TxACOL Workshop

Texas Asphalt Concrete Overlay Design and Analysis System

5-5123-03-P1

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General Information

- Two workshops were held respectively on Aug. 25 at Paris, Tx and on Oct. 6 at Austin, Tx
- More than 30 representatives from TxDOT attended
- Introduction of TxACOL software, key input parameters, and related lab and field tests were presented
- Attendees practiced the software step by step

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Presentation Outline

- Introduction
- Program training and exercises
- Key inputs for existing

  pavement and field testing
- Key inputs for asphalt overlay

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Expected Learning Outcomes

- Be able to perform program installation and un-installation
- Be familiar with creating, editing, saving, and running a project file
- Know how to design an asphalt overlay using the TxACOL program
- Understand Key input parameters and the requested lab or field test

Presentation Outline

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- Introduction
- Program training and exercises
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- Key inputs for asphalt overlay

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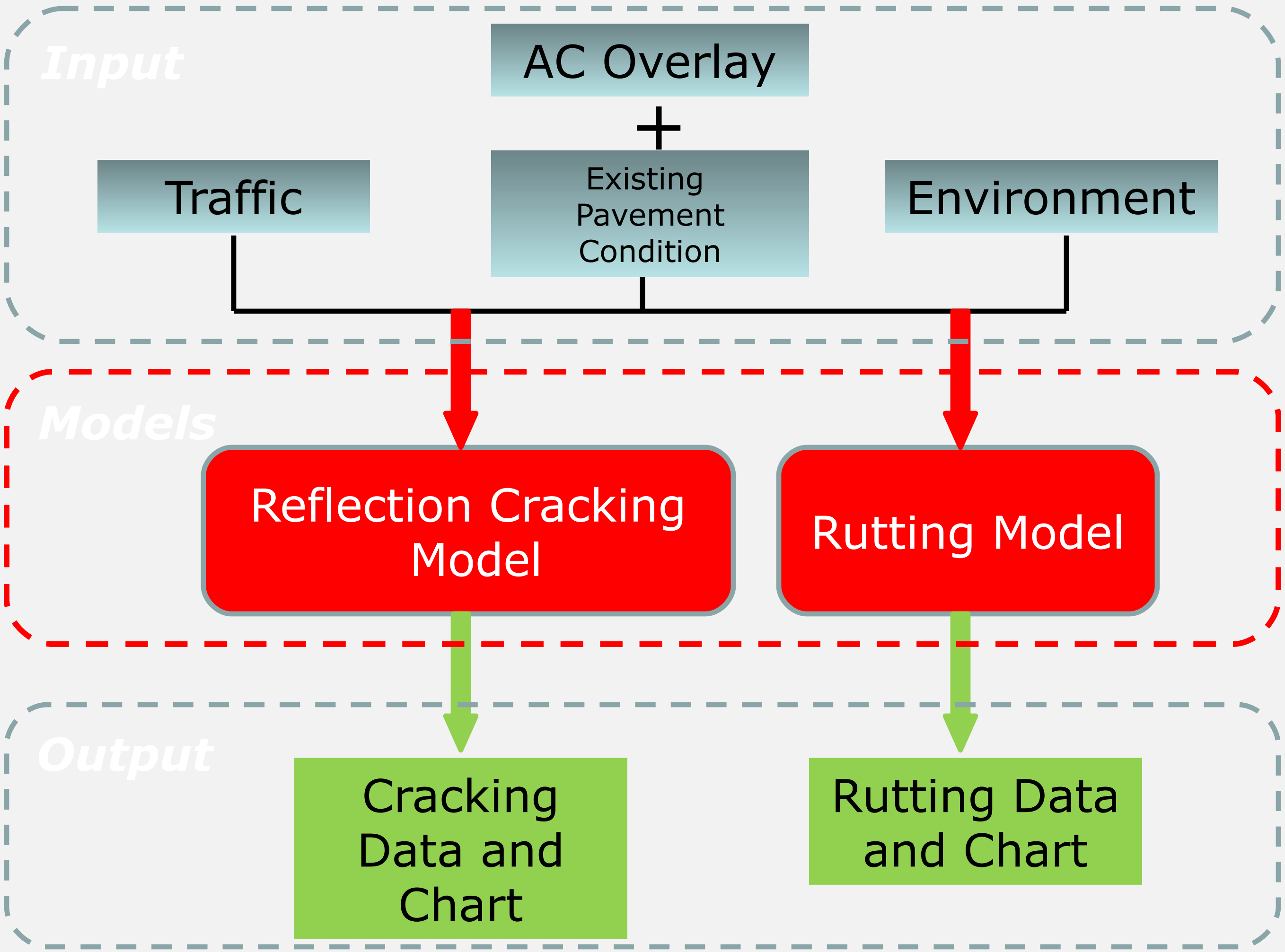
TxACOL Flowchart



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TxACOL Features

- M-E program
- User-friendly interface
- Short running time
- Default values provided in the software
- Traffic input is compatible to the current pavement design software FPS19W

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TxACOL Features (Continued)

- Pavement temperature is automatically predicted from EICM model
- Rutting and cracking are analyzed simultaneously
- Output is in Excel format and can be easily incorporated into electronic documents and reports

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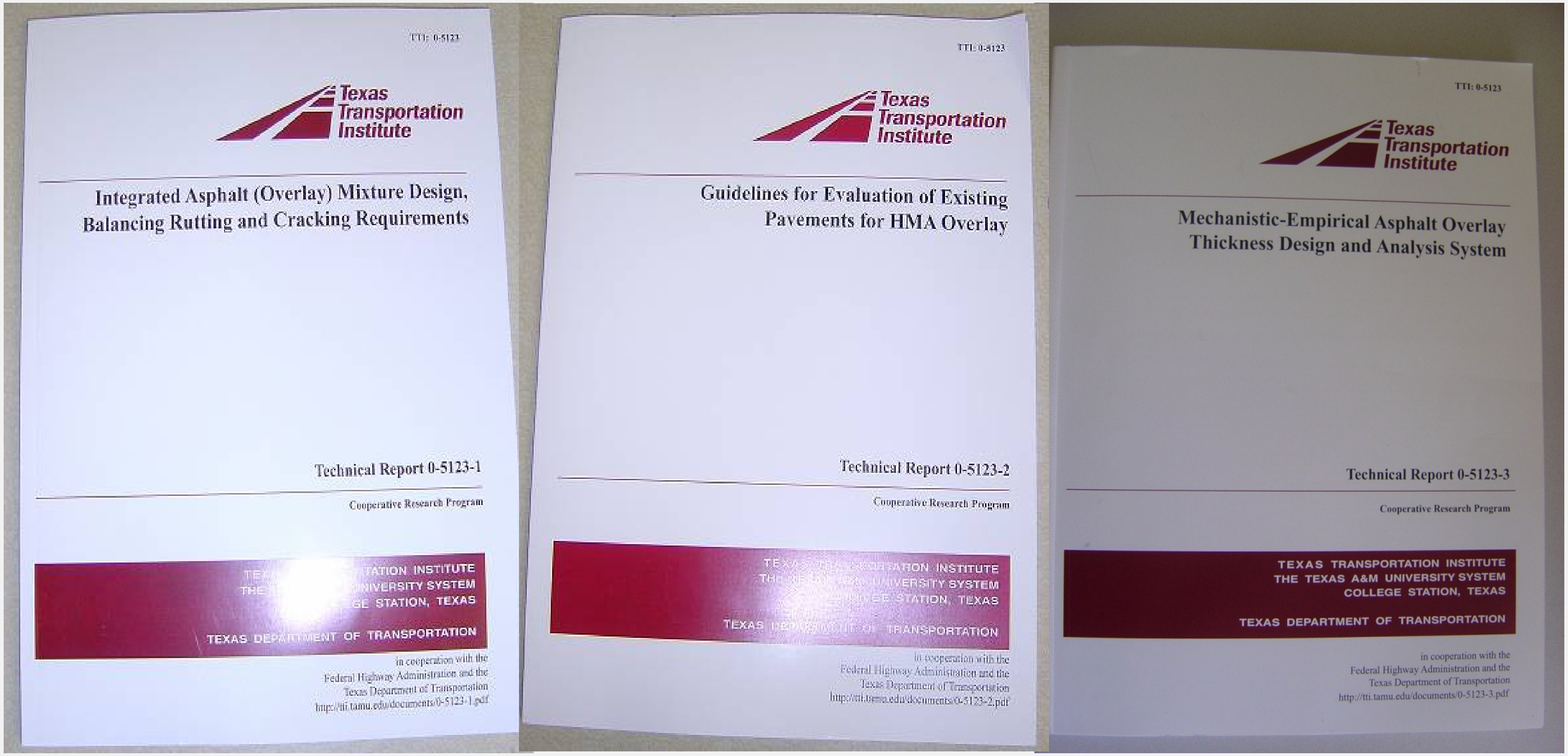
TxACOL Technical Background



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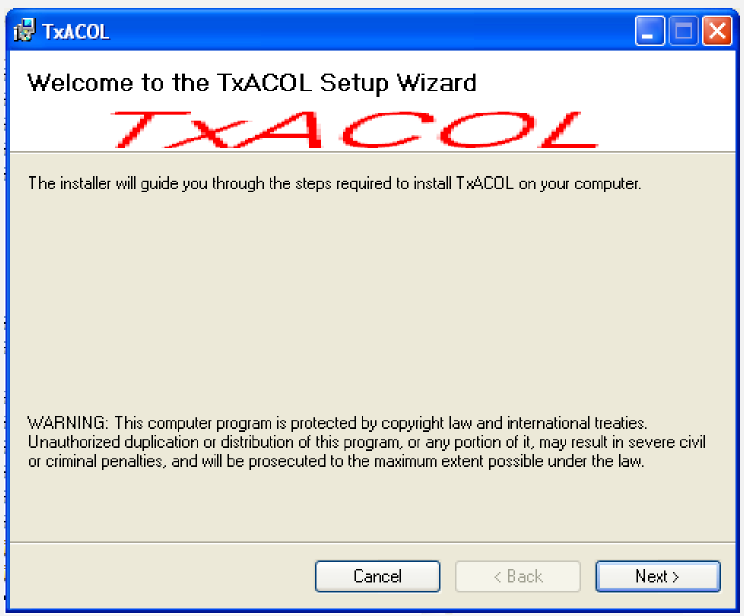
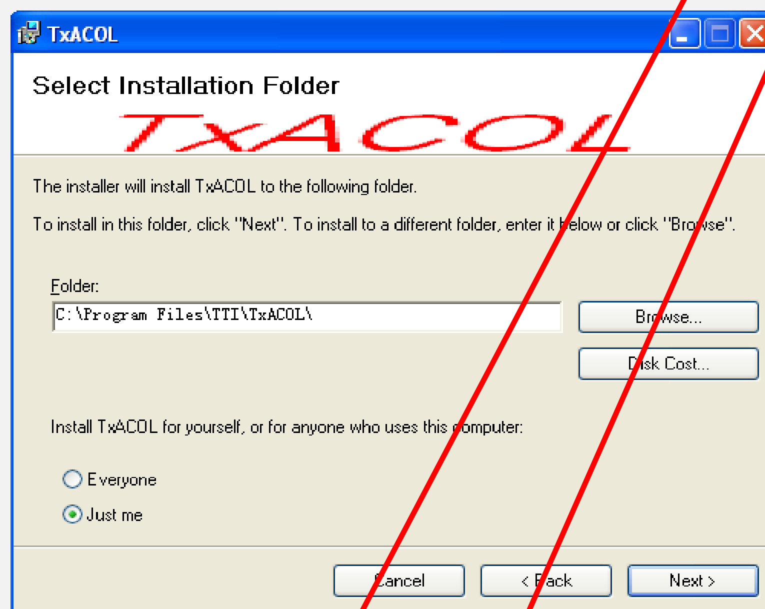
How to Install

- Double click “Setup.exe” file
- If this is the first installation, the following screens will appear:





Choose your favorite installation folder here

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How to Uninstall

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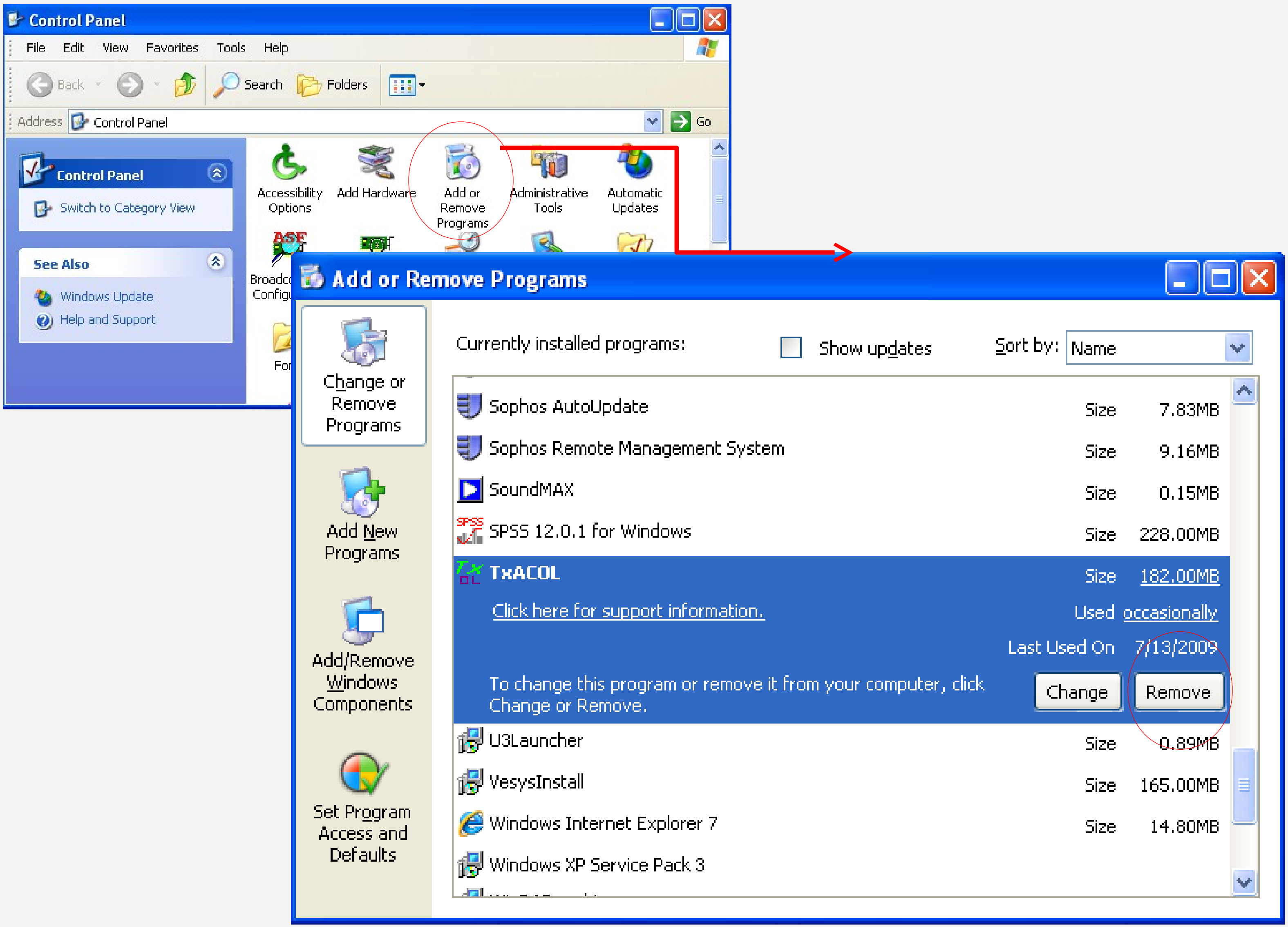

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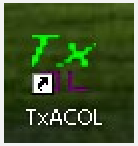
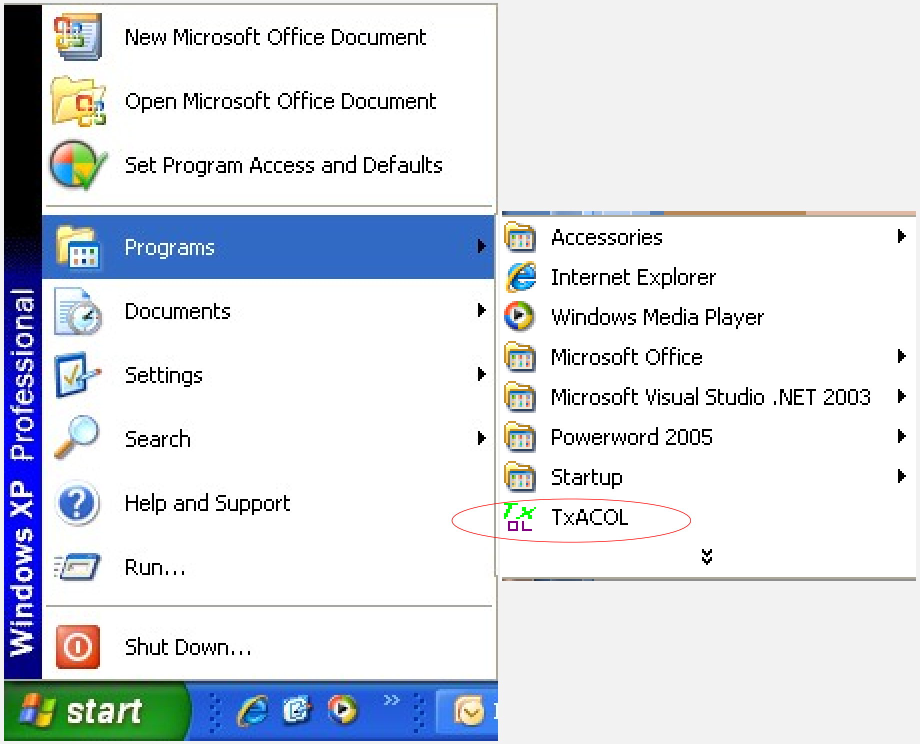
Launch the Program

Double click the icon 

or



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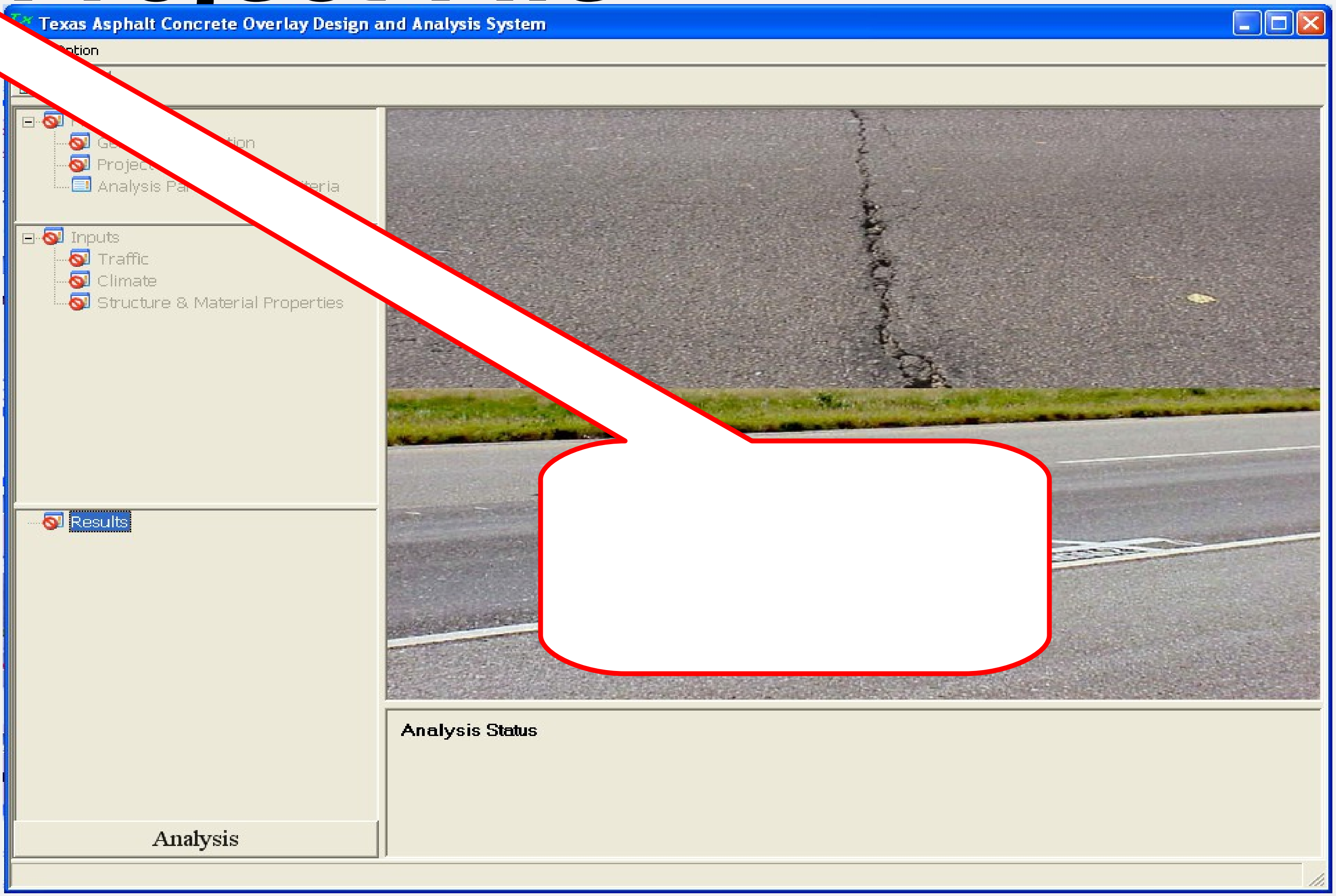
Presentation Outline

- Introduction
- Program training and exercises
- Key inputs for existing

  pavement and field testing
- Key inputs for asphalt overlay

Step 1: Create a New Project File



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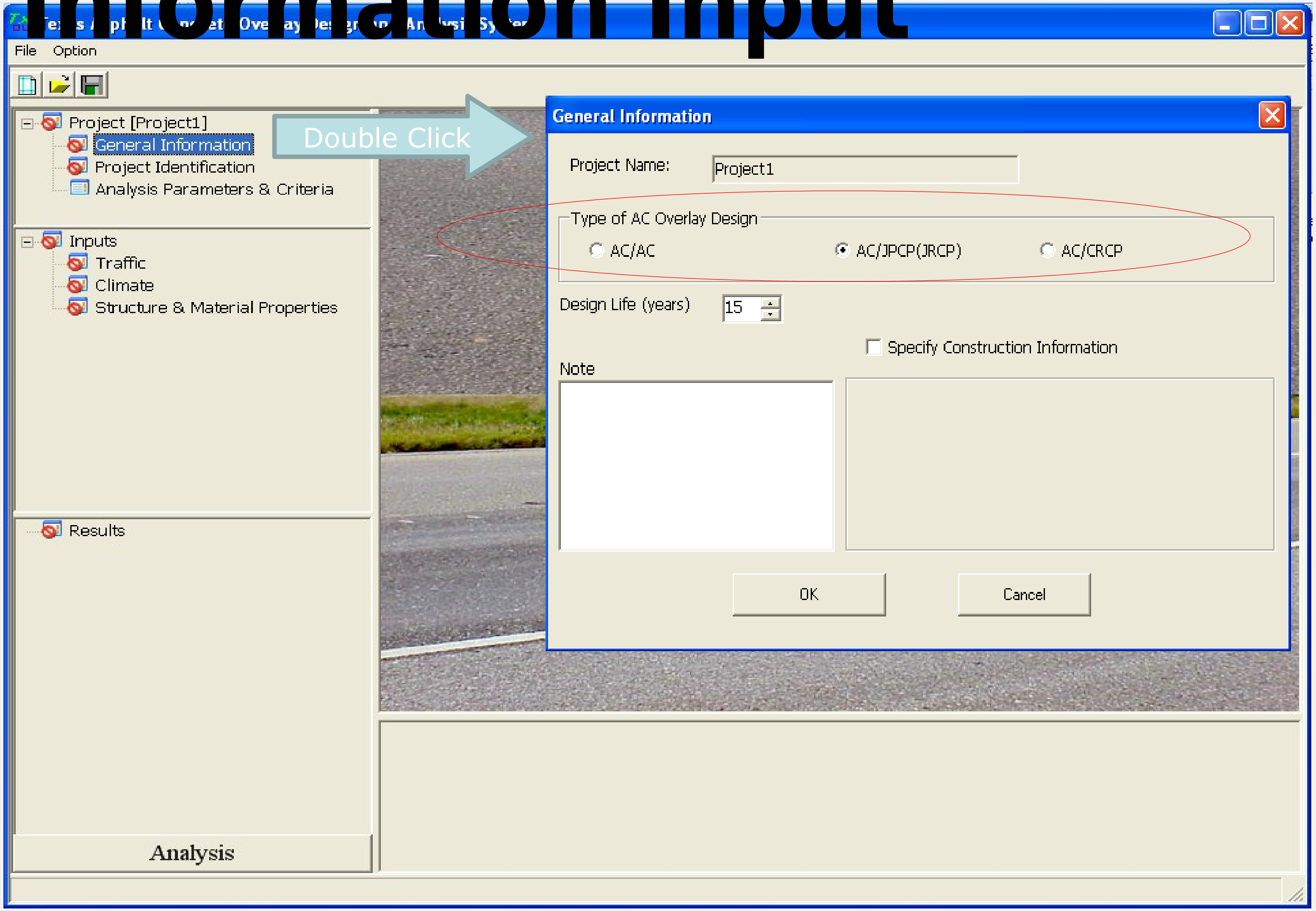
Step 2: General Information Input



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Step 3: Project Identification Input

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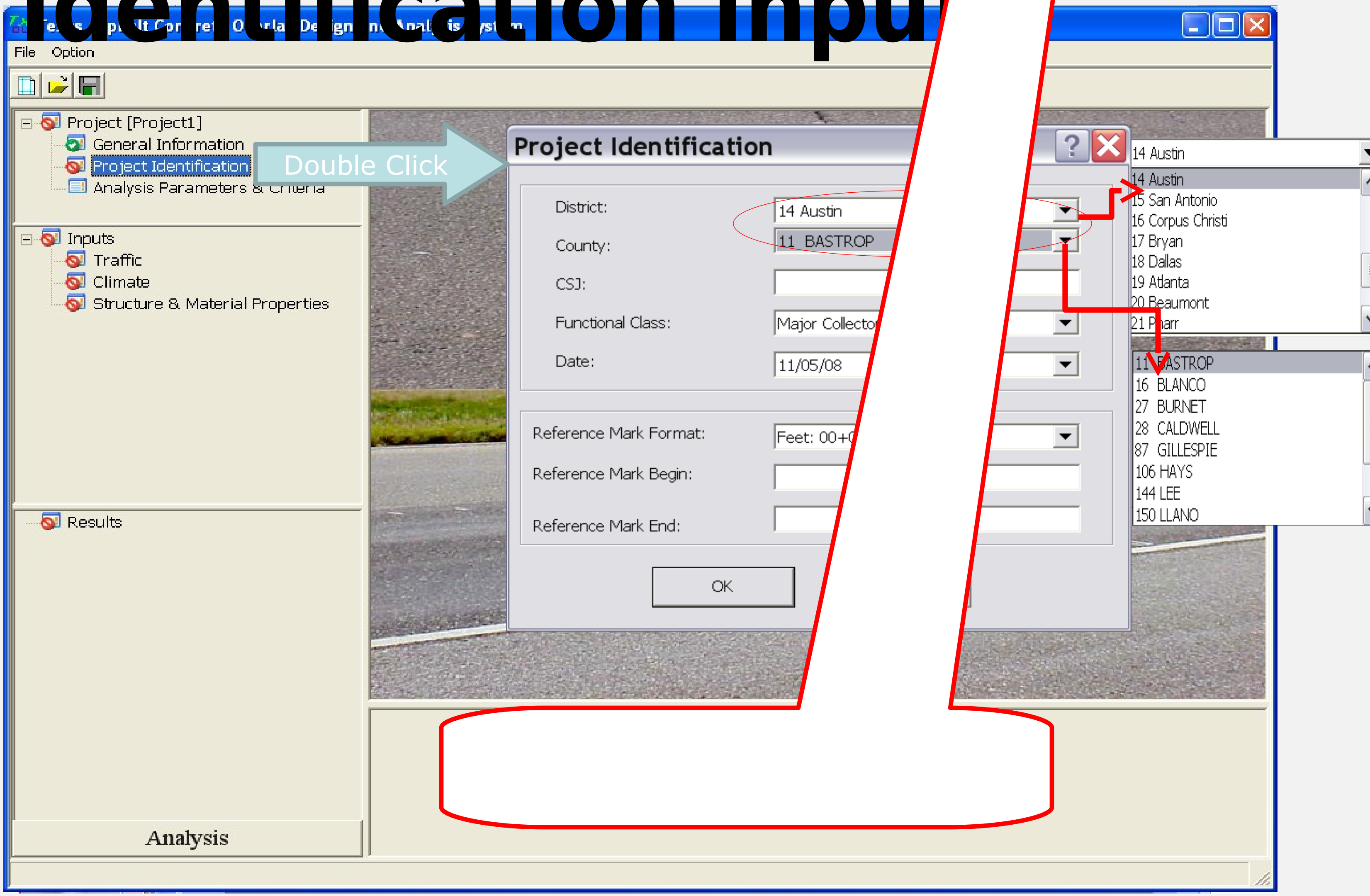

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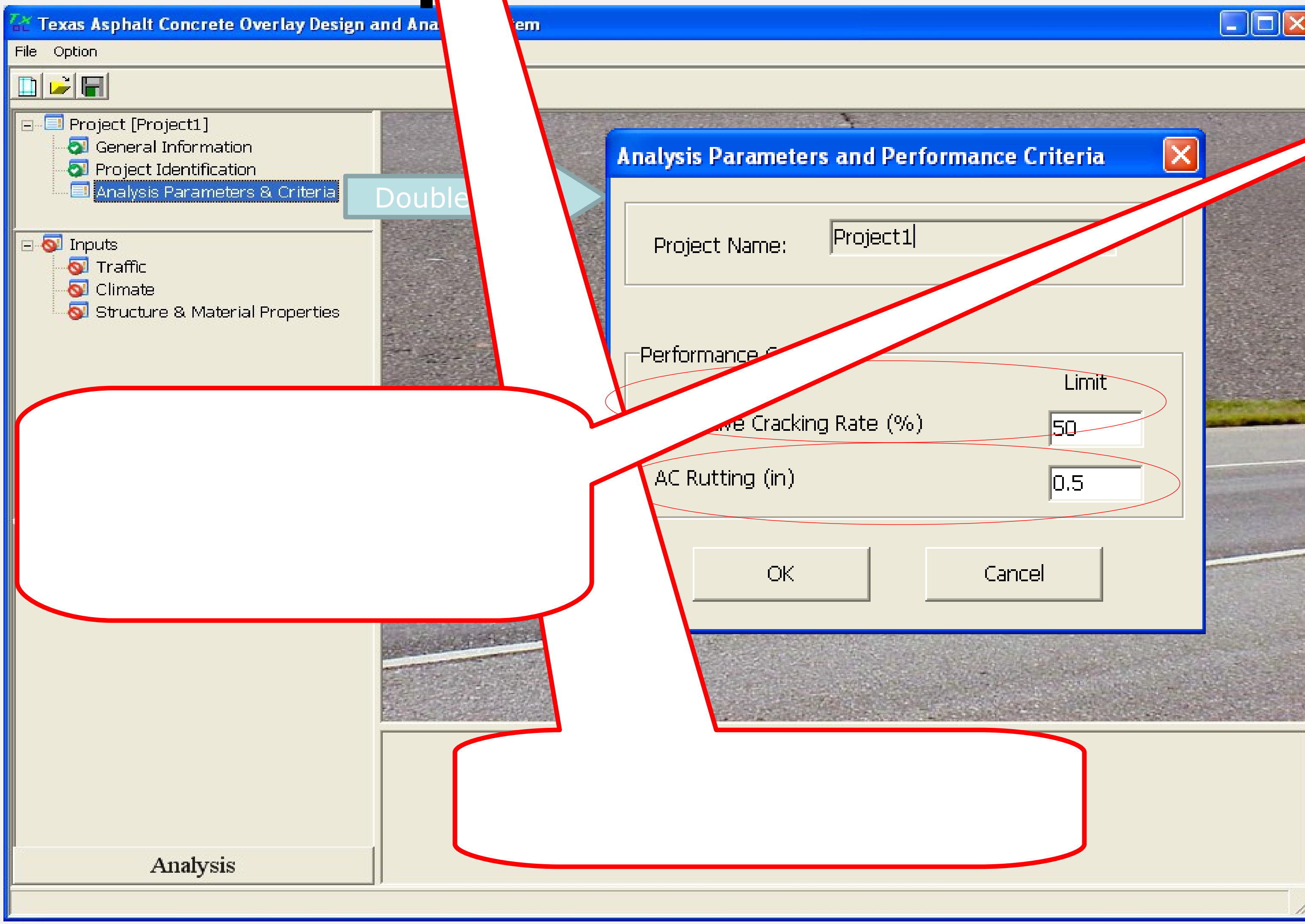
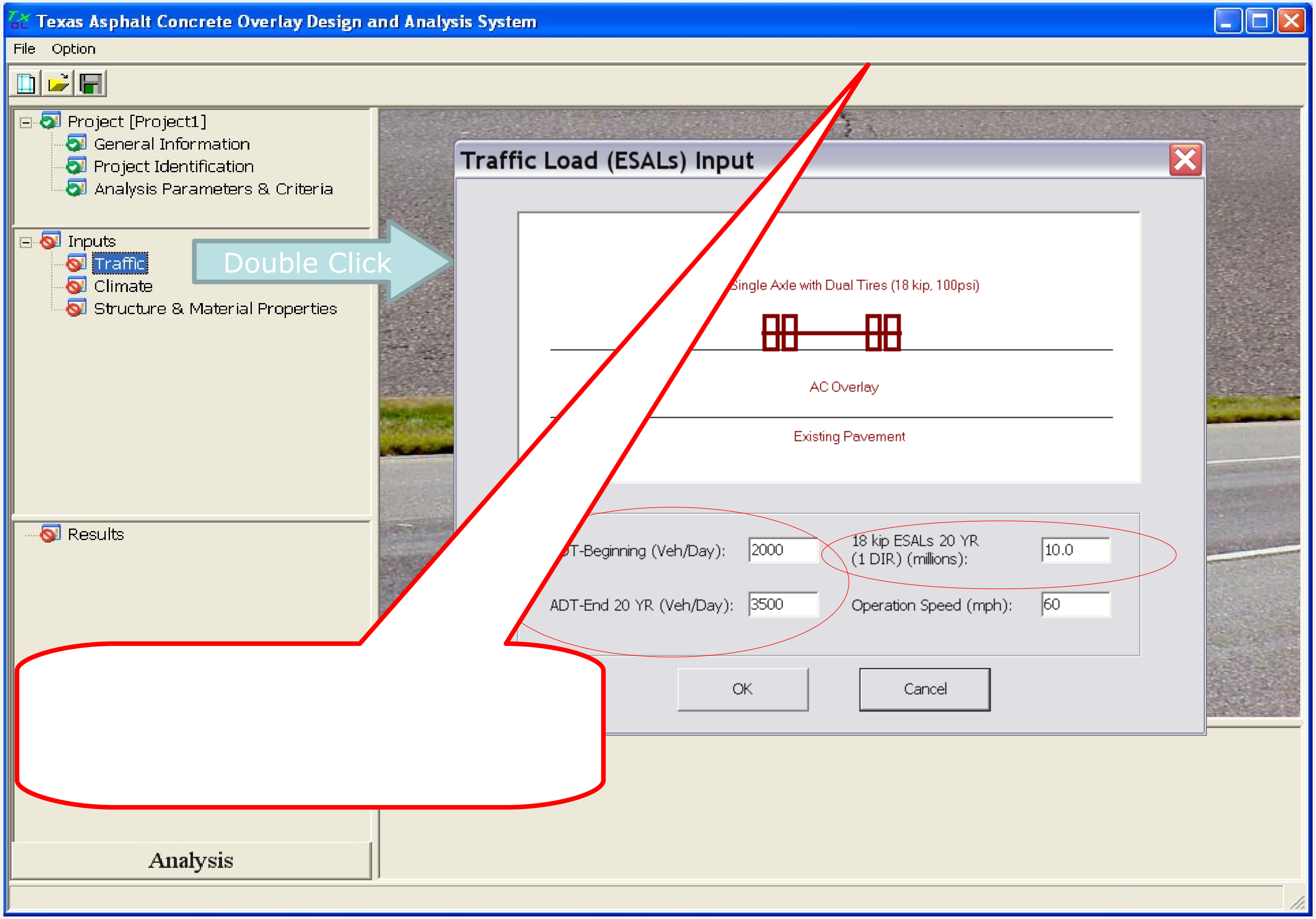
Step 4: Analysis Parameters & Criteria Input



Step 5: Traffic Input



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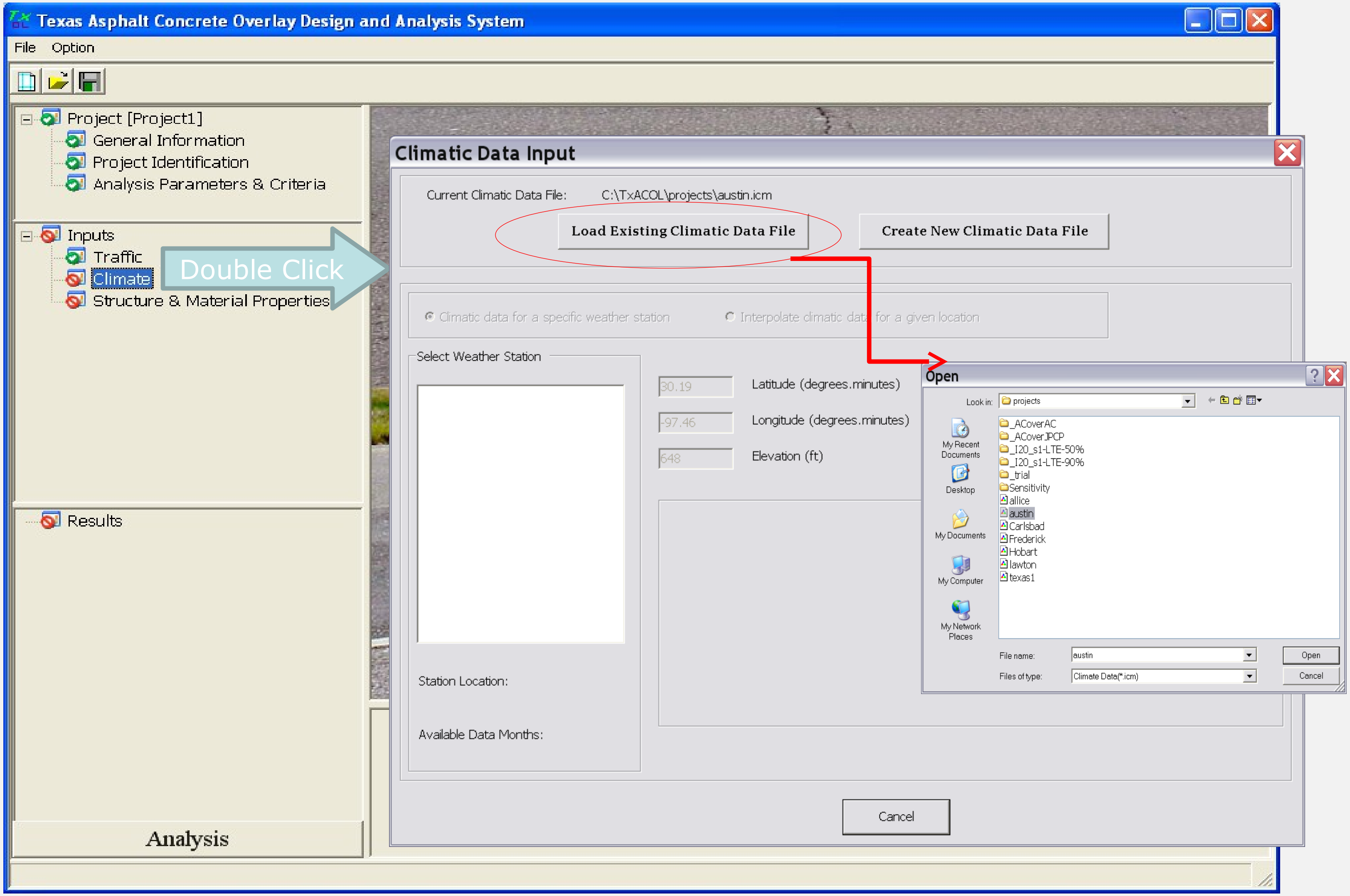
Step 6: Climate Input



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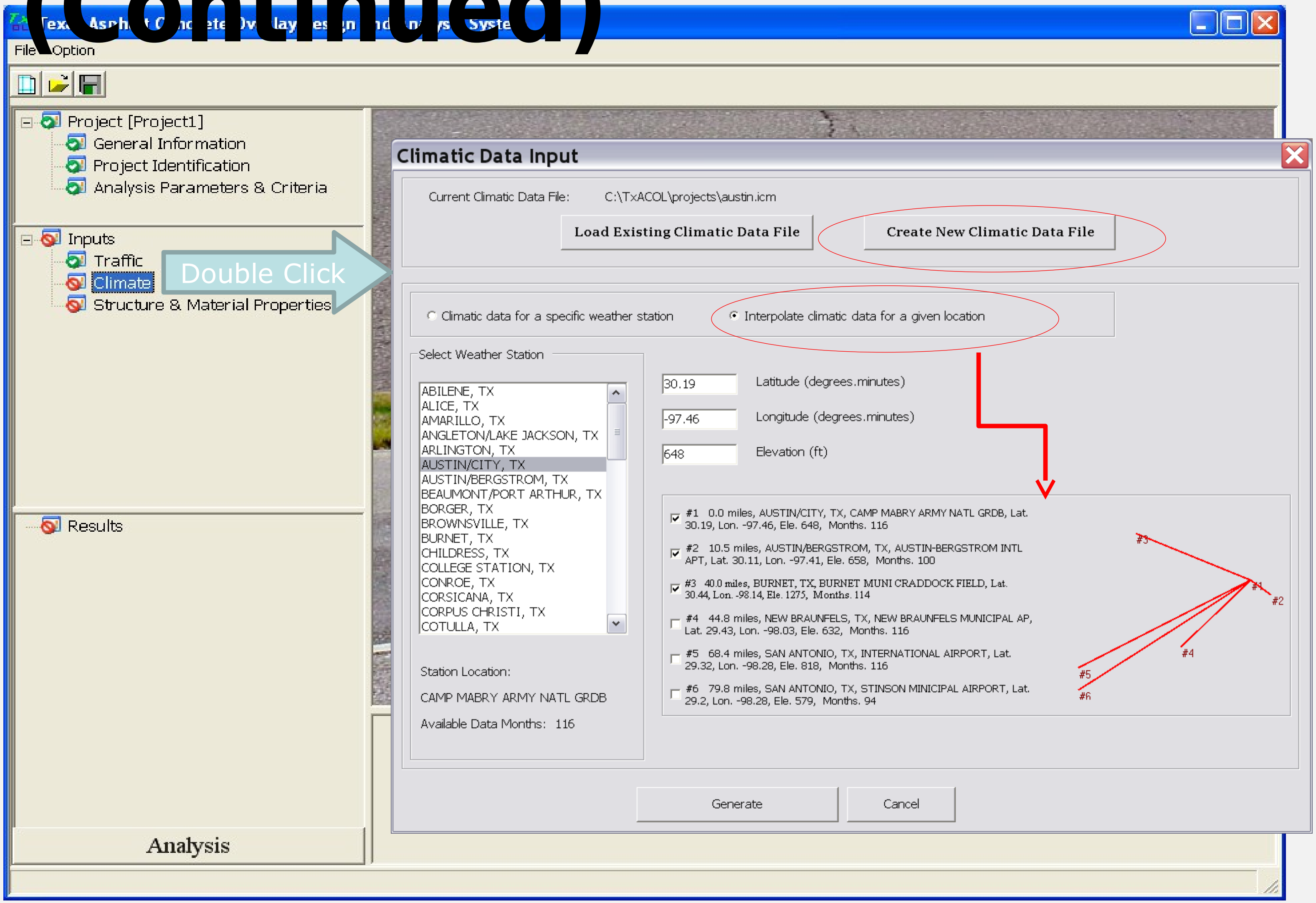
Step 7: Climate Input (Continued)



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Step 8: Structure Input

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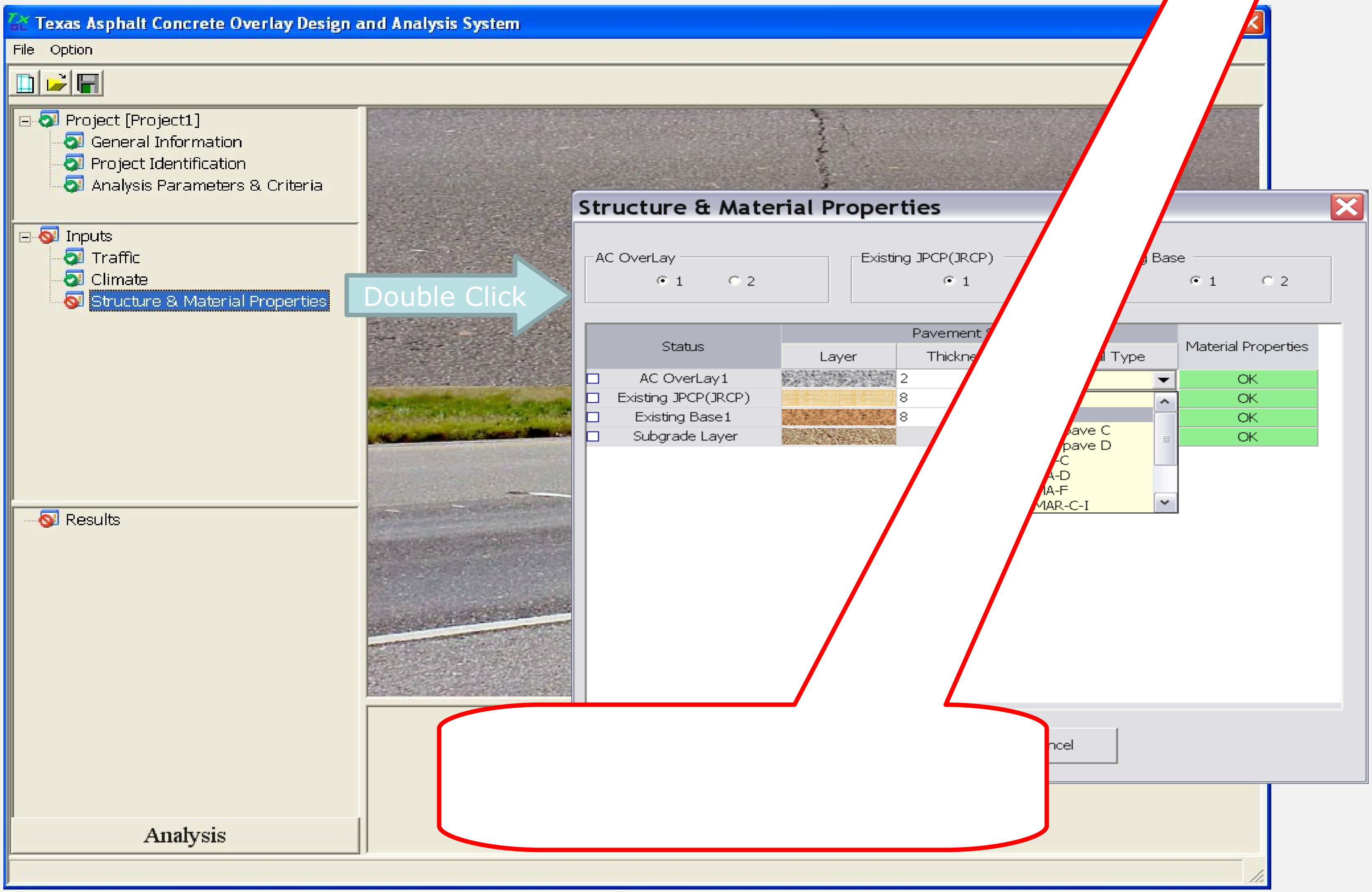

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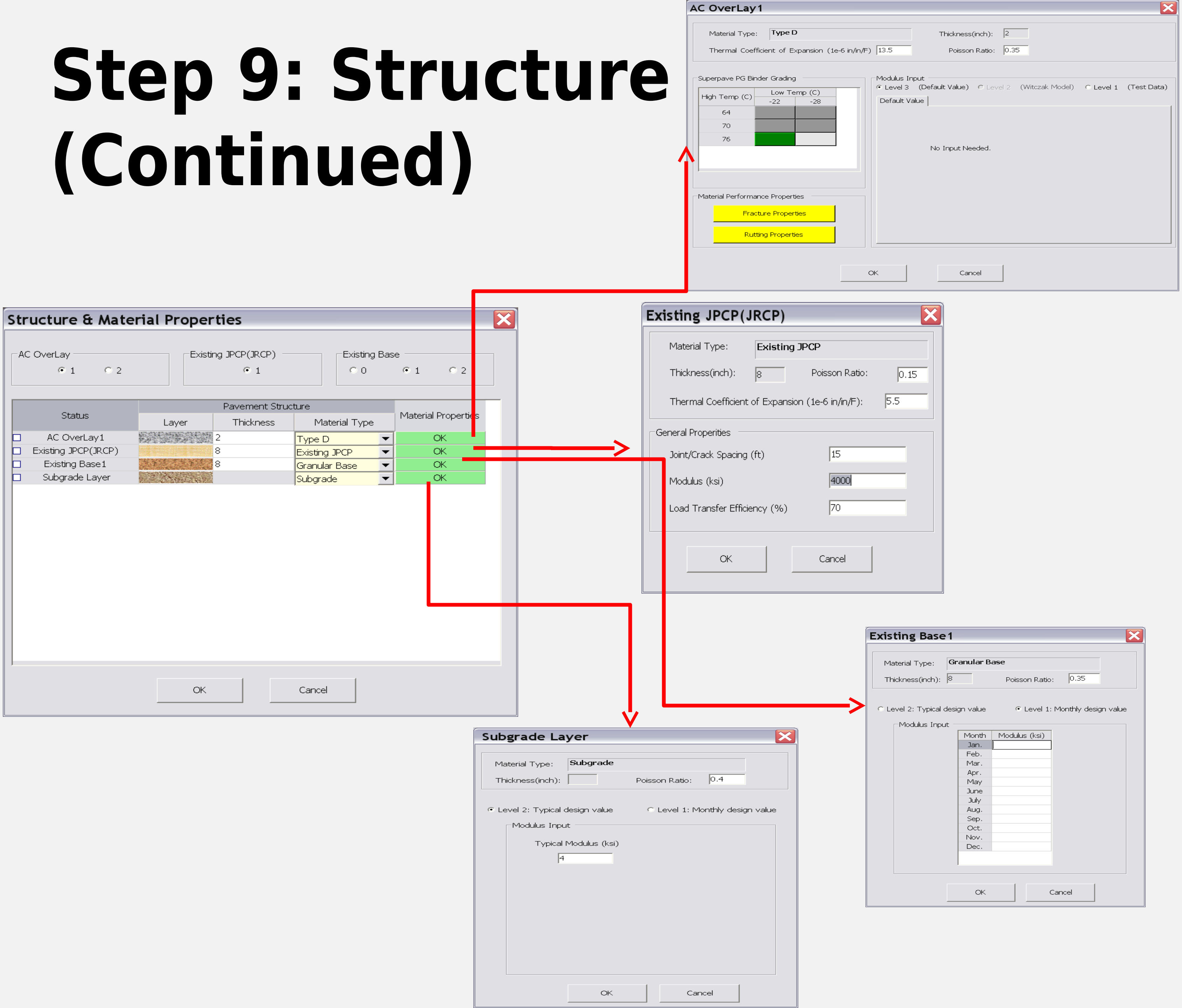
Step 9: Structure (Continued)



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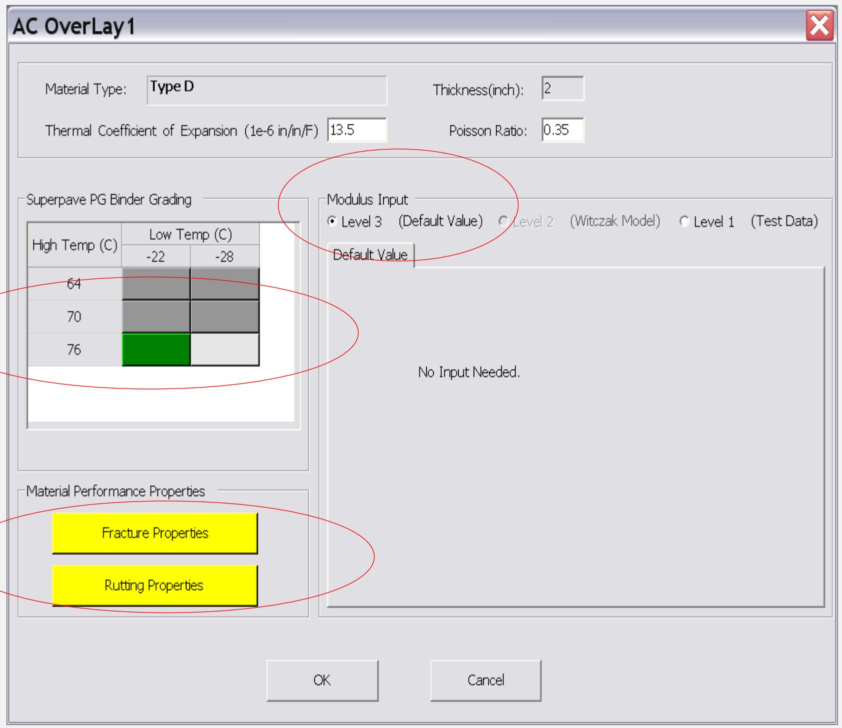
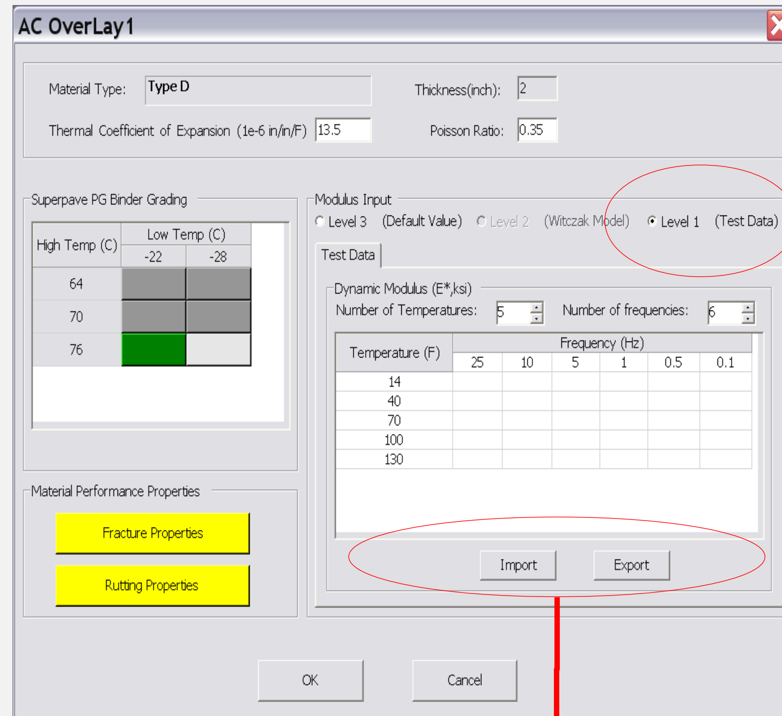
Step 10: AC Material Properties Input

Level 3 Input



Level 1 Input



You can import or export dynamic modulus here

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Step 11: Fracture and Rutting Properties Input

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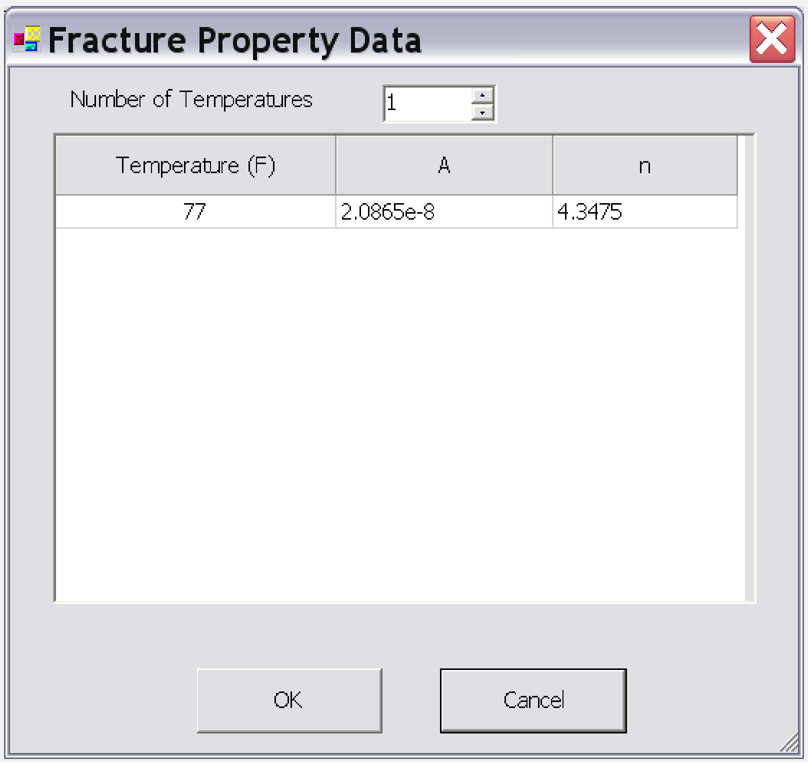
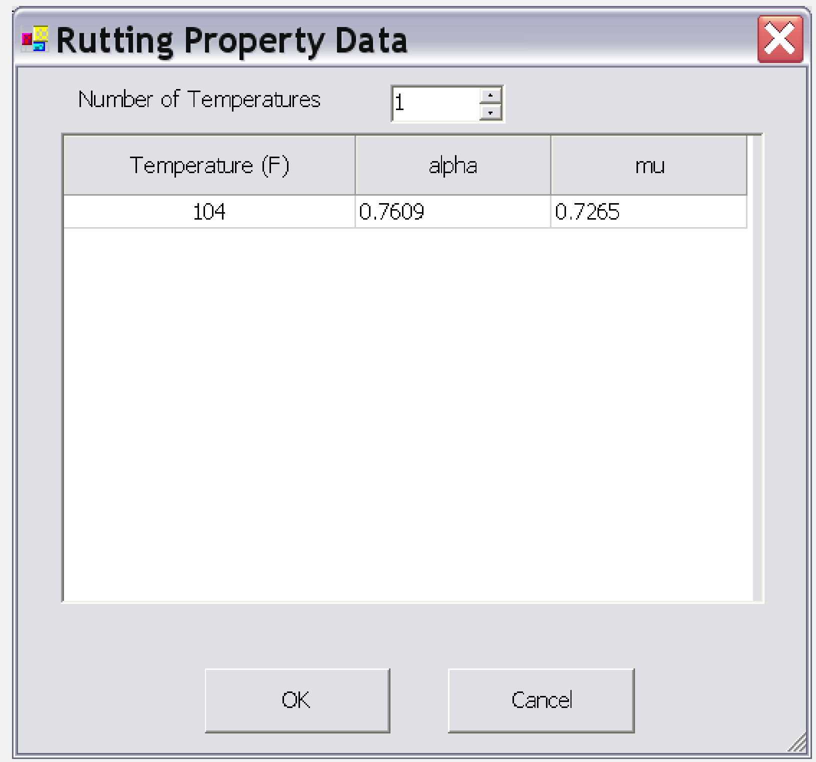
Fracture Properties Rutting Properties





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Step 12: Existing Layer Properties Input

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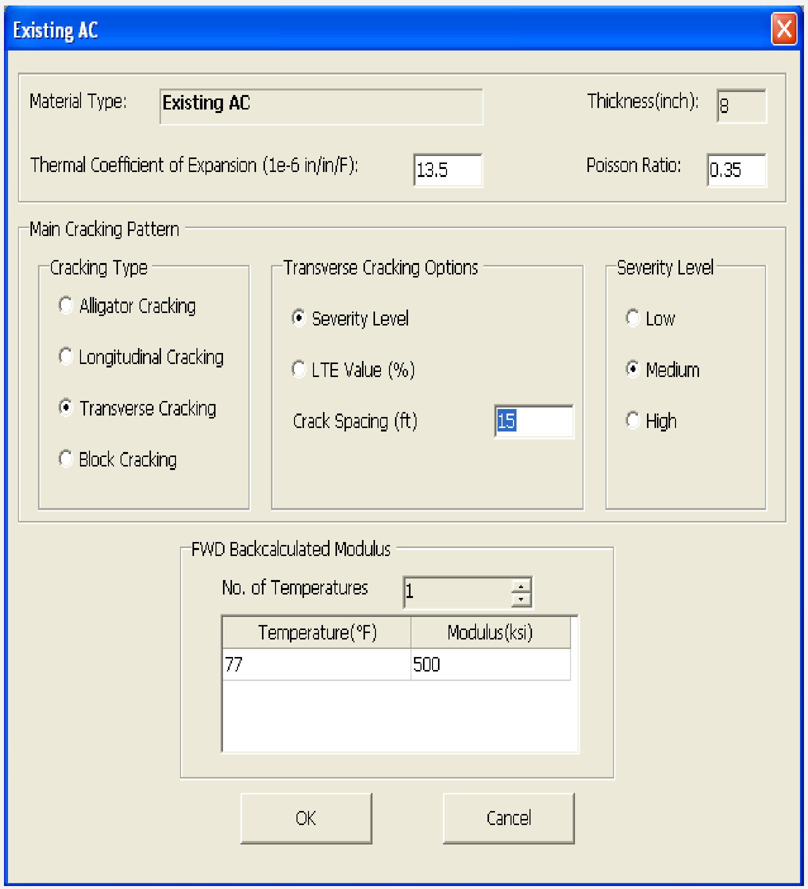
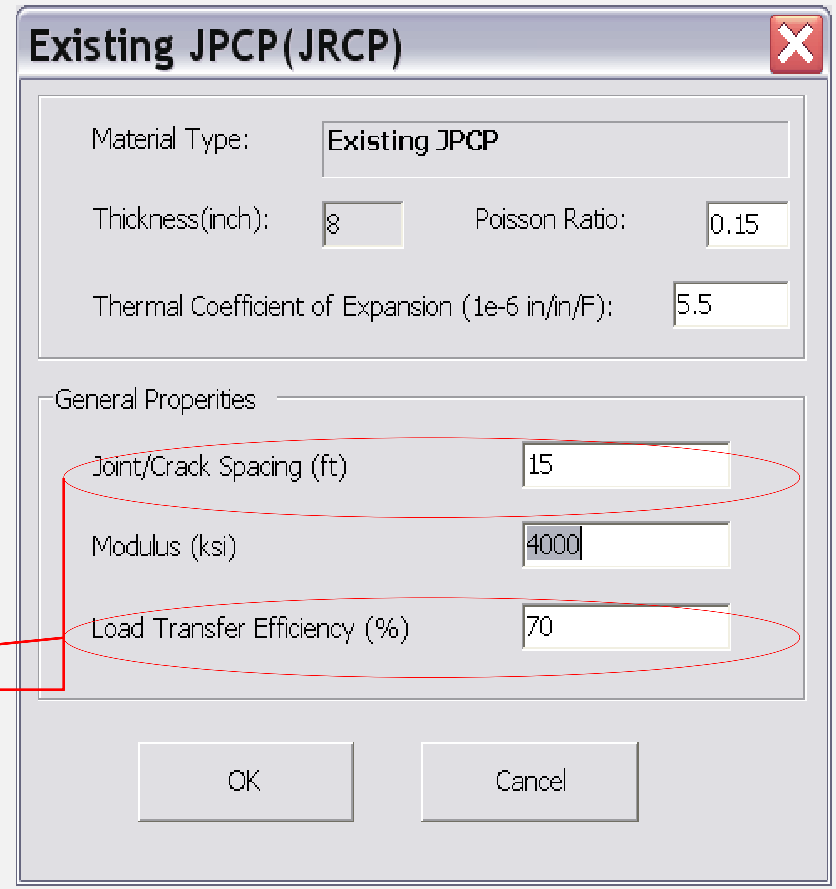
Existing AC

Existing PCC





The default values are different between JPCP and CRCP

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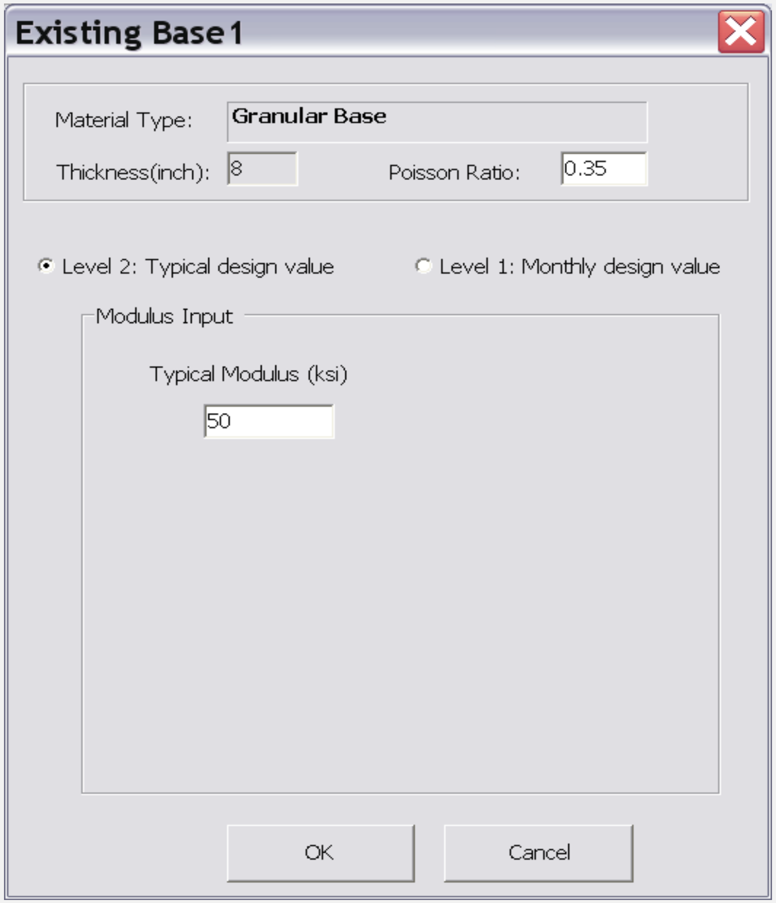
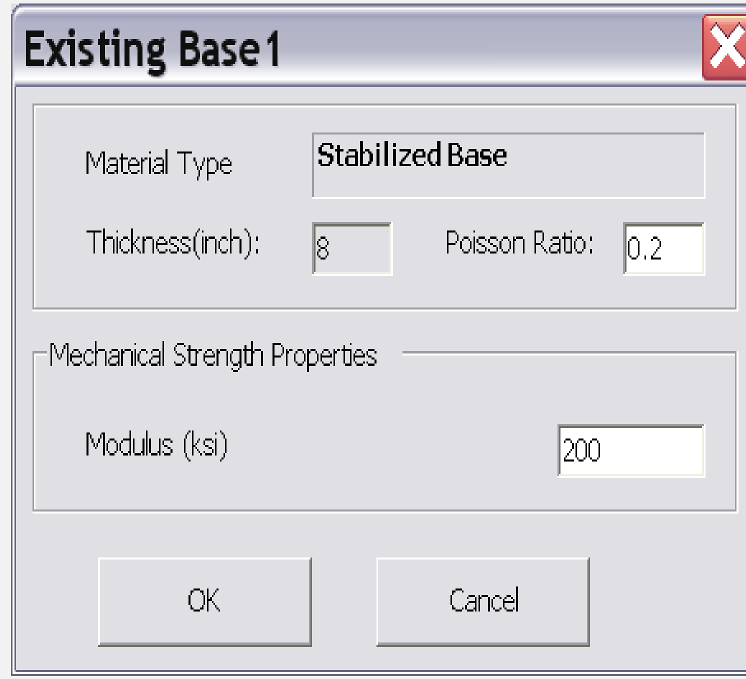
Step 13: Base Layer Properties Input

Granular Base | Stabilized Base





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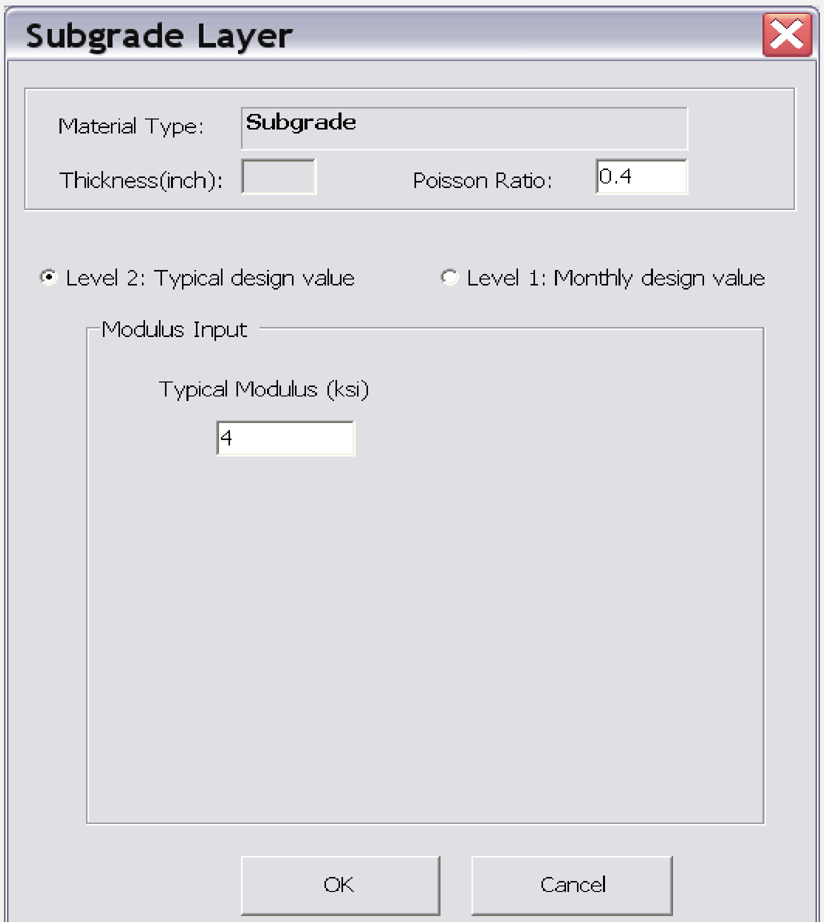
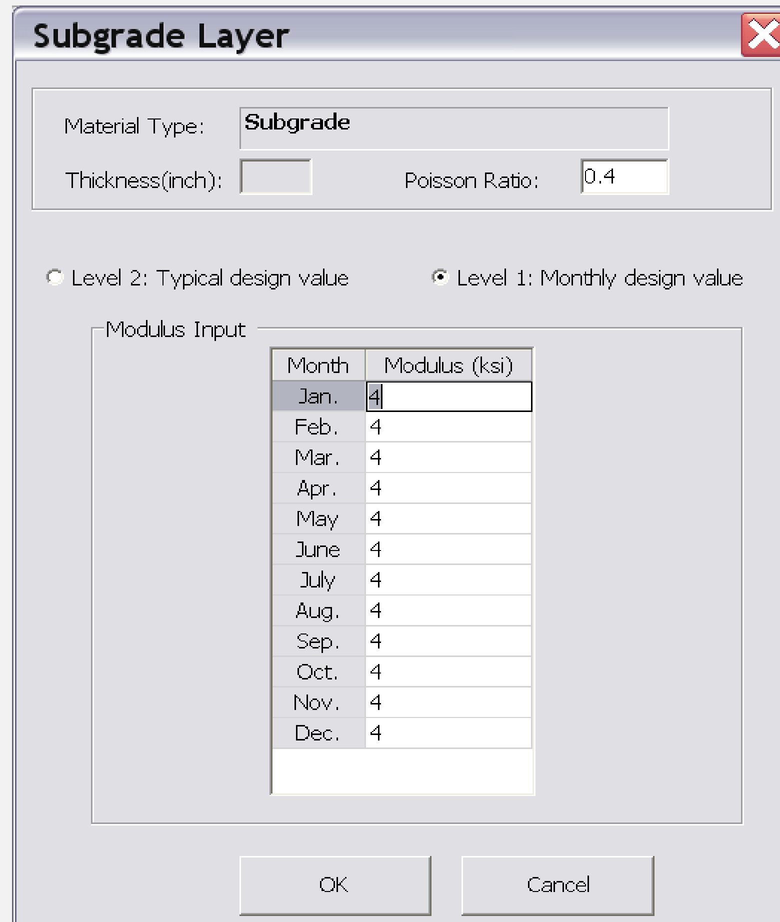
Step 14: Subgrade Properties Input

Level 2



Level 1



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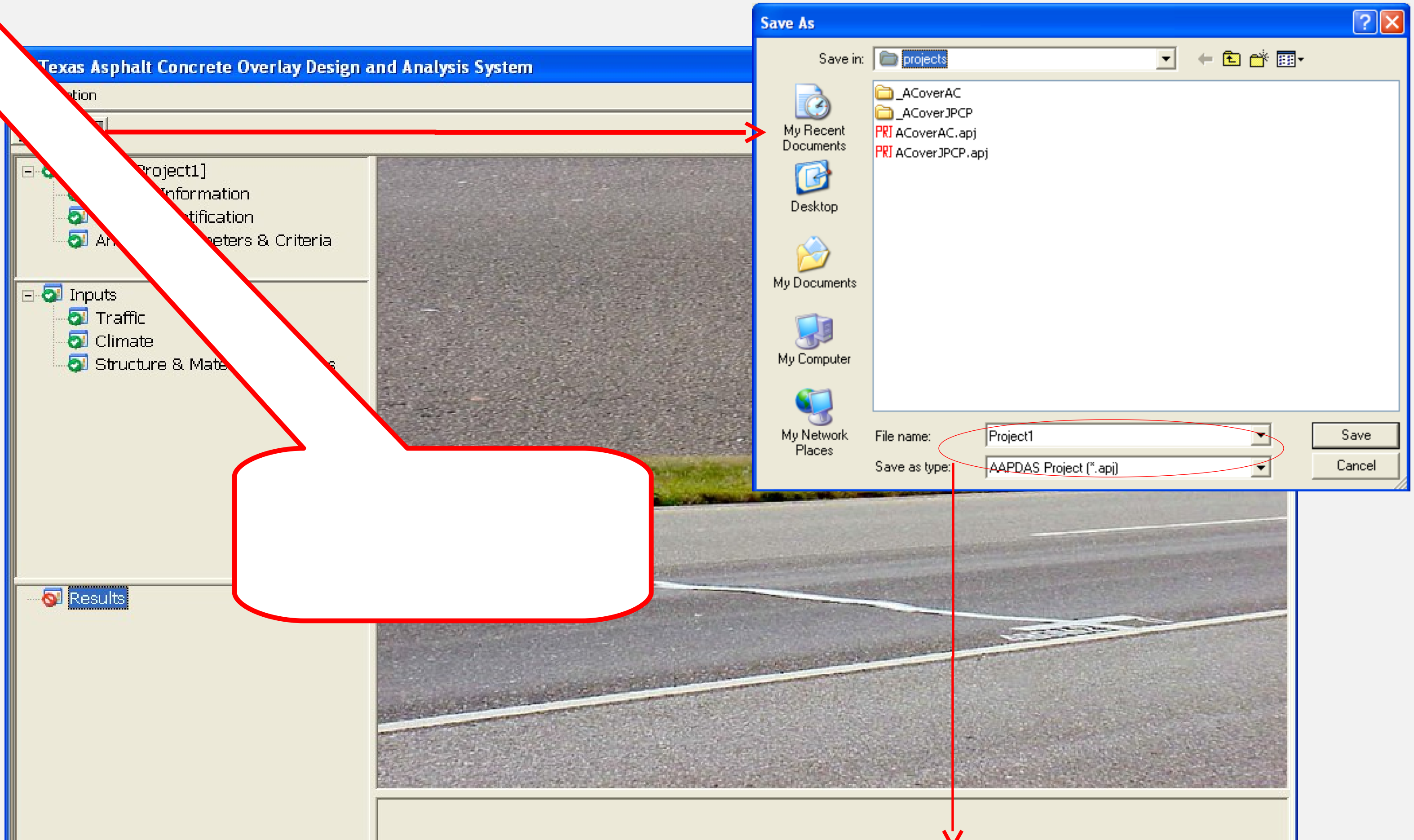
Step 15: Save the Project File



If it is the first time to save the project, this window will pop up and users can input project name here

Step 16: Run Analysis

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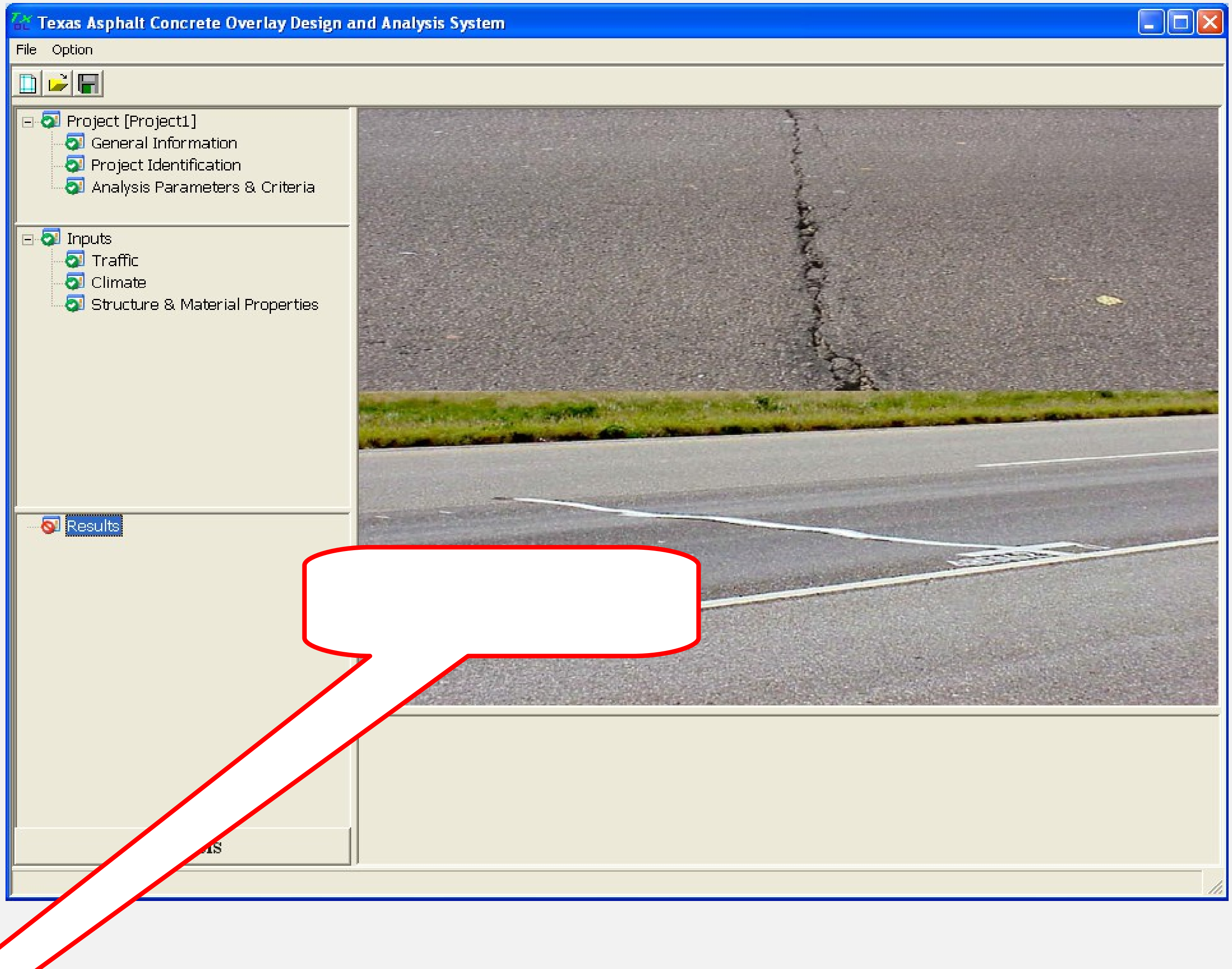

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Example 1 (Paris Workshop)

- AC over AC
- Design life: 10 years
- District: Paris, Lamar
- Traffic: 5 million ESALs for 20 years
- Location: latitude 33°39′, longitude -95°33′, and elevation 600 ft

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Example 1 (Paris Workshop) (Continued)

- Layer thickness
  - AC overlay: 2 inches; Existing AC: 3 inches; Base: 6 inches
- AC overlay property
  - Mix type: Type D; Binder type: PG 76-22
  - Modulus Input Level: Level 3-default values
  - Fracture properties and Rutting properties: default values
- Existing AC layer property
  - Transverse cracking, medium severity, cracking space: 15 ft
  - FWD modulus @ 77 °F: 500 ksi
- Base
  - Type: CTB, Modulus: 200 ksi
- Subgrade

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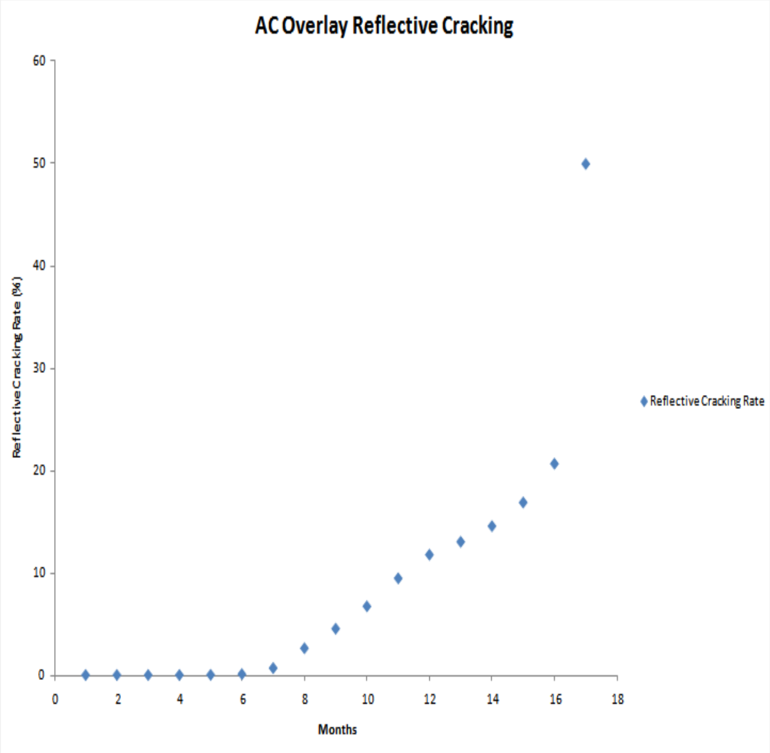
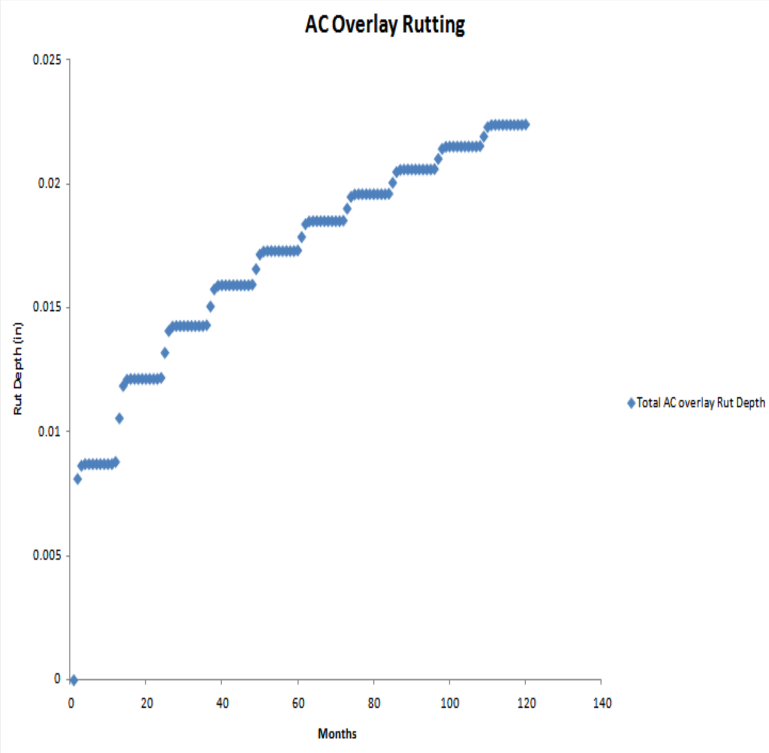
Example 1 (Paris Workshop) Result

Cracking

Rutting





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Example 1 (Austin Workshop)

- Overlay Type: AC over JPCP
- Design or Analysis Life: 15 years
- District: Austin; County: Travis
- Analysis Parameters & Criteria:

  Reflective Cracking Rate Limit: 50%

  AC Rutting: 0.5 inch
- Traffic: ADT-Beginning: 20000; ADT-End: 35000; ESALs: 5.0 million; Speed: 60 mph
- Weather Station: Austin/City, Tx

Example 1 (Austin Workshop) (Continued)

- Layer thickness
  - AC overlay: 2.5 inches; Existing JPCP: 9 inches; Base: 4 inches
- AC overlay property
  - Mix type: Type D; Binder type: PG 76-22
  - Modulus Input Level: Level 3-default values
  - Fracture properties and Rutting properties: default values
- Existing JPCP property
  - Modulus: 4000 ksi, cracking space: 15 ft, LTE: 70%
- Base
  - Type: Granular base, Modulus: 50 ksi
- Subgrade
  - Modulus: By default

Exercise 1

- Use “New” function
- Change the previous example to 2-lift overlays
- The top overlay is the same Type D mix, but its thickness reduces to 1.5 inches
- The bottom overlay is 1 inch CAM mix with a PG76-22 binder
- All the other inputs are kept the same as Example 1

Exercise 2

- Use "Save as" function
- Change the previous exercise back to one lift overlay
- Select overlay mix: SMA-D with a PG76-22 binder
- Keep all the other inputs the same as Example 1

Exercise 2_Hint

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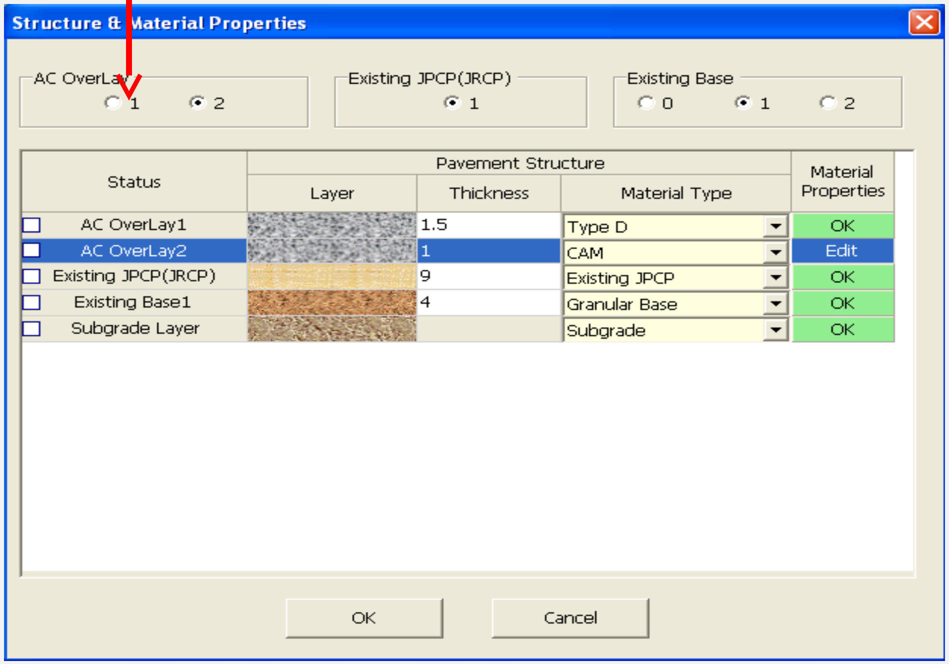
- Use “save as” function
- Click radio button “1” to remove an overlay (Remember: choose/highlight one overlay first)



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Summary for Different Overlay Mixes

2.5 inches Type D

After 52 months, Reflective Cracking Rate reaches 50%.

Rut depth reaches 0.084 inches after 15 years (180 months).

1.5 inches Type D +1 inch CAM

After 129 months, Reflective Cracking Rate reaches 50%.

Rut depth reaches 0.3 inches after 15 years (180 months).

2.5 inches SMA

After 129 months, Reflective Cracking Rate reaches 50%.

Rut depth reaches 0.08 inches after 15 years (180 months).

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Example 2 – Overlay Thickness Design

- Overlay Type: AC over JPCP
- Design Life: 10 years
- District: Wichita Falls; County: Cooke
- Analysis Parameters & Criteria:

  Reflective Cracking Rate Limit: 50%

  AC Rutting: 0.5 inch
- Traffic: ADT-Beginning: 19350; ADT-End: 28800; ESALs: 4.5 million; Speed: 60 mph
- Weather Station: Wichita Falls, Tx

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Example 2 – Overlay Thickness Design (Continued)

- Layer thickness
  - AC overlay: Unknown; Existing JPCP: 8 inches; Base: 4 inches
- AC overlay property
  - Mix type: Type D; Binder type: PG 76-22
  - Modulus Input Level: Level 3-default values
  - Fracture properties and Rutting properties: default values
- Existing JPCP property
  - Modulus: 4000 ksi, joint space: 15 ft, LTE: 70%
- Base
  - Type: Granular base, Modulus: 30 ksi
- Subgrade
  - Modulus: By default

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Trial Thicknesses During Design

- Overlay thickness trial 1: 2 inches

After 15 months, Reflective Cracking Rate reaches 50%.

Rut depth reaches 0.05 inches after 15 years (180 months).

- Overlay thickness trial 2: 4 inches

After 162 months, Reflective Cracking Rate reaches 50%.

Rut depth reaches 0.077 inches after 15 years (180 months).

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Trial Thicknesses During Design (Continued)

- Overlay thickness trial 3: 3.5 inches

After 100 months, Reflective Cracking Rate reaches 50%.

Rut depth reaches 0.07 inches after 15 years (180 months).

- Obviously for all these cases, the rutting problem is not significant. To meet the 10 years design life requirement, a 4 inches overlay is recommended

Exercise 3

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- Change the existing JPCP’s LTE to 50%
- Keep the other inputs the same as Example 2
- The recommended overlay thickness=?

Answer to Exercise 3

5 inches

- Trial 1: 4 inches, 69 months
- Trial 2: 5 inches, 148 months
- Trial 3: 4.5 inches, 105 months

Tips and Reminders

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- Accept default values if you don’t have specific test results
- Use climatic interpolation function when there is no existing weather station available in this area
- Use “save as” to reduce some input work
- Save the project file before clicking “Analysis” button
- Do not move or rename the project file manually

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Presentation Outline

- Introduction
- Program training and exercises
- Key inputs for existing pavement and field testing
- Key inputs for overlays and lab

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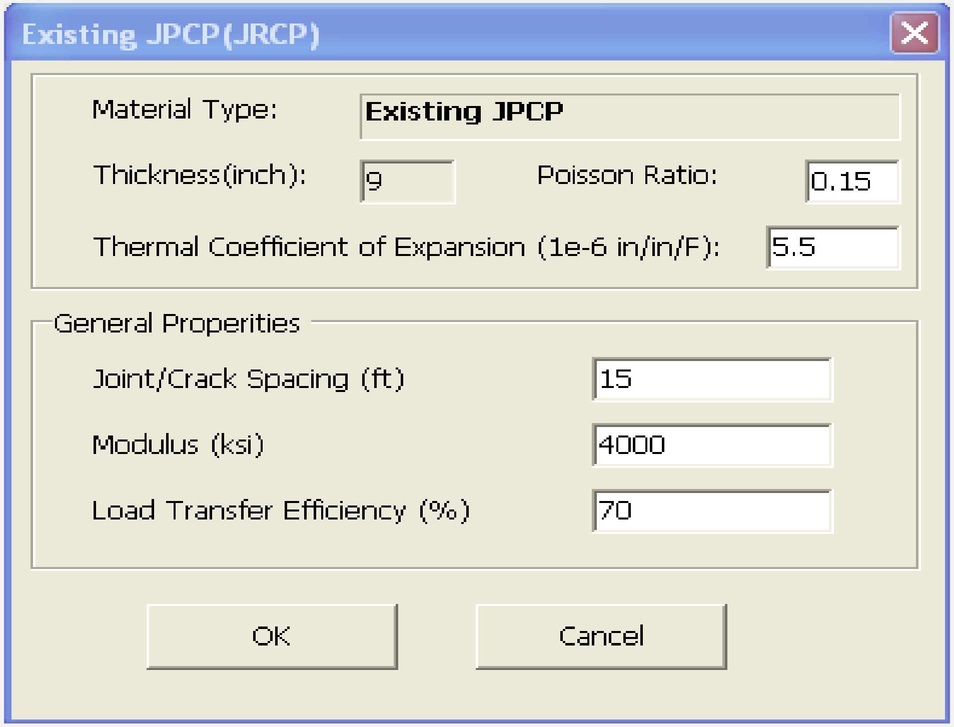
Key Input Parameters for Existing Pavements

- Existing pavements
  - 1) Layer modulus and 2) Joints/cracks LTE



- Field testing
  - FWD
  - RDD

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JPCP Pavement Evaluation

- For Layer modulus backcalculation
  - center slab
  - 30 drops per section (max spacing: 0.1 mile)
- For LTE
  - joint measurements
    - FWD
    - RDD

Texas Transportation Institute

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FWD Backcalculated Modulus

- In Texas, “MODULUS 6.0” is commonly used for modulus backcalculation

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 6.0)

District:20 (Beaumont)
County :122 (JASPER)
Highway/Road: US0096

	Thickness(in)	MODULI RANGE(psi) Minimum	MODULI RANGE(psi) Maximum	Poisson Ratio Values
Pavement:	10.00	340,000	5,500,000	H1: v = 0.20
Base:	10.00	10,000	550,000	H2: v = 0.35
Subbase:	0.00			H3: v = 0.00
Subgrade:	97.98(by DB)	5,000		H4: v = 0.35

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	11,070	4.55	4.01	3.55	3.00	2.52	1.96	1.59	3457.9	315.2	0.0	10.8	1.20	147.5
0.197	11,098	3.63	3.18	2.80	2.27	1.87	1.46	1.17	5165.5	163.8	0.0	16.0	0.92	137.0
0.399	11,051	4.20	3.72	3.25	2.65	2.21	1.80	1.42	3383.0	340.2	0.0	12.4	0.75	130.4
0.595	11,035	7.87	7.20	6.61	5.60	4.69	3.57	2.70	3037.8	81.1	0.0	5.8	2.53	125.1
0.797	10,880	5.10	4.41	3.86	3.12	2.54	1.95	1.50	3324.7	114.5	0.0	11.9	1.01	123.3
0.994	10,943	4.64	4.18	3.78	3.16	2.68	2.01	1.49	5458.4	59.1	0.0	10.8	1.96	102.6
1.200	10,975	6.05	5.27	4.56	3.61	2.76	1.89	1.20	2825.1	13.6	0.0	13.6	2.77	81.5 *
1.393	11,154	2.85	2.35	1.94	1.52	1.20	0.86	0.67	3437.5	316.6	0.0	28.1	1.11	91.5
1.601	10,876	4.72	4.09	3.54	2.91	2.37	1.80	1.34	3609.0	125.2	0.0	12.8	0.97	104.2
1.798	11,074	4.40	4.11	3.96	3.35	2.89	2.24	1.69	5500.0	71.7	0.0	10.4	5.29	108.7 *
1.995	10,979	3.49	3.04	2.66	2.26	1.92	1.56	1.28	3816.0	550.0	0.0	13.5	0.52	145.0 *
2.197	10,864	4.88	4.12	3.60	2.68	2.11	1.59	1.09	2649.9	103.6	0.0	15.3	1.46	92.3
2.399	11,051	3.67	3.24	2.89	2.39	2.03	1.61	1.24	4262.8	401.1	0.0	13.3	1.04	111.1
2.588	10,721	4.50	4.02	3.60	3.04	2.40	1.91	1.43	5065.9	60.5	0.0	11.8	1.39	103.7
2.789	10,947	2.69	2.17	1.78	1.36	1.06	0.74	0.59	3183.2	318.3	0.0	32.0	1.47	84.6
2.999	10,832	4.28	3.81	3.36	2.72	2.24	1.73	1.44	4323.0	131.4	0.0	13.0	1.04	149.4
3.200	10,947	2.44	2.03	1.64	1.22	0.93	0.66	0.52	4492.1	149.8	0.0	37.8	0.83	88.9
3.401	11,066	2.41	2.00	1.69	1.29	0.98	0.83	0.68	5500.0	82.2	0.0	36.6	3.86	300.0 *
3.610	11,039	2.97	2.39	2.01	1.52	1.17	0.84	0.62	3135.3	267.4	0.0	28.8	1.44	95.6
3.612	10,900	3.16	2.43	1.78	1.31	0.98	0.70	0.50	1743.7	289.0	0.0	35.5	1.48	86.9
3.796	11,051	1.79	1.41	1.13	0.80	0.58	0.39	0.31	5304.9	148.2	0.0	64.4	1.46	73.5
4.000	10,939	3.06	2.66	2.30	1.72	1.42	1.01	0.81	5500.0	27.2	0.0	26.9	2.19	96.4 *
4.194	10,943	2.55	2.21	1.83	1.55	1.22	0.99	0.85	4423.2	547.7	0.0	23.3	0.99	300.0
4.399	10,892	3.08	2.66	2.30	1.74	1.41	1.03	0.73	5500.0	31.5	0.0	26.1	1.84	89.1 *
4.600	10,880	2.70	2.30	1.99	1.65	1.34	1.06	0.87	4273.2	550.0	0.0	21.1	0.50	138.1 *
4.801	10,983	3.06	2.61	2.30	1.90	1.56	1.30	1.10	4096.2	550.0	0.0	17.3	1.22	300.0 *
4.998	10,876	2.80	2.26	1.98	1.52	1.17	0.90	0.75	3419.0	363.8	0.0	26.5	1.48	130.8
5.199	10,816	2.99	2.57	2.31	1.79	1.41	1.17	0.95	5500.0	103.0	0.0	22.4	2.83	149.6 *
5.400	10,896	3.28	2.91	2.48	1.95	1.64	1.30	1.08	4512.2	259.3	0.0	18.0	1.34	168.8
5.602	10,991	2.20	1.85	1.56	1.24	1.05	0.81	0.69	5500.0	144.2	0.0	36.5	6.64	118.9 *
5.799	10,717	2.87	2.49	2.15	1.79	1.62	1.11	0.85	4369.7	517.6	0.0	18.2	2.95	300.0
6.000	10,689	3.24	2.89	2.49	2.01	1.59	1.29	0.99	5161.6	176.3	0.0	18.0	1.00	109.2
6.204	10,705	3.24	2.69	2.35	1.90	1.51	1.16	0.96	3345.8	364.2	0.0	19.4	1.18	129.3
6.401	10,816	3.76	3.24	2.83	2.30	1.91	1.41	1.09	4500.3	152.8	0.0	16.1	1.62	109.5
Mean:		3.62	3.13	2.73	2.20	1.79	1.37	1.06	4199.3	232.1	0.0	21.3	1.77	118.0
Std. Dev:		1.21	1.14	1.08	0.93	0.79	0.61	0.45	1017.8	169.7	0.0	11.6	1.31	36.3
Var Coeff(%):		33.41	36.37	39.42	42.28	44.08	44.39	42.60	24.2	73.1	0.0	54.2	73.72	30.7

lide50

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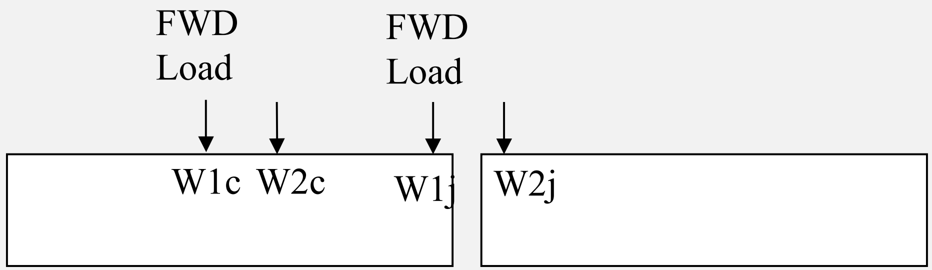
FWD Based LTE at Joints/Cracks

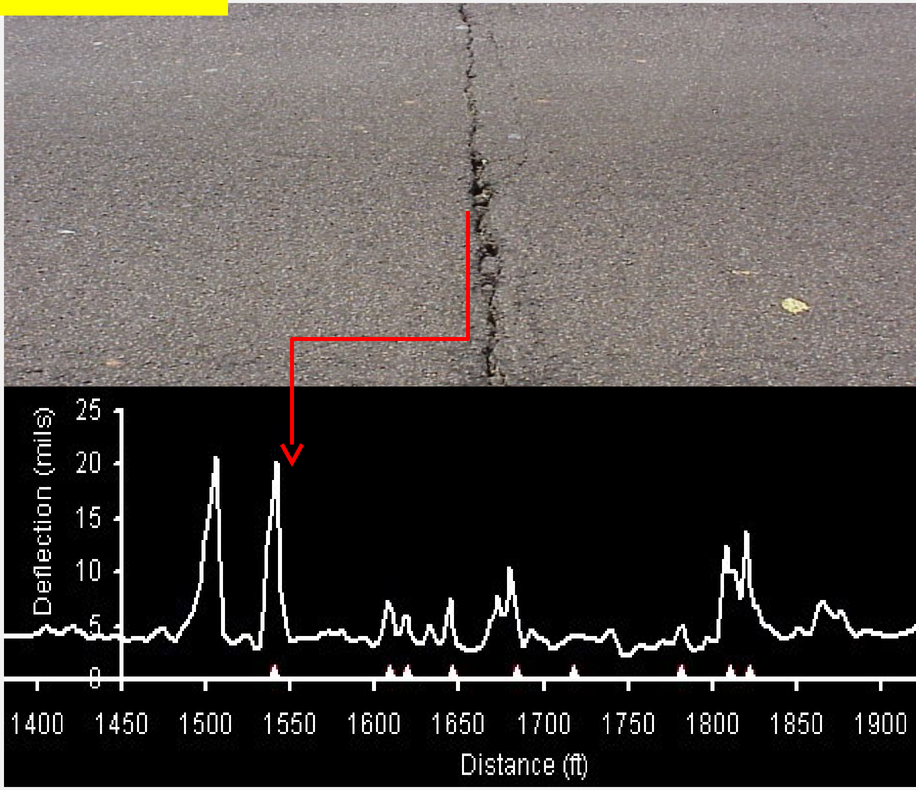


LTE = (W2j/W1j)/(W2c/W1c)

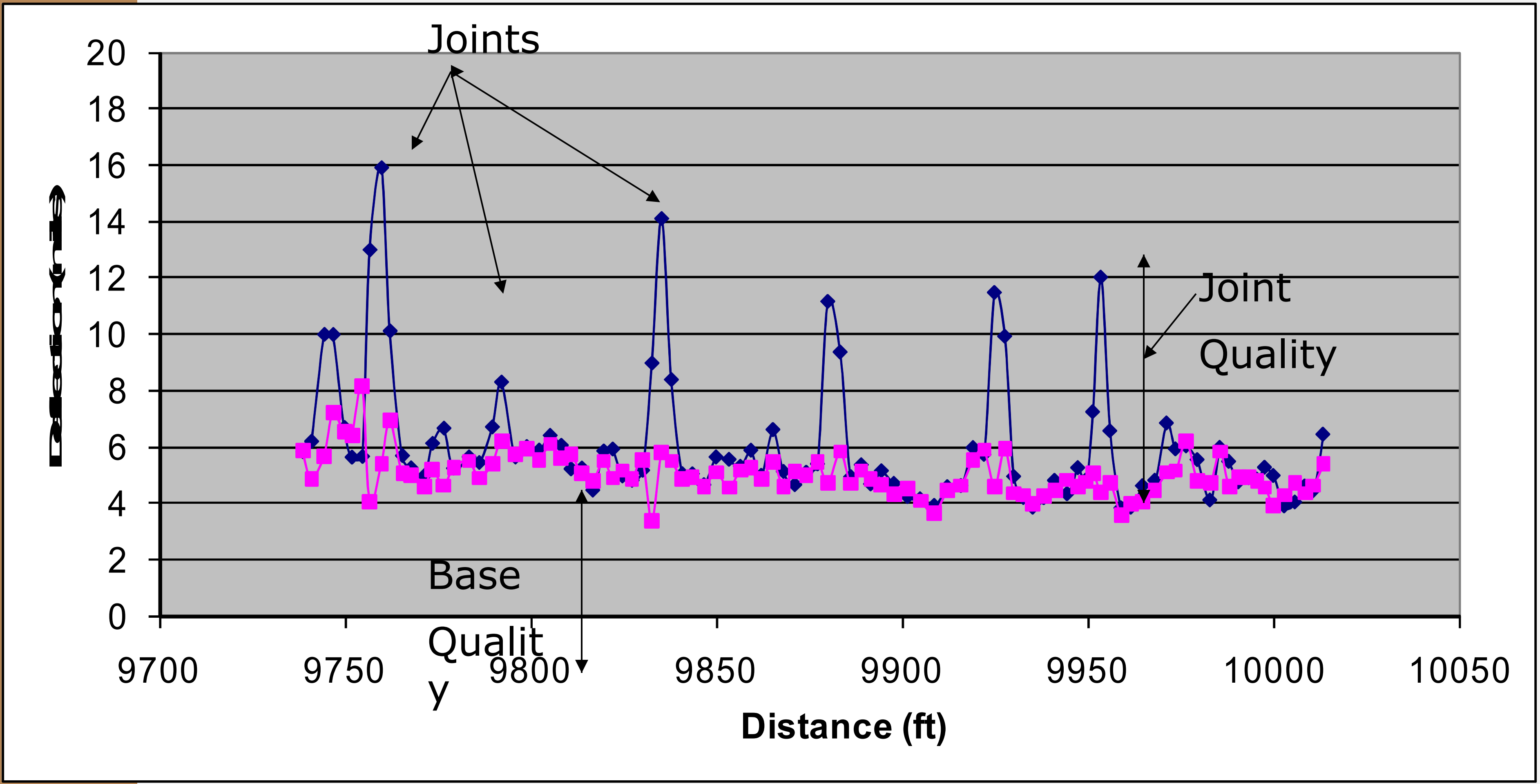
Near the slab center

Near the joint/crack

RDD Based LTE Evaluation



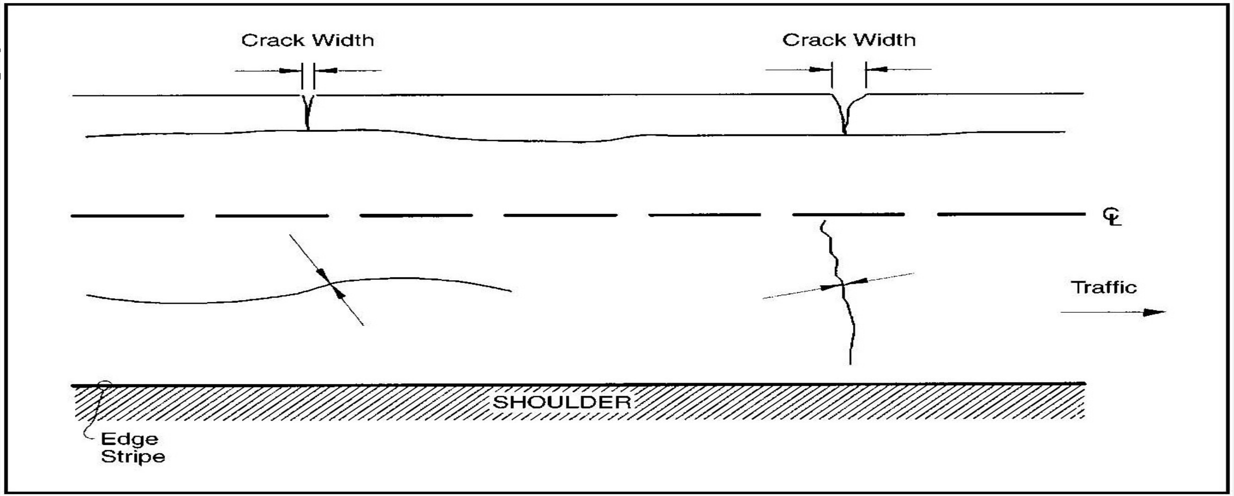
RDD Raw Data


Joints
Joint
Quality
Base
Qualit
y
20
18
16
14
12
10
8
6
4
2
0
9700
9750
9800
9850
9900
9950
10000
10050
Distance (ft)

Flexible Pavement Evaluation

Slide53

- For layer modulus backcalculation
  - 30 drops per section (max spacing 0.1 mile)
- For LTE evaluation
  - FWD based, similar to JPCP
  - C



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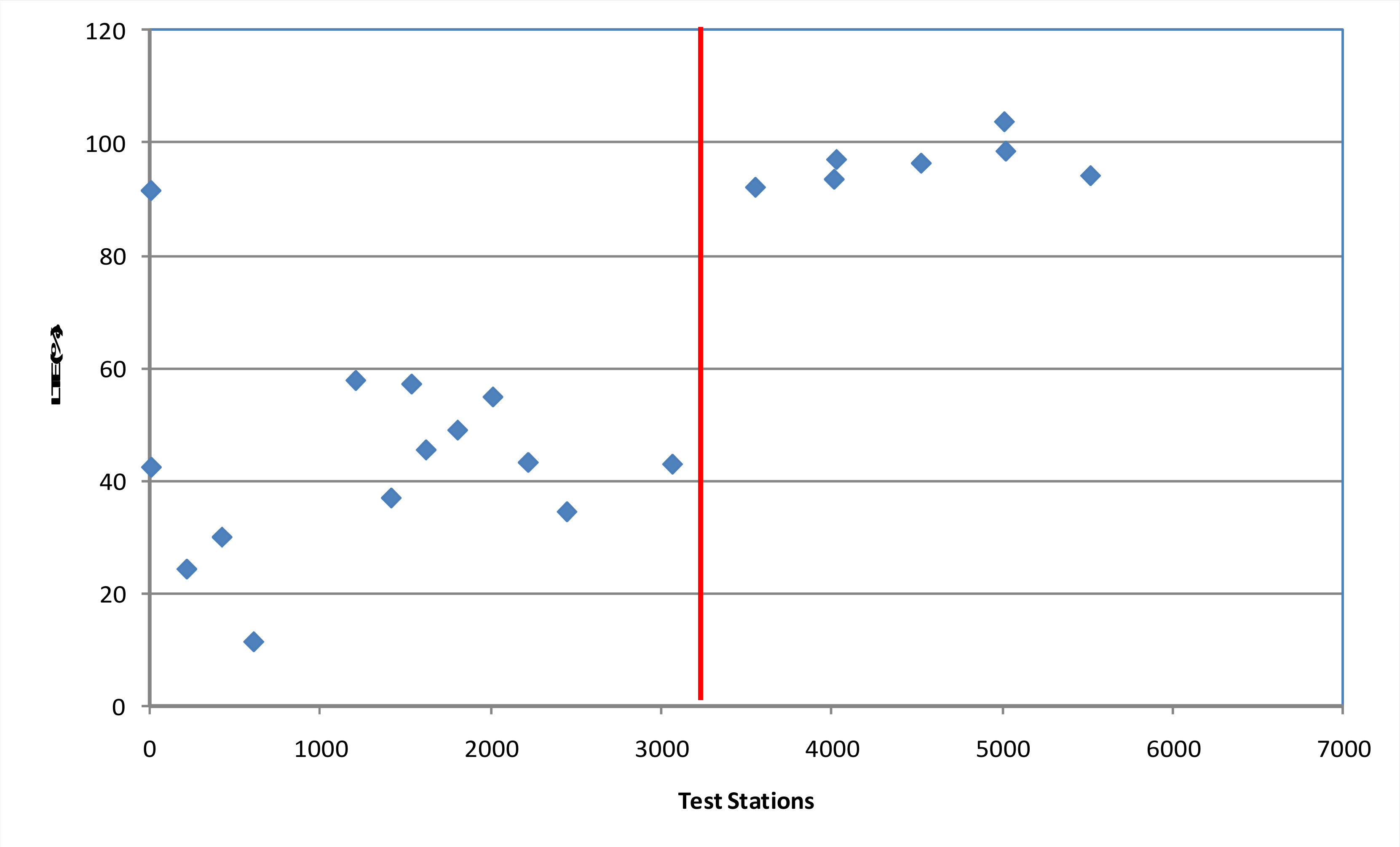
FWD Based LTE
ment

		Station	Load Measured (lbs)	Deflection (mils): R1	R2	R1/R2	LTE (%)
	Center	0	10,359	9.45	4.15	0.439153	
1/2	Crack	21	10,284	10.03	3.79	0.377866	**86**
	Center	67	10,355	7.31	3.55	0.485636	
3	Crack	84	10,312	10.31	3.68	0.356935	**73**
	Center	99	10,244	6.56	3.34	0.509146	
4	Crack	112	10,189	10.49	4.34	0.413727	**81**
	Center	136	9,795	9.04	5.14	0.568584	
5	Crack	153	10,288	11.52	4.41	0.382813	**67**
	Center	169	10,300	8.48	4.07	0.479953	
6	Crack	182	10,395	6.36	3.77	0.592767	**124**
	Center	196	10,153	10.19	5.63	0.552502	
7	Crack	207	10,343	8.87	4.35	0.490417	**89**
	Center	222	10,228	9.73	5.33	0.54779	
8	Crack	231	10,113	11.72	4.2	0.358362	**65**
	Center	248	10,077	11.04	5.7	0.516304	
9	Crack	262	10,153	10.57	4.39	0.415326	**80**
	Center	290	10,145	7.09	3.41	0.480959	
10	Crack	304	10,161	8.3	3.78	0.455422	**95**
	Center	325	10,252	6.8	3.82	0.561765	
11	Crack	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

lide55

FWD Based LTE Measurement



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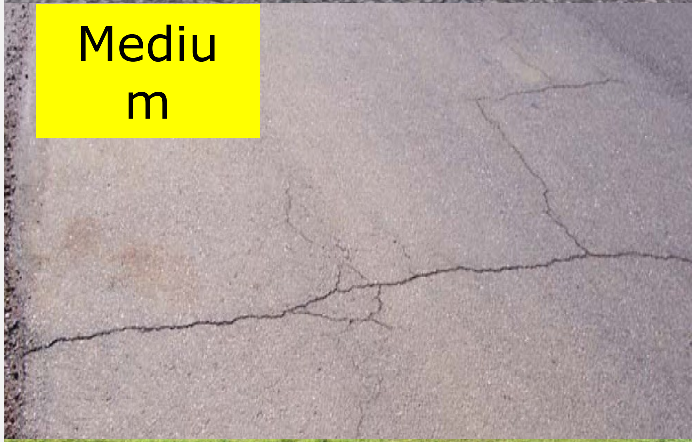
lide56

Flexible Pavement-Severity Level Base LTE

- Low severity crack: LTE=85%
  - Crack width<1/8"
- Medium severity crack: LTE=70%
  - 1/8"<Crack width<1/4" or any crack (<1/4") with adjacent random low severity cracking
- High severity crack: LTE=55%
  - Crack width>1/4" or any crack (<1/4") with adjacent random medium to high severity cracking



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Presentation Outline

lide57

- Introduction
- Program training and exercises
- Key inputs for existing

  pavement and field testing
- Key inputs for asphalt overlays

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Key Inputs for Asphalt Overlays Level 1

1. Dynamic modulus |*E**|
2. Fracture properties (A and n)
3. Rutting properties (α and μ)

Dynamic Modulus |*E**|

- Test equipment

Sample size:
4" diameter by 6" high

Replicates: 3

Dynamic Modulus |*E**| (Continued)

Slide60

- 5 test temperatures:

  14, 40, 70, 100, and 130°F

- 6 loading frequencies:

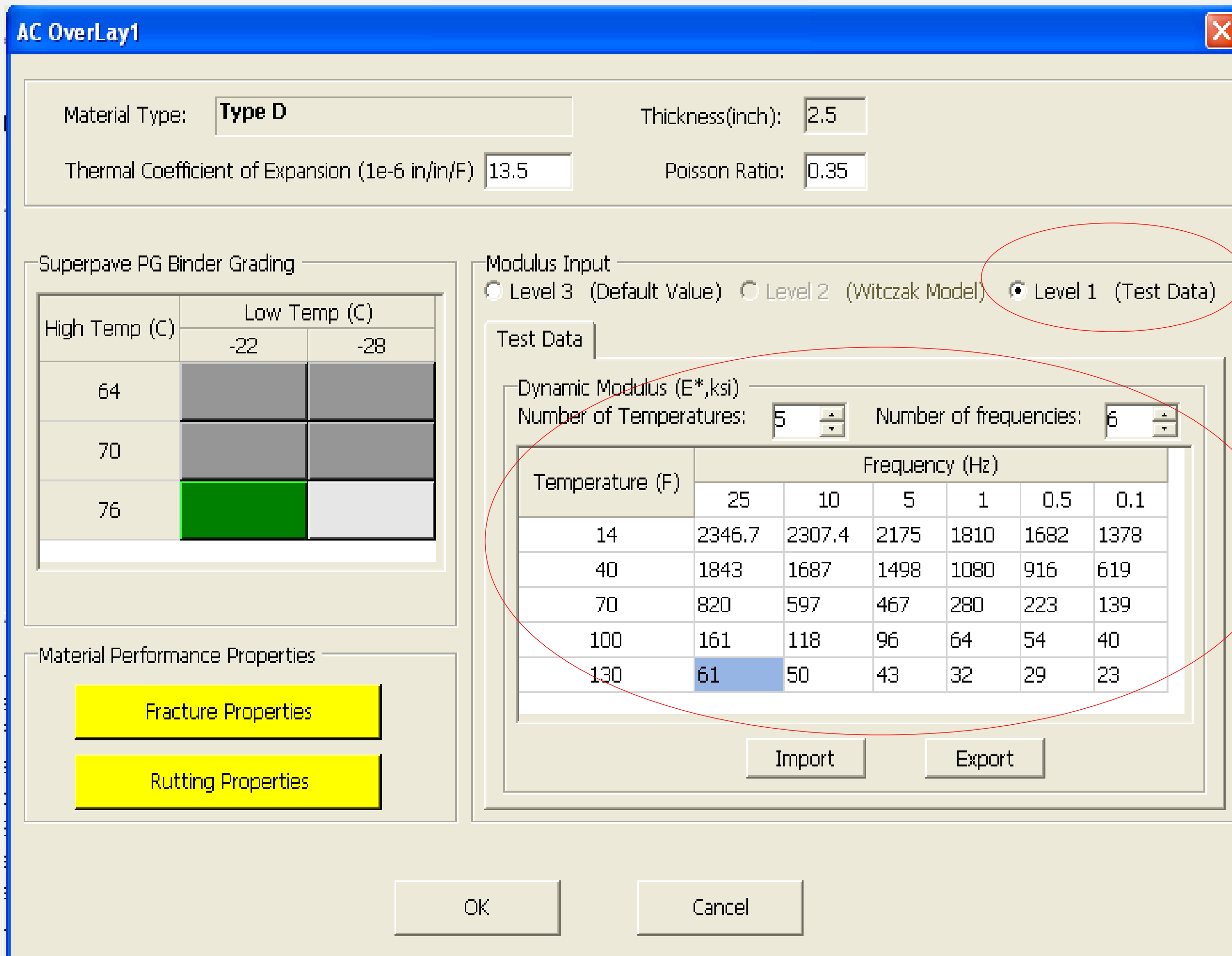
  25, 10, 5, 1, 0.5, and 0.1Hz

Sample |*E**| values (ksi)

	25Hz	10Hz	5Hz	1Hz	0.5Hz	0.1Hz
14°F	2346.7	2307.4	2175	1810	1682	1378
40°F	1843	1687	1498	1080	916	619
70°F	820	597	467	280	223	139

Dynamic Modulus |*E**|

- Input interface in the program



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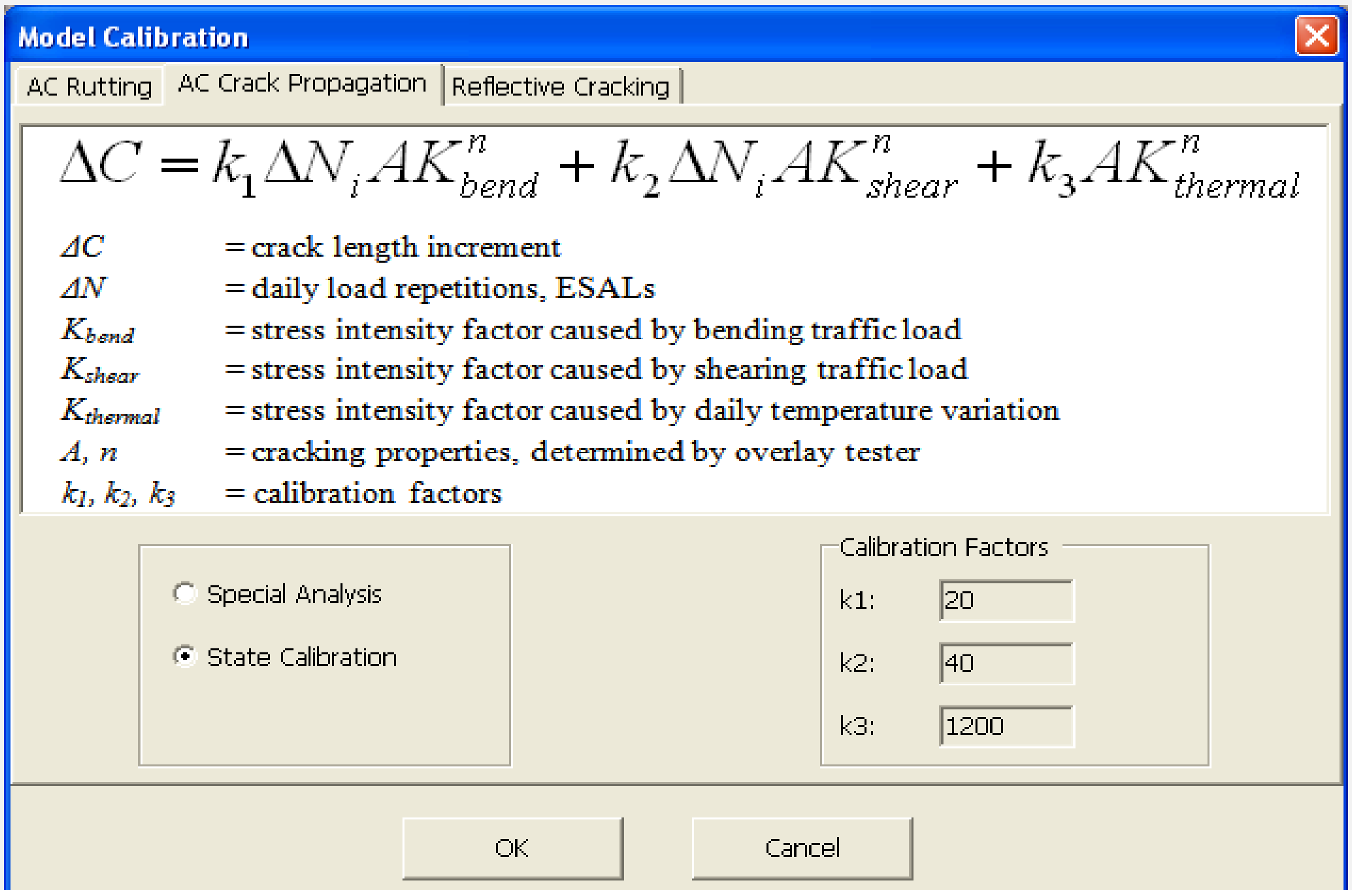
Fracture Properties: A & n

- Fracture model



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Fracture Properties A & n (Continued)

- Test equipment: Overlay Tester

Step 1: Modulus Test

Step 2: Cracking test to obtain A, n

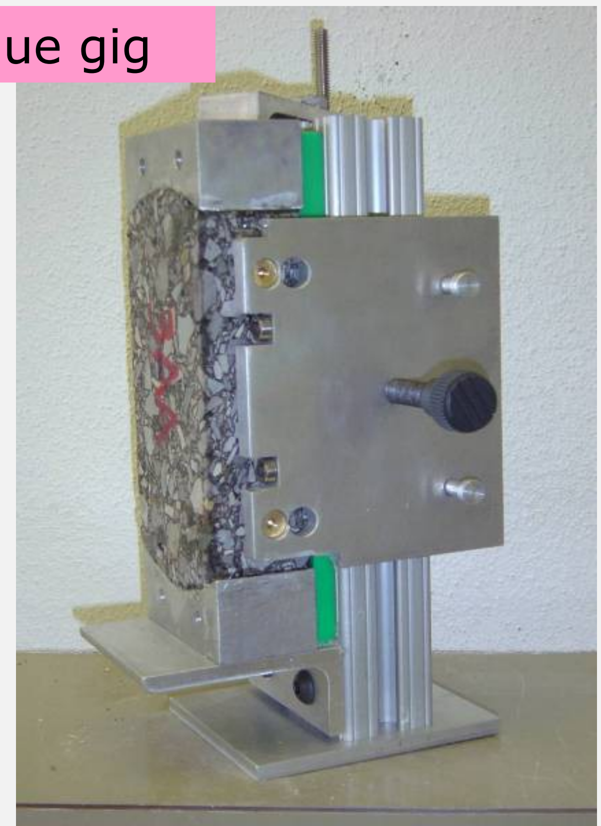
Three replicates required

lide64

Fracture Properties A & n (Continued)

- Modulus test –preparing samples

Sample glue gig



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Fracture Properties A & n (Continued)

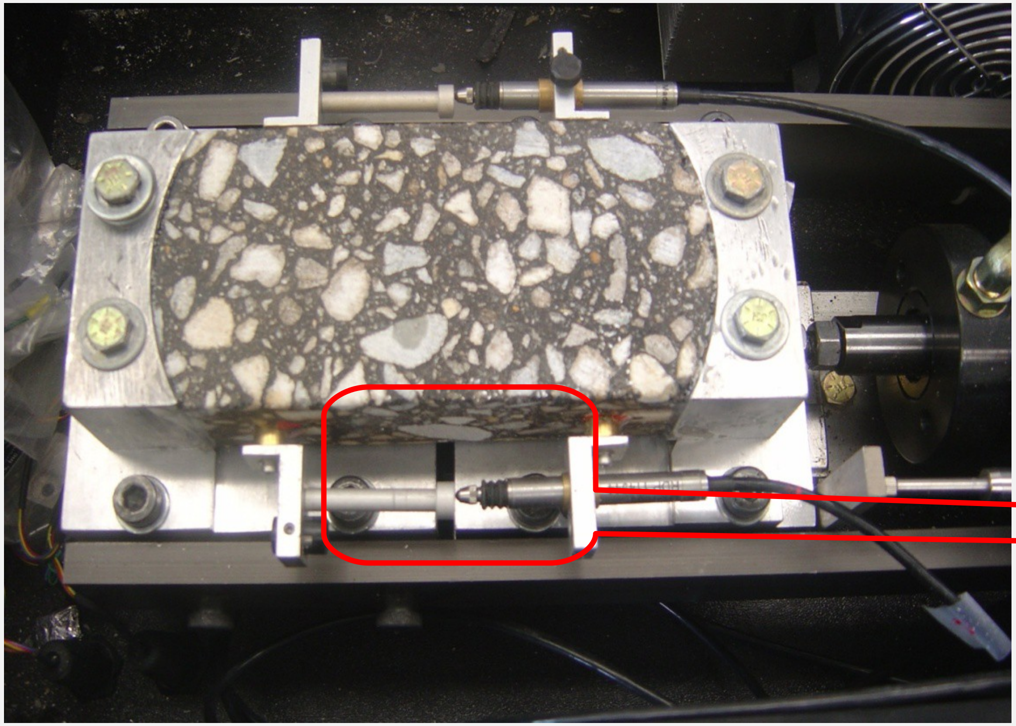
- Modulus test – installing new base plates

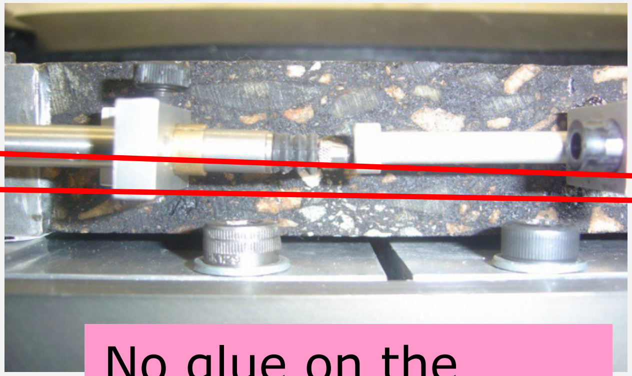
Regular OT Machine

OT-E* System

Fracture Properties A & n (Continued)

- Modulus test – mounting





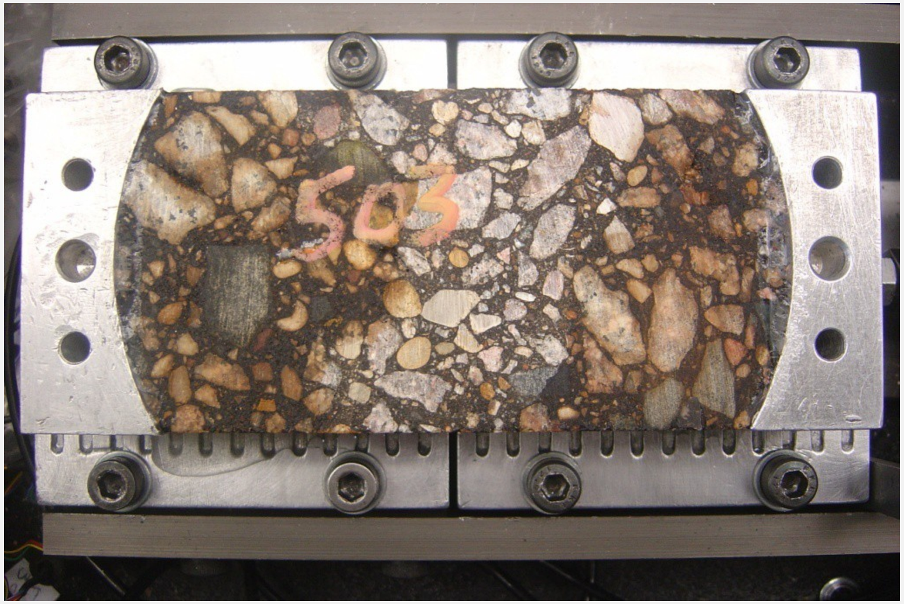
No glue on the bottom.

Slide67

Fracture Properties A & n (Continued)

- Cracking test

Same as regular OT test except with a smaller opening displacement: 0.017”



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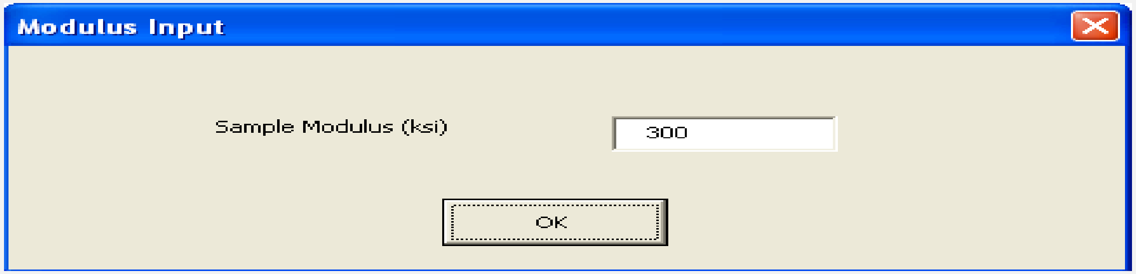
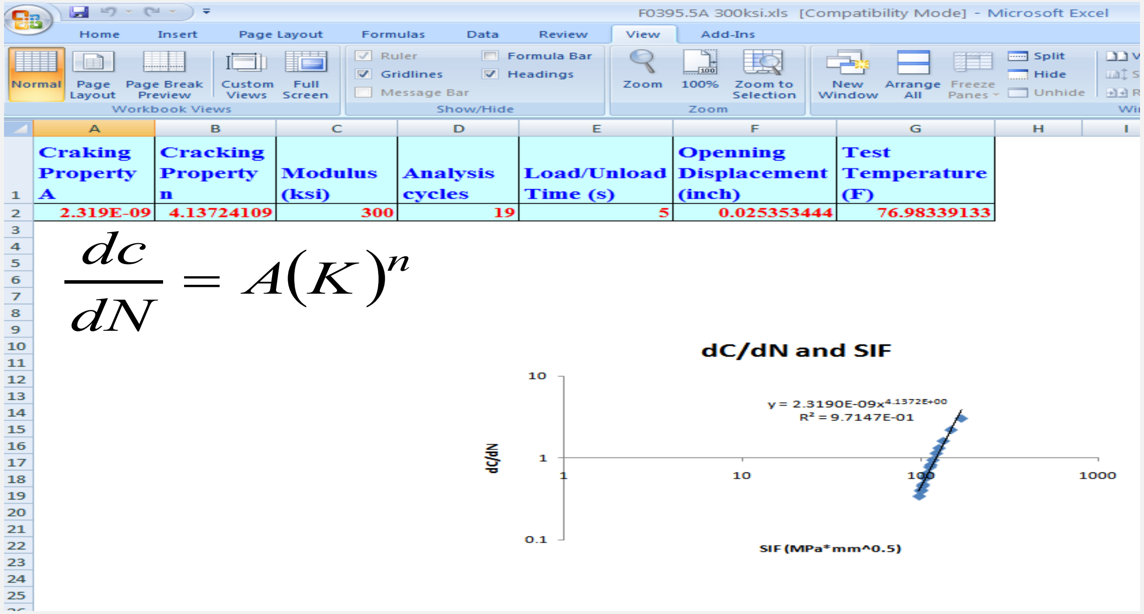
Fracture Properties A & n (Continued)

- Excel macro to determine A & n



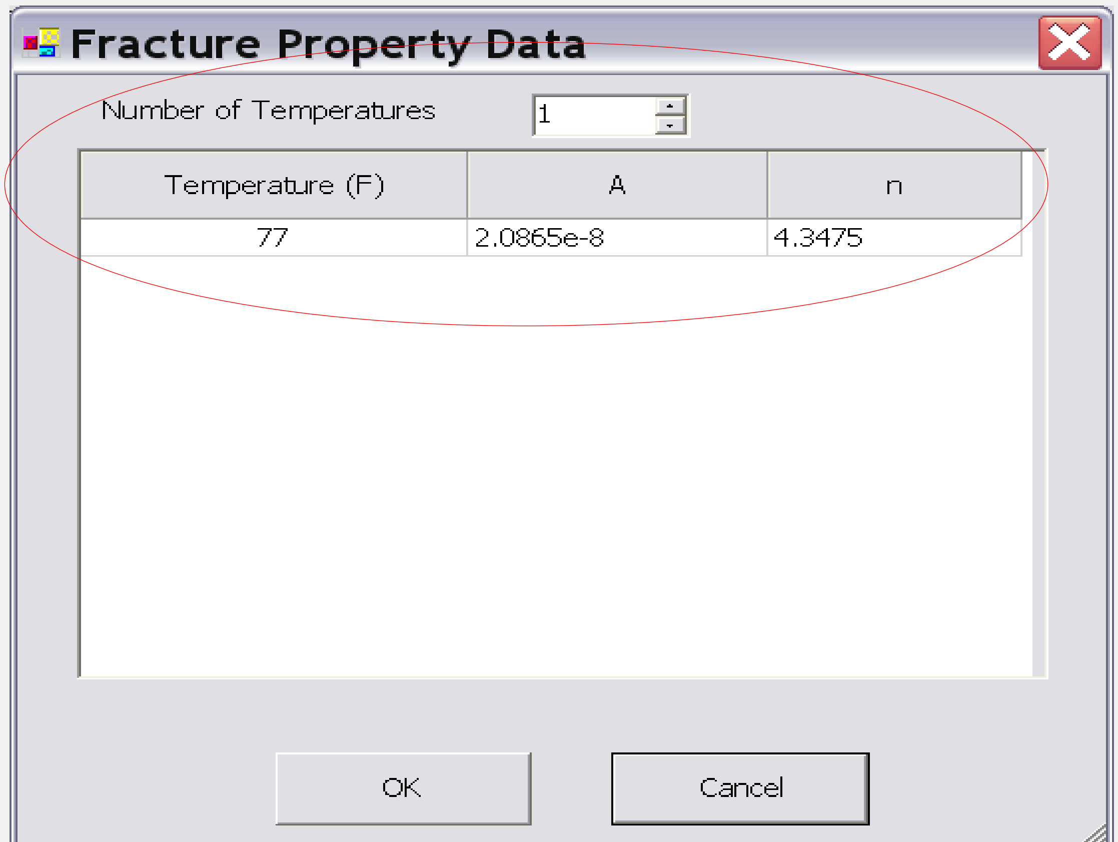
Input



Output

Fracture Properties: A & n

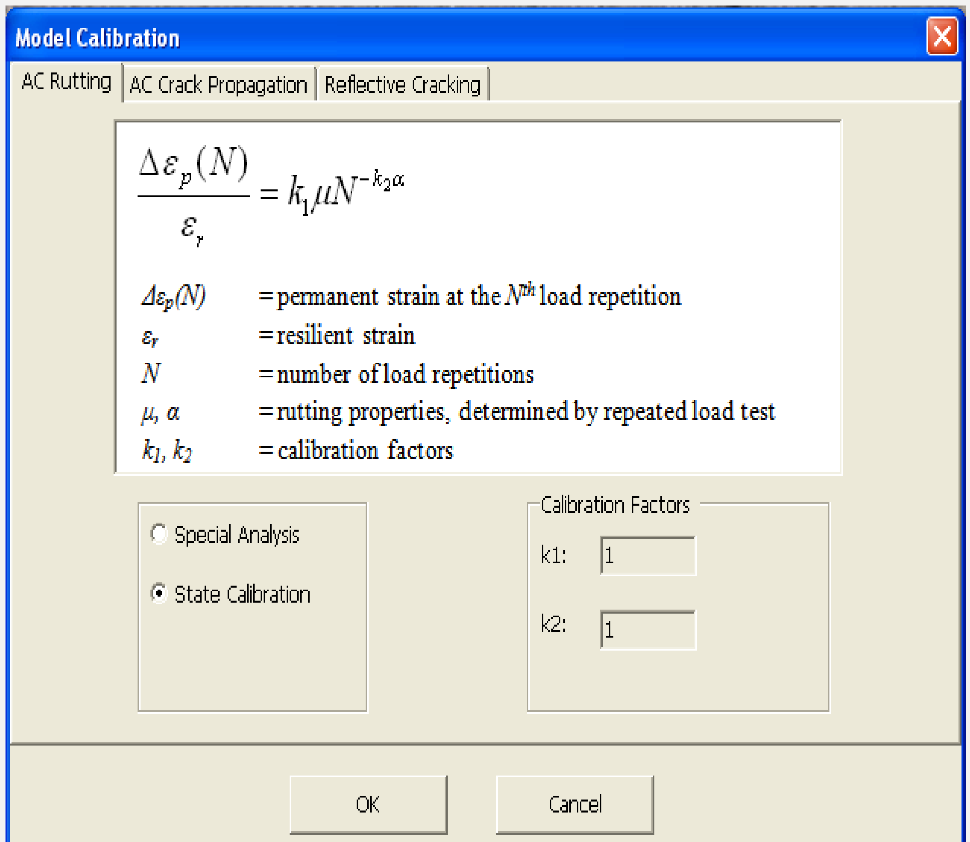
- Input interface in the program



Rutting Properties α & μ

lide70

- Rutting model



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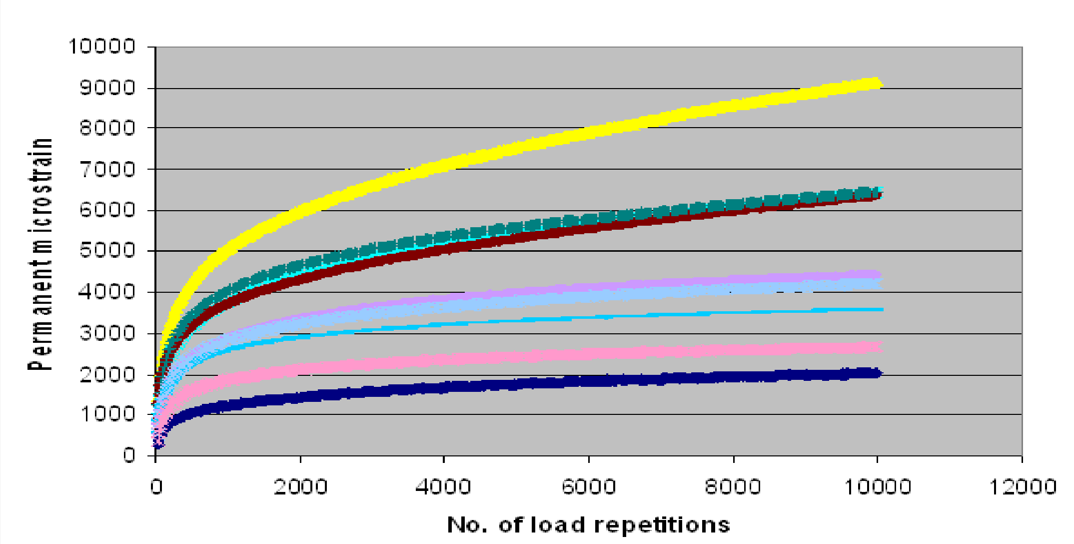
Rutting property α & μ (Continued)

- Test equipment: same as |*E**| test
- Test conditions

10,000 load repetitions

0.1s loading+0.9s rest

2 replicates required



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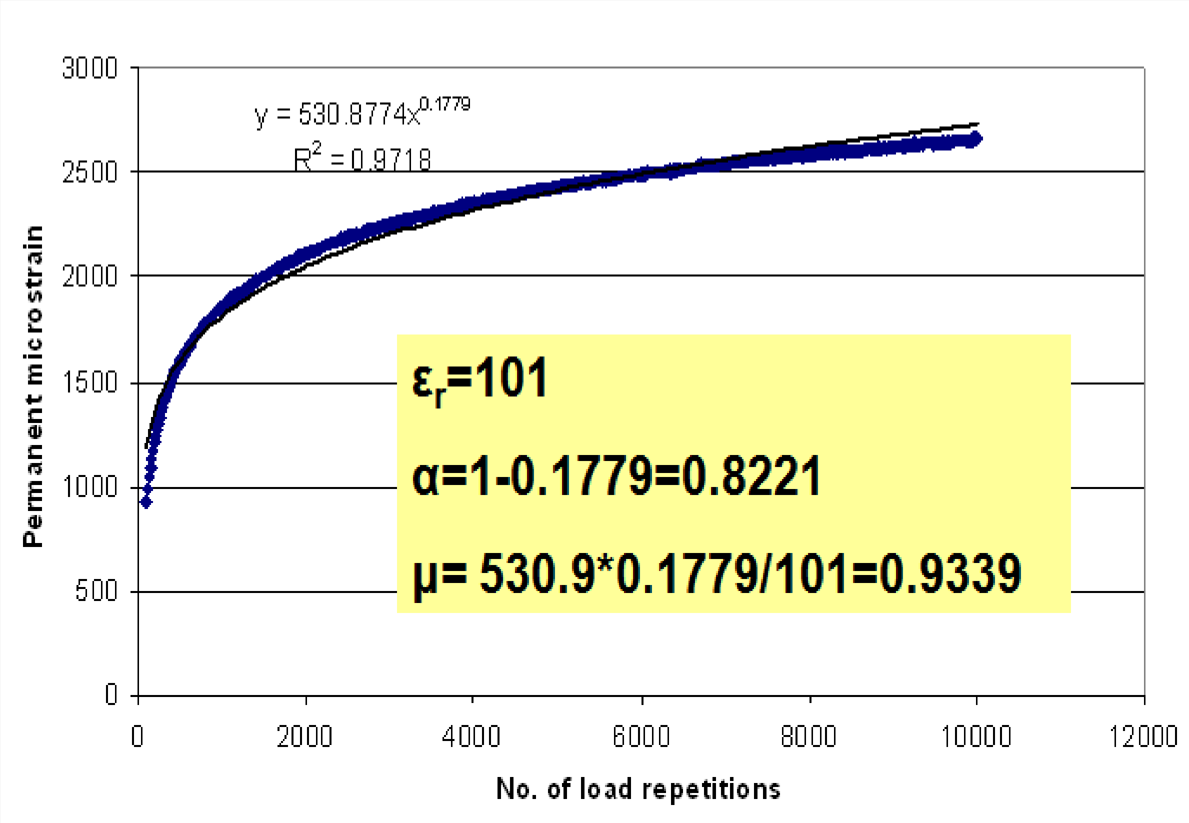
Rutting Properties: α & μ (Continued)

- α & μ determination method



$$\mu = \frac{ab}{\varepsilon_r}$$

$$\alpha = 1 - b$$

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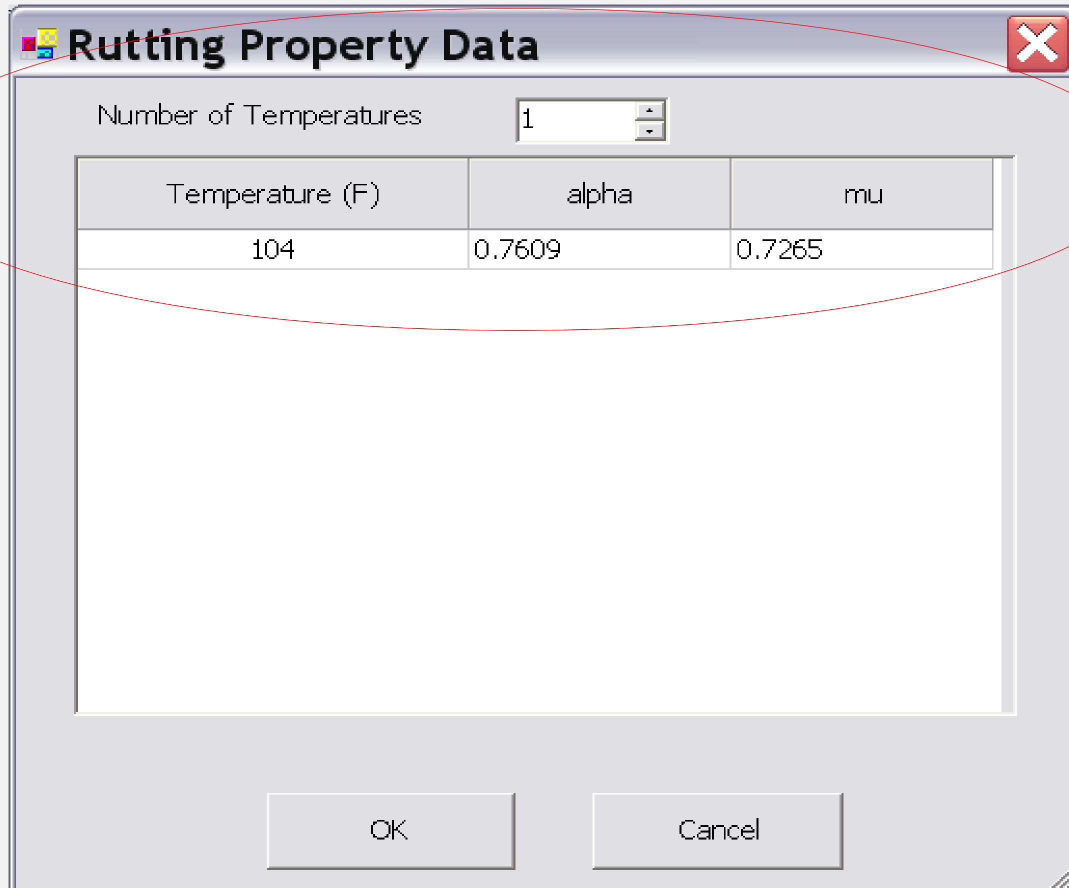
Rutting Properties: α & μ (Continued)

- Input interface in the program



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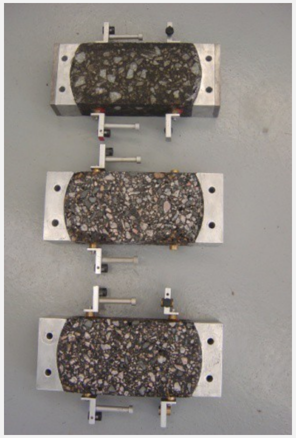
Lab Test Summary

Slide74

- Dynamic modulus |*E**| test 3 replicates

- Rutting properties (α & μ) test 2 replicates

- Cracking properties (A & n) test 3 replicates



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Questions?

Assistance needed?

lide76

- Contact TTI research team:
  - by email
    - Sheng Hu: S-hu@ttimail.tamu.edu
    - Fujie Zhou: F-zhou@ttimail.tamu.edu
    - Tom Scullion: T-scullion@tamu.edu
  - by phone
    - Sheng Hu: 979-845-9767
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    - Tom Scullion: 979-845-9913

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Thank you!

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APPENDIX

Handouts for Austin Workshop

Texas Transportation Institute

Example 1

- Overlay Type: AC over JPCP
- Design or Analysis Life: 15 years
- District: Austin; County: Travis
- Analysis Parameters & Criteria:
  - Reflective Cracking Rate Limit: 50%
  - AC Rutting: 0.5 inch
- Traffic:
  - ADT-Beginning: 20000; ADT-End: 35000; ESALs: 5.0 million; Speed: 60 mph
- Weather Station: Austin/City, Tx
- Layer thickness
  - AC overlay: 2.5 inches
  - Existing JPCP: 9 inches
  - Base: 4 inches
- AC overlay property
  - Mix type: Type D; Binder type: PG 76-22
  - Modulus Input Level: Level 3-default values
  - Fracture properties and Rutting properties: default values
- Existing JPCP property
  - Modulus: 4000 ksi, cracking space: 15 ft, LTE: 70%
- Base
  - Type: Granular base, Modulus: 50 ksi
- Subgrade
  - Modulus: By default

Analysis Result:

2.5 inches Type D

After 52 months, Reflective Cracking Rate reaches 50%.

Rut depth reaches 0.084 inches after 15 years (180 months).

Exercise 1

- Overlay Type: AC over JPCP
- Design or Analysis Life: 15 years
- District: Austin; County: Travis
- Analysis Parameters & Criteria:
  - Reflective Cracking Rate Limit: 50%
  - AC Rutting: 0.5 inch
- Traffic:
  - ADT-Beginning: 20000; ADT-End: 35000; ESALs: 5.0 million; Speed: 60 mph
- Weather Station: Austin/City, Tx
- Layer thickness
  - AC overlay 1: 1.5 inches
  - AC overlay 2: 1 inches
  - Existing JPCP: 9 inches
  - Base: 4 inches
- AC overlay 1 property
  - Mix type: Type D; Binder type: PG 76-22
  - Modulus Input Level: Level 3-default values
  - Fracture properties and Rutting properties: default values
- AC overlay 2 property
  - Mix type: CAM; Binder type: PG 76-22
  - Modulus Input Level: Level 3-default values
  - Fracture properties and Rutting properties: default values
- Existing JPCP property
  - Modulus: 4000 ksi, cracking space: 15 ft, LTE: 70%
- Base
  - Type: Granular base, Modulus: 50 ksi
- Subgrade
  - Modulus: By default

Analysis Result: (Please fill in the blanks):

1.5 inches Type D +1 inch CAM

After ____ months, Reflective Cracking Rate reaches 50%.
Rut depth reaches ____ inches after 15 years (180 months).

Exercise 2

- Use "Save as" function
- Change the previous exercise back to one lift overlay
- Select overlay mix: SMA-D with a PG76-22 binder
- Keep all the other inputs the same as Example 1

Analysis Result: (Please fill in the blanks):

2.5 inches SMA

After ____ months, Reflective Cracking Rate **reaches** 50%.
Rut depth reaches ____ inches after 15 years (180 months).

Example 2: US82 Overlay Thickness Design

- Overlay Type: AC over JPCP
- Design Life: 10 years
- District: Wichita Falls; County: Cooke
- Analysis Parameters & Criteria:
  - Reflective Cracking Rate Limit: 50%
  - AC Rutting: 0.5 inch
- Traffic
  - ADT-Beginning: 19350; ADT-End: 28800; ESALs: 4.5 million; Speed: 60 mph
- Weather Station: Wichita Falls, TX
- Layer thickness
  - AC overlay: **Using trial thickness**
  - Existing JPCP: 8 inches
  - Base: 4 inches
- AC overlay property
  - Mix type: Type D; Binder type: PG 76-22
  - Modulus Input Level: Level 3-default values
  - Fracture properties and Rutting properties: default values
- Existing JPCP property
  - Modulus: 4000 ksi, joint space: 15 ft, LTE: 70%
- Base
  - Type: Granular base, Modulus: 30 ksi
- Subgrade
  - Modulus: By default

The recommended overlay thickness=?

Answer :

4 inches

- Trial 1: 2 inches, 15 months
- Trial 2: 4 inches, 162 months
- Trial 3: 3.5 inches, 100 months

Exercise 3

- Change the existing JPCP's LTE to 50%
- Keep the other inputs the same as Example 2
- The recommended overlay thickness=?

Answer (Please fill in the blanks):

☐ inches

- Trial 1: 4 inches, ☐ months
- Trial 2: 5 inches, ☐ months
- Trial 3: 4.5 inches, ☐ months