Case 2-Small Mine 7 inch overlay

File Name: D:\My ME Design\FINAL REPORT\Case 2-Small Mine 7 inch overlay.dgpx

Design Inputs

Design Life: 20 years
Design Type: Flexible Pavement

Base construction: May, 2016
Pavement construction: June, 2017
Traffic opening: September, 2017

Climate Data Sources (Lat/Lon): 42.554, -92.401

Design Structure

Layer type	Material Type	Thickness (in.):
Flexible	Default asphalt concrete	7.0
NonStabilized	A-1-a	10.0
NonStabilized	Crushed stone	6.0
Subgrade	A-7-6	Semi-infinite

Volumetric at Construction:

Effective binder content (%)	11.6
Air voids (%)	7.0

Traffic

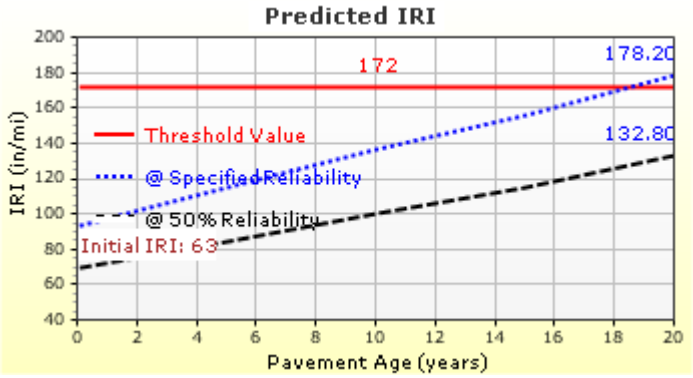
Age (year)	Heavy Trucks (cumulative)
2017 (initial)	15,900
2027 (10 years)	2,903,740
2037 (20 years)	5,807,480

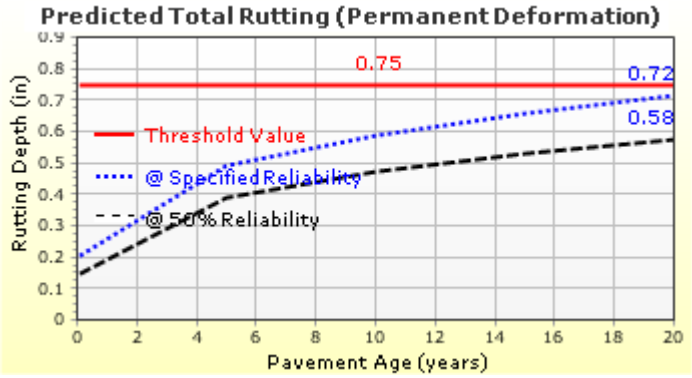
Design Outputs

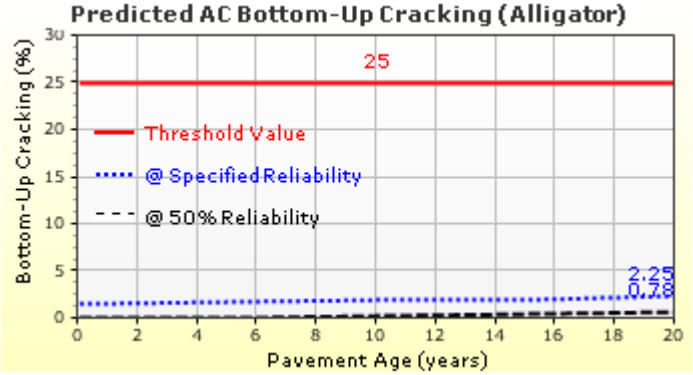
Distress Prediction Summary

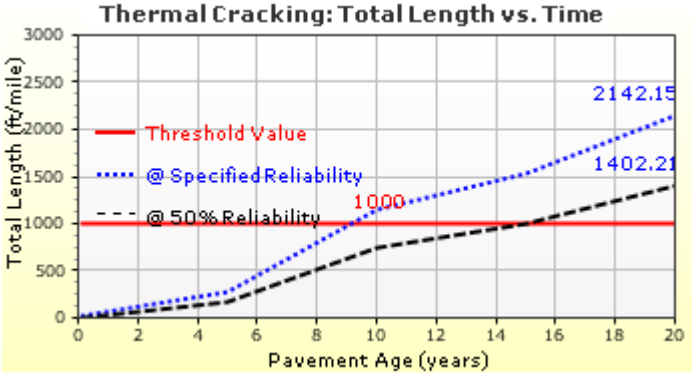
Distress Type	Distress @ Specified Reliability		Reliability (%)		Criterion Satisfied?
	Target	Predicted	Target	Achieved	
Terminal IRI (in./mile)	172.00	178.25	90.00	86.55	Fail
Permanent deformation - total pavement (in.)	0.75	0.72	90.00	94.27	Pass
AC bottom-up fatigue cracking (percent)	25.00	2.25	90.00	100.00	Pass
AC thermal cracking (ft/mile)	1000.00	2142.15	90.00	24.30	Fail
AC top-down fatigue cracking (ft/mile)	2000.00	1568.56	90.00	94.97	Pass
Permanent deformation - AC only (in.)	0.25	0.39	90.00	37.73	Fail

Distress Charts





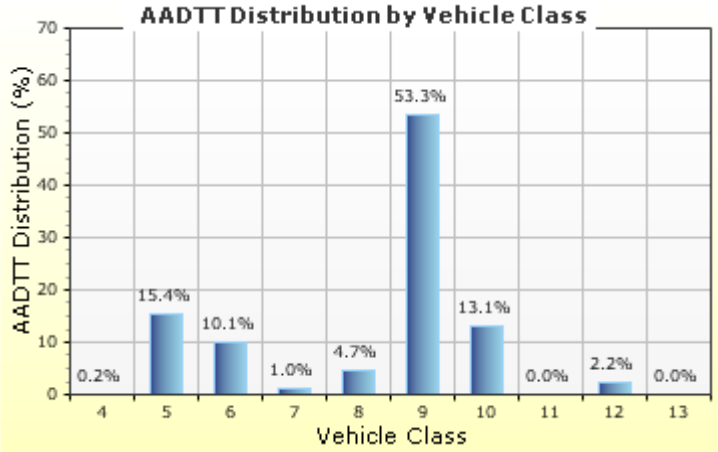


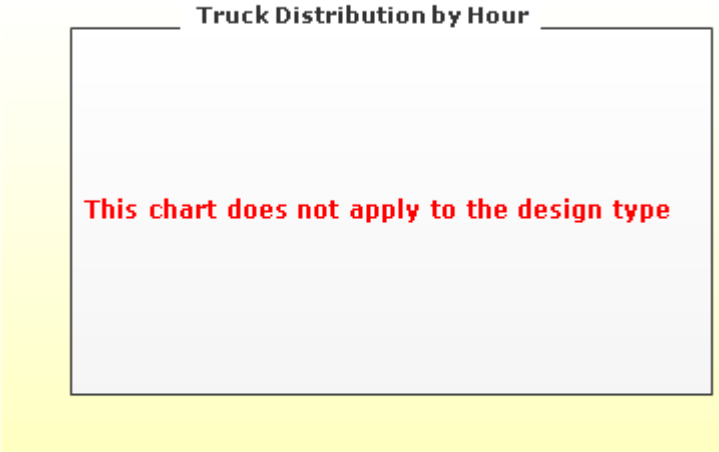


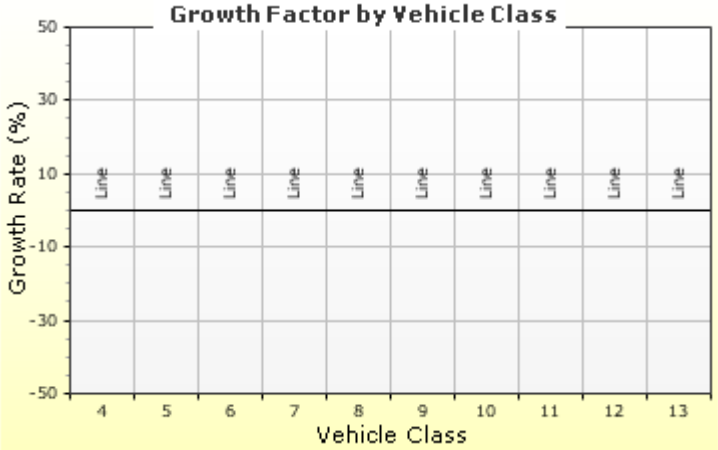
Traffic Inputs

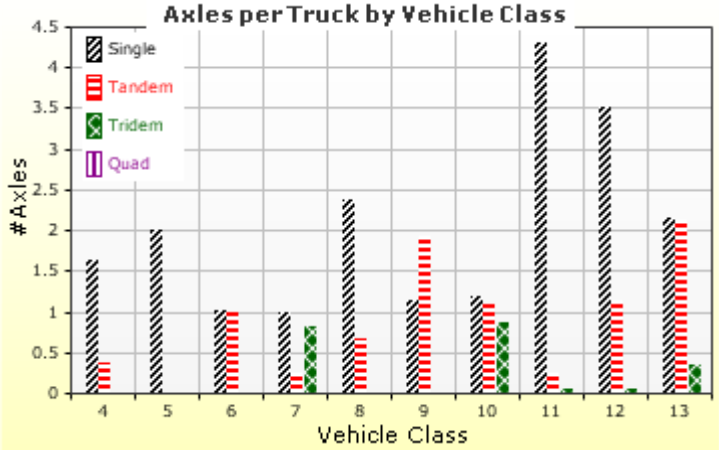
Graphical Representation of Traffic Inputs

Initial two-way AADTT:	15,900	Percent of trucks in design direction (%):	50.0
Number of lanes in design direction:	2	Percent of trucks in design lane (%):	10.0
		Operational speed (mph)	60.0

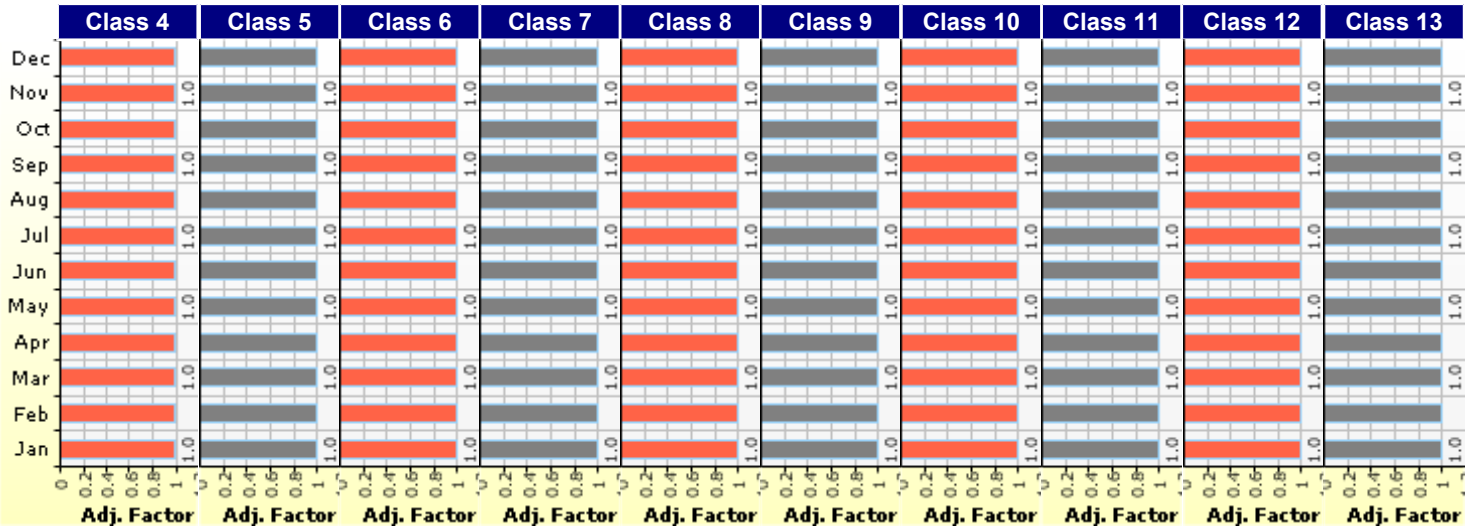








Traffic Volume Monthly Adjustment Factors



Tabular Representation of Traffic Inputs

Volume Monthly Adjustment Factors

Level 3: Default MAF

Month	Vehicle Class									
	4	5	6	7	8	9	10	11	12	13
January	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
February	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
March	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
April	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
May	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
June	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
July	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
August	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
September	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
October	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
November	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
December	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Distributions by Vehicle Class

Truck Distribution by Hour does not apply

Vehicle Class	AADTT Distribution (%) (Level 3)	Growth Factor	
		Rate (%)	Function
Class 4	0.2%	0%	Linear
Class 5	15.4%	0%	Linear
Class 6	10.1%	0%	Linear
Class 7	1%	0%	Linear
Class 8	4.7%	0%	Linear
Class 9	53.3%	0%	Linear
Class 10	13.1%	0%	Linear
Class 11	0%	0%	Linear
Class 12	2.2%	0%	Linear
Class 13	0%	0%	Linear

Axle Configuration

Traffic Wander	
Mean wheel location (in.)	18
Traffic wander standard deviation (in.)	10
Design lane width (ft)	12

Axle Configuration	
Average axle width (ft)	8.5
Dual tire spacing (in.)	12
Tire pressure (psi)	120

Average Axle Spacing	
Tandem axle spacing (in.)	51.6
Tridem axle spacing (in.)	49.2
Quad axle spacing (in.)	49.2

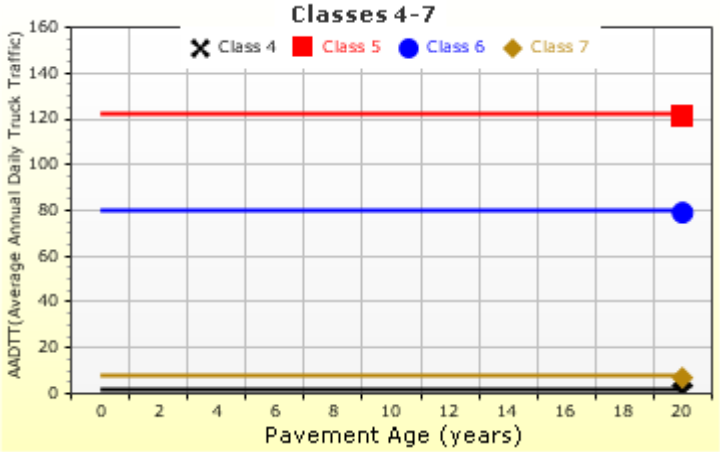
Wheelbase does not apply

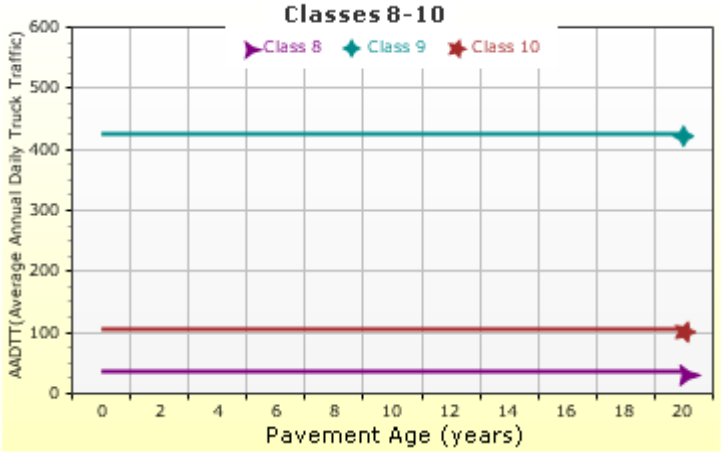
Number of Axles per Truck

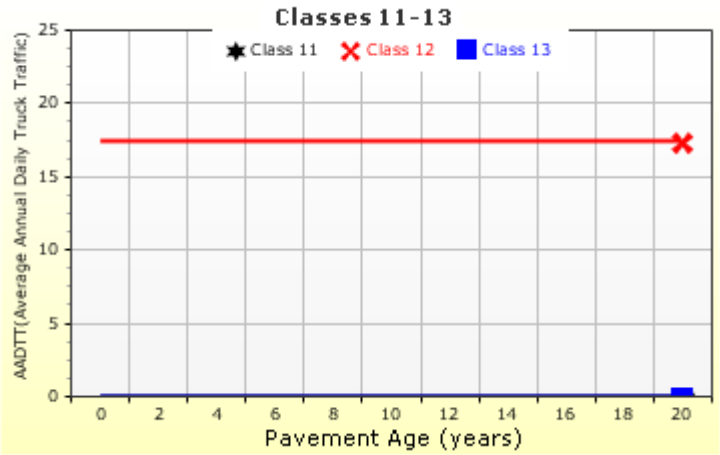
Vehicle Class	Single Axle	Tandem Axle	Tridem Axle	Quad Axle
Class 4	1.62	0.39	0	0
Class 5	2	0	0	0
Class 6	1.02	0.99	0	0
Class 7	1	0.26	0.83	0
Class 8	2.38	0.67	0	0
Class 9	1.13	1.93	0	0
Class 10	1.19	1.09	0.89	0
Class 11	4.29	0.26	0.06	0
Class 12	3.52	1.14	0.06	0
Class 13	2.15	2.13	0.35	0

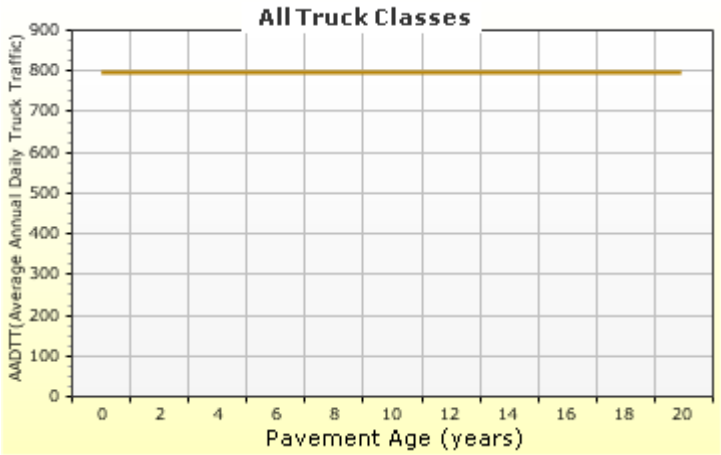
AADTT (Average Annual Daily Truck Traffic) Growth

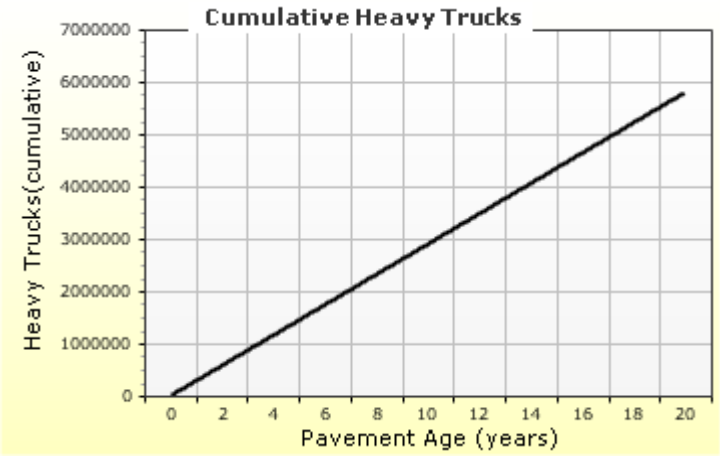
*** Traffic cap is not enforced**







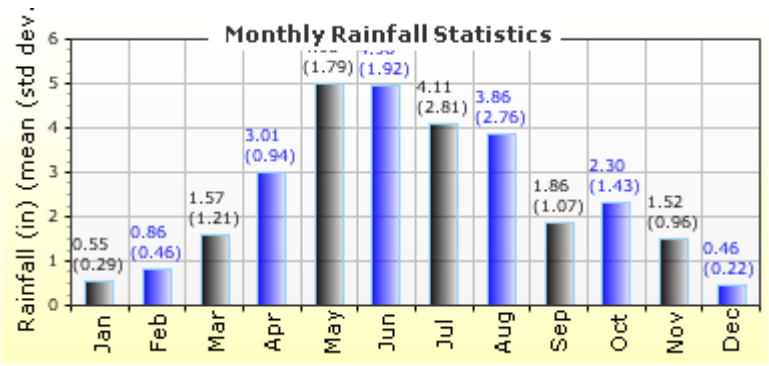




Climate Inputs

Climate Data Sources:

Climate Station Cities:	Location (lat lon elevation(ft))
WATERLOO, IA	42.55400 -92.40100 865

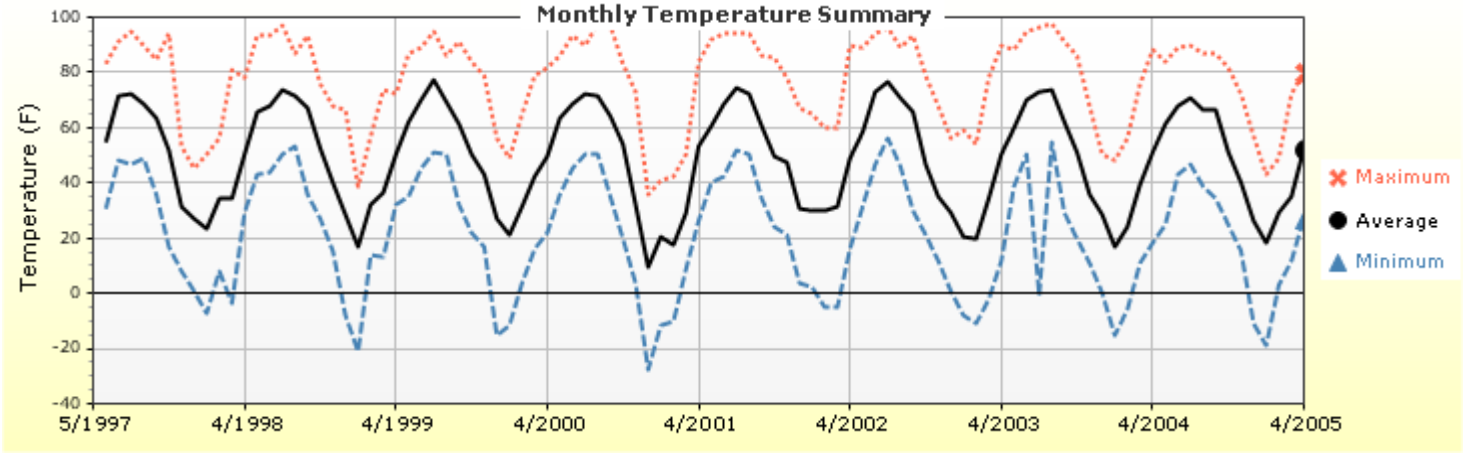


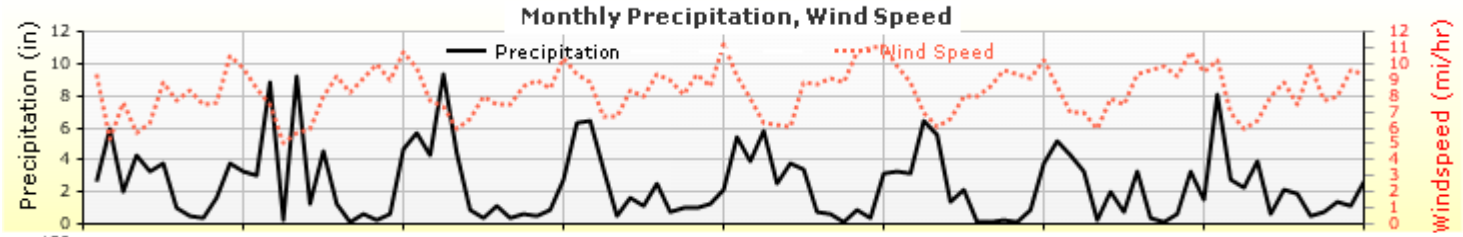
Annual Statistics:

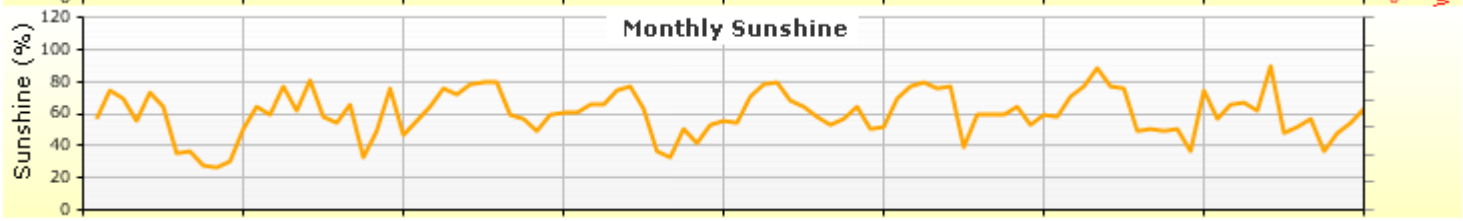
Mean annual air temperature (°F)	48.98
Mean annual precipitation (in.)	30.04
Freezing index (°F - days)	1894.842
Average annual number of freeze/thaw cycles:	74.47

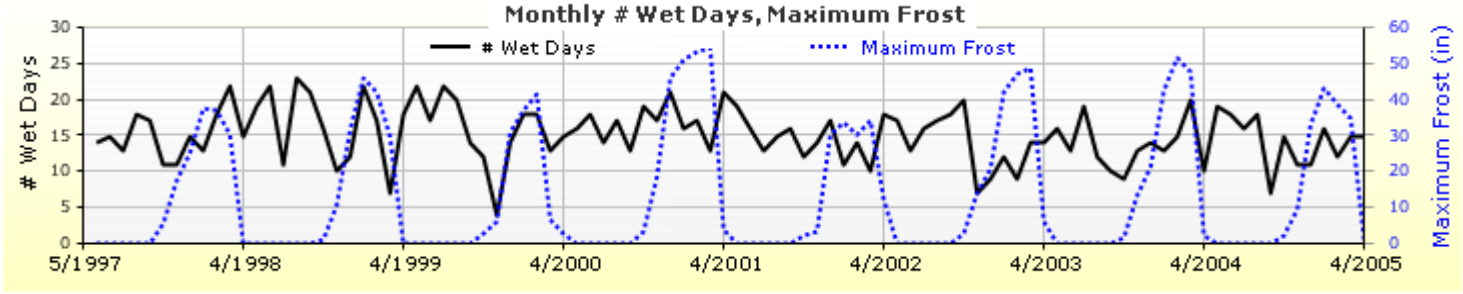
Water table depth (ft)	10.00

Monthly Climate Summary:

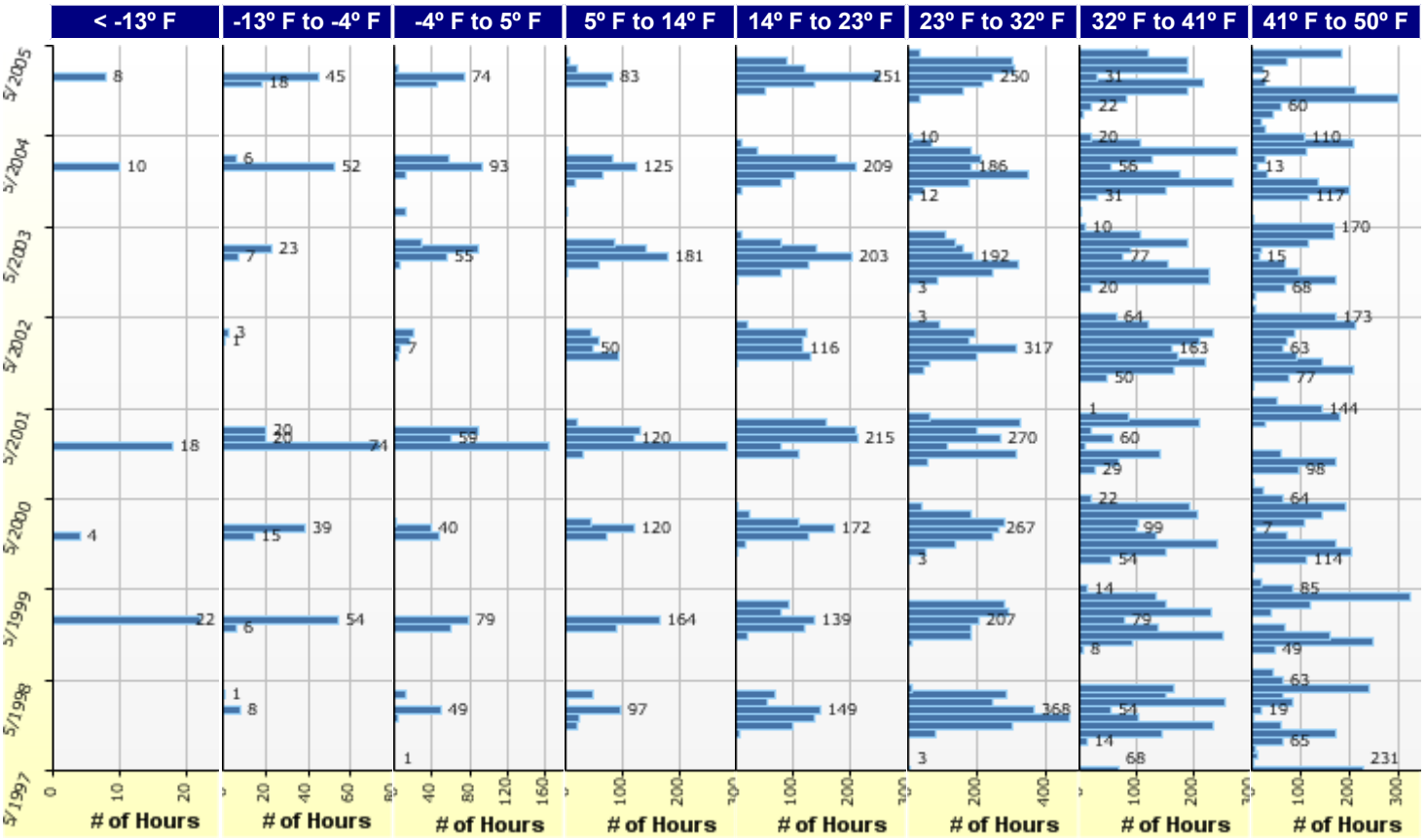


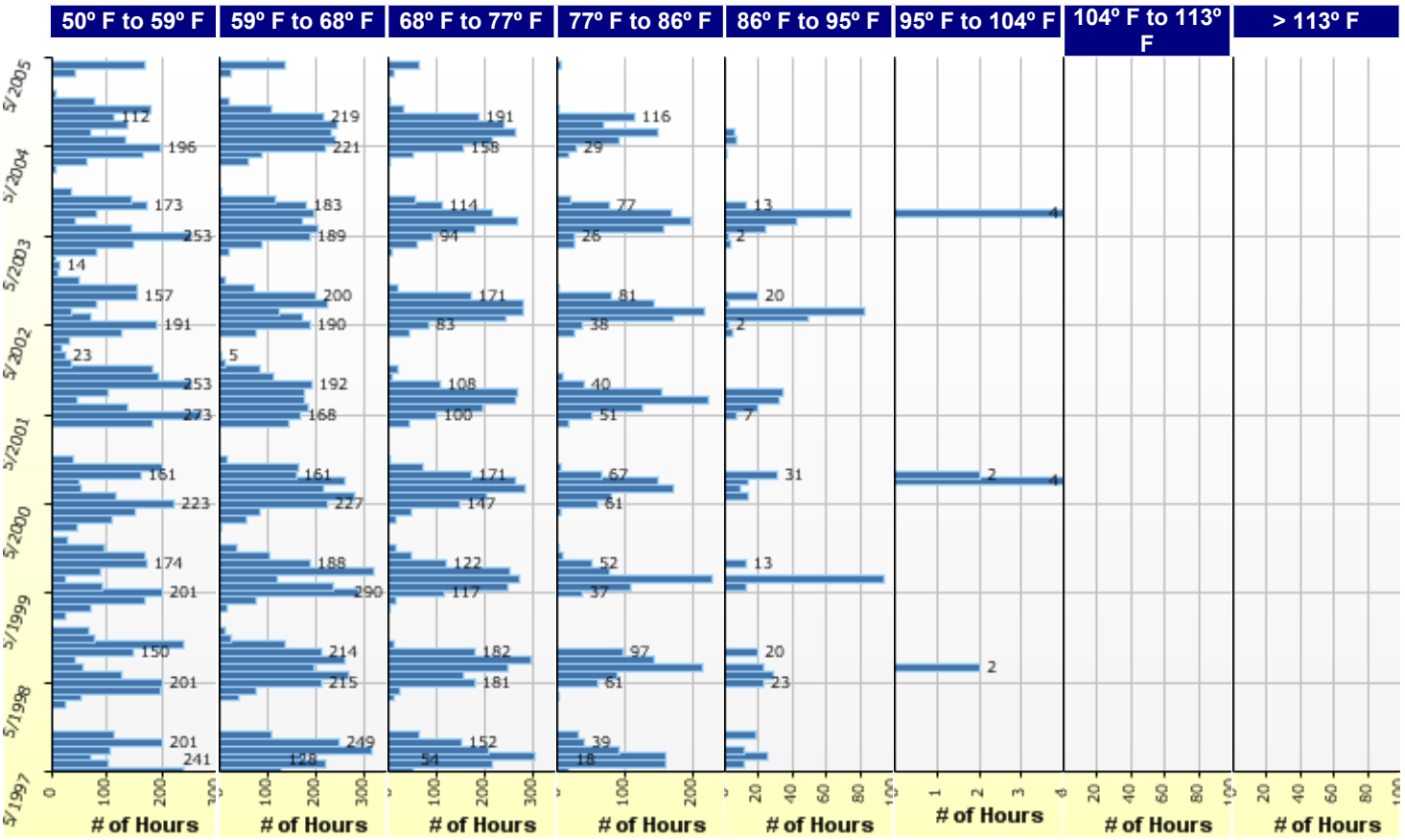






Hourly Air Temperature Distribution by Month:





Design Properties

HMA Design Properties

Use Multilayer Rutting Model	False
Using G* based model (not nationally calibrated)	False
Is NCHRP 1-37A HMA Rutting Model Coefficients	True
Endurance Limit	-
Use Reflective Cracking	True

Structure - ICM Properties	
AC surface shortwave absorptivity	0.85

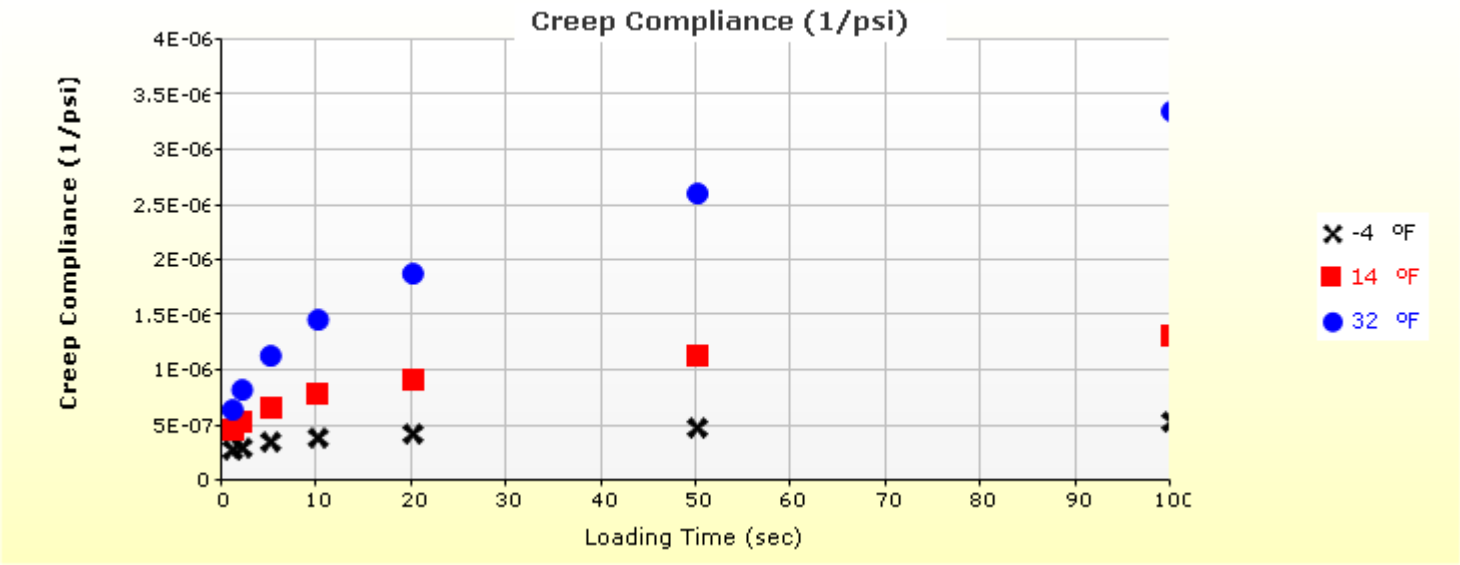
Layer Name	Layer Type	Interface Friction
Layer 1 Flexible : Default asphalt concrete	Flexible (1)	1.00
Layer 2 Non-stabilized Base : A-1-a	Non-stabilized Base (4)	1.00
Layer 3 Non-stabilized Base : Crushed stone	Non-stabilized Base (4)	1.00
Layer 4 Subgrade : A-7-6	Subgrade (5)	-

Thermal Cracking (Input Level: 3)

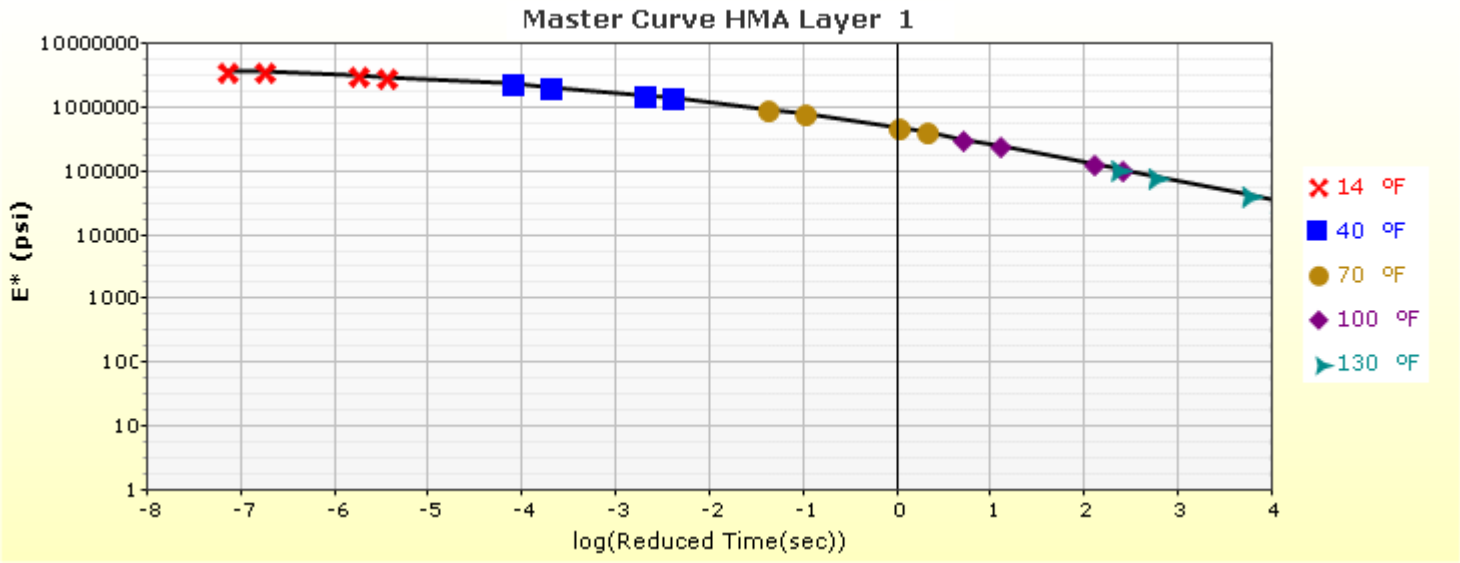
Indirect tensile strength at 14 ºF (psi)	361.14

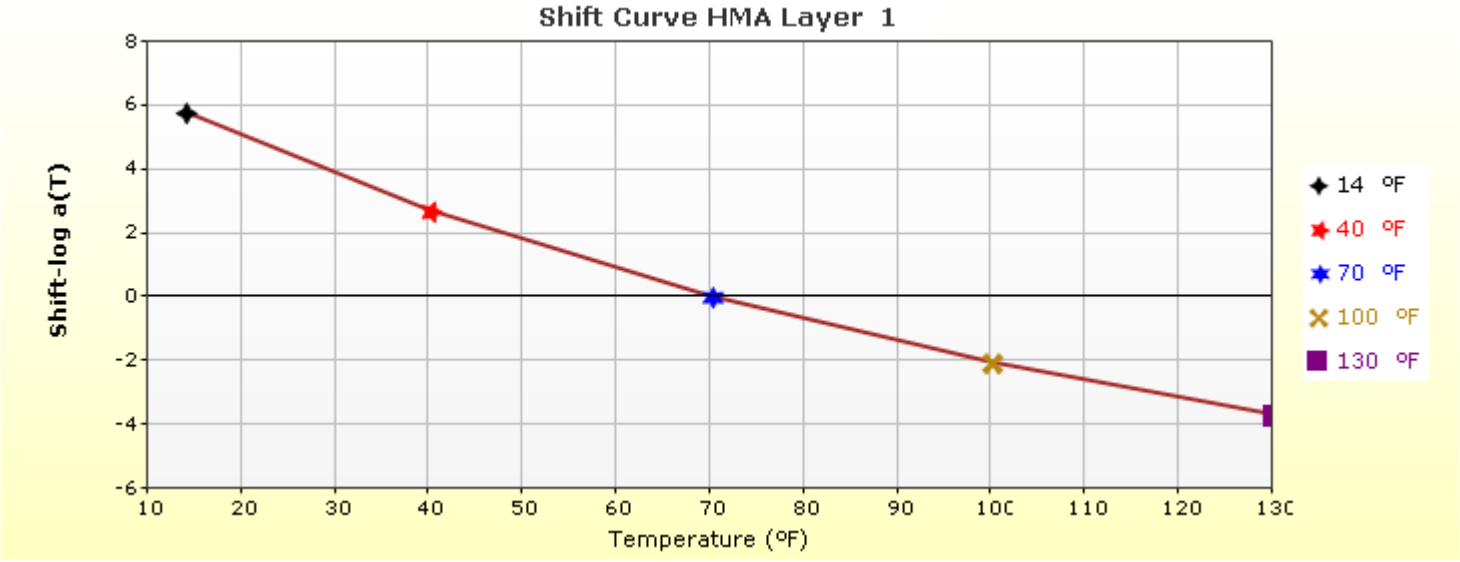
Thermal Contraction	
Is thermal contraction calculated?	True
Mix coefficient of thermal contraction (in./in./ºF)	-
Aggregate coefficient of thermal contraction (in./in./ºF)	5.0e-006
Voids in Mineral Aggregate (%)	18.6

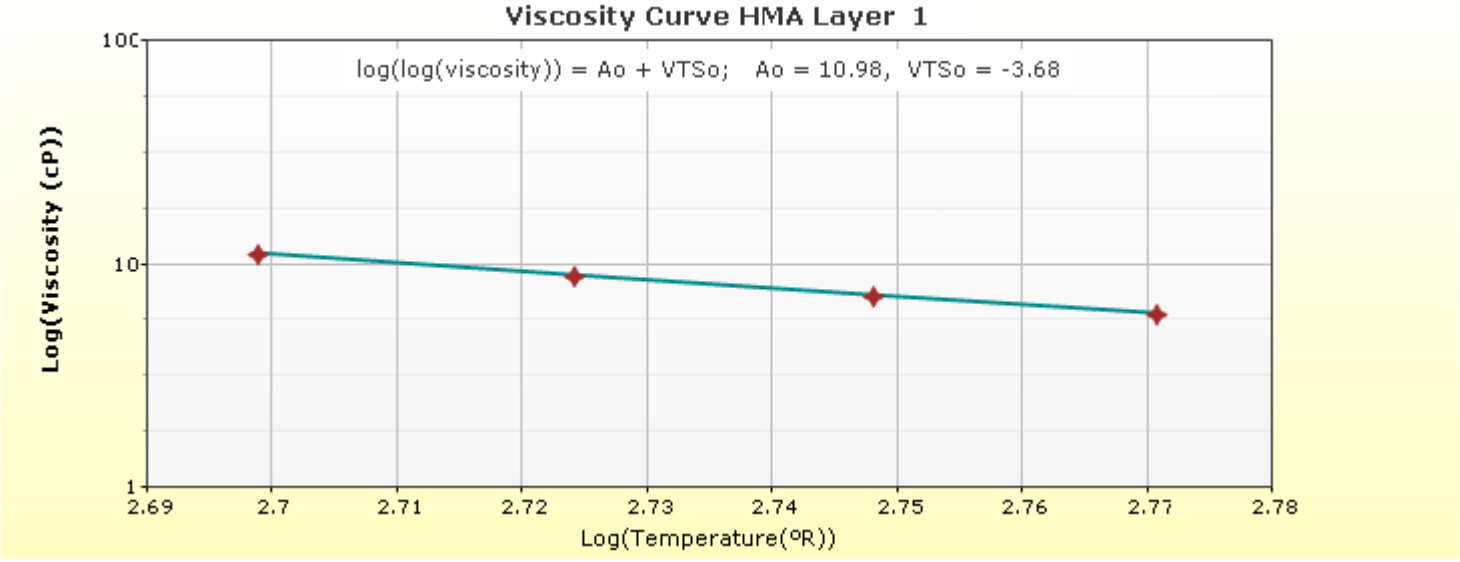
	Creep Compliance (1/psi)		
Loading time (sec)	-4 ºF	14 ºF	32 ºF
1	2.94e-007	4.79e-007	6.55e-007
2	3.23e-007	5.59e-007	8.38e-007
5	3.66e-007	6.86e-007	1.16e-006
10	4.02e-007	8.00e-007	1.48e-006
20	4.41e-007	9.34e-007	1.90e-006
50	5.00e-007	1.15e-006	2.63e-006
100	5.49e-007	1.34e-006	3.37e-006



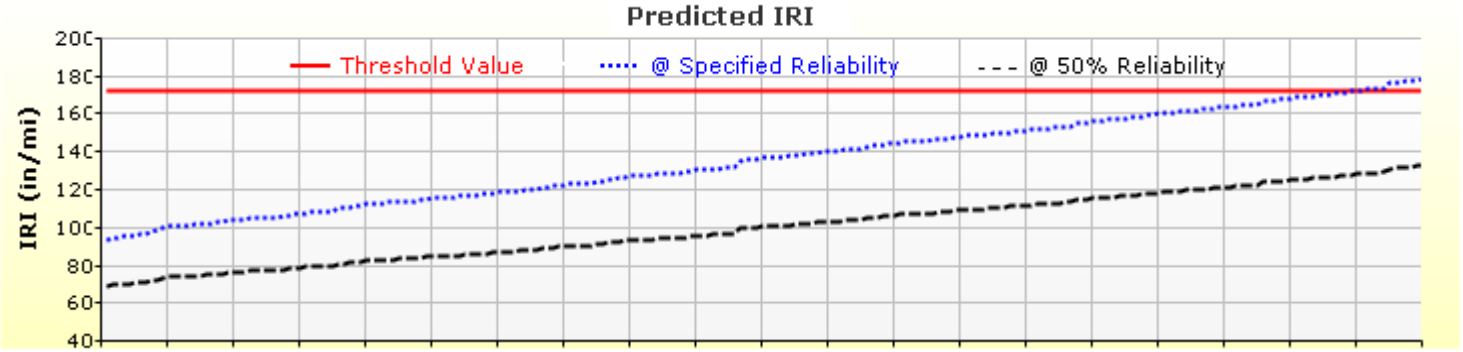
HMA Layer 1: Layer 1 Flexible : Default asphalt concrete

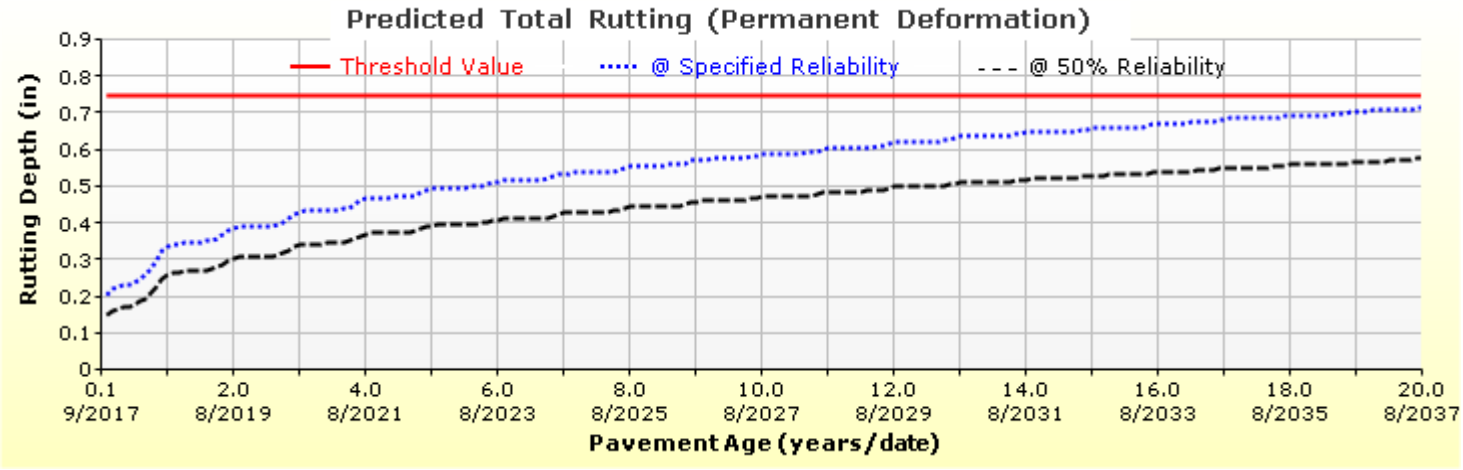


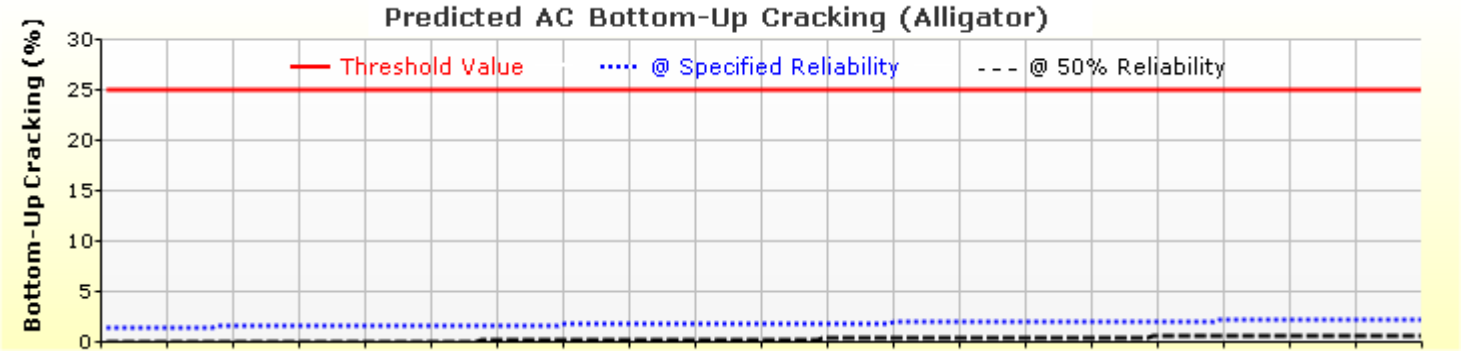


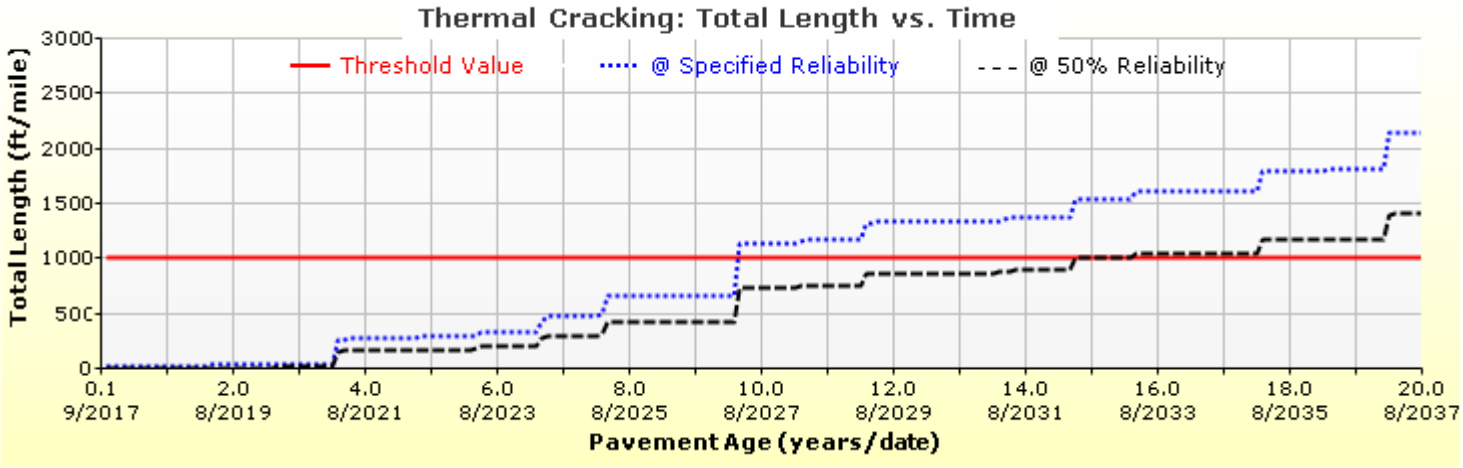


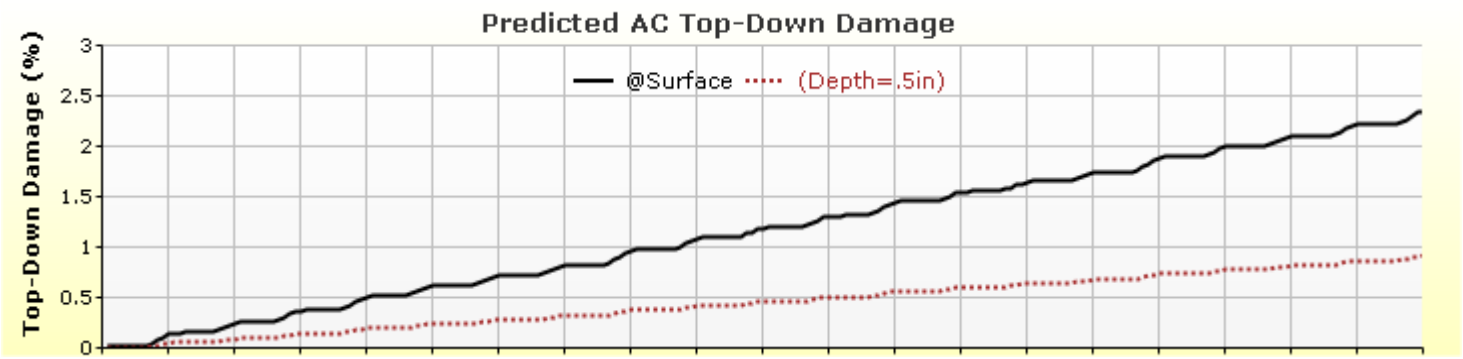
Analysis Output Charts

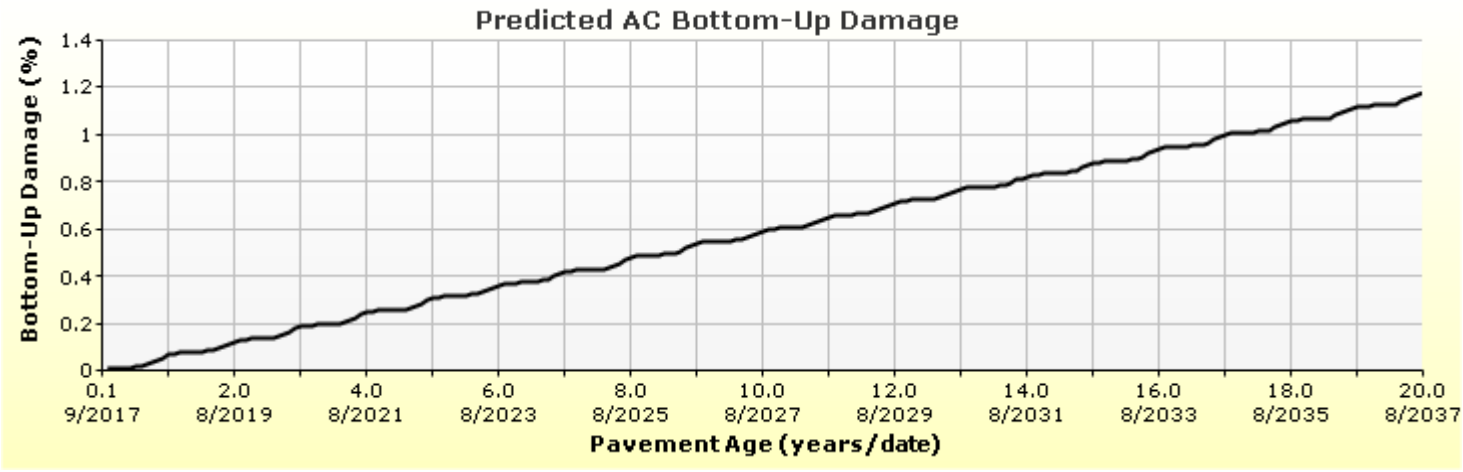


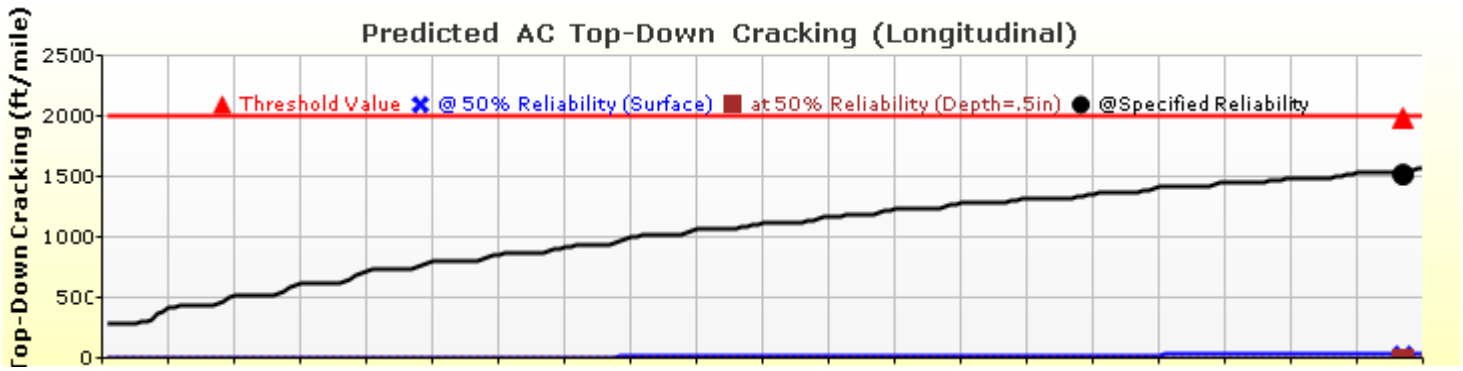


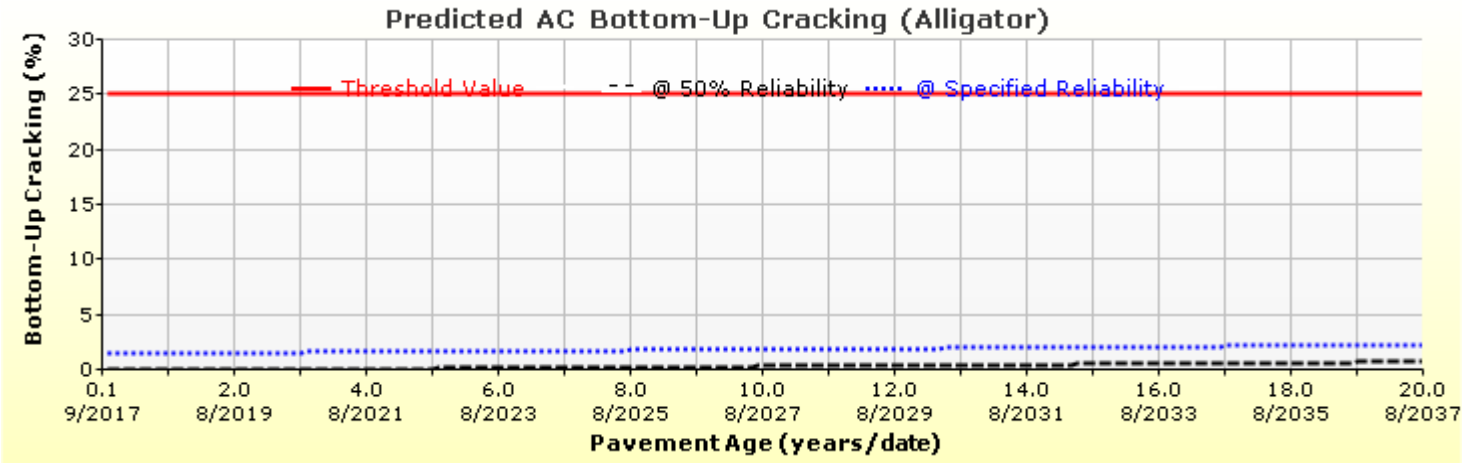


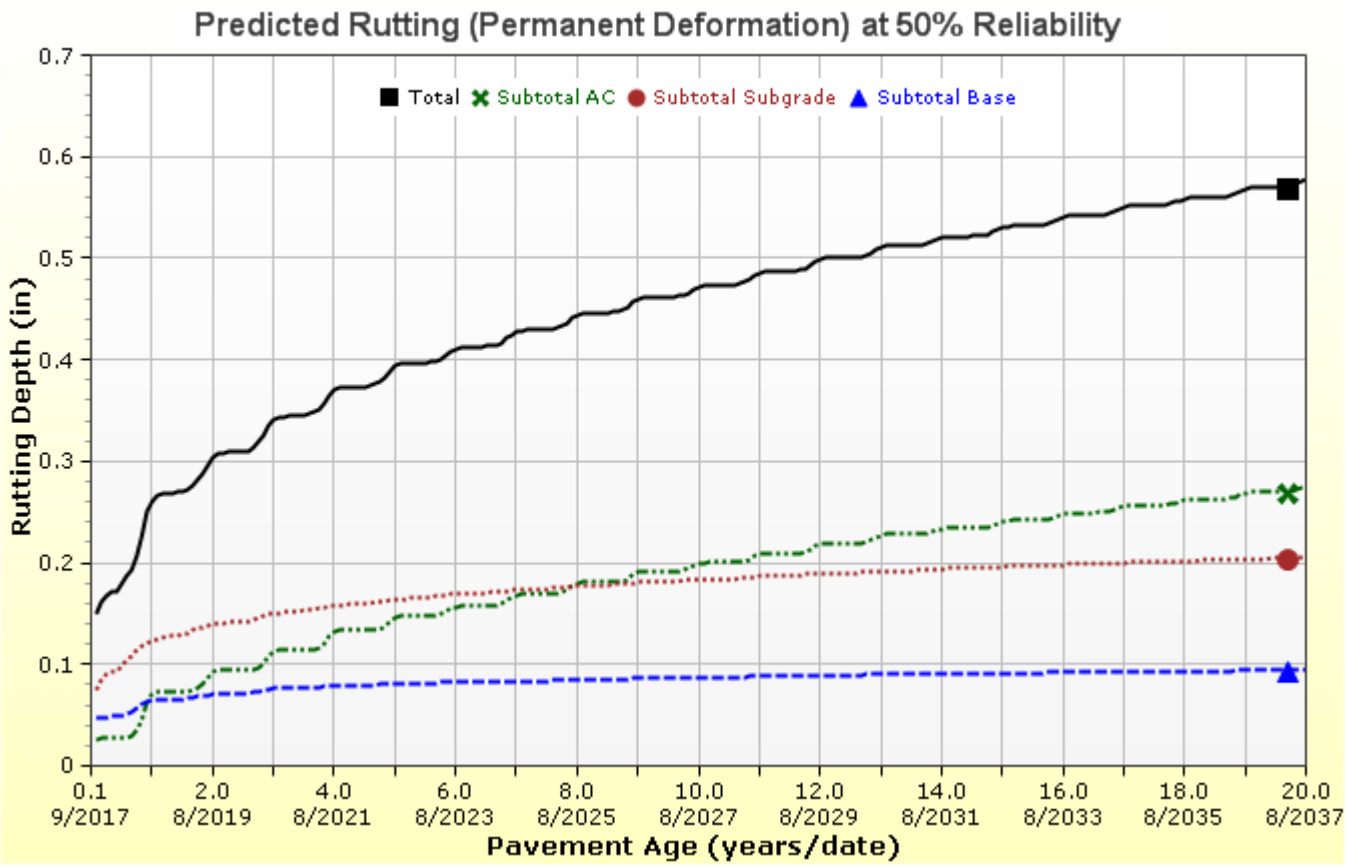


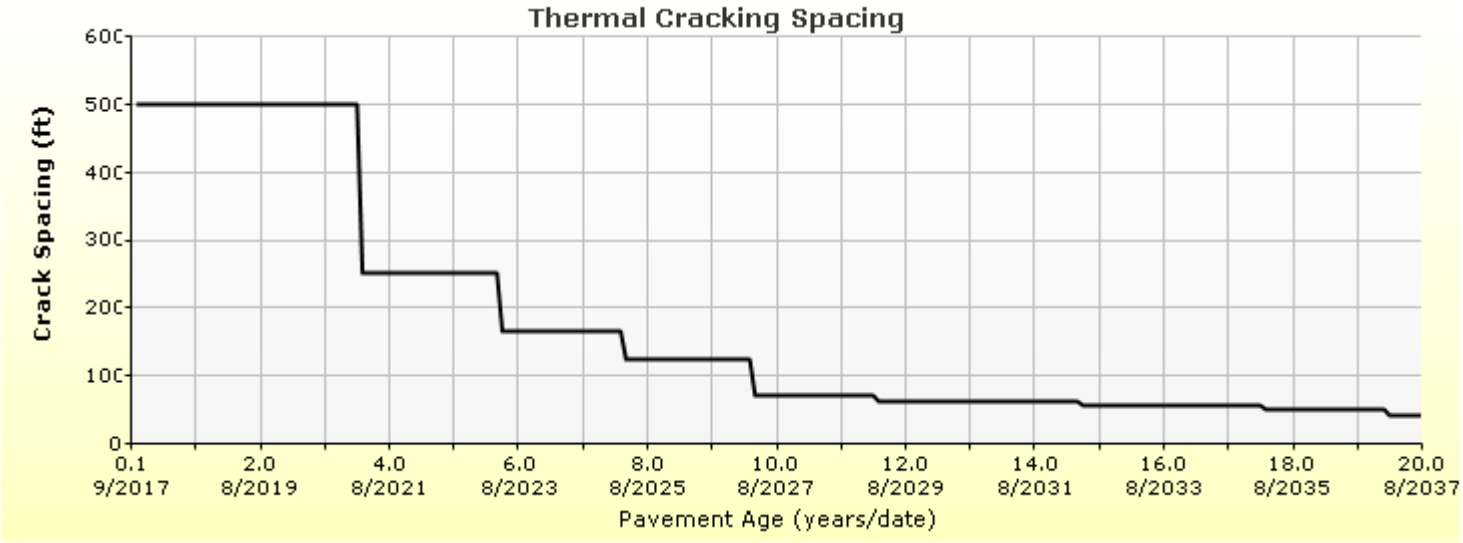

Predicted AC Top-Down Damage
Top-Down Damage (%)
@Surface
(Depth=.5in)
0
0.5
1
1.5
2
2.5
3

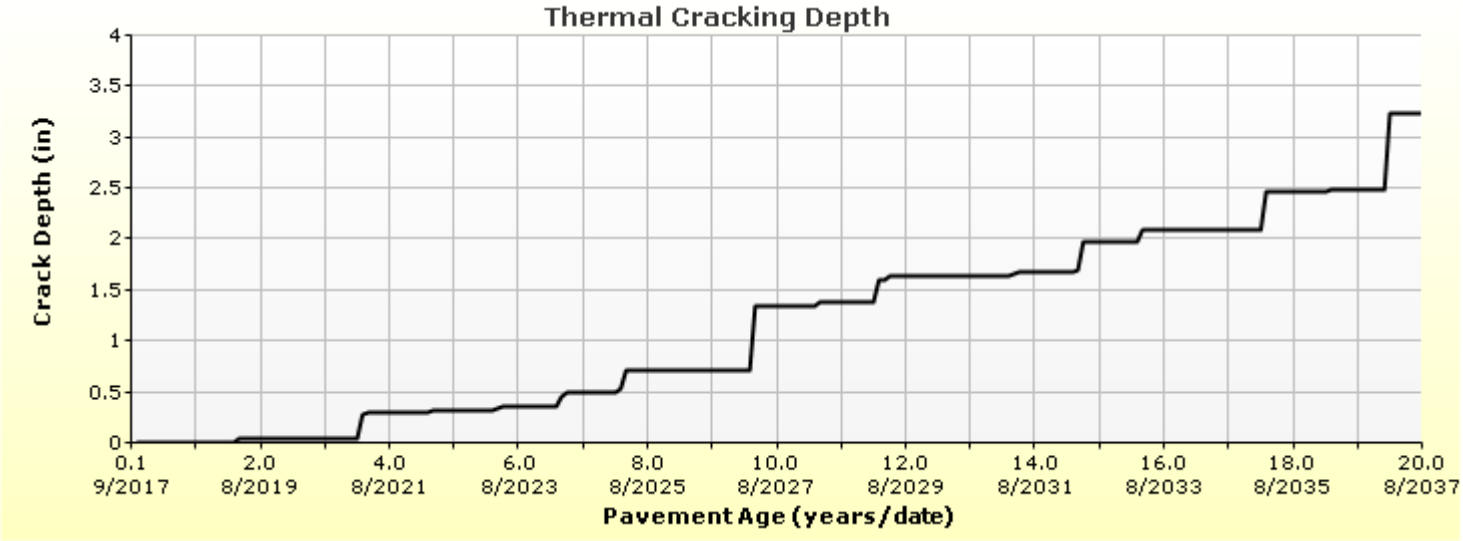

Predicted AC Bottom-Up Damage
Bottom-Up Damage (%)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
0.1
9/2017
2.0
8/2019
4.0
8/2021
6.0
8/2023
8.0
8/2025
10.0
8/2027
12.0
8/2029
14.0
8/2031
16.0
8/2033
18.0
8/2035
20.0
8/2037
Pavement Age (years/date)

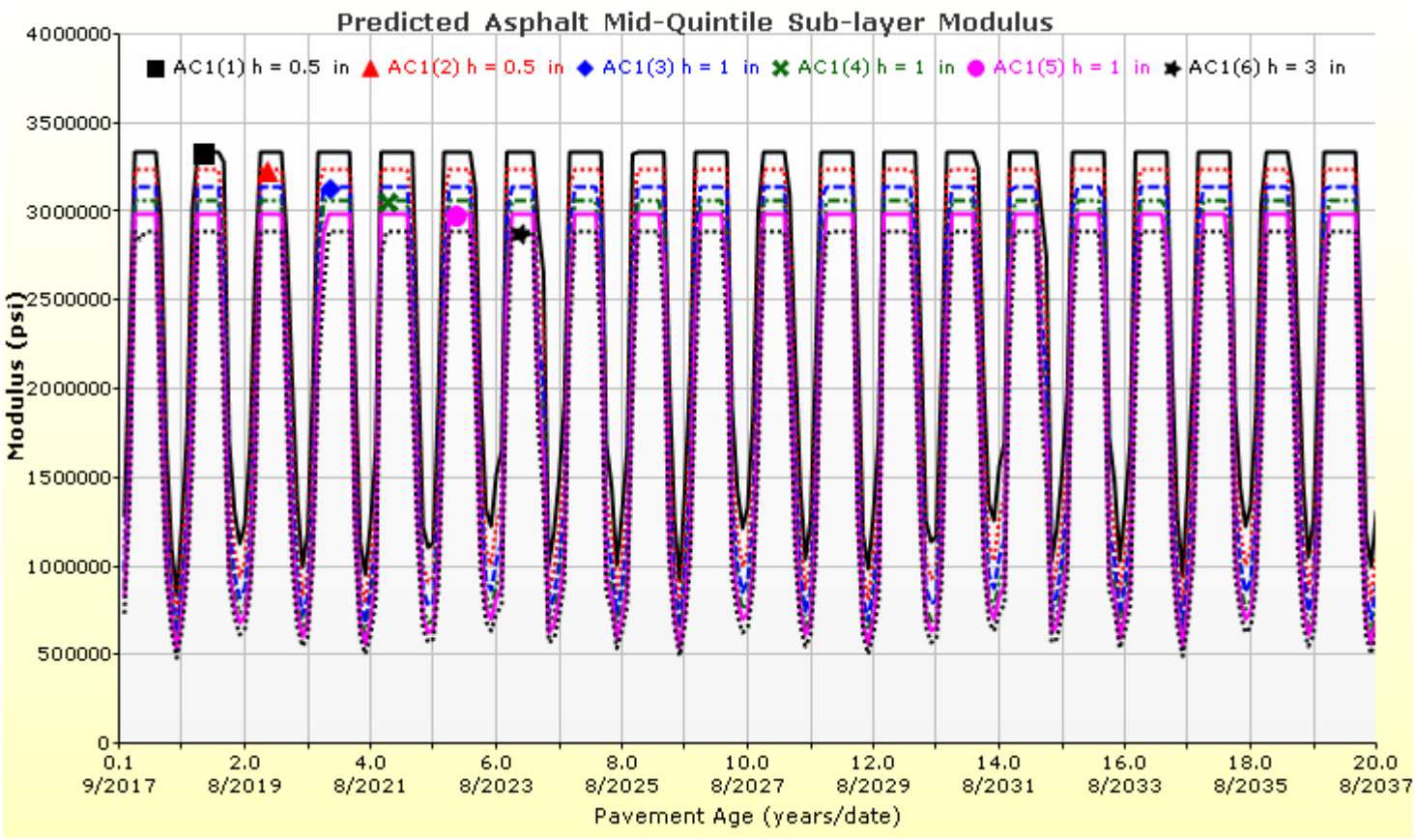

Predicted AC Top-Down Cracking (Longitudinal)
Top-Down Cracking (ft/mile)
Threshold Value
@ 50% Reliability (Surface)
at 50% Reliability (Depth=.5in)
@Specified Reliability
0
500
1000
1500
2000
2500

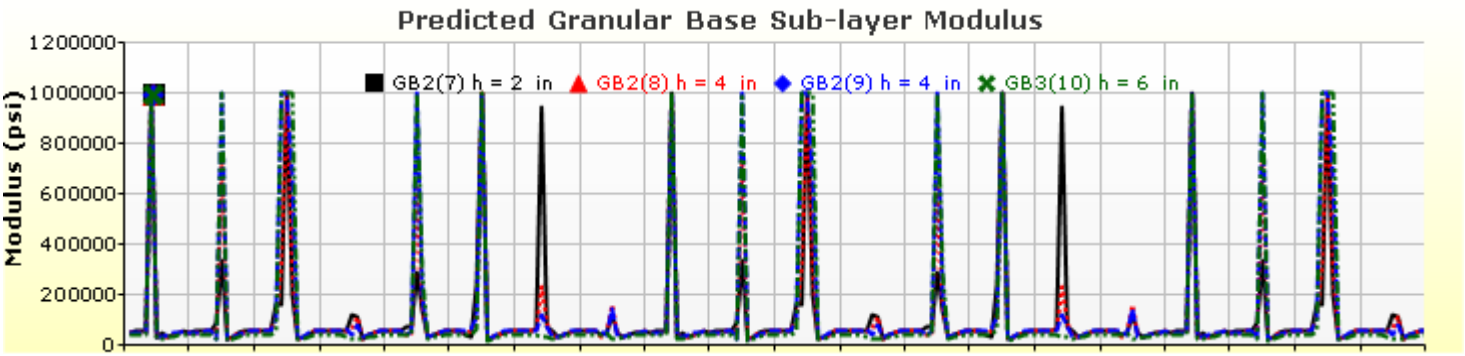

Predicted AC Bottom-Up Cracking (Alligator)
Bottom-Up Cracking (%)
Threshold Value
@ 50% Reliability
@ Specified Reliability
0
5
10
15
20
25
30
0.1
9/2017
2.0
8/2019
4.0
8/2021
6.0
8/2023
8.0
8/2025
10.0
8/2027
12.0
8/2029
14.0
8/2031
16.0
8/2033
18.0
8/2035
20.0
8/2037
Pavement Age (years/date)

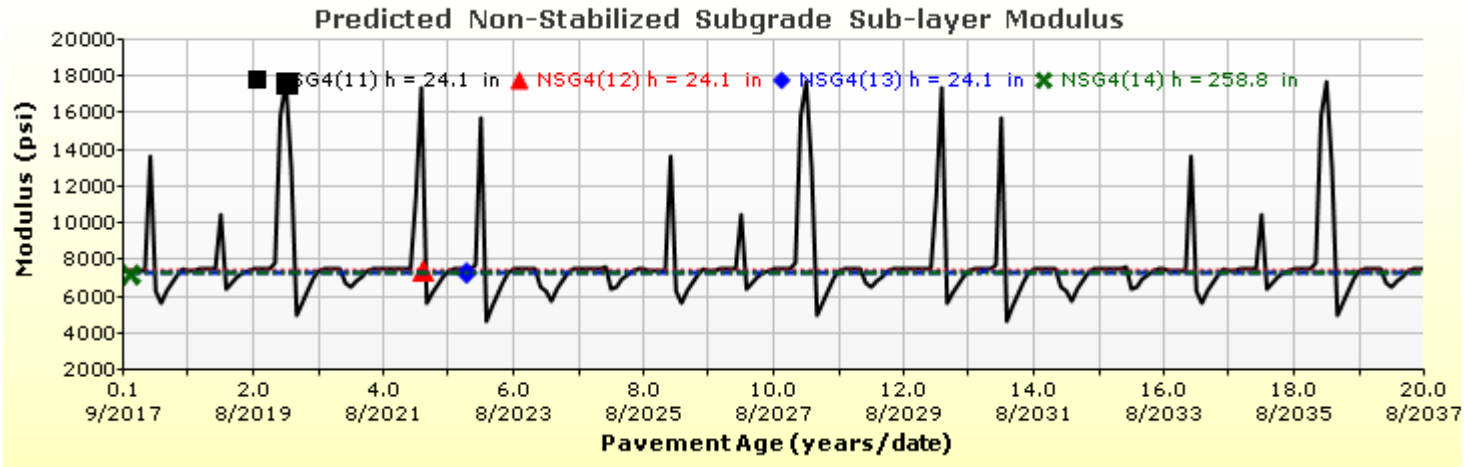

Predicted Rutting (Permanent Deformation) at 50% Reliability
Total
Subtotal AC
Subtotal Subgrade
Subtotal Base
Rutting Depth (in)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.1
9/2017
2.0
8/2019
4.0
8/2021
6.0
8/2023
8.0
8/2025
10.0
8/2027
12.0
8/2029
14.0
8/2031
16.0
8/2033
18.0
8/2035
20.0
8/2037
Pavement Age (years/date)


Thermal Cracking Spacing
Crack Spacing (ft)
600
500
400
300
200
100
0
0.1
9/2017
2.0
8/2019
4.0
8/2021
6.0
8/2023
8.0
8/2025
10.0
8/2027
12.0
8/2029
14.0
8/2031
16.0
8/2033
18.0
8/2035
20.0
8/2037
Pavement Age (years/date)


Thermal Cracking Depth
Crack Depth (in)
4
3.5
3
2.5
2
1.5
1
0.5
0
0.1
9/2017
2.0
8/2019
4.0
8/2021
6.0
8/2023
8.0
8/2025
10.0
8/2027
12.0
8/2029
14.0
8/2031
16.0
8/2033
18.0
8/2035
20.0
8/2037
Pavement Age (years/date)


Predicted Asphalt Mid-Quintile Sub-layer Modulus
AC1(1) h = 0.5 in
AC1(2) h = 0.5 in
AC1(3) h = 1 in
AC1(4) h = 1 in
AC1(5) h = 1 in
AC1(6) h = 3 in
Modulus (psi)
4000000
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
0.1
9/2017
2.0
8/2019
4.0
8/2021
6.0
8/2023
8.0
8/2025
10.0
8/2027
12.0
8/2029
14.0
8/2031
16.0
8/2033
18.0
8/2035
20.0
8/2037
Pavement Age (years/date)


Predicted Granular Base Sub-layer Modulus
GB2(7) h = 2 in
GB2(8) h = 4 in
GB2(9) h = 4 in
GB3(10) h = 6 in
Modulus (psi)
1200000
1000000
800000
600000
400000
200000
0


Predicted Non-Stabilized Subgrade Sub-layer Modulus
NSG4(11) h = 24.1 in
NSG4(12) h = 24.1 in
NSG4(13) h = 24.1 in
NSG4(14) h = 258.8 in
Modulus (psi)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0.1
9/2017
2.0
8/2019
4.0
8/2021
6.0
8/2023
8.0
8/2025
10.0
8/2027
12.0
8/2029
14.0
8/2031
16.0
8/2033
18.0
8/2035
20.0
8/2037
Pavement Age (years/date)

Layer Information

Layer 1 Flexible : Default asphalt concrete

Asphalt		
Thickness (in.)	7.0	
Unit weight (pcf)	150.0	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 3)

Gradation	Percent Passing
3/4-inch sieve	100
3/8-inch sieve	77
No.4 sieve	60
No.200 sieve	6

Asphalt Binder

Parameter	Value
Grade	Superpave Performance Grade
Binder Type	64-22
A	10.98
VTS	-3.68

General Info

Name	Value
Reference temperature (°F)	70
Effective binder content (%)	11.6
Air voids (%)	7
Thermal conductivity (BTU/hr-ft-°F)	0.67
Heat capacity (BTU/lb-°F)	0.23

Identifiers

Field	Value
Display name/identifier	Default asphalt concrete
Description of object	
Author	
Date Created	10/30/2010 12:00:00 AM
Approver	
Date approved	10/30/2010 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Layer 2 Non-stabilized Base : A-1-a

Unbound	
Layer thickness (in.)	10.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Modify input values by temperature/moisture
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
40000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-1-a
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.2
Saturated hydraulic conductivity (ft/hr)	False	5.054e-02
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	7.4

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	7.2555
bf	1.3328
cf	0.8242
hr	117.4000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	8.7
#100	
#80	12.9
#60	
#50	
#40	20.0
#30	
#20	
#16	
#10	33.8
#8	
#4	44.7
3/8-in.	57.2
1/2-in.	63.1
3/4-in.	72.7
1-in.	78.8
1 1/2-in.	85.8
2-in.	91.6
2 1/2-in.	
3-in.	
3 1/2-in.	97.6

Layer 3 Non-stabilized Base : Crushed stone

Unbound	
Layer thickness (in.)	6.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Modify input values by temperature/moisture
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
30000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	Crushed stone
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.2
Saturated hydraulic conductivity (ft/hr)	False	5.054e-02
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	7.4

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	7.2555
bf	1.3328
cf	0.8242
hr	117.4000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	8.7
#100	
#80	12.9
#60	
#50	
#40	20.0
#30	
#20	
#16	
#10	33.8
#8	
#4	44.7
3/8-in.	57.2
1/2-in.	63.1
3/4-in.	72.7
1-in.	78.8
1 1/2-in.	85.8
2-in.	91.6
2 1/2-in.	
3-in.	
3 1/2-in.	97.6

Layer 4 Subgrade : A-7-6

Unbound	
Layer thickness (in.)	Semi-infinite
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Modify input values by temperature/moisture
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
13000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-7-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	51.0
Plasticity Index	30.0
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	97.7
Saturated hydraulic conductivity (ft/hr)	False	8.946e-06
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	22.2

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	136.4179
bf	0.5183
cf	0.0324
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	79.1
#100	
#80	84.9
#60	
#50	
#40	88.8
#30	
#20	
#16	
#10	93.0
#8	
#4	94.9
3/8-in.	96.9
1/2-in.	97.5
3/4-in.	98.3
1-in.	98.8
1 1/2-in.	99.3
2-in.	99.6
2 1/2-in.	
3-in.	
3 1/2-in.	99.9

Calibration Coefficients

AC Fatigue

$$N_f = 0.00432 * C * \beta_{f1} k_1 \left(\frac{1}{\varepsilon_1}\right)^{k_2\beta_{f2}} \left(\frac{1}{E}\right)^{k_3\beta_{f3}}$$

$$C = 10^M$$

$$M = 4.84\left(\frac{V_b}{V_a + V_b} - 0.69\right)$$

k1: 0.007566	
k2: 3.9492	
k3: 1.281	
Bf1: 1	
Bf2: 1	
Bf3: 1	

AC Rutting

$$\frac{\varepsilon_p}{\varepsilon_r} = k_z \beta_{r1} 10^{k_1} T^{k_2\beta_{r2}} N^{k_3\beta_{r3}}$$

$$k_z = (C_1 + C_2 * depth) * 0.328196^{depth}$$

$$C_1 = -0.1039 * H_\alpha^2 + 2.4868 * H_\alpha - 17.342$$

$$C_2 = 0.0172 * H_\alpha^2 - 1.7331 * H_\alpha + 27.428$$

Where:

$H_{ac} = total\ AC\ thickness(in)$

$\varepsilon_p = plastic\ strain\left({}^{in}/_{in}\right)$
$\varepsilon_r = resilient\ strain\left({}^{in}/_{in}\right)$
$T = layer\ temperature(^{\circ}F)$
$N = number\ of\ load\ repetitions$

AC Rutting Standard Deviation	0.24*Pow(RUT,0.8026)+0.001	
AC Layer	K1:-3.35412 K2:1.5606 K3:0.4791	Br1:1 Br2:1 Br3:1

Thermal Fracture

$$C_f = 400 * N\left(\frac{\log C / h_{ac}}{\sigma}\right)$$

$$\Delta C = (k * \beta t)^{n+1} * A * \Delta K^n$$

$$A = 10^{(4.389 - 2.52 * \log(E * \sigma_m * n))}$$

$C_f = observed\ amount\ of\ thermal\ cracking(ft/500ft)$
$k = refression\ coefficient\ determined\ through\ field\ calibration$
$N() = standard\ normal\ distribution\ evaluated\ at()$
$\sigma = standard\ deviation\ of\ the\ \log\ of\ the\ depth\ of\ cracks\ in\ the\ pavments$
$C = crack\ depth(in)$
$h_{ac} = thickness\ of\ asphalt\ layer(in)$
$\Delta C = Change\ in\ the\ crack\ depth\ due\ to\ a\ cooling\ cycle$
$\Delta K = Change\ in\ the\ stress\ intensity\ factor\ due\ to\ a\ cooling\ cycle$
$A, n = Fracture\ parameters\ for\ the\ asphalt\ mixture$
$E = mixture\ stiffness$
$\sigma_M = Undamaged\ mixture\ tensile\ strength$
$\beta_t = Calibration\ parameter$

Level 1 K: 1.5	Level 1 Standard Deviation: 0.1468 * THERMAL + 65.027
Level 2 K: 0.5	Level 2 Standard Deviation: 0.2841 *THERMAL + 55.462
Level 3 K: 1.5	Level 3 Standard Deviation: 0.3972 * THERMAL + 20.422

CSM Fatigue

$$N_f = 10^{\left(\frac{k_1 \beta_{c1} \left(\frac{\sigma_s}{M_r}\right)}{k_2 \beta_{c2}}\right)}$$

$N_f = number\ of\ repetitions\ to\ fatigue\ cracking$
$\sigma_s = Tensile\ stress(psi)$
$M_r = modulus\ of\ rupture(psi)$

k1: 1	k2: 1	Bc1: 1	Bc2:1

Subgrade Rutting

$$\delta_a(N) = \beta_{s_1} k_1 \varepsilon_v h \left(\frac{\varepsilon_0}{\varepsilon_r}\right) \left| e^{-\left(\frac{\rho}{N}\right)^{\beta}} \right|$$

$\delta_a = permanent\ deformation\ for\ the\ layer$
$N = number\ of\ repetitions$
$\varepsilon_v = average\ veritcal\ strain(in/in)$
$\varepsilon_0, \beta, \rho = material\ properties$
$\varepsilon_r = resilient\ strain(in/in)$

Granular		Fine	
k1: 2.03	Bs1: 1	k1: 1.35	Bs1: 1
Standard Deviation (BASERUT) 0.1477*Pow(BASERUT,0.6711)+0.001		Standard Deviation (BASERUT) 0.1235*Pow(SUBRUT,0.5012)+0.001	

AC Cracking

AC Top Down Cracking

$$FC_{top} = \left(\frac{C_4}{1 + e^{(C_1 - C_2 * log_{10}(Damage))}}\right) * 10.56$$

c1: 7	c2: 3.5	c3: 0	c4: 1000

AC Cracking Top Standard Deviation

200 + 2300/(1+exp(1.072-2.1654*LOG10 (TOP+0.0001)))

AC Bottom Up Cracking

$$FC = \left(\frac{6000}{1 + e^{(C_1 * C_1' + C_2 * C_2' log_{10}(D * 100))}}\right) * \left(\frac{1}{60}\right)$$

$$C_2' = -2.40874 - 39.748 * (1 + h_{ac})^{-2.856}$$

$$C_1' = -2 * C_2'$$

c1: 1	c2: 1	c3: 6000

AC Cracking Bottom Standard Deviation

1.13+13/(1+exp(7.57-15.5*LOG10 (BOTTOM+0.0001)))

CSM Cracking

$$FC_{ctb} = C_1 + \frac{C_2}{1 + e^{C_3 - C_4(Damage)}}$$

C1: 1	C2: 1	C3: 0	C4: 1000

CSM Standard Deviation

CTB*1

IRI Flexible Pavements

C1 - Rutting
C2 - Fatigue Crack
C3 - Transverse Crack
C4 - Site Factors

C1: 40	C2: 0.4	C3: 0.008	C4: 0.015