PaveXpress

A Simplified Pavement Design Tool

WAPA Annual Conference
December 2014
Today’s Agenda

- Why PaveXpress?
- An Introduction
- Overview of system
- Design scenarios using PaveXpress
- What is happening next
We’ve got a lot of roads

http://www.fhwa.dot.gov/planning/images/thnhsjpg.jpg
Examples of over and under-designed pavement abound
Perpetual pavement design

Wheel Loads

Typical Depths

- 1.5 - 3 inches: High Quality HMA/SMA/OGFC
- 4 - 7 inches: High Modulus Rut Resistant HMA
- 3 - 4 inches: Fatigue Resistant HMA
- Maximum Tensile Strain

Material

Subgrade
AASHTO has been developing MEPDG for high volume roads, but a gap has developed for local roads and lower volumes.
PaveXpress Objectives

• Provide tool to develop technically sound pavement designs for roadway pavements
• Provide a user-friendly, visually appealing, pavement design tool accessible to users on a variety of devices
• Provide a free application for conducting pavement designs following 1993/1998 AASHTO
• Provide resources to enhance understanding and comfort with asphalt pavement design
Target Audience

• Local Agencies
• A/E/C Firms
• Engineering Students

Non-Pavement Design Specific Engineers!
Guiding Principles

• Provide accurate un-biased results...**be a trusted resource**
• Only ask the user for what is required to perform a technically sound design
• Where appropriate suggest industry accepted defaults to minimize user input
• Provide context sensitive help and guidance
• Assume users aren’t pavement design experts
I don’t always do pavement designs, but when I do, I prefer PaveXpress.

Image from themostinterestingblogintheworld.com
Approach: Web Delivery

- Browser based delivery
- Available via the web
- Supports all kinds of devices/OS
  - Desktops
  - Laptops
  - Tablets (7” – 10” - includes iPad Mini on up.
  - Handheld device capabilities
- Easily scalable and updatable
Approach: Technical

• Provide technically sound designs using:
  – Flexible: AASHTO ’93
  – Rigid: AASHTO ‘93 w/ ‘98 Supplement
  – Parking lot guidance (Flexible only)
• Use industry accepted standards and guidance
• Linkages to State and Local guidance
• Linkages to Pavement Interactive
A sneak preview at some of the highlights.

LET’S TAKE A CLOSER LOOK!
Welcome to PaveXpress
A simplified pavement design tool for flexible and rigid pavements using AASHTO 93/98.

Introduction
Welcome to PaveXpress, a scoping tool to help you create simplified pavement designs while taking into account key engineering inputs.

Resources
PaveXpress includes access to resources such as design guides from state DOTs and industry associations so you can build formal designs from its simple recommendations.

Get Started
Click on the button below to launch the PaveXpress Scoping Tool and start creating your own designs, with options for both flexible and rigid pavement construction.

View Resources

Launch

Home page: Welcome to PaveXpress
Welcome to PaveXpress
A simplified pavement design tool for local engineers, consultants, and students.

Introduction
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Navigation up top, resources to familiarize you
Background

Flexible  Rigid

1993 AASHTO Flexible Pavement Structural Design

Empirical equations are used to relate observed or measurable phenomena (pavement characteristics) with outcomes (pavement performance). This article presents the 1993 AASHTO Guide basic design equation for flexible pavements. This empirical equation is widely used and has the following form:

\[
\log_{10} (W_{18}) = Z_R \times S_0 + 9.36 \times \log_{10} (SN + 1) - 0.20 + \frac{\log_{10} \left( \frac{\Delta PSI}{4.2 - 1.5} \right)}{0.40 + \frac{1094}{(SN + 1)^{5.19}}} + 2.32 \times \log_{10} (M_R) - 8.07
\]

These variables will be further explained in the inputs section.

Where:

- \( W_{18} \): predicted number of 80 kN (18,000 lb.) ESALs

Background Information is available
AASHO Road Test

The AASHO Road Test, a $27 million (1960 dollars) investment and the largest road experiment of its time, was conceived and sponsored by the American Association of State Highway Officials (AASHO) as a study of the performance of highway pavement structures of known thickness under moving loads of known magnitude and frequency (Highway Research Board, 1961). The test studied both portland cement concrete and asphaltic concrete pavements, as well as certain types of short-span bridges.

The information obtained from the AASHO Road Test was crucial in advancing knowledge of pavement structural design, pavement performance, load equivalencies, climate effects, and much more. The basic performance information resulted in the performance equations and nomographs used in the AASHTO Guide. This section provides some background information on the AASHO Road Test. It should be helpful in understanding the experiment’s strengths, weaknesses and limitations.

Background

This section provides some of the basic background for the AASHO Road Test and is taken primarily from Highway Research Board’s Special Report 61A, The AASHO Road Test: History and Description of the Project (1961).
FAQ

What data do I need to have ready in order to use the tool?

You should know the intended design life of the pavement, have traffic counts in order to determine loads, and have an idea of what layer types to include in the pavement structure. Many of the tool inputs can be based on estimates or use default values provided by the tool itself.

How is the output of the tool provided?

The tool will generate a recommended structural design and layer thicknesses for the pavement structure being scoped. In addition, the tool can provide you with additional resources to review for design guidance.

Can this substitute for a formal design program such as DARWin-ME?

PaveXpress is designed as a scoping tool so that users can quickly scope potential pavement designs based on minimal input requirements. The tool applies standard design equations to generate its recommendations, but is not a replacement for an agency's formal design process.

Does the tool use a mechanistic-empirical design process?

The design equations used by the scoping tool are empirical in nature. Additional features to incorporate mechanistic inputs are currently being considered.
You must register with email and password.
Once logged in, go to My Projects to view your designs.
Create and manage your folders of designs
Create a new project and design at the click of a button
Give it a name and location
A clean, step wise process for creating the design
1. Start with general project information, locations
2. Expand into design parameters
Context sensitive help linked to resources throughout
Enter traffic and loading information
Calculate traffic from AADT using AASHTO methods
Completion year traffic is set, now on to LEF
Create composite load equivalency factor
Specify your surface layer information
Warnings where appropriate to alert of changes
Enter your base layer and subgrade information
Add multiple base layers if needed
And enter your subgrade...can use conversion tables
And voila...a design and resources are available
And the calculations are shown
Iterate back and forth to check sensitivity, add layers
For Rigid, a similar process with a few alterations
Additional design parameters for weather
Specify the surface characteristics
Specify the base characteristics
And again, voila, a design is presented with calculations
Parking lots you ask?
Light duty points directly to local guidance (catalogs)
Takes you to local guidance from WAPA
Some other capabilities you should be aware of
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<th>Last Update</th>
<th>Type</th>
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Organize, store, and print your designs
Share your design directly from PaveXpress via email
<table>
<thead>
<tr>
<th>Roadway Classification</th>
<th>Local</th>
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<tbody>
<tr>
<td>Pavement Type</td>
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**Design Parameters**

**Traffic Parameters**

**Pavement Structure**

**Design Recommendation**

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<th>Binder/Intermediate 2.00”</th>
<th>Base 3.00”</th>
<th>Granular Base 6.00”</th>
<th>Granular Base 6.00”</th>
<th>Subbase</th>
<th>Subbase</th>
<th>Subbase</th>
</tr>
</thead>
</table>

Compare up to 3 designs side by side
Future of *PaveXpress*

A framework to continue to build upon:

- Overlay design (empirical)
- Simplified mechanistic design for both new construction and overlays
- Comparison tools for mechanistic and empirical methods
- And more
A Simplified Pavement Design Tool

www.pavexpressdesign.com

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