Estimation of Stress Conditions for the Flow Number Simple Performance Test – TRB 10-2652

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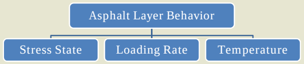
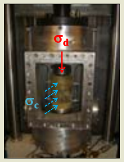
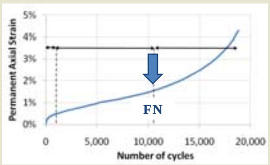
Objectives



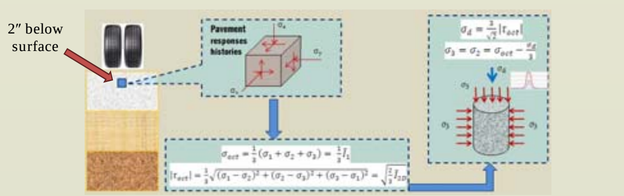
1. Define **loading conditions** in the asphalt layer created by moving truck load.
2. Recommendations for equivalent triaxial loading characteristics, deviator (σ_d) & confining (σ_c) stresses, in the **FLOW NUMBER (FN)** test.

Flow number test



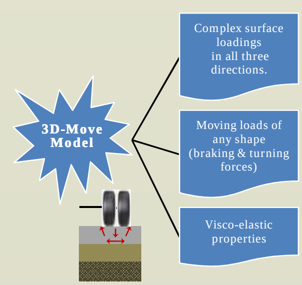


Stress state in the pavement/triaxial condition

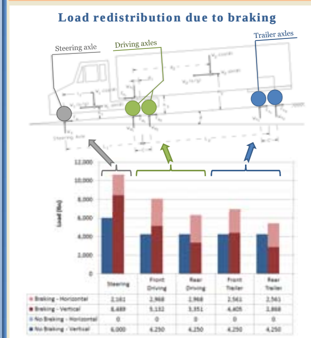


Database of pavement stresses

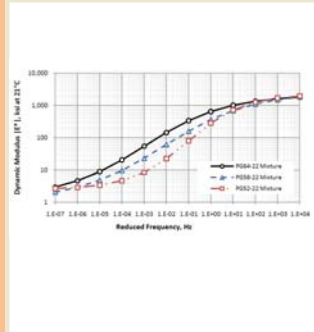
3D-Move model overview



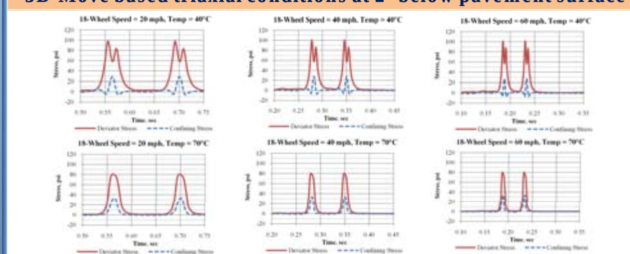
Load distribution on 18-wheel Truck



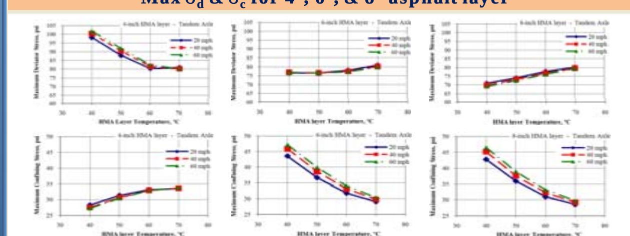
Material properties characterization – AMPT E*



3D-Move based triaxial conditions at 2″ below pavement surface



Max σ_d & σ_c for 4″, 6″, & 8″ asphalt layer



Predictive equations for 4″, 6″, & 8″ asphalt layer

- 4-inch HMA layer (without braking):

$$\sigma_d = -0.0844(T) + 0.06|E^*| + 83.708$$

$$\sigma_c = 0.0232(T) - 0.0169|E^*| + 32.495$$

- 6-inch HMA layer (without braking):

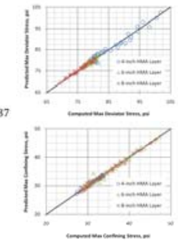
$$\sigma_d = -0.804(T) + 0.0066(T^2) + 0.076(S) - 0.000922(T)(S) - 7.045 \times log(|E^*|) + 114.37$$

$$\sigma_c = -0.000967(T^2) - 0.1107(S) + 0.00171(T)(S) + 0.00139(T)|E^*| + 31.41$$

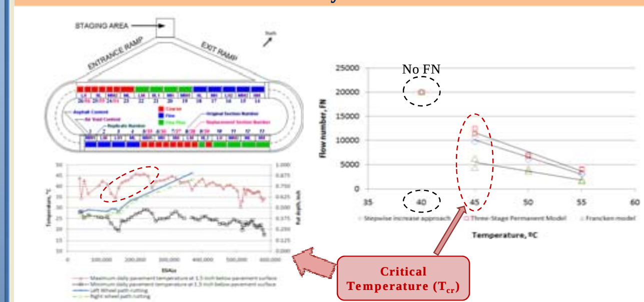
- 8-inch HMA layer (without braking):

$$\sigma_d = 0.000576(T^2) + 0.000316(S^2) + 0.0463(|E^*|) - 0.00199(T)(|E^*|) + 79.01$$

$$\sigma_c = -0.000826(T^2) - 0.11284(S) + 0.00168(T)(S) + 0.00139(T)|E^*| + 30.26$$



Case of study: WesTrack



Overall conclusions

- Amplitude of the equivalent triaxial σ_d & σ_c are highly affected by:
  - *mixture's |E*|*
  - *pavement effective temperature*
  - *vehicle speed*
- Prediction equations for estimating σ_d & σ_c as a function of pavement thickness.
- Lab determined T_{cr} for the WesTrack mix showed consistency with field-observed critical rutting temperature.
- The combination of elevated temperatures for a extended period of time & the traffic-induced loading contributes to the increased rate of rutting.

Acknowledgments

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