

TxDOT News of Interest to TCPA

Specifications: The following changes are likely to be submitted for AGC and FHWA review and comment within the next two months:

- Item 421 Hydraulic Cement Concrete:
 - Trucks with automated in-transit slump flow monitoring and control will be allowed and results will be used in place of manual slump and temperature testing.
 - Continuing changes to fly ash chemistry have altered how TxDOT will be addressing ASR Mitigation Options. In short, the historical classifications of “C” and “F” will be discontinued and TxDOT will establish minimum Option 1 replacement percentages for each source of ash, to be published on the MPL. This proposed change will **not** have an appreciable impact on Class P and other non-structural classes of concrete.
 - Fineness Modulus limits will be waived for Optimized Aggregate Gradation (OAG) concrete.

Research: The following are TxDOT sponsored research projects of potential interest to TCPA members.

- One Mat Vs. Two Mats of Reinforcing Steel in 12 and 13 CRCP— Recent evaluations of 1-mat, 12+ inch CRCP revealed issues with delamination at the steel depth, requiring significant repairs. The research will instrument and monitor test sections with varying steel configurations to determine differences in pavement stresses and performance. Finite element modeling will complement the findings of the field work.
- Seamless Bridge with Concrete Pavement—A pilot project is being planned, likely in the Panhandle, to build a seamless bridge (connected to CRCP). The research will focus on analyzing the frictional resistance provided by common bond breakers and base materials, develop model parameters and design recommendations, and develop instrumentation plan for the pilot bridge project.

Future Concrete Pavement Investigation: The design and construction of transverse construction joints in CRCP has long been an area with potential for improvement. TxDOT and Texas Tech are devising a plan to look at the performance of simple alternatives (removal of longitudinal short bars, better curing, etc.).

Organizational Changes: 1) Pavement Design functions moved to Maintenance Division. 2) Materials & Tests Division reformed with Buddy Williams as Director. 3) Pavement maintenance and forensic responsibilities moved to Maintenance Division. 4) Construction Division and Materials & Tests Division coordinating on construction issues. 5) Materials & Tests retains responsibility for Item 361.

Database System Changes: TxDOT CONNECT is a new, custom-built system for managing the delivery of transportation programs, projects and right of way. The first 2 districts and 2 divisions have recently launched the system which is replacing DCIS, ROWIS and other legacy systems: <https://youtu.be/RYnTcEnntlw>

Texas Concrete Pavement Association



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*Expanding the use of quality
concrete pavements in Texas*

Texas Concrete Pavement Association

Elizabeth (Lisa) Lukefahr, P.E.,
Executive Director

Phone: 512-956-8272 (TCPA)
E-mail: lisa@texasconcrete.org

P.O. Box 300416
Austin, TX 78703
Website: www.texasconcrete.org

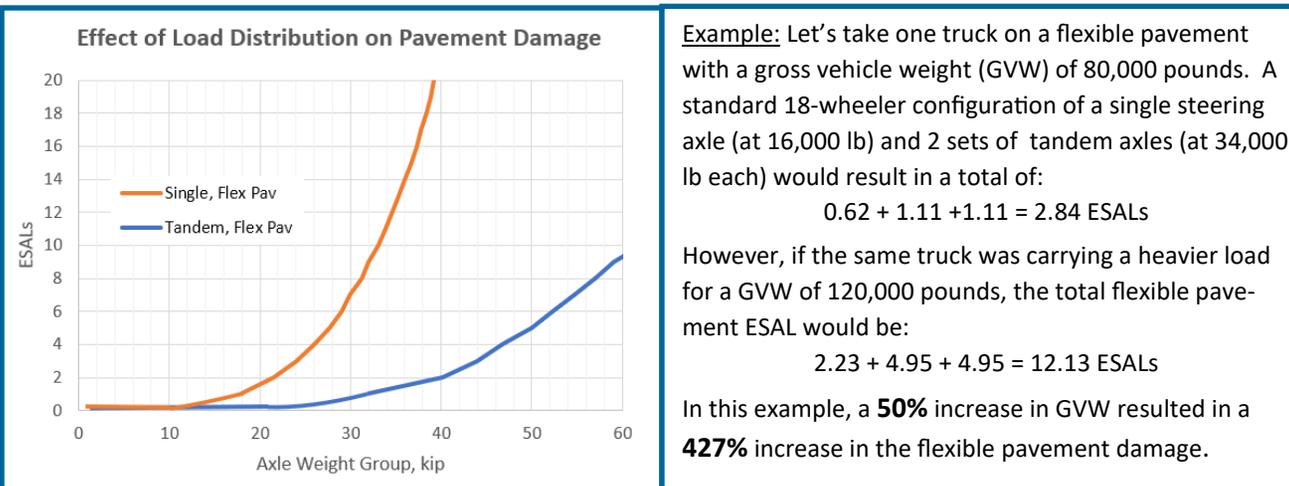
Pavement Design Life—Part I: Do Pavements Last As Long As They Are Supposed To?

Do concrete pavements live up to their design expectations? What about hot-mix pavements? Do they perform as intended? Your answer may be influenced by the industry in which you work, but it's worth trying to get to the bottom of whether or not pavement design practices are accomplishing pavement performance expectations.

To start with, let's remind ourselves about a key input to designing all types of highway pavements: **traffic**. The vehicles on a Texas highway can range from a 1900-lb Smart Car to 2,000,000+ pound super-heavy loads. Based on the gross vehicle weight and how that weight is distributed, vehicles will impart different levels of "damage" or wear on a pavement. The traditional approach to pavement design has been to normalize traffic to Equivalent Single Axle Loads (ESALs). TxDOT pavement design still uses this approach for both rigid and flexible pavement design.

The "Design ESALs" is the traffic load summary statistic that represents the predicted level and mix of traffic over the design life or analysis period of a pavement. Most DOTs, including TxDOT, use a 20-year period to accumulate ESALs on flexible pavement and a 30-year period for rigid pavements. Imagine trying to predict not just the total traffic level on any stretch of highway for the next 20 to 30 years, but also the mix of that traffic: how many passenger vehicles and how many trucks; the weight of all those trucks; and the axle configuration of those trucks.

Let's look a little deeper into the importance of the weight and axle configuration of trucks on pavement design and pavement performance. The following graph plots the relationship between axle group weight and ESAL factors for single and tandem axles, adapted from Table D.5 of the 1993 AASHTO Pavement Design Guide.



The example above shows how small errors in estimating future truck traffic **amount and weight** can result in large impacts on how soon the "Design ESALs" used in the pavement design process are realized. In general, flexible pavements across the TxDOT network are lasting the full number of ESALs for which they are designed. However, since all other aspects of highway construction, maintenance and usage operate on a time basis, not a ESAL basis, the answer to the original question, "Do pavements last as long as they are supposed to?" will depend on traffic prediction accuracy.

What is an ESAL?

An Equivalent Single Axle Load (ESAL) is not just a way to represent traffic; it represents the damage that the traffic does to the pavement.

The reference axle load (what all other load distributions are converted to) is an 18,000-lb single axle with dual tires.



The result of the passage of a single axle load of 18,000-lb is a damage of 1 unit, or **1 ESAL**.

As concrete (rigid) pavement is better able to carry heavy loads than a hot mix (flexible) pavement, the damage factors are different for each pavement type. Rigid ESALs are roughly 50% higher than flexible ESALs.

Bottom Line:

Concrete pavements are better able, by far, to account for rapid rates of ESAL accumulation and thus are better values when incorporating the risk element of higher-than-expected ESAL levels in the future.

A recent analysis by TxDOT's Pavement Group concluded that on average TxDOT CRCP pavements, which are designed for 30 years, actually last 35 years despite the reality that the accumulated ESAL level during that time is well above 100% of the Design ESAL. There are numerous TxDOT CRCP pavements currently on their third and fourth design lives—

that is, they have exceeded their "Design ESALs" 3 and 4 times over!

Without drastically improved traffic prediction capabilities, owners like TxDOT would be well served by using a Risk Management approach to pavement design. A simple risk assessment would include performing the pavement design using the provided Design ESALs and then redesign using several increased ESAL levels. The cost sensitivity of the designs using higher ESAL levels would be instructive in the pavement type selection decision.

Coming up in Part II: Pavement Design Example using a Risk Management process.