



# for Local Roads

## Local Road Material Properties and Calibration

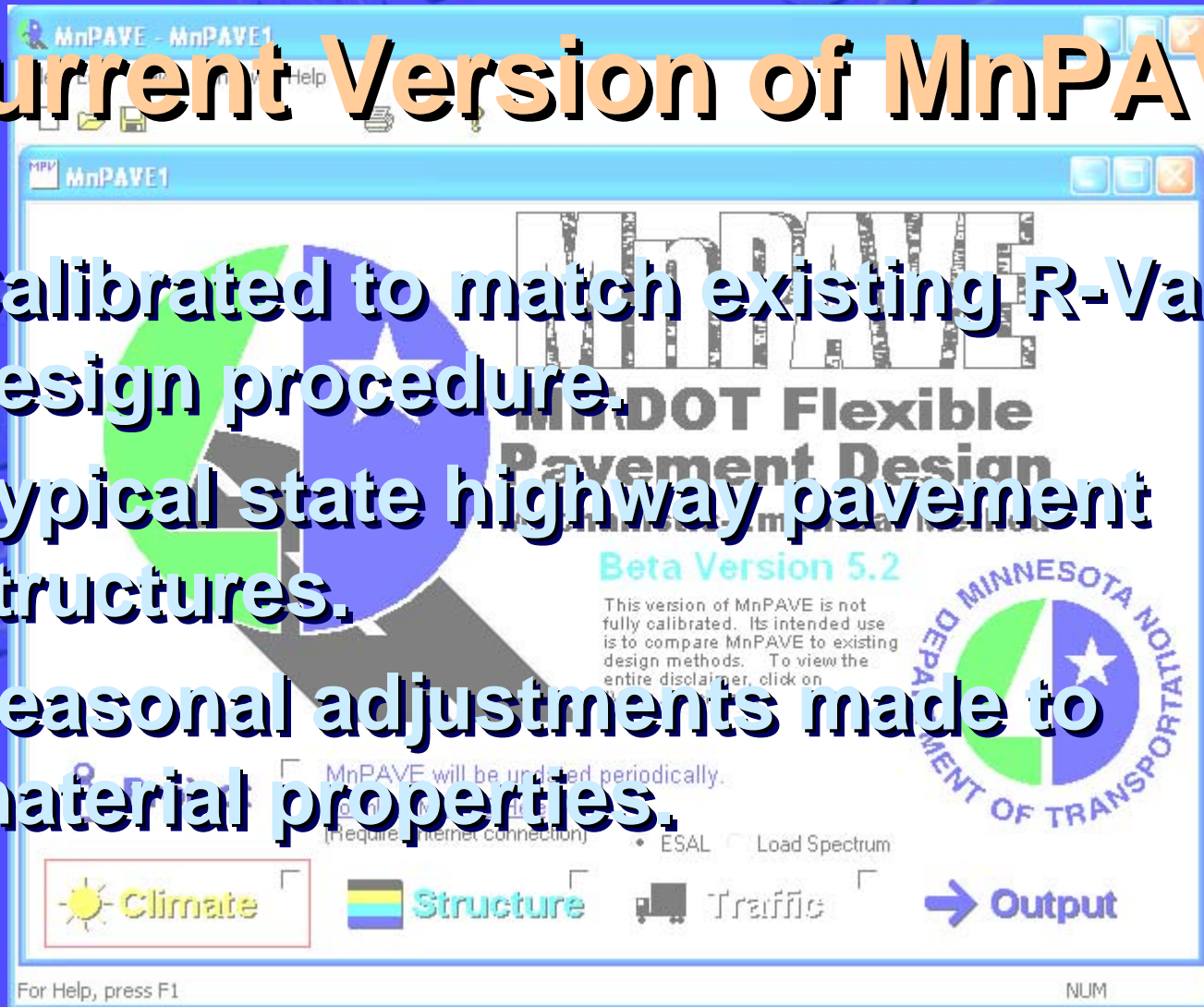
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**Research Project Engineer**  
**Mn/DOT**

<http://www.dot.state.mn.us/app/MnPAVE/LRRB828.html>



# Current Version of MnPAVE

- Calibrated to match existing R-Value design procedure.
- Typical state highway pavement structures.
- Seasonal adjustments made to material properties.



# MnPAVE for Local Roads

- **Will be calibrated for local roads**
  - **Pavement information obtained by survey.**
  - **FWD and GPR testing as needed.**
- **Resilient modulus test results.**
- **Models for moisture, freezing & thawing effects from literature or research in progress.**

# **MnPAVE for Local Roads**

- **Total Cost: \$56,000**
- **Task 1: Survey Local Officials (\$18,000)**
- **Task 2: Model Selection (\$8,000)**
- **Task 3: MnPAVE Programming (\$10,000)**
- **Task 4: Calibration (\$10,000)**
- **Task 5: Expand MnPAVE Help Files (\$5,000)**
- **Task 6: Final Report & MnPAVE CD (\$5,000)**

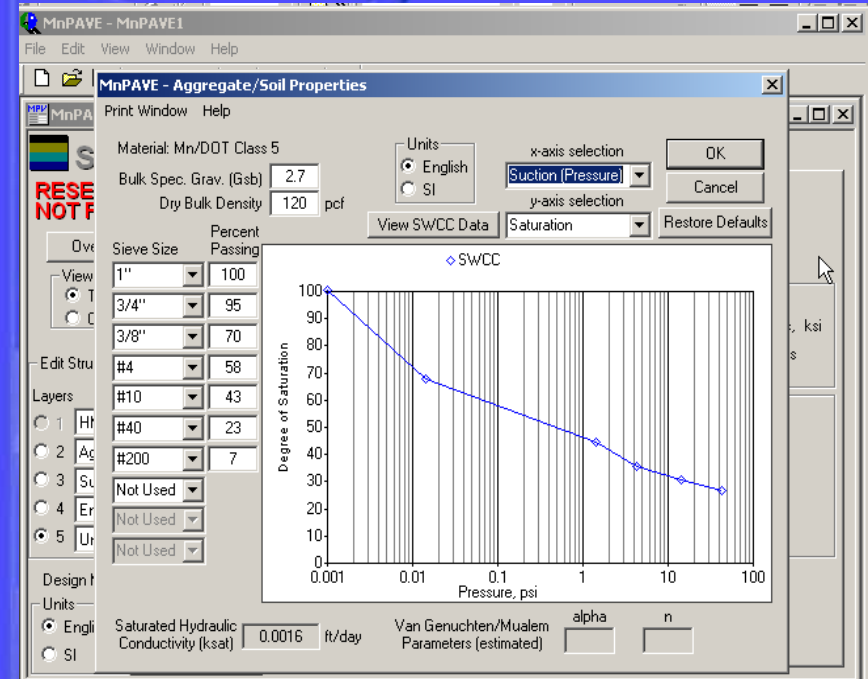
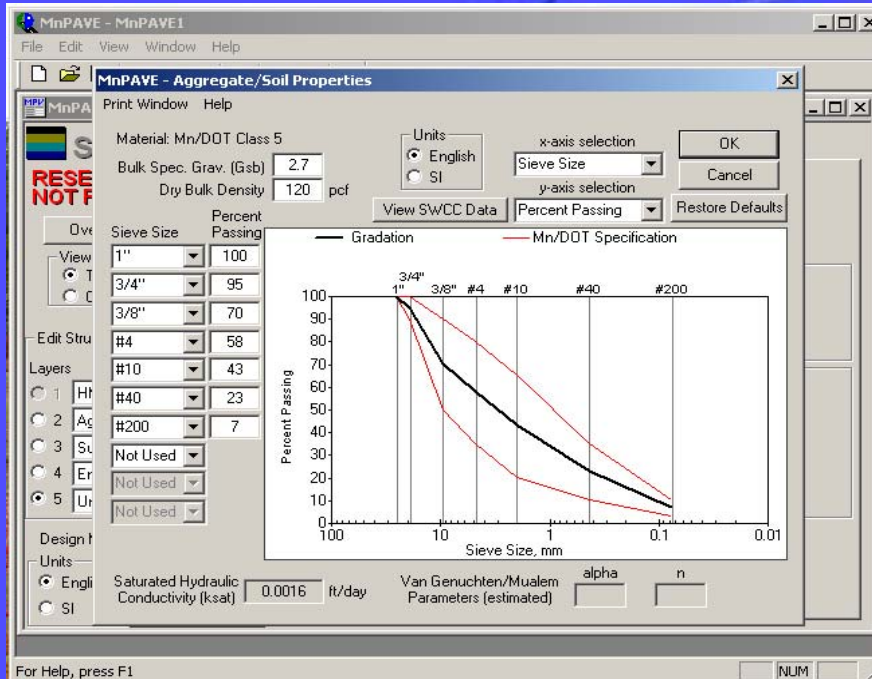
# Moisture Conditions

- **Moisture conditions within the pavement system vary over time and space.**
- **Need to estimate moisture retention properties of aggregate base and subgrade materials to predict resilient and shear response in base and subgrade.**

# Material Moisture Characterization for M-E Design

- Estimating Soil Water Characteristic Curve
- Pedo-transfer function
- $\Theta$  (cm/cm) = a + b x sand(%) + c x BD(g/cm<sup>3</sup>)  
(A.Singh, R.Roberson and S. Gupta, 2004)
- M-E Design
- Stiffness (Resilient Modulus)
- Strength (Failure Response)
- $\tau = c' + (\sigma_n - u_a) \tan \phi' + (u_a - u_w) [(\Theta^k) \tan \phi']$   
(Vanapalli 1996)

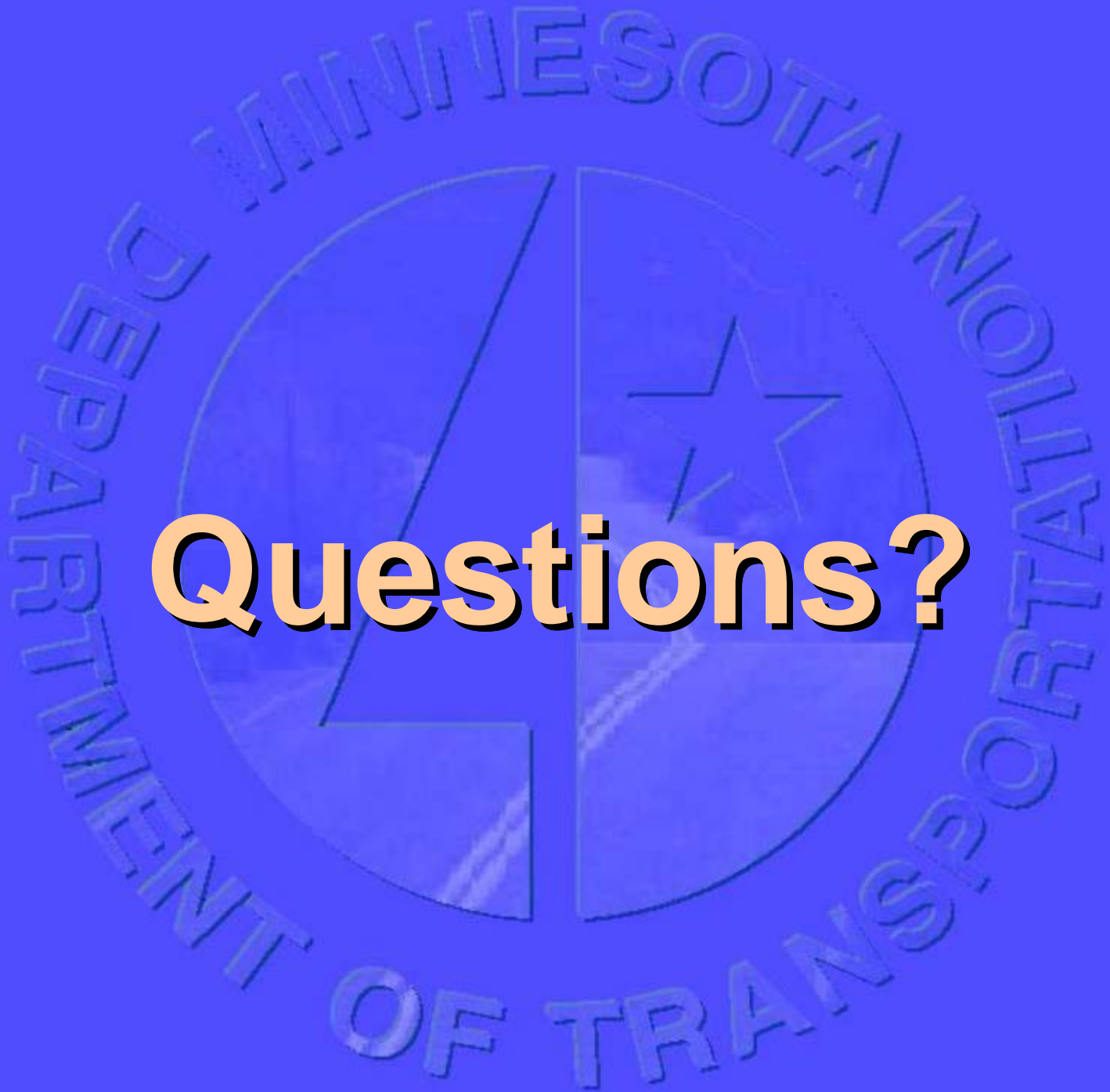
$$\Theta \text{ (cm/cm)} = a + b \times \text{sand}(\%) + c \times \text{BD}(\text{g/cm}^3)$$



h	b x 10 <sup>-3</sup>	c x 10 <sup>-2</sup>	a x 10 <sup>-2</sup>	Probability	R <sup>2</sup>
1.0		-36.86	97.65	0.000	0.98
10.2		-20.62	60.04	0.012	0.41
102	-4.33	12.53	27.11	0.008	0.46
306	-4.17	16.33	15.99	0.004	0.62
510	-4.00	16.23	13.50	0.003	0.65
714	-3.80	15.80	12.46	0.002	0.66
1020	-3.60	15.25	11.62	0.002	0.66
3060	-3.25	13.88	10.13	0.003	0.64
5100	-3.14	13.50	09.66	0.003	0.64
10200	-3.04	13.14	09.27	0.004	0.63
15300	-3.00	12.99	09.10	0.004	0.62

# Matching Funds

- Mn/DOT will provide FWD and GPR testing as needed (\$10,000)



**Questions?**