

# LTPP Newsletter

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## LTPP Creates Analysis-Ready Datasets

The Long-Term Pavement Performance (LTPP™) program has established more than 2,500 pavement test sections since the program started collecting data in 1989, and significant amounts of performance data have been collected on each section, including surface distresses, longitudinal and transverse profiles, and surface deflections. In addition, the LTPP program has collected data quantifying the factors influencing performance, including pavement layer structure and material properties, climatic (moisture and temperature) conditions, traffic loadings and volumes, and

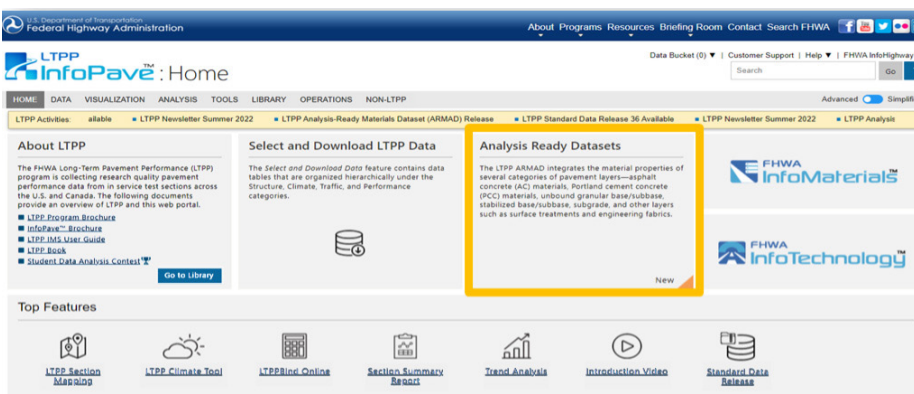
construction features, all of which are stored in the LTPP database. Understanding and using the LTPP database requires knowledge of both the LTPP program and the database structure, which can be challenging for users. To address this user challenge, the LTPP program is developing analysis-ready datasets (ARDs) to help users obtain the appropriate data for their research projects.

LTPP data are typically distributed across multiple tables in the database, making some data elements hard to mine. A given data element may also have multiple

values, making it difficult to know which value(s) to use, while in other cases missing values require imputation. In addition, users may have to interpret the data further to provide meaningful results. ARDs are a result of the data-wrangling effort, which organizes and groups data elements from multiple tables across the LTPP database and uses sound engineering judgment to compute the values for data users.

The first dataset created was the Analysis-Ready Materials Dataset (ARMAD), which solves the challenges for the layer thicknesses and material properties of LTPP test sections. The ARMAD was completed in the summer of 2022 and is now available on the [LTPP InfoPave™](#) Web portal shown in figure 1. Please refer to the [ARMAD TechBrief](#) for a summary of how the dataset was created. Additional ARDs for performance, climate, and traffic are anticipated to be available in the portal this summer.

The LTPP program team is excited to provide these datasets to make the data easier to use for our customers. This data wrangling also



Source: FHWA.

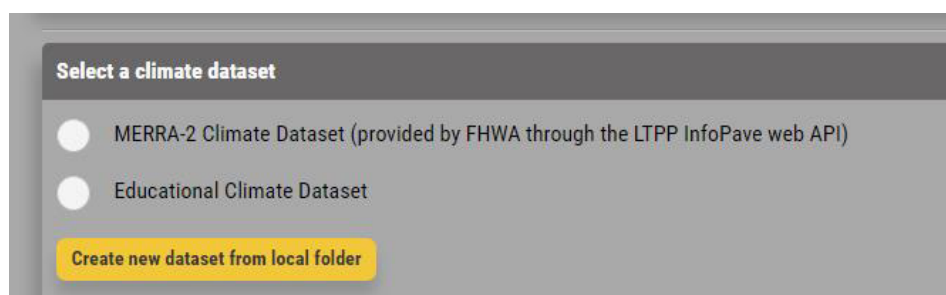
Figure 1. Screenshot. ARDs on the LTPP InfoPave Web portal.<sup>1</sup>

<sup>1</sup>LTPP InfoPave™ (web page). <https://infopave.fhwa.dot.gov/>, last accessed April 12, 2023.

results in data that can support pavement performance applications, including model calibrations and design software. For more information about the ARDs, contact Jane Jiang at [jane.jiang@dot.gov](mailto:jane.jiang@dot.gov).

### MERRA-2 Data API for AASHTO Software Generating Buzz Among Pavement Researchers

The LTPP program has been hosting the National Aeronautics and Space Administration Modern-Era Retrospective Analysis for Research and Applications, Version 2 (MERRA-2) data on the LTPP InfoPave Web portal since 2017. The LTPP program has developed the capability in InfoPave to create an hourly climatic database (HCD) file that users can download and input into the AASHTOWare® Pavement ME Design software.<sup>2</sup> American Association of State Highway and Transportation Officials (AASHTO) design software users recommended simplifying the transfer of climate data from InfoPave. The Federal Highway Administration (FHWA)



© 2023 AASHTOWare® Pavement ME Design.

Figure 2. Screenshot. AASHTOWare Pavement ME Design API to select MERRA-2 cells.<sup>3</sup>

“The ability to access InfoPave climate data directly from within the Pavement ME Design software is a valuable feature that speeds up the design process and makes life easier for pavement design engineers,” Clark S. Morrison, P.E., Ph.D., State Pavement Design Engineer for the North Carolina Department of Transportation and chairperson of the AASHTOWare Pavement ME Design Task Force.

and AASHTO worked together to eliminate the required manual user interference and implemented an application programming interface (API), shown in figure 2, that provides functionality to directly select nine MERRA-2 cells nearest to a specified location. This API is integrated with AASHTOWare

Pavement ME Design software to provide direct access to these HCD files from InfoPave for the required analysis.

### LTPP Program Hosts Successful Events at 2023 TRB Annual Meeting

The LTPP program hosted two successful events at the 102nd Transportation Research Board (TRB) annual meeting in January. The TRB Lectern Session 4049 on the LTPP program (sponsored by the TRB Standing Committee on Pavement Management Systems (AKT10) with cosponsorship by eight other pavement committees) was well attended. The LTPP program staff described the new ARDs (see featured article), the initiative to manage the data that will be collected from FHWA’s new pavement testing facility (which replaces the accelerated loading facility built in the 1990s), and the update of the [LTPP data analysis plan](#). Ohhoon Kwon introduced the research



Source: FHWA.

Note: Left to right, Deborah Walker (FHWA), Jian Liu (student contest second-place winner), Chuang Chen (student contest first-place winner), Jane Jiang (FHWA), Javier Ponce (FHWA), Larry Wisner (FHWA), Craig Thor (FHWA), Ohhoon Kwon (Florida Department of Transportation).

Figure 3. Photo. Participants of TRB Lectern Session 4049.

<sup>2</sup>AASHTO. 2020. *Mechanistic-Empirical Pavement Design Guide: A Manual of Practice*, 3rd Edition. Washington, DC: American Association of State Highway and Transportation Officials.

<sup>3</sup>AASHTO. 2015. *AASHTOWare® Pavement ME Design* (software).



being conducted at Florida's pavement testing facility, and the first-place winner of the Long-Term Infrastructure Performance (LTIP) student data analysis contest presented his analysis study.

TRB Workshop 1024—Use of Available Data to Extend the Life of Highway Infrastructure was a joint event with the Long-Term Bridge Performance Program and was sponsored by the TRB Section on Pavements (AKP00) with cosponsorship by 10 other pavement and structures committees. Presentations from experts across both the pavement and bridge



Source: FHWA.

Note: Left to right, Jian Liu (student contest second-place winner) and Chuang Chen (student contest first-place winner).

*Figure 4. Photo. Winners of the 2022 LTIP student data analysis contest at the LTPP program lectern session.*

professions addressed the work to collect, understand, organize, analyze, and foster trust in the data and their supporting information. A lively panel discussion also occurred in which the members and audience provided their views on the questions: How do we get people to use the data that we have? How can we effectively use the data? Are current data-collection efforts addressing analysis needs?

The workshop will be summarized in a document that will include the next steps to help pavement and bridge asset owners use available data to extend infrastructure life. For a copy of the workshop summary or presentations from the lectern or workshop events, please contact the LTPP Customer Support Service Center at [ltpinfo@dot.gov](mailto:ltpinfo@dot.gov).

## In Brief

### Winners of the 2022 Student Data Analysis Contest

Four papers were selected for awards in the LTIP student data analysis contest. The student winners are as follows:

- Chan Yang, Ph.D. candidate; Peng Lou, Ph.D., research associate; and Hani Nassif, P.E., Ph.D., professor and director. Rutgers, the State University of New Jersey. First place (Bridge): "Correlation of Bridge Deck Deterioration with Truck Load Spectra based on Weigh-In-Motion Data."
- Chuang Chen, Ph.D. student; Yong Deng, postdoctoral research associate; Mengyan Li, assistant professor (Bentley University); and Xianming Shi, professor. Washington State University. First place (Pavement): "Key Climatic Factors Affecting Asphalt Pavement Roughness Differ in Different Climate Regions: Exploratory Analyses."

- Jian Liu, Ph.D. candidate; and Linbing Wang, Ph.D., P.E., professor. Virginia Polytechnic Institute and State University. Second place (Pavement): "Optimizing Asphalt Mix Design Considering IRI of Asphalt Pavement Predicted Using Autoencoders and Machine Learning."
- Muhamad Munum Masud, graduate research assistant; and Syed Waqar Haider, Ph.D., P.E. associate professor. Michigan State University. Third place (Pavement): "Relationship between Gross Vehicle Weight with Commercial Freight Tonnage—Case Studies Based on LTPP WIM Data."

Congratulations to the winners and thank you to everyone who participated. This year's [LTIP Student Data Analysis Contest](#) is underway, and papers are due August 1, 2023.

### Transportation Pooled Fund Solicitations

Two active Transportation Pooled Fund Program research projects involve the LTPP program. One continues the forensic investigations of LTPP test sections ([LTPP Forensic Investigations - Stage 2 TPF-5\(500\)](#)), and the other evaluates and documents the long-term performance of pavement preservation treatments ([National Partnership to Improve the Quality of Preventive Maintenance Treatment Construction & Data Collection Practices \(PG Phase III\) Solicitation 1581](#)). Please consider being a partner in these new efforts.

### New Publications

#### Reports

[Long-Term Pavement Performance Warm-Mix Asphalt Study, Volume I: Final Report](#)

[[FHWA-HRT-22-018 PDF](#)]

[Long-Term Pavement Performance Warm-Mix Asphalt Study Final Report, Volume II: SPS-10 Experimental Matrix and Research Plan](#)

[FHWA-HRT-22-019 PDF]

[Long-Term Pavement Performance Warm-Mix Asphalt Study Final Report, Volume III: SPS-10 Nomination Guidelines](#)

[FHWA HRT-22-020 PDF]

[Long-Term Pavement Performance Warm-Mix Asphalt Study Final Report, Volume IV: SPS-10 Materials Sampling and Testing Requirements](#)

[FHWA-HRT-22-021 PDF]

[Long-Term Pavement Performance Warm-Mix Asphalt Study Final Report, Volume V: SPS-10 Performance Monitoring Guide](#)

[FHWA-HRT-22-022 PDF]

[Long-Term Pavement Performance Warm-Mix Asphalt Study Final Report, Volume VI: SPS-10 Construction Documentation Guide](#)

[FHWA-HRT-22-023 PDF]

#### **TechBriefs**

[Effects of Seasonal and Diurnal FWD Measurements on LTE of JPCP—LTPP SMP Data](#)

[FHWA HRT-22-094 PDF]

[Introduction to the LTPP Analysis-Ready Materials Dataset \(ARMAD\)](#)

[FHWA HRT-22-114 PDF]

#### **Research Note**

[LTPP Analysis-Ready Materials Dataset \(ARMAD\) Release Research Note](#)

[FHWA-HRT-22-079 PDF]

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