

Incorporating Pavement Preservation Into the Mechanistic-Empirical Pavement Design Guide



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Presentation Overview

- Background
- Today
- The Future
- Questions & Answers?

Background

- Pavements are designed, constructed, maintained to meet performance expectations
- Designs based on loads, materials and their properties, environment
- Performance has both functional and structural components

Background (continued)

- Since the 1960s, AASHTO pavement design based on relationship between serviceability and performance
- Performance period of 20 years was (and in many cases still is) common

Background (continued)

As analysis periods stretch, it begs the question “How?”

- Rehabilitation
- Maintenance
- Preventive maintenance

Today

- “The emphasis of highway construction has gradually shifted from new design and construction activities to maintenance and rehabilitation.”
- “In actual practice the performance period can be significantly affected by the type and level of maintenance applied.”

AASHTO 1993

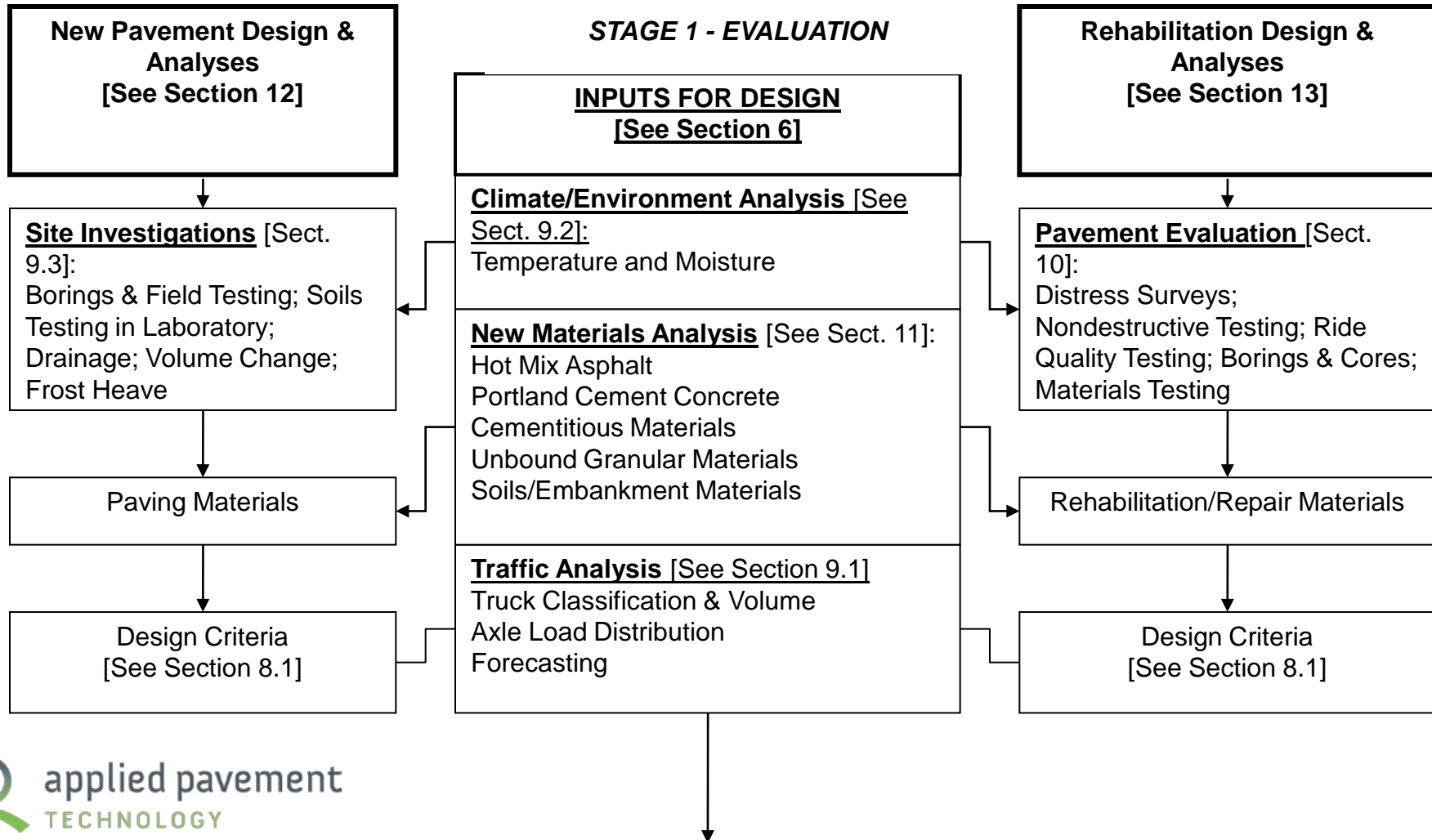
Pavement Design, Maintenance, and Preservation—1993

“In general, one of the least understood areas of state of the art rehabilitation concerns the ability to confidently and accurately predict probable performance (e.g., serviceability-traffic loading/time) for nonoverlay rehabilitation solutions. This is one of the most significant limitations of the rehabilitation guidelines, and user agencies are strongly encouraged to build a continuous and accurate performance data base to increase the overall accuracy and confidence level of performance predictions.”

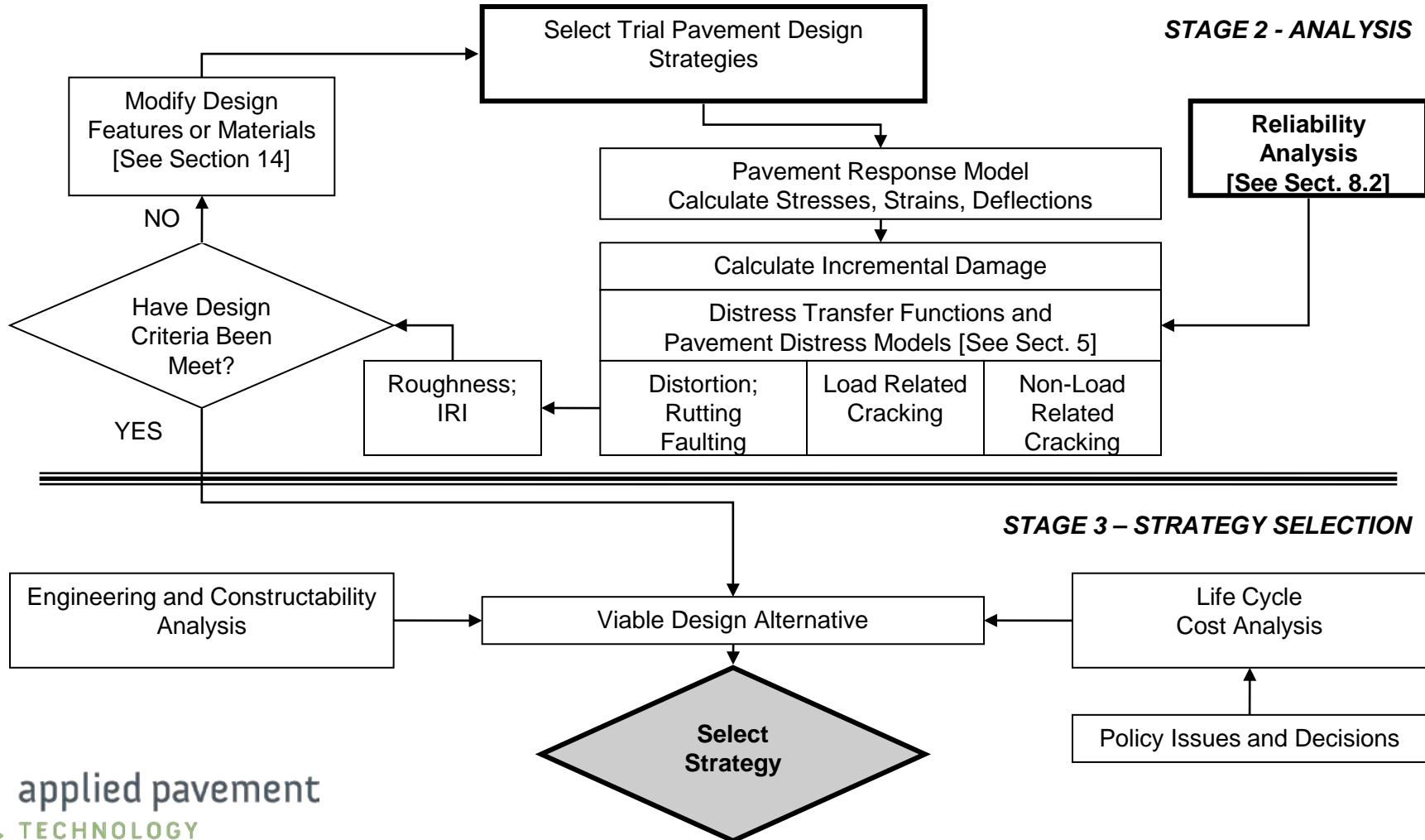
The MEPDG (20xx)

- Work on new design procedure has extended for more than a decade
- Procedure based on mechanistic inputs
 - Material properties
 - Response of pavement structure to “loads”
- No test sections: uses existing models
- Design characteristics analyzed in terms of their effect on performance

Overview of MEPDG—Part 1



Overview of MEPDG—Parts 2/3



Status of MEPDG

- 2008 Interim Edition: A Manual of Practice
- Ongoing implementation/local calibration
- FHWA
 - Use of PMS data in local calibration
 - Use of FWD
- Software revisions to develop design tool

And what about pavement preservation?

MEPDG and PP

Pavement preservation programs and strategies are policy decisions which are not considered directly in the distress predictions. Pavement preservation treatments applied to the surface of HMA [hot-mix asphalt] layers early in their life may have an impact on the performance of flexible pavements and HMA overlays. The pavement designer needs to consider the impact of these programs in establishing the local calibration coefficients or develop agency specific values – primarily for load and non-load related cracking. This pavement preservation issue is discussed in more detail in the Calibration Guide (NCHRP 2007), a future AASHTO publication, for determining the regional or agency specific calibration factors. Preservation is considered in JPCP design only in the ability to design a restoration project.

The Gap

- PM affects pavement performance (but not stress, strain, deflection)
- What affects pavement performance affects pavement design
- 2009 report prepared under NCHRP 20-07, Task 251 identifies gap and offers recommendations
- Co-authors Linda Pierce and James Krstulovich

Some Observations

- Pavement preservation affects performance
- It is not known how the existing models account for preservation
- Pavements could be over- or under-designed

Effects of PM on Performance— HMA Surfaces

		PERFORMANCE INDICATORS					
		Rutting	Non-load-related transverse Cracking	Load-related fatigue cracking	Load-related longitudinal cracking	Reflection cracking	Smoothness (IRI)
Treatment							
Hot-Mix Asphalt Surfaced Pavements	Crack Sealing/ Crack Filling		+			+	-
	Fog Seal/ Rejuvenators		+	+			+
	Slurry Seal/ Microsurfacing	+	+	+		-	
	Chip Seals			+			-
	Thin HMA Overlays	+	+	+			+
	Ultra-thin Friction Course		+	+			
	In-Place Surface Recycling	+	+	+	+		+

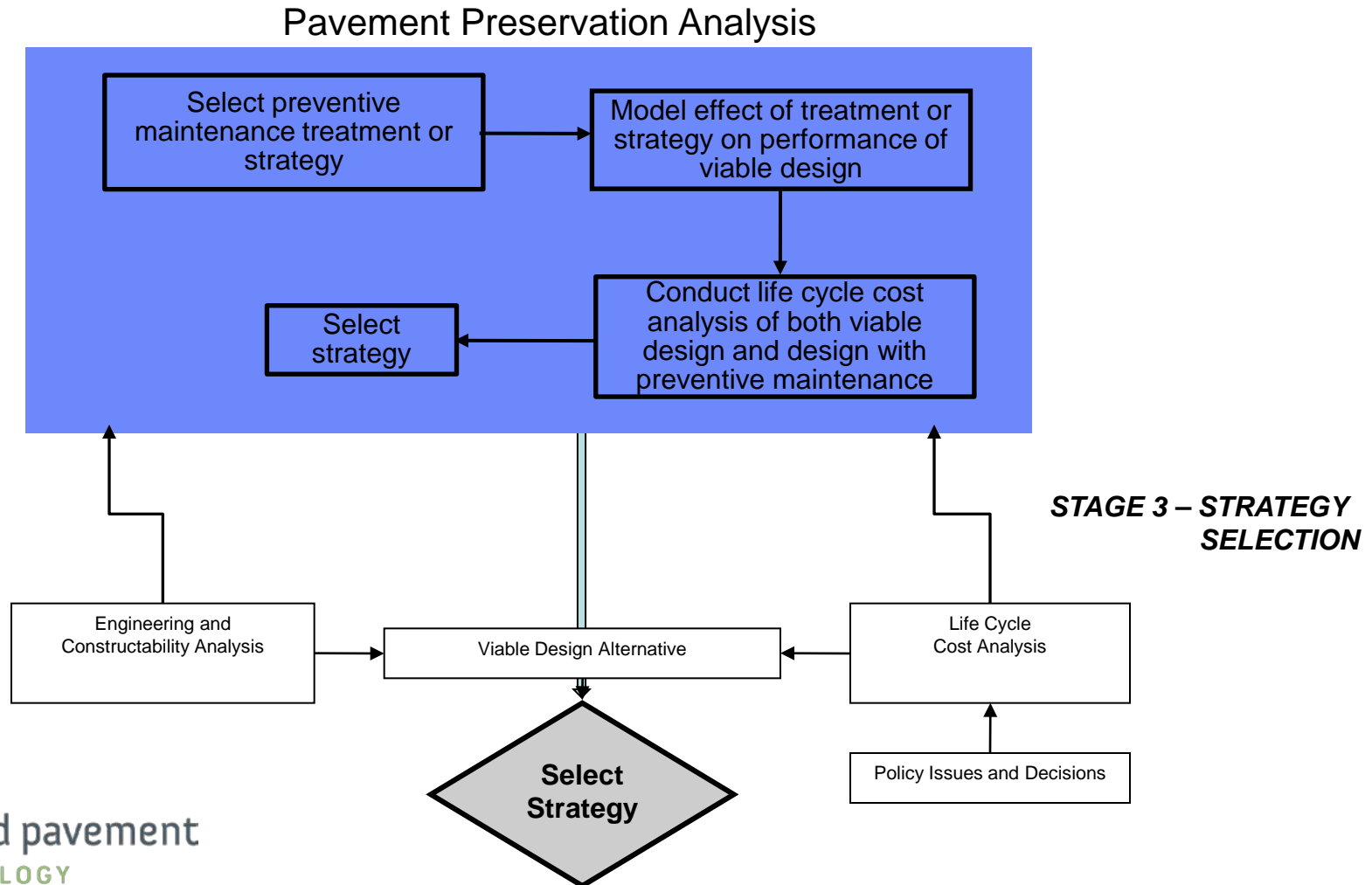
Effects of PM on Performance— PCC Surfaces

		PERFORMANCE INDICATORS							
		Jointed Plain Concrete Pavement				Continuously Reinforced Concrete Pavement			Smoothness (IRI)
		Joint faulting	Load transfer efficiency	Load-related transverse cracking	Joint spalling	Crack spacing/width	Load transfer efficiency	Punchouts	
Treatment									
Portland Cement Concrete Pavements	Crack Sealing/ Joint Resealing	+		+	+				-
	Diamond Grinding	+							+
	Load Transfer Restoration	+	+						+
	Undersealing	+	+						
	Pavement Patching		+	+	+			+	+/-

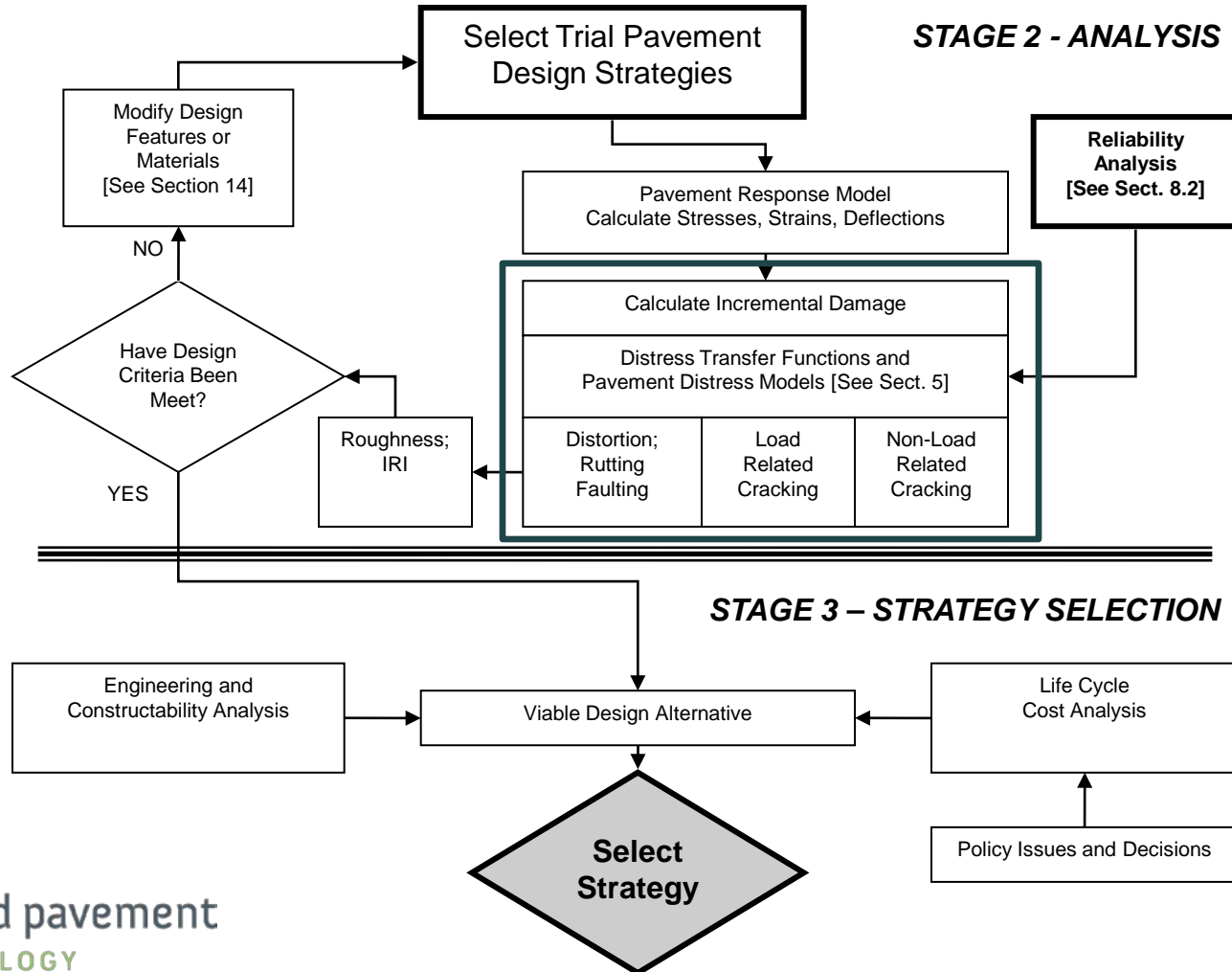
Recommendations

- Without data
 - Consider preservation in Stage 3—Strategy Selection
 - Address in Stage 2—Analysis
 - Construct test sections and generate data
- With data
 - Local calibration using pavements with preservation
 - Consider effects of PM on material properties

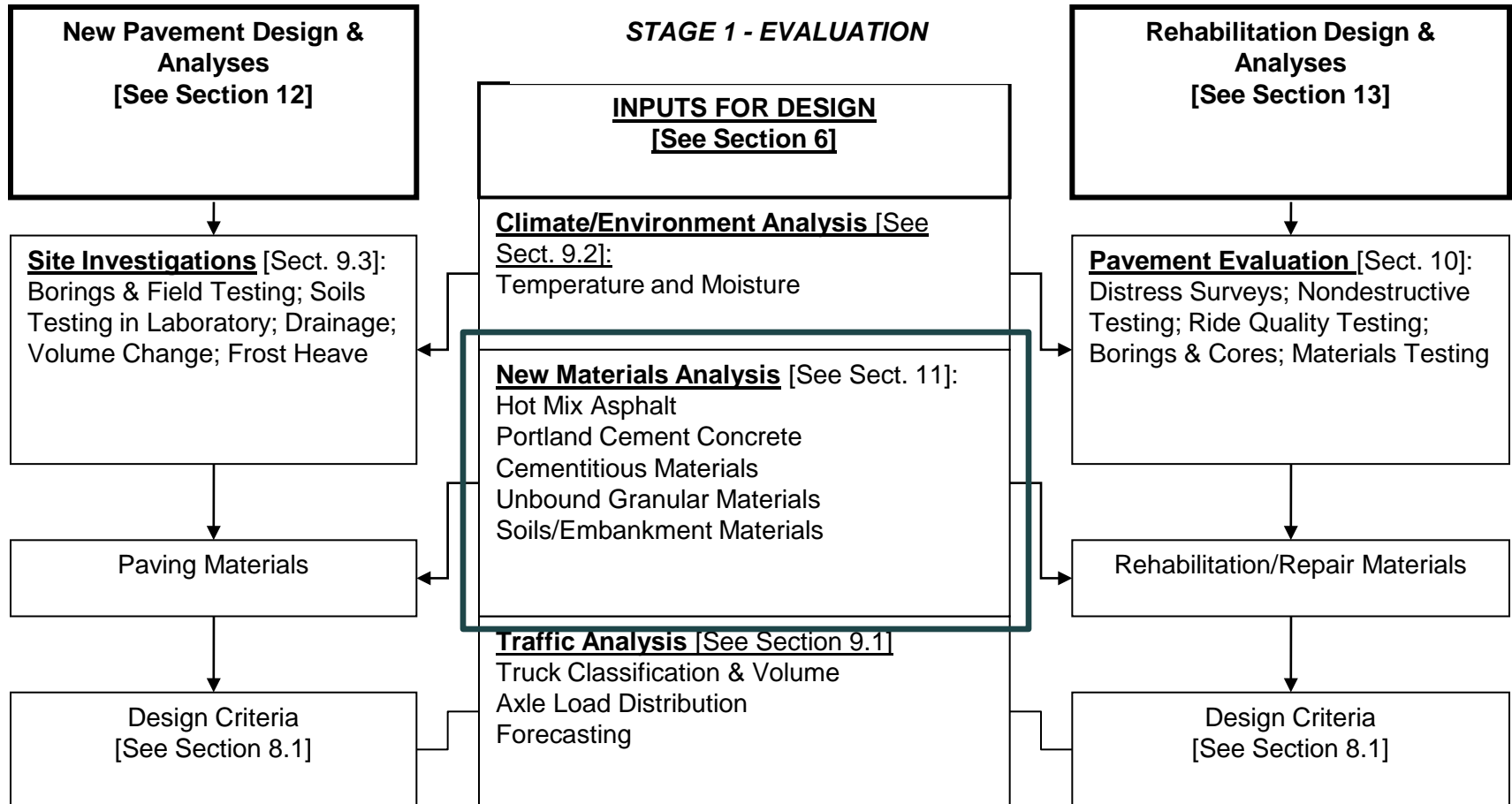
No Data: Stage 3



No Data: Stage 2



Data: Stage 1



The Future: Further Research

- Use lab tests to adjust mechanistic models
- Analyze effects of preventive maintenance treatments on material inputs used in generating inputs for design or analysis.
- Better quantify effects of preventive maintenance treatments on pavement materials over time in order to modify MEPDG calculations of incremental damage over time.

Further Research (continued)

- Analyze existing data to determine feasibility of refining global models for select treatments
- Refine and better quantify impacts of pavement preservation on models
- Better quantify effects of preventive maintenance on reducing roughness and extending pavement life

Further Research (continued)

- Investigate feasibility of national experiment to develop global models that reflect effect of pavement preservation on pavement performance and, therefore, on pavement design

NCHRP 1-48

- Objective: develop procedures for incorporating PP treatments into MEPDG analysis process
- Deliverable: chapter on PP in a format consistent with the MEPDG manual for consideration and adoption by AASHTO
- 24 Months/\$300,000
- Proposals due later this month

Questions & Answers?

Thank You!

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