MODULUS OF ELASTICITY VALIDATION

OBJECTIVES

The objective of this document is to document the validation of the initial elastic modulus of elasticity.

MODULUS OF ELASTICITY

As the magnitude of corner curling is affected by the stiffness of the concrete at the time step under consideration, it is critical to obtain an accurate estimate of the modulus of elasticity of the pavement. The pavement is loaded by thermal stresses as soon as setting of the slab occurs and creep effects, therefore, influence the buildup of the modulus of elasticity significantly.

During construction of the slab, cylinders were taken and tested in the laboratory. The concrete specimen in the cylinder, and the concrete cured under field conditions, experienced different temperature histories. Figure 1 provides an example of the differences in concrete temperature experienced.

From figure 1, it can clearly be seen that 24 h of real time for the lab specimen would not be equal 24 h of real time for the concrete pavement. This is due to the fact that these concrete has been exposed to different temperatures and, therefore, different degrees of hydration at the same real time. Through the equivalent time concept, the age of the cylinders were related to that of the field poured concrete pavement.

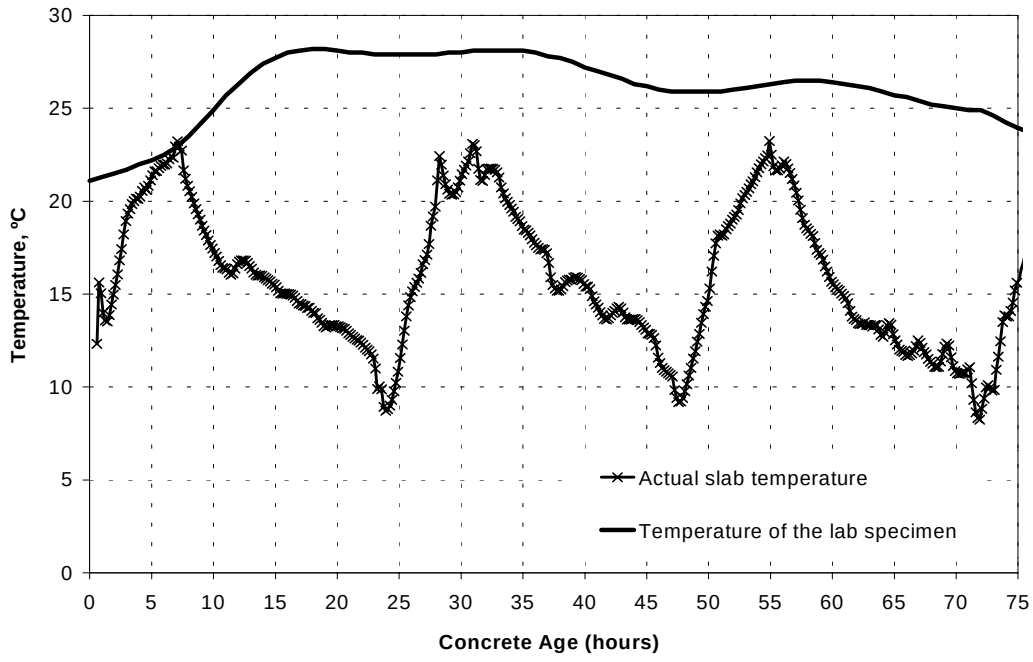

Figure 1. The temperature histories of the concrete slab and the lab specimen.

In order to estimate the modulus of elasticity for each of the field measured time steps a curve was fit through the modulus of elasticity of the concrete pavement. Note that this curve is only intended to be used to determine the modulus of elasticity for each time step up to 72 h after placement.

Through the Adiabatic testing procedure, the hydration shape and time parameters, were determined for the concrete mix design used during this project. Based on the hydration shape and time parameters obtained from the adiabatic testing, the pavement modulus of elasticity was very well predicted by the current HIPERPAV subroutine.

ARIZONA (Slabs 1,3 & 6)

Based on the hydration shape and time parameters obtained from the adiabatic testing, the pavement was well predicted by the current HIPERPAV subroutine. The measured compared to the predicted modulus of elasticity for slab 1, 3, and 6 for the State of Arizona is shown in figures 1,2 and 3. For other slabs, please refer to reference 1.

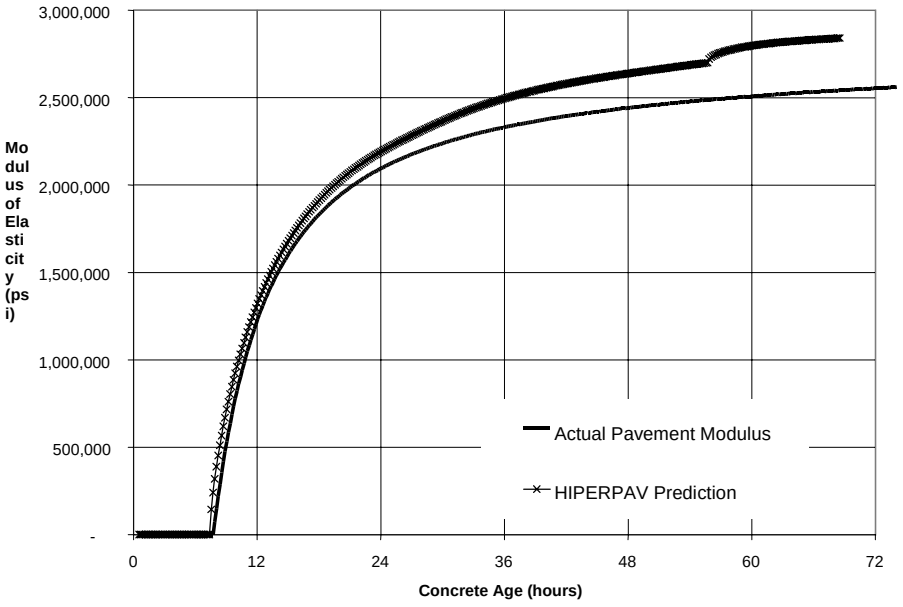

Figure 1. HIPERPAV predicted modulus and the actual pavement modulus (Arizona: slab 1).

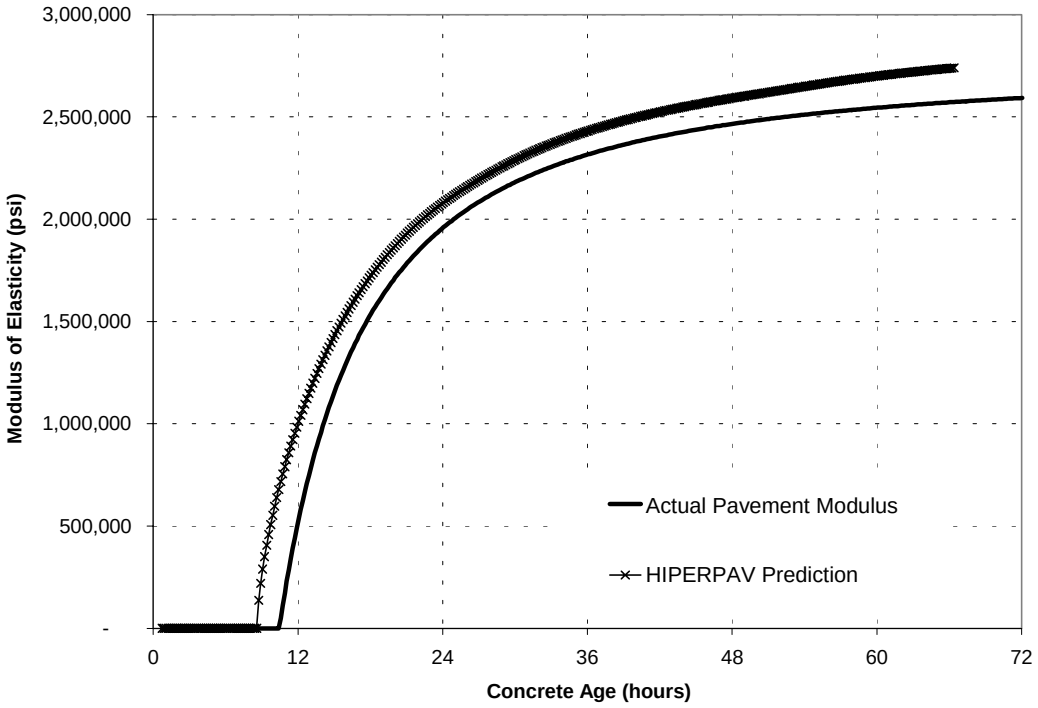

Figure 2. HIPERPAV predicted modulus and the actual pavement modulus (Arizona: slab 3).

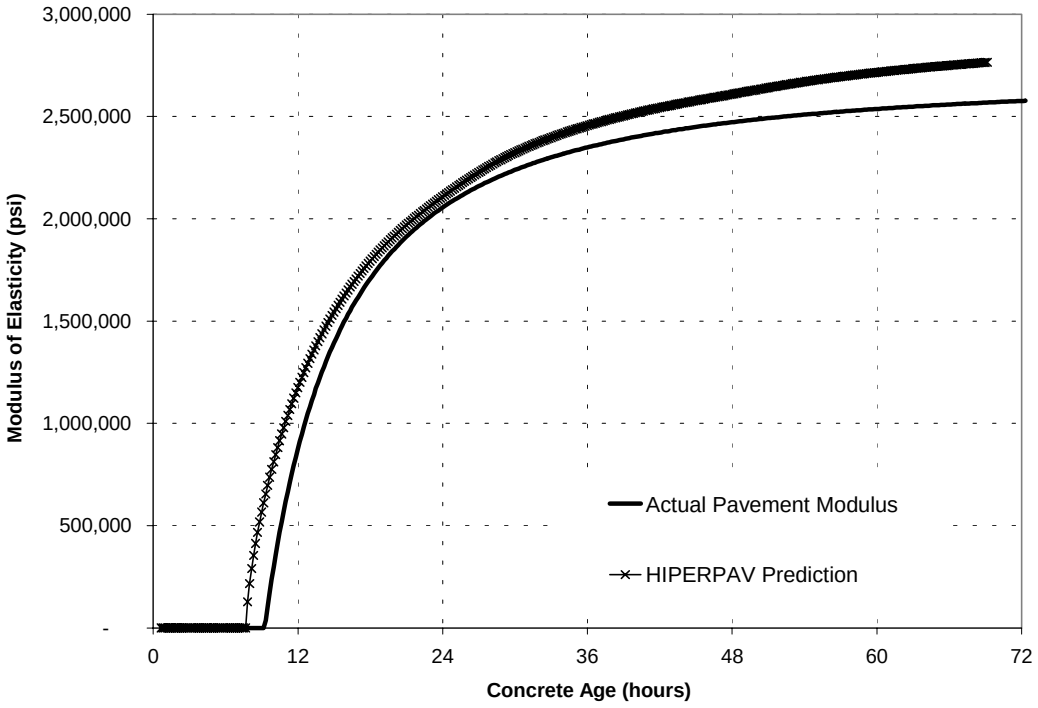

Figure 3. HIPERPAV predicted modulus and the actual pavement modulus (Arizona: slab 6).

The R^2 values for the predicted versus the actual modulus of elasticity are presented in table 1. These relatively high values for R^2 indicate that the current HIPERPAV model accurately predicts the modulus of elasticity. For other slab, please refer to table 3 of the TM 298007-18.

Table 1. R^2-values for the initial modulus of elasticity, Arizona slabs 1, 3 and 6.

Property	***Value***		
	Slab 1	***Slab 3***	***Slab 6***
R^2-value	0.85	0.91	0.92

REFERENCE

(1) Technical Memorandum No. 18, *Modulus of Elasticity Validation*