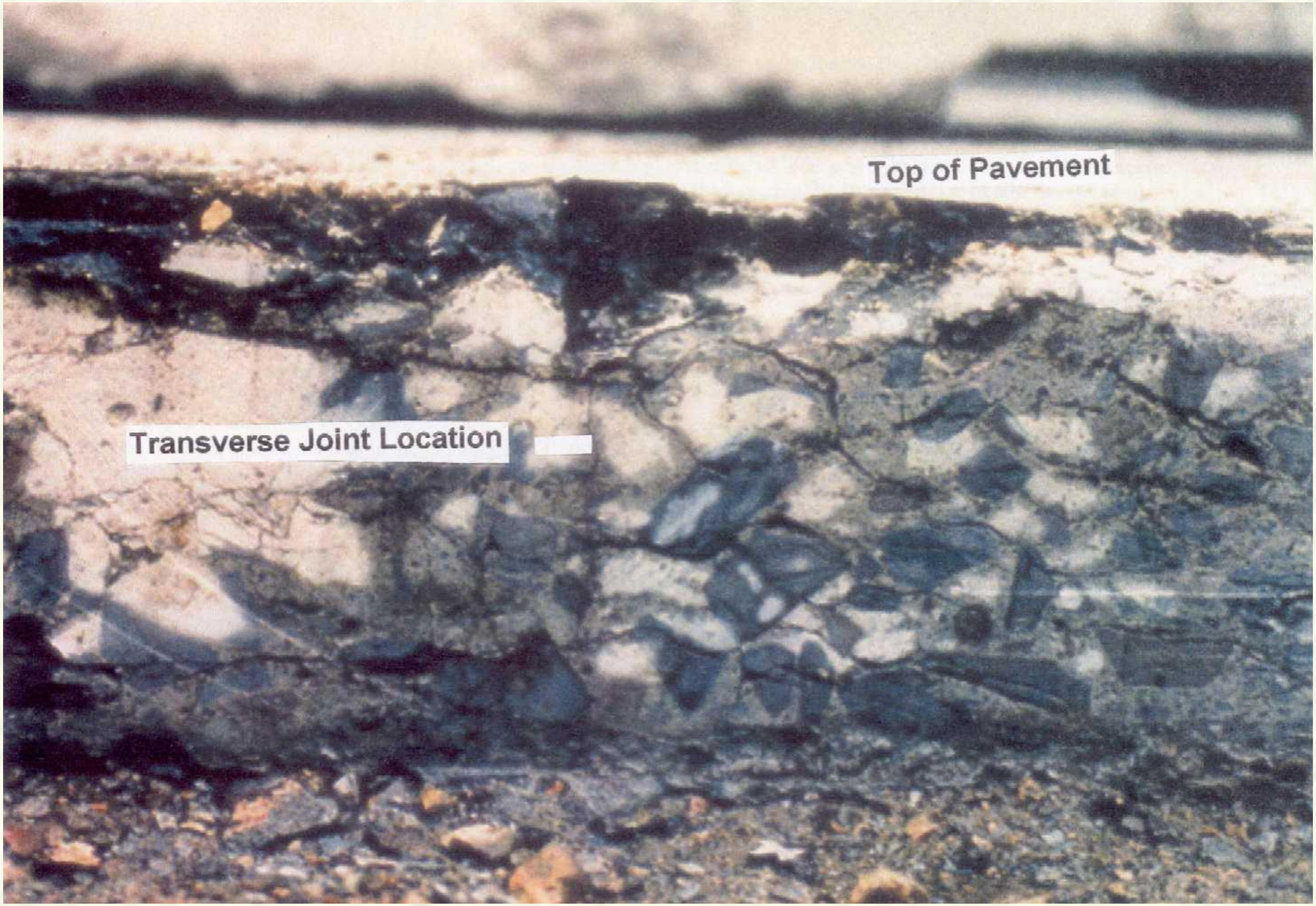
Do We Know if the Drained Sections are Now Bathtub Sections?

Do We Know the Impact of Tied Concrete Shoulders?

Separation Layer Between LCB and PCCP

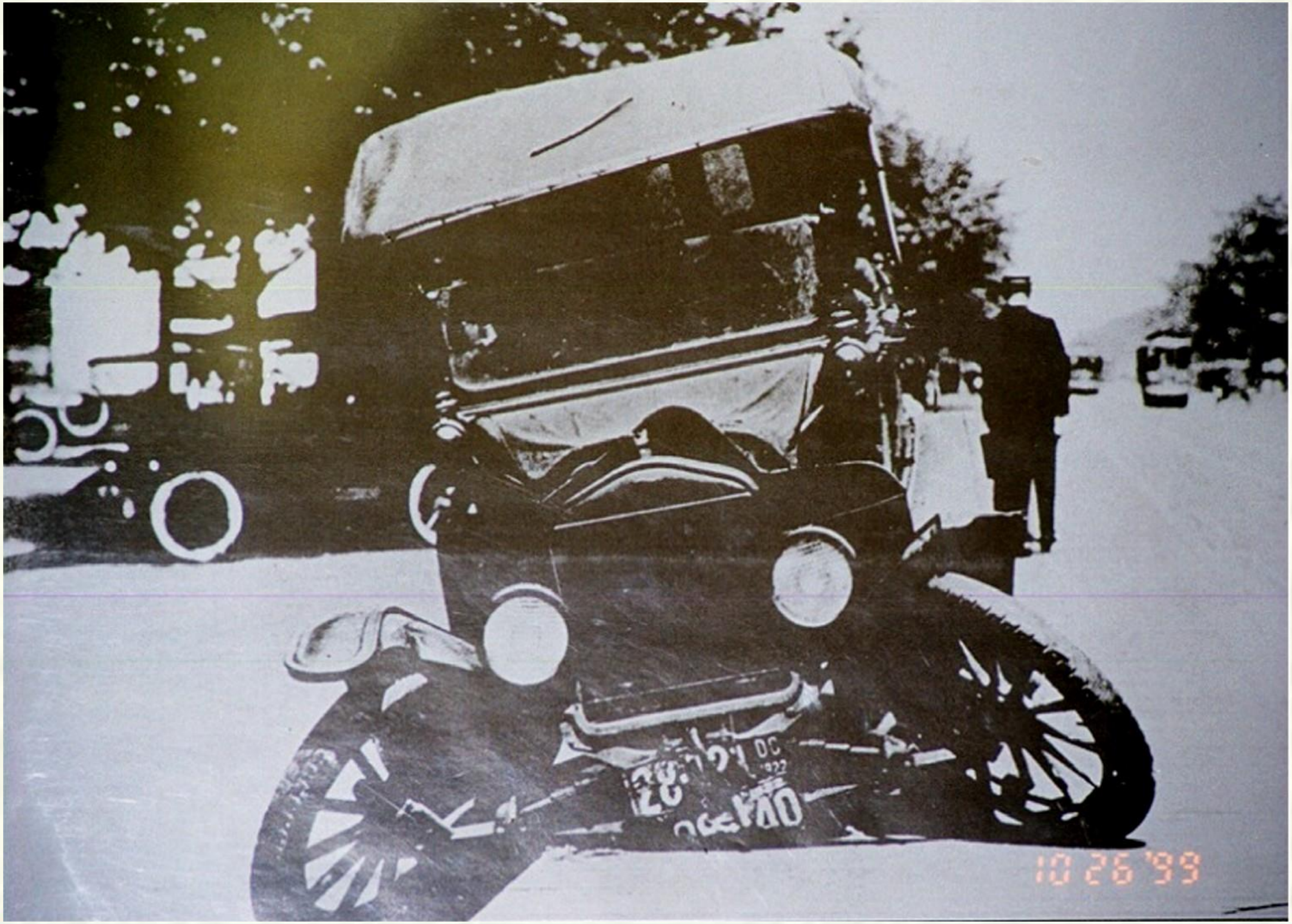


Do the Mix Design Procedures Predict Actual Performance



Do We Know the Impact Dowel Stiffness On PCCP Performance

Performance– Impact of Localized Roughness



Is Sealant Cost Effective?

FHWA Sealant Effectiveness Study


CONCRETE PAVEMENT
CPTP
TECHNOLOGY PROGRAM

TechBrief

The Concrete Pavement Technology Program (CPTP) is an integrated, national effort to improve the long-term performance and cost-effectiveness of concrete pavements. Managed by the Federal Highway Administration through partnerships with State highway agencies, industry, and academia, CPTP's primary goals are to reduce congestion, improve safety, lower costs, improve performance, and foster innovation. The program was designed to produce user-friendly software, procedures, methods, guidelines, and other tools for use in materials selection, mixture proportioning, and the design, construction, and rehabilitation of concrete pavements.

www.fhwa.dot.gov/pavement/concrete

U.S. Department of Transportation
Federal Highway Administration

Performance of Sealed and Unsealed Concrete Pavement Joints

This TechBrief presents the results of a nationwide study of the effects of transverse joint sealing on performance of jointed plain concrete pavement (JPCP). This study was conducted to assess whether JPCP designs with unsealed transverse joints performed differently from JPCP designs with sealed transverse joints. Distress and deflection data were collected from 117 test sections at 26 experimental joint sealing projects located in 11 states. Performance of the pavement test sections with unsealed joints was compared with the performance of pavement test sections with one or more types of sealed joints.

BACKGROUND

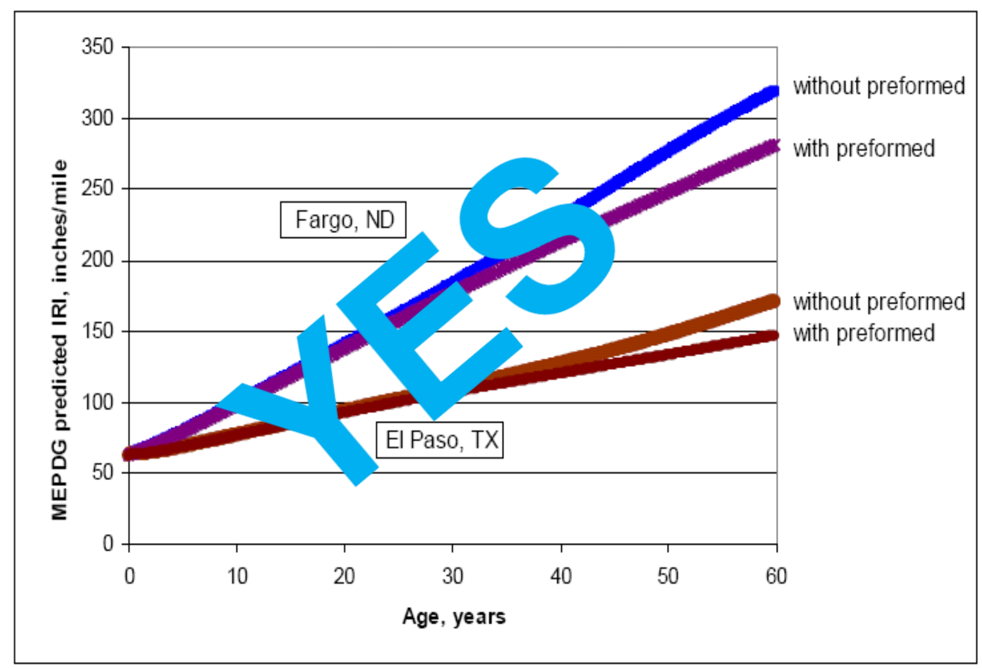
The sealing of transvers[illegible] joints in JPCP has been standard practice throughout much [illegible] Unit[illegible]s for many years. Its widespread use is due to the comm[illegible] belief that sea[illegible] joints improves concrete pavement performance in tw[illegible] ways: by reducin[illegible] er infiltration into the pavement structure [illegible] ereby r[illegible] ng the occurre[illegible] of moisture-related distresses such as pumpi[illegible] d faul[illegible] nd by pr[illegible] ing the infiltration of incompressibles (i.e., sa[illegible] d sma[illegible] he joints, thereby reducing the likeli[illegible] d of pressu[illegible] ated joint distresses such as joint spalling and blowups. [illegible] Jointed concrete pavement (JCP) are typically created [illegible] cut to force controlled cracking, followed by a second, [illegible] r saw cut to produce a reservoir for the joint sealant material. This traditi[illegible] approach of sawing and sealing transverse contraction joints is estimate[illegible] account for between 2 and 7 percent of the initial construction cost of a JC[illegible]. Moreover, these sealed transverse joints require resealing one or more times over the service life of the pavement, leading to additional costs in terms of labor, materials, operations, and lane closures.

Recently, several State departments of transportation (DOTs) have been questioning conventional transverse joint sawing and sealing practices. These agencies contend that the benefits derived from sealing do not offset the costs associated with the placement and continued upkeep of the sealant over the life of the pavement. As a result, they have been experimenting with different sawing and sealing alternatives, for example:

- Narrow unsealed joints, consisting of single saw cuts that are left unsealed.
- Narrow filled joints, consisting of single saw cuts that are filled with sealant that adheres to the sides and bottom of the saw cut.
- Narrow sealed joints, consisting of single saw cuts that contain a narrow backer rod and sealant material.

NO

AASHTO New Design Guide



In Summary

- SPS-2 is the Largest On Going Concrete Research Project in the World
- We Need to Exploit the SPS-2 Research from Cradle to Grave, which includes Preservation
- The Pooled Fund Experiment is the World's Largest Ongoing Concrete Preservation Research Project
- Its Time for SPS-2 Phase II………

Questions?

IGGA
International Grooving
& Grinding Association

Your Pavement Preservation Resource® since 1972