The New Mechanistic-Empirical Pavement Design Guide:
Implementation and Other Issues…or

What in the world is going on?

Kevin D. Hall, Ph.D., P.E.
University of Arkansas
Department of Civil Engineering

Southeastern Asphalt User-Producer Group
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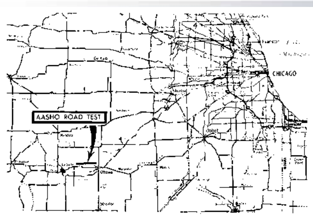
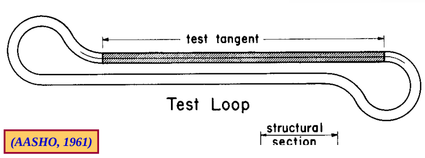
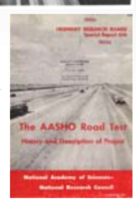
First things first…

- What is the mechanistic-empirical pavement design guide (MEPDG)?
  - A product of NCHRP 1-37a
    - With refinements under NCHRP 1-40
  - A pavement *analysis* tool
    - Provides predictions of pavement distress, given a trial structural pavement section
- What is it NOT?
  - An official AASHTO product (yet)
  - A traditional "design" program (yet?)
  - (likely) in its final form

Memory Lane: the AASHO Road Test
(late 1950's)







(AASHO, 1961)

AASHTO Pavement Design (current)

$$\log_{10} W_{18} = Z_R * S_o + 9.36 * \log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2-1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 * \log_{10} M_R - 8.07$$

Flexible pavement design:
the ***answer*** is structural number (SN)

Then you break SN into layers:

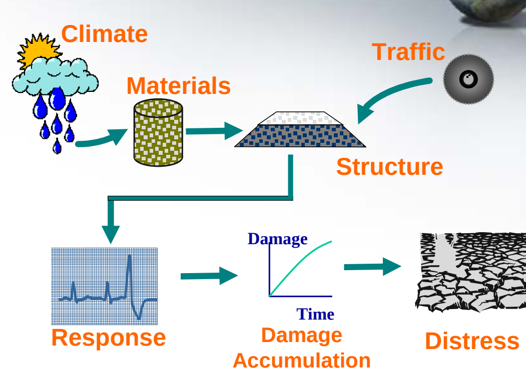
$SN \leq (a_{ACHM} * d_{ACHM}) + (a_{base} * d_{base})$

The ***design*** is layer thickness

MEPDG: Flexible Pavements

- Distress Models
  - Fatigue Cracking (bottom up)
  - Rutting
  - Thermal Cracking
  - Roughness (IRI)

Mechanistic-Empirical Design/Analysis:
The "nickel tour"

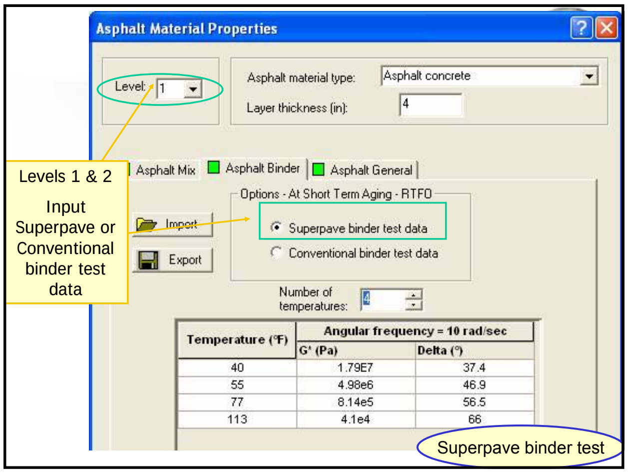


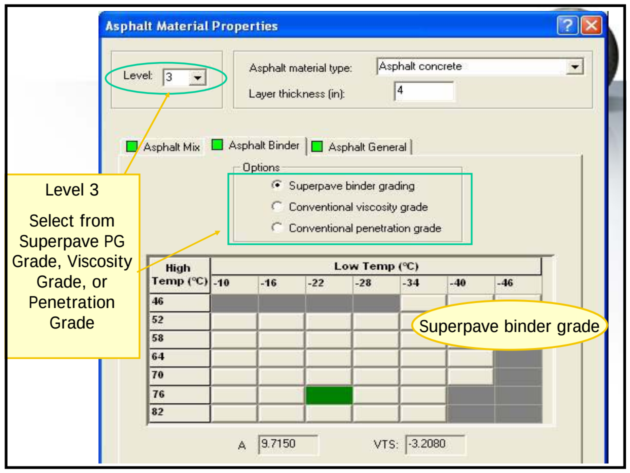
MEPDG: Materials Inputs

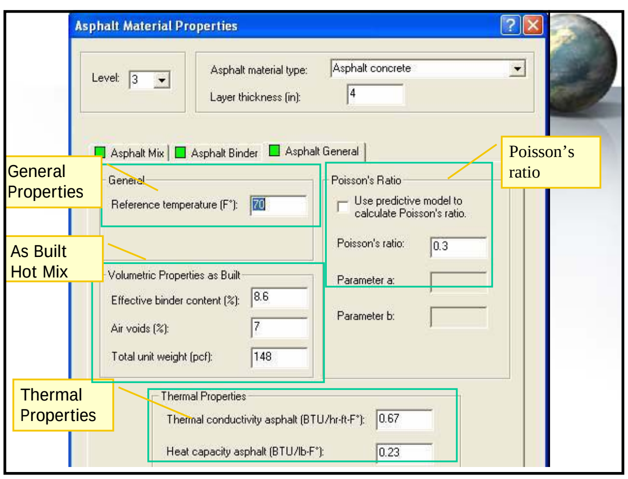
- Complicating Factors
  - LOTS MORE!!!!
    - Some inputs not currently measured/tracked
  - "Levels" of inputs
    - Level 3: I don't know much about the input…
    - Level 2: I know "some" about the input…
    - Level 1: I know a lot about the input…
- Typical Approaches
  - catalogs/libraries
  - correlations

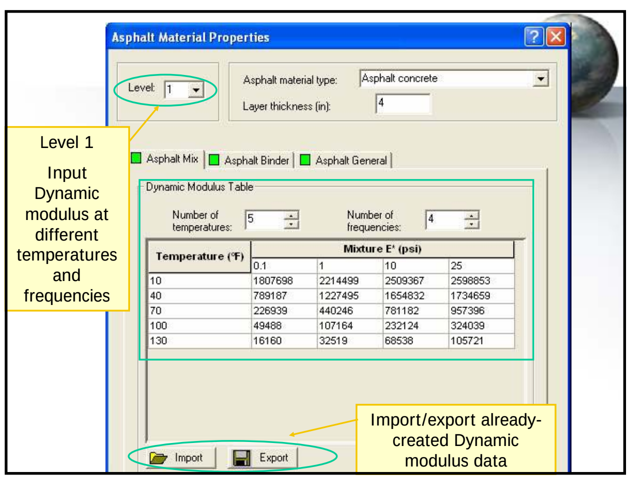
Asphalt Materials Properties

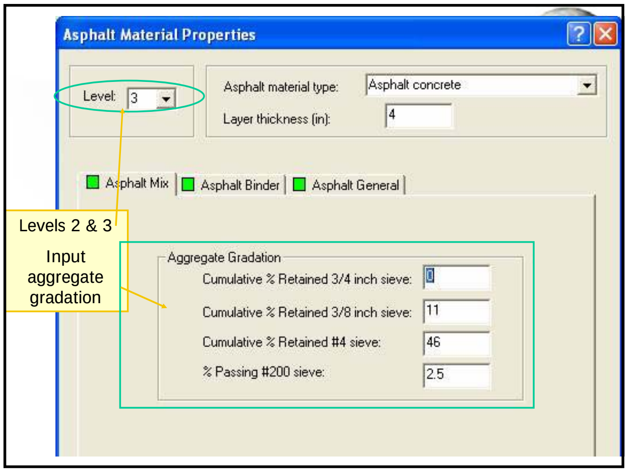

Parameter	Level 1	Level 2	Level 3
Dynamic Modulus, E*	Lab: simple performance test	Mix volumetric properties	Mix volumetric properties
Tensile strength & Creep compliance	Lab: indirect tension test	Lab: IDT at 1 temperature	Default data calculated

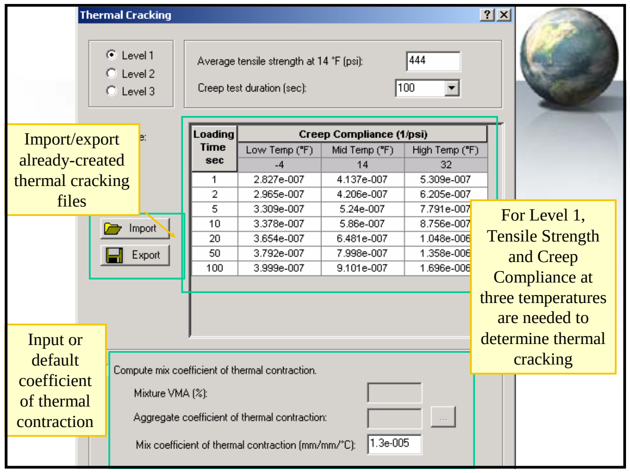







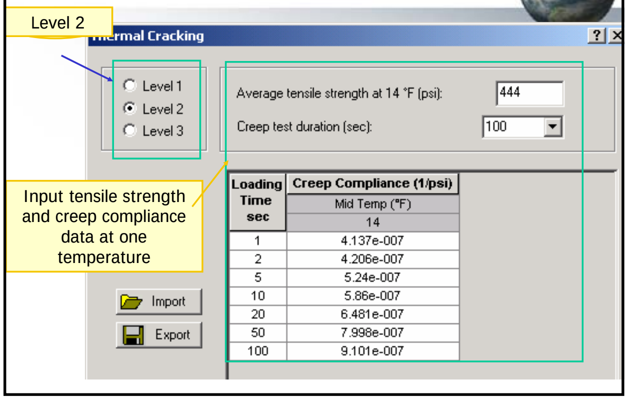






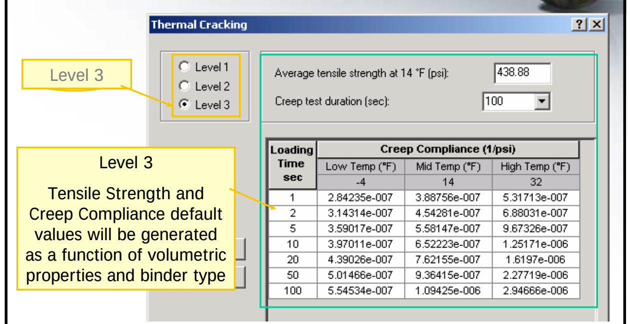
Loading Time sec	Creep Compliance (1/psi)		
	Low Temp (°F)	Mid Temp (°F)	High Temp (°F)
	-4	14	32
1	2.827e-007	4.137e-007	5.309e-007
2	2.965e-007	4.206e-007	6.205e-007
5	3.309e-007	5.24e-007	7.791e-007
10	3.378e-007	5.86e-007	8.756e-007
20	3.654e-007	6.481e-007	1.048e-006
50	3.792e-007	7.998e-007	1.358e-006
100	3.999e-007	9.101e-007	1.696e-006

Thermal Cracking - Level 2



Loading Time sec	Creep Compliance (1/psi)
	Mid Temp (°F)
	14
1	4.137e-007
2	4.206e-007
5	5.24e-007
10	5.86e-007
20	6.481e-007
50	7.998e-007
100	9.101e-007

Thermal Cracking – Level 3



Loading Time sec	Creep Compliance (1/psi)		
	Low Temp (°F)	Mid Temp (°F)	High Temp (°F)
	-4	14	32
1	2.84235e-007	3.88756e-007	5.31713e-007
2	3.14314e-007	4.54281e-007	6.88031e-007
5	3.59017e-007	5.58147e-007	9.67326e-007
10	3.97011e-007	6.52223e-007	1.25171e-006
20	4.39026e-007	7.62155e-007	1.6197e-006
50	5.01466e-007	9.36415e-007	2.27719e-006
100	5.54534e-007	1.09425e-006	2.94666e-006

MEPDG: Pavement Responses

- Ties to materials inputs
- Typical Approach: **Sensitivity Analysis**
  - Identifies “critical” inputs
    - “Where do I need to spend my money?”
  - Provides an assessment of the suitability of using default values
  - Allows designers to focus on topics most affecting design
    - Gives designers tools to affect one distress without affecting others

MEPDG: Local Calibration

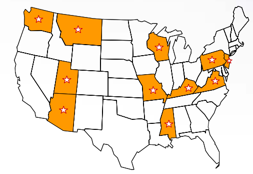
- This is where the “empirical” of M-E comes in…
- Compare predicted distress versus real life
- Adjust distress prediction models to “fit”
  - Current calibration is *national*
- Typical Approach
  - Start with LTPP sections
  - Add existing sections (PMS??)
  - Plan new sections
  - DATA QUALITY IS KEY
- This could be a long-term effort!!!

To Sum Up…

- Materials and traffic inputs have gotten intense
  - Catalog and document past & future testing efforts
- Pavement responses must be understood
  - Sensitivity analyses – R – us
- Make it real – but make sure it's complete
  - Local calibration makes the MEPDG work for you

A final thought: you are not alone!

- FHWA Design Guide Implementation Team (DGIT)
- Lead States



- Technology Transfer

THANK YOU

QUESTIONS?