The Asphalt Pavement Alliance Presents:

A Five-Part Webinar Series On Mechanistic Empirical Pavement Design Guide (MEPDG) Implementation Specific to Asphalt Pavements

Part 1: Pavement Design, Where We've Come From and What We're Trying to Accomplish

Part 2: Local Calibration

Part 3: Individual Distress Models

Part 4: Major Inputs – Where Do They Come From & How Do We Get Them?

Part 5: Moving Beyond Data Input (Advanced)

AMERICA RIDES ON US Asphalt.

The Asphalt Pavement Alliance Presents:

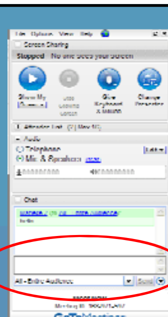
A Five-Part Webinar Series On Mechanistic Empirical Pavement Design Guide (MEPDG) Implementation Specific to Asphalt Pavements

- **Today's Webinar: Part-5**
  Moving Beyond Data Input (Advanced)
- **Speaker:**
  David Newcomb, Ph.D., P.E.
  Senior Research Scientist with the Texas Transportation Institute
- **Moderator:**
  Mike Kvach, APA

AMERICA RIDES ON US Asphalt.

Webinar Protocol:

- **Audio Quality**
  - All attendees have been muted upon joining.
- **Questions & Answers**
  - Questions Box – Make sure to change the drop-down menu to "Organizer & Panelists Only"
- **Recorded Webinars**
  - www.asphaltfacts.com/webinars/
  - Click on: "View Webinars"



AMERICA RIDES ON US Asphalt.

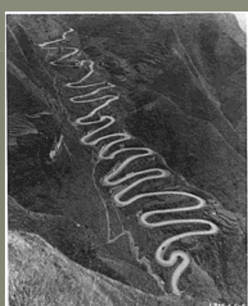
Part 5:
Moving Beyond Data Input (Advanced)

- **Speaker:**
  David Newcomb, Ph.D., P.E.
  Senior Research Scientist with the Texas Transportation Institute

- **Panelist:**
  Kevin Hall, PhD., P.E.
  Professor and Head of the Department of Civil Engineering at the University of Arkansas

AMERICA RIDES ON US Asphalt.

Pavement M-E: Now that we have it, what do we do with it?



Asphalt Pavement Alliance
Webinar
September 2013

What have we covered?

- Why we need to change
  - Outdated design procedures
    - Materials
    - Traffic
    - Thickness
  - Better flexibility
    - New Materials
    - Actual Performance Predictions
    - Better Understanding of What's Important
  - Easier to change procedures

What have we covered?

- Inputs
  - Materials
    - Asphalt - dynamic modulus
    - Soil and Base – resilient modulus
  - Traffic
    - Use load spectrum, not ESALs
  - Climate
    - Requires inputs from weather stations
    - Marches through time in 1-hr intervals
  - Use Average Input Values – Not Conservative Values

What have we covered?

- Models
  - Bottom-up fatigue
    - Depends upon
      - Thickness
      - Modulus
  - Top-down fatigue
    - Place-holder right now
  - Thermal Cracking
    - Works well
  - Rutting
    - Careful about subgrade rutting
  - Roughness
    - Depends upon other distresses

What have we covered?

- Calibration – Have to do!
  - What distresses are important?
  - Characterize materials
    - Develop catalogs of properties
      - Soils
      - Bases
      - Asphalt Mixes
  - Traffic
    - Not for low-volume roads
  - Get the models to work for your conditions

What have we covered?

- Design
  - Pavement-ME™ is not a design method
  - It is for analysis
  - Develop design catalog
  - Use for special conditions
  - Use to analyze consequences
- Things to Come
  - Rehabilitation – Being worked on.
  - Low-Volume Roads – Needs work.

Today: Beyond Input and Output

- How can M-E be used?
  - Disclaimer: Examples today were done with Weslea for Windows for ease of use. Same things can be done with Pavement-ME™.
- What's coming down the road?
  - Research projects
- What's on your mind?

Ideas

- How will new materials perform?
- How will changes in design affect economics?
- Can soil stabilization improve performance and design?
- How will changes in traffic affect design?

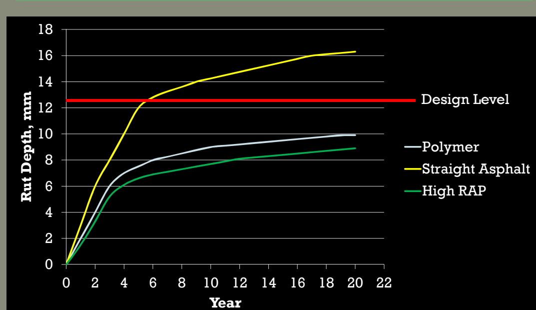
Materials

- Get credit for polymers
- Performance of SMA
- High RAP mixes
- Advantages of soil stabilization

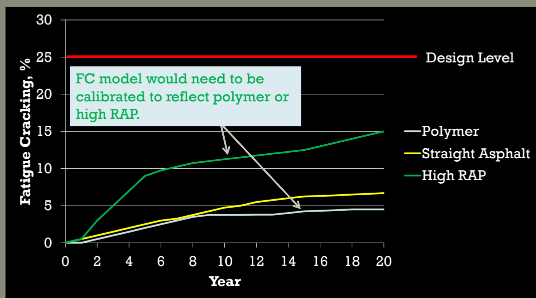
Polymers and RAP

- Adding polymers or RAP increases the modulus of asphalt mixture
- Increased modulus:
  - Reduced tensile strains – Improved fatigue life
  - Reduced permanent deformation – Improved rutting life

Asphalt Rutting Performance



Fatigue Performance

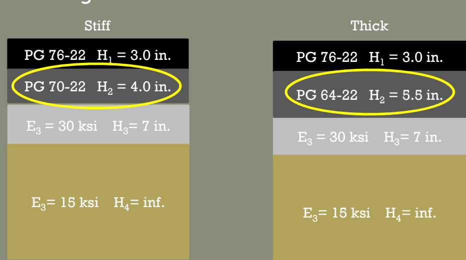


Different Paths to Same Answer

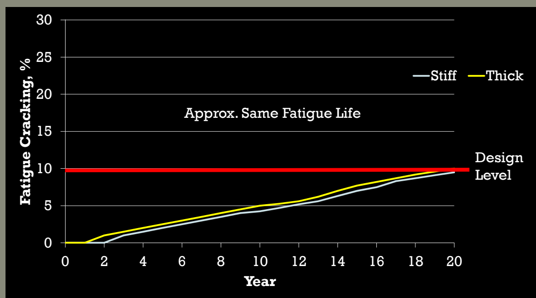
- Polymers
  - Improved Rutting Resistance
  - Polymer Mix can Cost $20 to $40/ton More
  - Another Approach?
- RAP
  - Increased RAP can Improve Rutting Resistance and Meet Fatigue Requirements
  - Reduced Cost, BUT
  - What is the Effect on Other Performance Measures? Thermal Cracking, etc.

Pavement Economics

- Trade-offs
  - Use high-modulus materials vs. thickness



Fatigue Life



Evaluate Economics

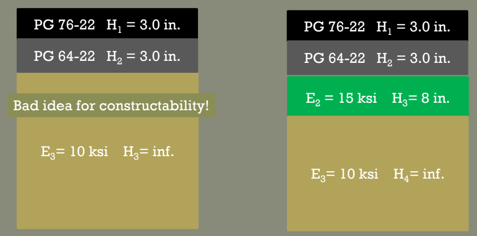
- PG76-22 Mix
  - TN Bid Tab (2013) = $140/ton
- PG 70-22 Mix
  - TN Bid Tab (2013) = $103/ton
- PG 64-22 Mix
  - TN Bid Tab (2013) = $85/ton
- Economic Comparison
  - Stiff Pavement Mix Cost = $328,000/lane-mile
  - Thick Pavement Mix Cost = $351,000/lane-mile
  - Save $23,000/lane-mile using Stiff Pavement

Caveats

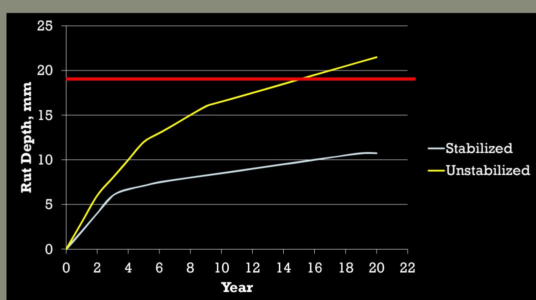
- Other Performance Criteria Need to be Checked
  - Rutting
  - Thermal Cracking
  - Etc.
- Bid Prices Depend Upon:
  - Competition
  - Material Prices at the Time of Bid
  - Quantities
  - Phase of the Moon
- Results May Vary

Stabilized Materials

- Soil: What is the advantage of using lime stabilization in a weak subgrade?



Total Rutting

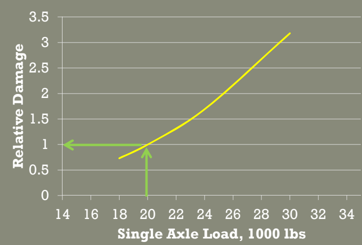


Other Considerations for Weak Subgrade

- Other Improvement Techniques
  - Granular Base
  - Stabilized Base over Unstabilized Soil
- Economics
- Distresses
  - Rutting controlled over Fatigue
  - Need to check others
- May need stabilization for other reasons, e.g., swelling soil

Traffic

- Effects of overweight vehicles
- Effects of changes in legal weights



Traffic

- Going from duals to super-singles
  - Super-singles could increase damage by 27%?

Traffic

- Going from duals to super-singles
  - Super-singles could increase damage by 27%?

NO!

  - Tests at NCAT Test Track show lower asphalt strains for Super Singles.
  - Layered elastic analysis as used in Pavement-ME™ is not appropriate for every situation.
  - Need an understanding of limitations before applying it.

Limitations

- Circular Loads
  - Rectangular Loads – Need to Modify Code
- No Edge Effects
- Material Properties Equal in All Directions
  - Depends on Aggregate Shape
  - Compaction
- Linear Elastic Behavior Only
  - Stress Dependency
  - Viscoelasticity
  - Large Strains
- With All the Limitations, We're Still MUCH Better Off!

Things to Come

- NCHRP 1-41: Models for Predicting Reflection Cracking of Hot-Mix Asphalt Overlays
  - Completed
- NCHRP 1-47: Sensitivity Evaluation of MEPDG Performance Prediction
  - Completed
- NCHRP 1-48: Incorporating Pavement Preservation into the MEPDG
  - Completion Date:8/30/13

Things to Come

- NCHRP 1-50: Quantifying the Influence of Geosynthetics on Pavement Performance
  - Completion Date: 3/1/14
- NCHRP 1-52: A Mechanistic-Empirical Model for Top-Down Cracking
  - Completion Date: 3/4/16
- NCHRP 9-44A: Validating an Endurance Limit for HMA Pavements: Laboratory Experiment and Algorithm Development
  - Completed

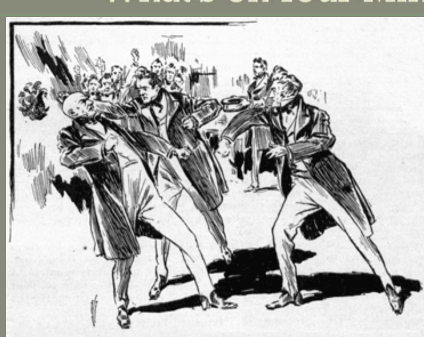
Final Thoughts on Pavement Design

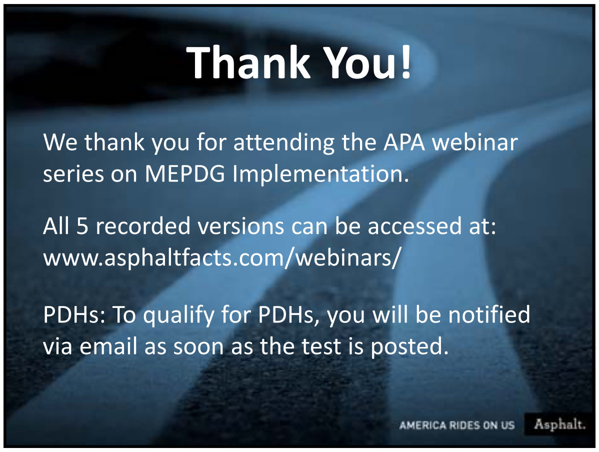
- It's not rocket science – we're still talking about asphalt and rocks
- Precision
  - Tolerance on asphalt thickness ± 0.25"
  - Tolerance on granular layer ± 0.5"
- Traffic – difficult to forecast
  - Growth or decline?
  - Political decisions
  - Fuel consumption

Final Thoughts

- ME design works but also requires work
  - Greater flexibility
  - Use the right materials in the right places
  - More realistic performance predictions
  - Analysis is powerful
  - Need to understand how it works

What's on Your Mind?




Thank You!
We thank you for attending the APA webinar series on MEPDG Implementation.
All 5 recorded versions can be accessed at: www.asphaltfacts.com/webinars/
PDHs: To qualify for PDHs, you will be notified via email as soon as the test is posted.
AMERICA RIDES ON US
Asphalt.