Using the BCOA- ME Guide

Bonded Concrete Overlay of Asphalt Pavements Mechanistic-Empirical Design Guide (BCOA – ME)

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FHWA Pooled Fund Study TPF 5-165

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BCOA ME
University of Pittsburgh

Instruction:

Select from drop-down list; | Enter data; | Enter data or use calculation.

(Please enable the Macros and the Internet Explorer (not mandatory) to run the spreadsheet.)

General Information

Latitude (degree):	44.5
Longitude (degree):	-93.1
Elevation (ft):	874
Estimated Design Lane ESALs:	1,000,000
Maximum Allowable Percent Slabs Cracked (%):	25%
Desired Reliability against Slab Cracking (%):	85%

Geographic Information

ESALs Calculator

Climate

AMDAT Region ID	5
Sunshine Zone	2

Existing Structure

Post-milling HMA Thickness (in):	6
HMA Condition (Fatigue cracking in the HMA):	Adequate
Composite Modulus of Subgrade Reaction, k-value (psi/in):	150
Does the existing HMA pavement have nondeteriorated transverse cracks?	Yes

Examples

k-value Calculator

Transverse Cracking

PCC Overlay

Average 28-day flexural (third point) strength (psi):	650
Estimated PCC Elastic Modulus (psi):	4,000,000
Coefficient of Thermal Expansion (10^{-6} in/°F/in)	5.5
Fiber Type:	No Fibers
Fiber Content(lb/cu yd) (Only used when a fiber type is selected	0.0

Epcc Calculator

CTE Calculator

Joint Design

Joint Spacing (transverse x longitudinal, ft x ft):	6 x 6

Calculate Design

Performance Analysis

Calculated PCC Overlay Thickness (in):	3.84
Design PCC Overlay Thickness (in):	**4.0**
Is there potential for reflective cracking?	Yes.

Solved.

General Information: Traffic

Level 1

Estimated Design Lane ESALs:	10,000,000	ESALs Calculator

ESALs Estimation:
Is One-Way ADT available?

Yes | No

Cancel

Level 2

Estimate ESALs:

Design Life (yrs):	10
Terminal Serviceabilty:	2
Number of Lanes in Each Direction:	1
Percent Trucks(%):	6
ADTT Growth Rate (%):	3
Traffic Growth Rate Type:	Non linear
Road Category:	Collector
One-Way Average Daily Traffic (ADT):	5,000

Submit | Cancel

Level 3

Estimate ESALs:

Design Life (yrs):	10
Terminal Serviceabilty:	2
Number of Lanes in Each Direction:	1
Percent Trucks(%):	6
ADTT Growth Rate (%):	3
Traffic Growth Rate Type:	Non linear
Road Category:	Collector

Submit | Cancel

General Information: Location

Latitude (degree):	44.5
Longitude (degree):	93.1
Elevation (ft):	874

Geographic Information

Geographic Information

Option 1

Visit Link in Internet Explorer — Open Webpage

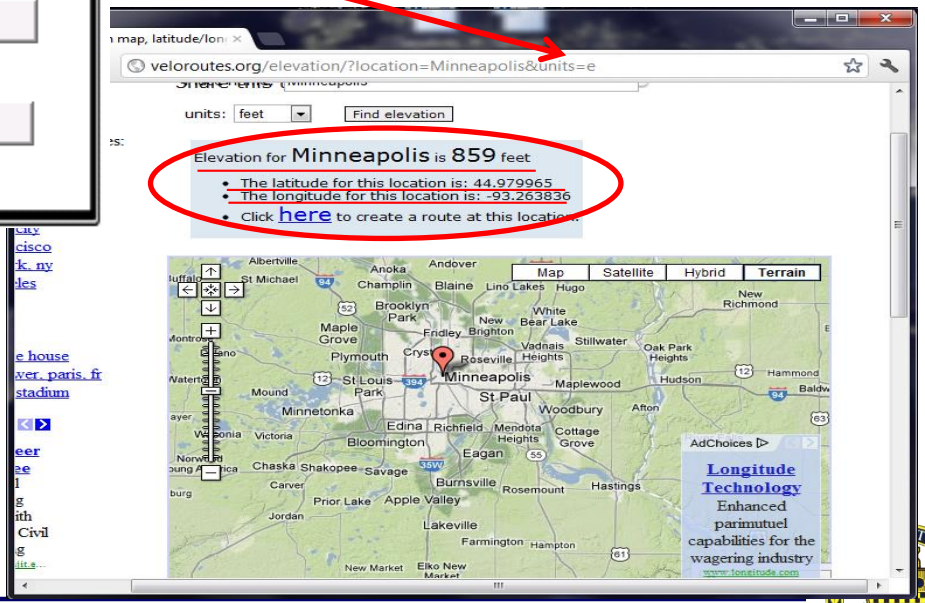
Or

Option 2 **Level 2**

Closest Location: MINNEAPOLIS, MN — Submit

Cancel

Level 1

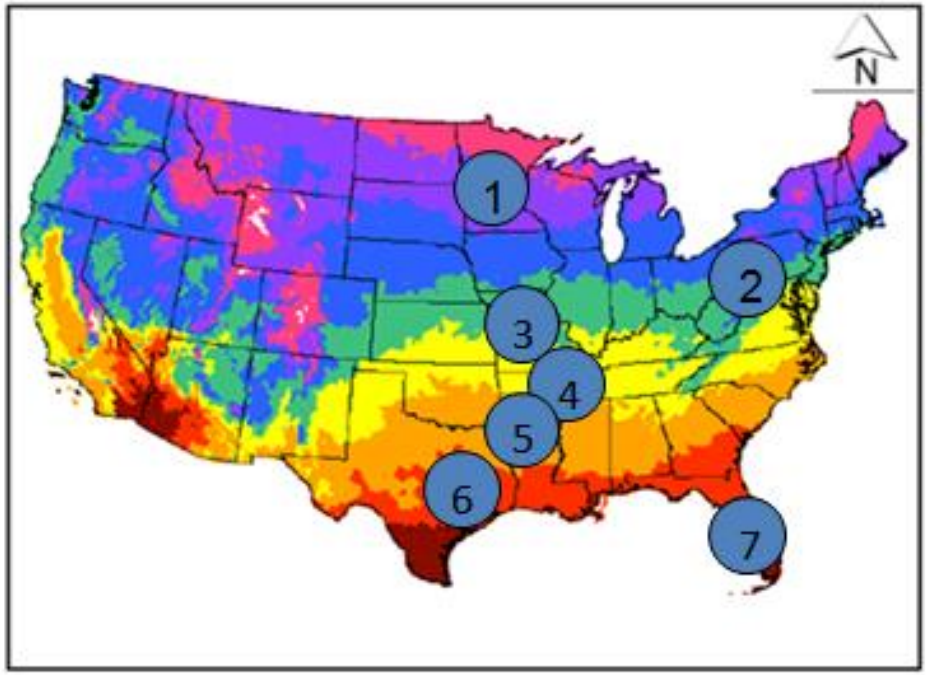


Climate: Temperature region

Climate

AMDAT Region ID	5
Sunshine Zone	2

AMDAT = Annual mean daily average temp.



Region ID	Color code	AMDAT (°F)
1		32.0-45.0
2		45.1-50.0
3		50.1-55.0
4		55.1-60.0
5		60.1-65.0
6		65.1-70.0
7		>70.0

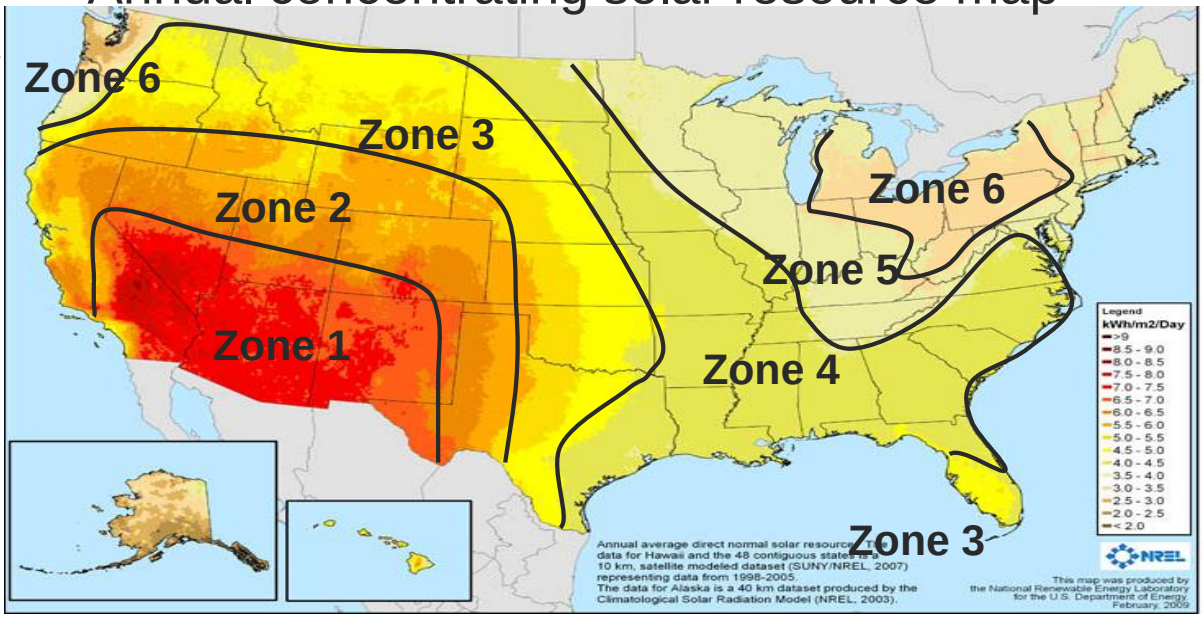
(http://cdo.ncdc.noaa.gov/climaps/temp0313.pdf, accessed on January, 2010).

Climate: Sunshine zones

Climate

AMDAT Region ID	5
Sunshine Zone	2

Annual concentrating solar resource map



(http://www.nrel.gov/gis/solar.html, as in May 2010)

Fig. 4 Transverse Cracking

(a) Transverse cracking in an existing HMA pavement (non-deteriorated)

(*MnROAD*, 1997)

(b) Transverse cracking in an an existing HMA pavement (deteriorated)

(*http://www.pavementinteractive.org/article/transverse-cracking/*)

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Existing Structure: E_{HMA}

Post-milling HMA Thickness (in):	6
HMA Condition:	Adequate
Composite Modulus of Subgrade Reaction, k-value (psi/in):	150
Does the existing HMA pavement have temperature cracks?	No

PCC Overlay

Average 28-day Flexural Strength (psi):	650
Estimated PCC Elastic Modulus (psi):	4,000,000

Category	Fatigue Cracking
Adequate	0% - 8%
Marginal	8% - 20%

Epcc Calculator

% surface area with fatigue cracking

Existing structure: E_{HMA} Examples

Existing Structure

Post-milling HMA Thickness (in):	6
HMA Condition (Fatigue cracking in the HMA):	Adequate
Composite Modulus of Subgrade Reaction, k-value (psi/in):	150
Does the existing HMA pavement have nondeteriorated transverse cracks?	Yes

Examples

k-value Calculator

Transverse Cracking

Fig. 3 Examples of fatigue cracking in HMA pavement

Description

Fatigue cracking is found in areas subjected to repeated traffic loadings (wheelpaths). It can appear as a series of interconnected cracks in the early stages of development. It ultimately develops into many-sided, sharp-angled pieces, characteristically with an alligator pattern, in later stages. (*Distress Identification Manual for The LTPP*. FHWA, 2003)

Severity Levels

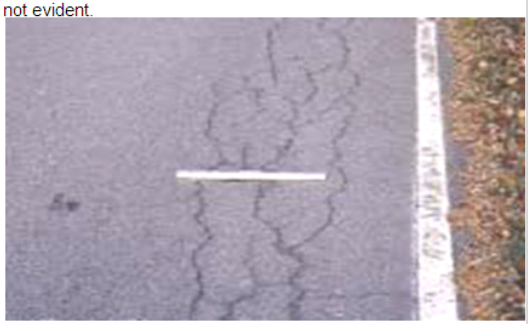
(a) Adequate

Wheelpath cracking has only a few connecting cracks; cracks are not spalled or sealed; pumping is not evident.

(http://www.pavementinteractive.org/wp-content/uploads/2008/08/WSDOT062.jpg)

(b) Marginal

Wheelpath cracks are interconnected and form a complete pattern; cracks may be slightly spalled or sealed; pumping is not evident.



Distress Identification Manual for The LTPP. FHWA, 2003)

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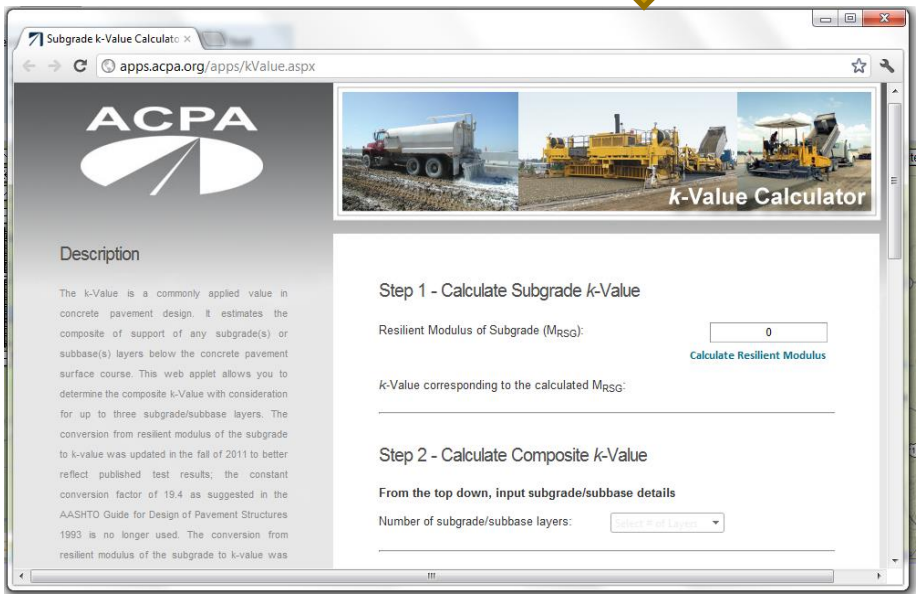
Existing Structure: k-value

Existing Structure

Post-milling HMA Thickness (in):	6
HMA Condition:	Adequate
Composite Modulus of Subgrade Reaction, k-value (psi/in):	200
Does the existing HMA pavement have temperature cracks?	Yes

k-value Calculator



Existing Structure: k-value

Whitetopping

E= HMA

$k_{composite}$ = All granular layers

Composites

No bond @ old HMA/old PCC interface

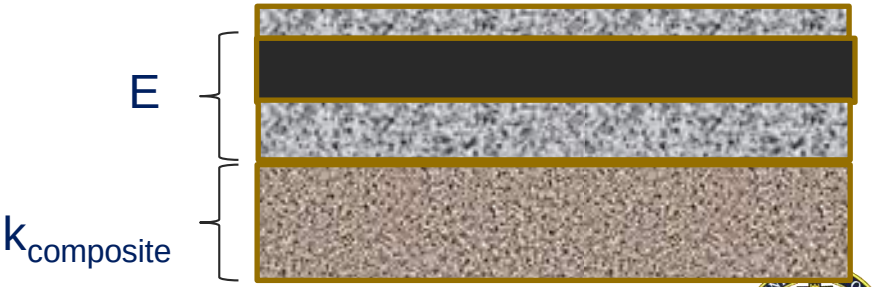
E= HMA

$k_{composite}$ = old PCC + All granular layers

Bond @ old HMA/old PCC interface

E= HMA + old PCC

$k_{composite}$ = All granular layers



Existing structure: Transverse cracking

Existing Structure

Post-milling HMA Thickness (in):	6
HMA Condition (Fatigue cracking in the HMA):	Adequate
Composite Modulus of Subgrade Reaction, k-value (psi/in):	150
Does the existing HMA pavement have nondeteriorated transverse cracks?	Yes

Examples
k-value Calculator
Transverse Cracking

Fig. 4 Transverse Cracking

(a) Transverse cracking in an existing HMA pavement (non-deteriorated)

(*MnROAD*, 1997)

(b) Transverse cracking in an an existing HMA pavement (deteriorated)

(*http://www.pavementinteractive.org/article/transverse-cracking/*)

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PCC Overlay: Strength & stiffness

Internally estimates E_{pcc} based on either:

Compressive strength

Flexural strength

PCC Overlay

Average 28-day Flexural Strength (psi):	700
Estimated PCC Elastic Modulus (psi):	4,000,000
Coefficient of Thermal Expansion (10^{-6} in/°F/in)	5.5
Fiber Type:	No Fibers
Fiber Content(lb/cu yd) (Only used when a fiber type is selected):	0

Epcc Calculator

CTE Calculator

PCC Overlay

Average 28-day Compressive Strength (psi):	5,000
Estimated PCC Elastic Modulus (psi):	4,000,000
Coefficient of Thermal Expansion (10^{-6} in/°F/in)	5.5
Fiber Type:	No Fibers
Fiber Content(lb/cu yd) (Only used when a fiber type is selected):	0

Epcc Calculator

CTE Calculator

CTE

PCC Overlay

Average 28-day Flexural Strength (psi):	700
Estimated PCC Elastic Modulus (psi):	4,000,000
Coefficient of Thermal Expansion (10^{-6} in/°F/in)	5.5
Fiber Type:	No Fibers
Fiber Content(lb/cu yd) (Only used when a fiber type is selected):	0

Epcc Calculator

CTE Calculator

CTE Estimator:

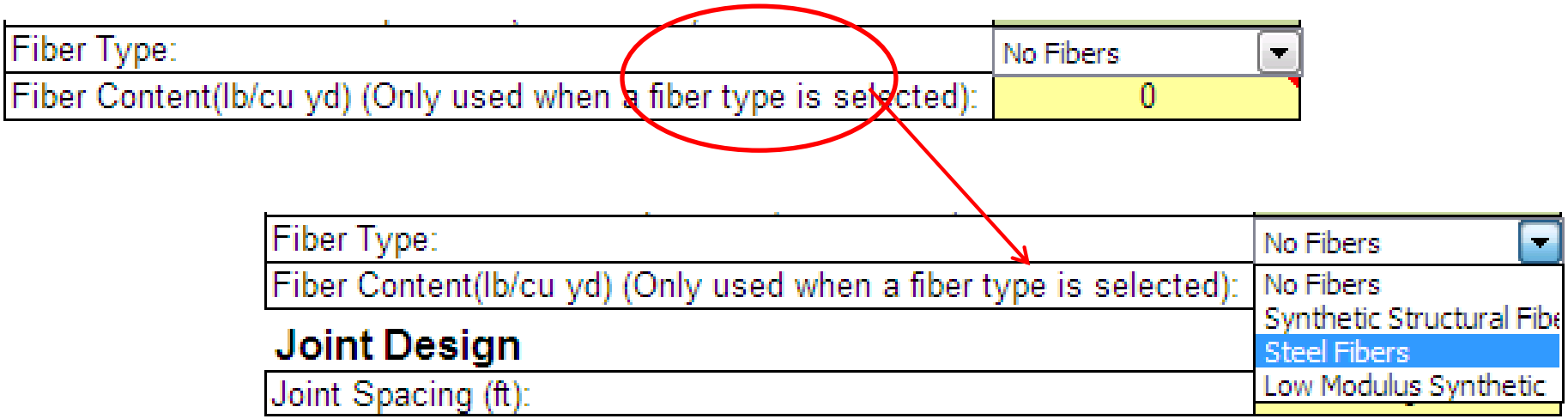
Type of Coarse Aggregate: Gravel

Recommended Value of the Thermal Coef. of PCC as a Function of Agg. Types	
Type of Coarse Aggregate	**Concrete Thermal Coef. (10e-6/°F)**
Quartz	6.6
Sandstone	6.5
Gravel	6.0
Granite	5.3
Basalt	4.8
Limestone	3.8

(AASHTO 93, pp II-29)

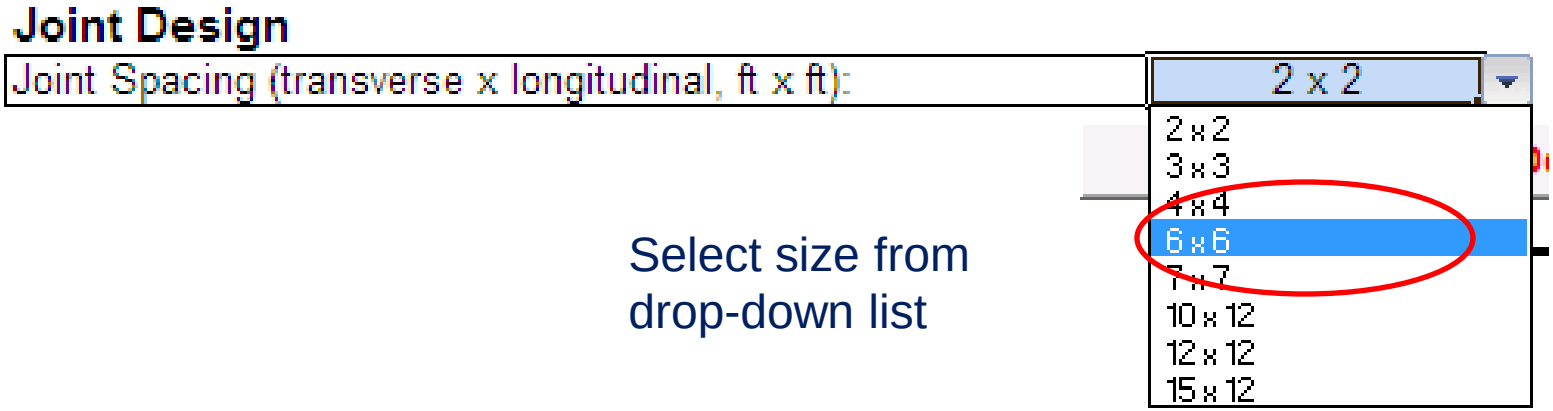
Submit Cancel

PCC Overlay: Fiber content



Select type from drop-down list

Joint spacing



Select size from drop-down list

Design thickness

PCC Overlay

Average 28-day Flexural Strength (psi):	700
Estimated PCC Elastic Modulus (psi):	4,000,000
Coefficient of Thermal Expansion (10^{-6} in/°F/in)	5.5
Fiber Type:	No Fibers
Fiber Content(lb/cu yd) (Only used when a fiber type is selected):	0

Epcc Calculator

CTE Calculator

Joint Design

Joint Spacing (ft):	6

Calculate Design

Performance Analysis

Calculated PCC Overlay Thickness (in):	3.21
Design PCC Overlay Thickness (in):	**3.5**
Is there potential for reflective cracking?	Yes

Solved.