



Illinois Department of Transportation

To: John Fortman Attn: District One
From: John D. Baranzelli
Subject: Pavement Design
Date: September 12, 2012

FAP Route 397 (IL Route 83)
Section (0405-1 & 0506-2)R-1
Cook County
From Kedzie Avenue to Western Avenue

We have reviewed the revised pavement selection for the project, which was submitted to BDE by memo dated September 12, 2012. The project will reconstruct IL 83 and a portion of Western Avenue/Dixie Highway. The original design approval was granted by BDE on November 16, 2011.

Revised life cycle costs favor the PCC option by more than 10%, and will not require alternate bids. Due to constraints required for contract letting, the stabilized sub-base will be retained in the contract documents; likewise, the revised pavement thicknesses will be increased to match the original thickness in the contract plans.

The approved pavement design for this project is as follows:

IL Route 83 (147th Street)

9.25 inches of PCC pavement with tied PCC Curb and Gutter
4.5 inches of Stabilized Sub-Base
12 inches of Aggregate Subgrade

Dixie Highway/Western Avenue

10 inches of PCC pavement with tied PCC Curb and Gutter
4.5 inches of Stabilized Sub-Base
12 inches of Aggregate Subgrade

If you have any questions, please contact Paul Niedernhofer at (217) 524-1651.



Illinois Department of Transportation

Memorandum

To: John D. Baranzelli Attn: Paul Niedernhofer
From: John Fortmann By: Jose Dominguez
Subject: Revised Pavement Design*
Date: September 12, 2012

*Route: FAP 397 IL Route 83 Section: (0405-1 & 0506-2) R-1
Limits: Kedzie Avenue to Western Avenue County: Cook
Contract No.: 60M57 Job No.: D-91-130-11
Letting: 09CY12

The District performed a revised 20-year mechanistic pavement design for the subject improvement. The purpose of the revised analysis was to ensure pavement design equivalency between the PCC and HMA options. The stabilized sub-base was not considered in the revised Life-cycle Cost analysis. Our original design that resulted in Alternate Bid included the stabilized sub-base. Our current Life Cycle Cost Analysis favors PCC over HMA by over 10%, therefore there will be no need for an alternate bid option according to Chapter 54 of the BDE manual.

We recommend revising the plans to reflect PCC pavement design only and no longer include the HMA pavement alternative. Since the original PCC design is within reasonable limits of our updated pavement design, we further recommend PCC pavement thicknesses remain as shown on the plans. Likewise, the 4 ½" stabilized sub-base will remain as part of the plans. The approved pavement design for this project is as follows:

IL-83 (147th Street)

Tied PCC Curb and Gutter
Pavement Reconstruction

9.25" PCC Pavement Jointed
4.5" Stabilized sub-base.
12" Aggregate Subgrade

Life Cycle: favors PCC 28.9%

Dixie Hwy/Western Ave.

Tied PCC Curb and Gutter
Pavement Reconstruction

10" PCC Pavement Jointed
4.5" Stabilized sub-base
12" Aggregate Subgrade

Life Cycle: favors PCC 26.1%

John D. Baranzelli
September 12, 2012
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If you have any questions or need additional information, please contact
Jenpai Chang, Acting Pavement Design Engineer, at (847)705-4432.

By: *Jose A. Dominguez*
Jose A. Dominguez, P.E.
Project Support Engineer

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: IL-83 (147th Street)	Comments: 147th Street		
Section: 1414.2B	Design Date: 06/16/2011	MK	<- BY
County: Cook	Modify Date: 09/10/2012	MR	<- BY
Location: Kedzie to Western		ADT	Year
		Current: 17,500	2008
		Future: 23,000	2030
Facility Type: Other Marked State Route	# of Lanes = 4		
Road Class: I		Structural Design Traffic	
Subgrade Support Rating (SSR): Poor		Minimum ADT	Actual ADT
Construction Year: 2013			Actual % of Total ADT
Design Period (DP) = 20 years		PV = 0	19,210
		SU = 250	1,679
		MU = 750	361
		Struct. Design ADT = 21,250	(2023)
			% of ADT in Design Lane
			P = 32%
			S = 45%
			M = 45%

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT

Cpv = 0.15
 Csu = 132.5
 Cmu = 482.53
 TF flexible (Actual) = 3.59 (Actual ADT)
 TF flexible (Min) = 3.56 (Min ADT Fig. 54-2.C)

RIGID PAVEMENT

Cpv = 0.15
 Csu = 143.81
 Cmu = 696.42
 TF rigid (Actual) = 4.46 (Actual ADT)
 TF rigid (Min) = 5.02 (Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement	JPC Pavement
Use TF flexible = 3.59	Use TF rigid = 5.02
PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.R)	Edge Support = Tied Shoulder or C.&G.
HMA Mixture Temp. = 75.5 deg. F (Fig. 54-5.C)	Rigid Pavt Thick. = 9.00 in. (Fig. 54-4.E)
Design HMA Mixture Modulus (E _{HMA}) = 680 ksi (Fig. 54-5.D)	
Design HMA Strain (ε _{HMA}) = 83 (Fig. 54-5.E)	
Full Depth HMA Design Thickness = 10.25 in. (Fig. 54-5.F)	CRCP Pavement
Limiting Strain Criterion Thickness = 14.75 in. (Fig. 54-5.I)	Use TF rigid = 5.02
Use Full-Depth HMA Thickness = 10.25 inches	IBR value = 3
	CRCP Thickness = 8.00 in. (Fig. 54-4.M)

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC	Unbonded Concrete Overlay
Use TF flexible = 3.59	Review 54-4.03 for limitations and special considerations.
District = 3,4,5,6	JPCP Thickness = NA inches
HMA Overlay Design Thickness = 8.25 in. (Fig. 54-5.U)	

CONTACT BMPR FOR ASSISTANCE

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN

Class I Roads	Class II Roads	Class III Roads	Class IV Roads
4 lanes or more Part of a future 4 lanes or more One-way Streets with ADT > 3500	2 lanes with ADT > 2000 One way Street with ADT <= 3500	2 Lanes (ADT 750 -2000)	2 Lanes (ADT < 750)

Facility Type	Min. Str. Design Traffic (Fig 54-2.C)		
	PV	SU	MU
Interstate or Supplemental Freeway	0	500	1500
Other Marked State Route	0	250	750
Unmarked State Route	No Min	No Min	No Min

Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

Class	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4.C)		Flexible (Fig. 54-5.B)	
	Csu	Cmu	Csu	Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV	129.58	562.47	109.14	384.35

Class Table for 2 or 3 lanes (not future 4-lane & not one-way street)	
ADT	Class
0 - 749	IV
750 - 2000	III
>2000	II

Number of Lanes	Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)					
	Rural			Urban		
	P	S	M	P	S	M
1 Lane Ramp	100%	100%	100%	100%	100%	100%
2 or 3	50%	50%	50%	50%	50%	50%
4	32%	45%	45%	32%	45%	45%
6 or more	20%	40%	40%	8%	37%	37%

LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT

ROUTE: IL-83 (47th Street)
 COUNTY: 1414.28
 LOCATION: Cook
 FACILITY TYPE: Non-Interstate

PROJECT LENGTH: 7426 FT ==> 1.41 Miles
 # OF LANES: 3 CL, 4 LANES
 # OF EGGS: 4 EP
 AVERAGE WIDTH: 13.13 FT
 SHOULDER WIDTH: 0 FT
 HMA: Inside Outside

PAVEMENT THICKNESS (FEET): 10.25 IN
 POLICY OVERLAY THICKNESS: 2.50 IN

DESIGN: 14.75 IN MAX
 HMA 2.5 Standard Design

TRAFFIC FACTORS

MINIMUM: 3.50 ACTUAL: 3.50 USER: Overdrive

MAINTENANCE COSTS:

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST	USER SUPPLIED QUANTITY	SUPPLIED UNIT PRICE	COST
HMA SURFACE	(2.50")	43,335	SQ YD	\$33.27 / SQ YD	\$2,308,447	53		\$1,746,510
HMA TOP BINDER	(1.50")	43,335	SQ YD	\$10.71 / SQ YD	\$463,872			\$463,872
HMA LOWER BINDER	(2.25")	43,335	SQ YD	\$12.21 / SQ YD	\$529,455			\$529,455
HMA LOWER BINDER COURSE	(6.00")	43,335	SQ YD	\$28.12 / SQ YD	\$1,217,820			\$1,217,820
HMA SHOULDER	(8.00")	0	TONS	\$23.00 / TON	\$0			\$0
CONTR. & JOINTS		0	LN FT	\$30.00 / LN FT	\$0			\$0
SUBGRADE GRAN. MTL. TY C (TONS)		170	TONS	\$25.00 / TON	\$4,250			\$4,250
IMPROVED SUBGRADE	Aggregate	46,385	SQ YD	\$7.00 / SQ YD	\$324,795			\$324,795
Reserved For User Supplied Item		0	SQ YD	\$0.00 / SQ YD	\$0			\$0
PAVEMENT REMOVAL		0	SQ YD	\$0.00 / SQ YD	\$0			\$0
SHOULDER REMOVAL		0	SQ YD	\$0.00 / SQ YD	\$0			\$0
RESERVED FOR USER SUPPLIED QUANTITY		0	SQ YD	\$0.00 / SQ YD	\$0			\$0
MAINTENANCE COSTS:					\$2,637,887			\$2,637,887
RECONSTRUCTION INITIAL COST					\$76,400			\$76,400
FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE					\$110,510			\$110,510
THICKNESS								
MATERIAL								
UNIT COST								
ROUTINE MAINTENANCE ACTIVITY					\$0.00			\$0.00
LINE/MI/VEH/YEAR								
HMA OVERLAY PAINT	(2.50")	1.41	MI/VEH	\$10.64 / MI/VEH	\$14.90			\$14.90
HMA OVERLAY PAINT	(1.50")	1.41	MI/VEH	\$7.28 / MI/VEH	\$10.26			\$10.26
HMA SURFACE MIX	(1.50")	1.41	MI/VEH	\$3.57 / MI/VEH	\$5.03			\$5.03
HMA BINDER MIX	(0.75")	1.41	MI/VEH	\$9.07 / MI/VEH	\$12.79			\$12.79
HMA OVERLAY SHLD	(2.25")	1.41	MI/VEH	\$8.00 / MI/VEH	\$11.20			\$11.20
HMA OVERLAY SHLD	(2.00")	1.41	MI/VEH	\$8.00 / MI/VEH	\$11.20			\$11.20
MILLING (2.00 IN)		1.41	MI/VEH	\$3.00 / MI/VEH	\$4.23			\$4.23
PARTIAL DEPTH PAINT PATCH	(HMA SURFACE MIX)	1.41	MI/VEH	\$0.64 / MI/VEH	\$0.90			\$0.90
PARTIAL DEPTH SHLD PATCH	(HMA SHLD MIX)	1.41	MI/VEH	\$0.64 / MI/VEH	\$0.90			\$0.90
PARTIAL DEPTH PAINT PATCH	(HMA SURFACE MIX)	1.41	MI/VEH	\$0.64 / MI/VEH	\$0.90			\$0.90
PARTIAL DEPTH SHLD PATCH	(HMA SHLD MIX)	1.41	MI/VEH	\$0.64 / MI/VEH	\$0.90			\$0.90
LONGITUDINAL SHOULDER JOINT ROUT & SEAL		1.41	MI/VEH	\$19.52 / MI/VEH	\$27.52			\$27.52
CENTRELINE JOINT ROUT & SEAL		1.41	MI/VEH	\$19.52 / MI/VEH	\$27.52			\$27.52
RANDOM / THERMAL CRACK ROUT & SEAL		1.41	MI/VEH	\$2.00 / MI/VEH	\$2.81			\$2.81
(100% Retain = 10.00' / Station / Lane)					\$2.00			\$2.00
FLEXIBLE TOTAL LIFE-CYCLE COST					\$3,811.130			\$3,811.130
FLEXIBLE TOTAL ANNUAL COST PER MILE					\$110,510			\$110,510

PCC PAVEMENT

ROUTE: IL-83 (47th Street)
 COUNTY: 1414.28
 LOCATION: Cook
 FACILITY TYPE: Non-Interstate

PROJECT LENGTH: 7426 FT ==> 1.41 Miles
 # OF LANES: 3 CL, 4 LANES
 # OF EGGS: 4 EP
 AVERAGE WIDTH: 13.13 FT
 SHOULDER WIDTH: 10 FT
 PCC: Inside Outside

PAVEMENT THICKNESS (RIGID): 9.25 IN
 SHOULDER THICKNESS: 10.00 IN

DESIGN: TED-SHLD

TRAFFIC FACTORS

MINIMUM: 5.02 ACTUAL: 5.02 USER: Overdrive

MAINTENANCE COSTS:

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST	USER SUPPLIED QUANTITY	SUPPLIED UNIT PRICE	COST
HMA POLICY OVERLAY	(2.50")	43,335	SQ YD	\$12.74 / SQ YD	\$551,872			\$551,872
HMA SURFACE MIX	(1.50")	43,335	SQ YD	\$7.88 / SQ YD	\$340,880			\$340,880
HMA BINDER MIX	(1.50")	43,335	SQ YD	\$3.76 / SQ YD	\$162,740			\$162,740
HMA POLICY OVERLAY SHLD	(2.50")	0	TONS	\$10.00 / TON	\$0			\$0
CLASS A PAVEMENT PATCHING		0	LN FT	\$105.00 / LN FT	\$0			\$0
CLASS B PAVEMENT PATCHING		0	LN FT	\$145.00 / LN FT	\$0			\$0
CLASS C SHOULDER PATCHING		0	LN FT	\$145.00 / LN FT	\$0			\$0
PARTIAL DEPTH PAINT PATCH (Mill & Fill HMA Surf)		1.41	MI/VEH	\$7.28 / MI/VEH	\$10.26			\$10.26
PARTIAL DEPTH SHLD PATCH (Mill & Fill HMA Surf)		1.41	MI/VEH	\$7.28 / MI/VEH	\$10.26			\$10.26
CENTRELINE JOINT ROUT & SEAL		1.41	MI/VEH	\$2.00 / MI/VEH	\$2.81			\$2.81
REFLECTIVE TRANSVERSE CRACK ROUT & SEAL		1.41	MI/VEH	\$2.00 / MI/VEH	\$2.81			\$2.81
RANDOM CRACK ROUT & SEAL		1.41	MI/VEH	\$2.00 / MI/VEH	\$2.81			\$2.81
(100% Retain = 10.00' / Station / Lane)					\$2.00			\$2.00
RIGID CONSTRUCTION INITIAL COST					\$2,248,854			\$2,248,854
RIGID CONSTRUCTION ANNUAL COST PER MILE					\$68,127			\$68,127
ROUTINE MAINTENANCE ACTIVITY					\$0.00			\$0.00
LINE/MI/VEH/YEAR								
HMA POLICY OVERLAY PAINT	(2.50")	1.41	MI/VEH	\$12.74 / MI/VEH	\$17.97			\$17.97
HMA SURFACE MIX	(1.50")	1.41	MI/VEH	\$7.88 / MI/VEH	\$10.99			\$10.99
HMA BINDER MIX	(1.50")	1.41	MI/VEH	\$3.76 / MI/VEH	\$5.29			\$5.29
HMA POLICY OVERLAY SHLD	(2.50")	0	TONS	\$10.00 / TON	\$0			\$0
CLASS A PAVEMENT PATCHING		0	LN FT	\$105.00 / LN FT	\$0			\$0
CLASS B PAVEMENT PATCHING		0	LN FT	\$145.00 / LN FT	\$0			\$0
CLASS C SHOULDER PATCHING		0	LN FT	\$145.00 / LN FT	\$0			\$0
PARTIAL DEPTH PAINT PATCH (Mill & Fill HMA Surf)		1.41	MI/VEH	\$7.28 / MI/VEH	\$10.26			\$10.26
PARTIAL DEPTH SHLD PATCH (Mill & Fill HMA Surf)		1.41	MI/VEH	\$7.28 / MI/VEH	\$10.26			\$10.26
CENTRELINE JOINT ROUT & SEAL		1.41	MI/VEH	\$2.00 / MI/VEH	\$2.81			\$2.81
REFLECTIVE TRANSVERSE CRACK ROUT & SEAL		1.41	MI/VEH	\$2.00 / MI/VEH	\$2.81			\$2.81
RANDOM CRACK ROUT & SEAL		1.41	MI/VEH	\$2.00 / MI/VEH	\$2.81			\$2.81
(100% Retain = 10.00' / Station / Lane)					\$2.00			\$2.00
RIGID TOTAL LIFE-CYCLE COST					\$2,288,507			\$2,288,507
RIGID TOTAL ANNUAL COST PER MILE					\$69,213			\$69,213

RECONSTRUCTION - HMA OVER RUBBLIZED PAVEMENT

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised: 2.58 PM 07/16/12

CONSTRUCTION	INITIAL COST	PRESENT WORTH	ANNUAL COST PER MILE
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	ANNUAL COST PER MILE
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	ANNUAL COST PER MILE

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	TYPE / PERCENTAGE	JPCP	HMA
OTHER OPTIONS (LOWEST TO HIGHEST)			

LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT

ROUTE: IL-83 (47th Street)
 COUNTY: 1414.28
 LOCATION: Cook
 FACILITY TYPE: Non-Interstate

PROJECT LENGTH: 7426 FT ==> 1.41 Miles
 # OF LANES: 3 CL, 4 LANES
 # OF EGGS: 4 EP
 AVERAGE WIDTH: 13.13 FT
 SHOULDER WIDTH: 0 FT
 HMA: Inside Outside

PAVEMENT THICKNESS (FEET): 10.25 IN
 POLICY OVERLAY THICKNESS: 2.50 IN

DESIGN: 14.75 IN MAX
 HMA 2.5 Standard Design

TRAFFIC FACTORS

MINIMUM: 3.50 ACTUAL: 3.50 USER: Overdrive

MAINTENANCE COSTS:

YEAR	ITEM	% QUANTITY	UNIT COST	COST	PRESENT WORTH
YEAR 5	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 10	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 15	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 20	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 25	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 30	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 35	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 40	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 45	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 50	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 55	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 60	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 65	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 70	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 75	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 80	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 85	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 90	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 95	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 100	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 105	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 110	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 115	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 120	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 125	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 130	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 135	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 140	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 145	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 150	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 155	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 160	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 165	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 170	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 175	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 180	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 185	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 190	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 195	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 200	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 205	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 210	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 215	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 220	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 225	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 230	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 235	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 240	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 245	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 250	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 255	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 260	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 265	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 270	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 275	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 280	LONG SHLD JT RAS	LN FT 100.00%	20.704	\$2.00	\$39,408
YEAR 285	LONG SHLD JT RAS	LN FT 100.			

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: Dixie Hwy/Western Ave		Comments: Dixie Hwy/Western Ave Design				
Section: 1414.2B		Design Date: 06/06/2011		MK	<- BY	
County: Cook		Modify Date: 09/10/2012		MR	<- BY	
Location: 147th Street					ADT	Year
					Current:	15,200 2008
					Future:	11,000 2030
Facility Type: Other Marked State Route		# of Lanes = 4				
Road Class: 1				Structural Design Traffic		
Subgrade Support Rating (SSR): Poor				Minimum ADT	Actual ADT	Actual % of Total ADT
Construction Year: 2013						% of ADT in Design Lane
Design Period (DP) = 20 years				PV = 0	11,559	93.7%
				SU = 250	543	4.4%
				MU = 750	234	1.9%
				Struct. Design ADT = 12,336		(2023)
						P = 32%
						S = 45%
						M = 45%

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT

Cpv = 0.15
 Csu = 132.5
 Cmu = 482.53
 TF flexible (Actual) = 1.68 (Actual ADT)
 TF flexible (Min) = 3.56 (Min ADT Fig. 54-2.C)

RIGID PAVEMENT

Cpv = 0.15
 Csu = 143.81
 Cmu = 696.42
 TF rigid (Actual) = 2.18 (Actual ADT)
 TF rigid (Min) = 5.02 (Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement		JPC Pavement	
Use TF flexible = 3.56		Use TF rigid = 5.02	
PG Grade Lower Binder Lifts = PG-64-22 (Fig. 53-4.R)		Edge Support = Tied Shoulder or C.&G.	
HMA Mixture Temp. = 75.5 deg. F (Fig. 54-5.C)		Rigid Pavt Thick. = 9.00 in. (Fig. 54-4.E)	
Design HMA Mixture Modulus (E _{HMA}) = 680 ksi (Fig. 54-5.D)			
Design HMA Strain (ε _{HMA}) = 84 (Fig. 54-5.E)		CRCP Pavement	
Full Depth HMA Design Thickness = 10.25 in. (Fig. 54-5.F)		Use TF rigid = 5.02	
Limiting Strain Criterion Thickness = 14.75 in. (Fig. 54-5.I)		IBR value = 3	
Use Full-Depth HMA Thickness = 10.25 inches		CRCP Thickness = 8.00 in. (Fig. 54-4.M)	

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC		Unbonded Concrete Overlay	
Use TF flexible = 3.56		Review 54-4.03 for limitations and special considerations.	
District = 3,4,5,6		JPCP Thickness = NA inches	
HMA Overlay Design Thickness = 8.00 in. (Fig. 54-5.U)			

CONTACT BMPR FOR ASSISTANCE

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN

Class I Roads	Class II Roads	Class III Roads	Class IV Roads
4 lanes or more Part of a future 4 lanes or more One-way Streets with ADT > 3500	2 lanes with ADT > 2000 One way Street with ADT <= 3500	2 Lanes (ADT 750 -2000)	2 Lanes (ADT < 750)

Facility Type	Min. Str. Design Traffic (Fig 54-2.C)		
	PV	SU	MU
Interstate or Supplemental Freeway	0	500	1500
Other Marked State Route	0	250	750
Unmarked State Route	No Min	No Min	No Min

Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

Class	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4.C)		Flexible (Fig. 54-5.B)	
	Csu	Cmu	Csu	Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV	129.58	562.47	109.14	384.35

Class Table for 2 or 3 lanes (not future 4 lane & not one-way street)	
ADT	Class
0 - 749	IV
750 - 2000	III
>2000	II

Number of Lanes	Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)					
	Rural			Urban		
	P	S	M	P	S	M
1 Lane Ramp	100%	100%	100%	100%	100%	100%
2 or 3	50%	50%	50%	50%	50%	50%
4	32%	45%	45%	32%	45%	45%
6 or more	20%	40%	40%	8%	37%	37%

LIFE-CYCLE COST ANALYSIS - NEW CONSTRUCTION / RECONSTRUCTION
FULL-DEPTH HMA PAVEMENT
 Standard Design

ROUTE: Dixie Hwy/Western Ave
 SECTION: 14100 IN
 COUNTY: Cook
 LOCATION: 147th Street

PROJECT TYPE: NONINTERSTATE
 PROJECT LENGTH: 2840 FT = 0.53 Miles
 # OF CENTERLINES: 4 LINES
 # OF EDGES: 2 EP
 LANE WIDTH - AVERAGE: 11 FT
 SHOULDER WIDTH: HMA Inside
 Outside

PAVEMENT THICKNESS (FLEXIBLE): 10.25 IN
 SHOULDER THICKNESS: 8.00 IN
 POLICY OVERLAY THICKNESS: 14.75 IN MAX
 HMA SD Standard Design

TRAFFIC FACTORS: MINIMUM: 3.50 ACTUAL: 1.50 USER: 3.50
 On User

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST	USER QUANTITY	UNIT PRICE	USER COST
HMA SURFACE (FULL-DEPTH)	(10.25")	12,951	SQ YD	\$53.11 / SQ YD	\$689,780	53		\$2,806
HMA TOP BINDER (2.25")	(2.25")	12,951	SQ YD	\$14.08 / SQ YD	\$182,650			\$182,650
HMA LOWER BINDER (2.25")	(2.25")	12,951	SQ YD	\$14.08 / SQ YD	\$182,650			\$182,650
HMA POLICY OVERLAY (2.50")	(2.50")	12,951	SQ YD	\$27.62 / SQ YD	\$357,800			\$357,800
HMA SHOULDER (8.00")	(8.00")	0	LN FT	\$72.00 / LN FT	\$0			\$0
CHRG & GUTTER		0	LN FT	\$30.00 / LN FT	\$0			\$0
SUBBASE GRAN. M/LTY. (1.0")		32	TONS	\$58.00 / TON	\$1,856			\$1,856
IMPROVED SUBGRADE	Aggregate	13,496	SQ YD	\$7.00 / SQ YD	\$94,472			\$94,472
Reserved For User Supplied Item		0	SQ YD	\$0.00 / SQ YD	\$0			\$0
Reserved For User Supplied Item		0	SQ YD	\$0.00 / SQ YD	\$0			\$0
PAVEMENT REMOVAL		12,951	SQ YD	\$0.00 / SQ YD	\$0			\$0
SHOULDER REMOVAL		0	SQ YD	\$0.00 / SQ YD	\$0			\$0

Note: * Denotes User Supplied Quantity

ITEM	THICKNESS	FLEXIBLE CONSTRUCTION INITIAL COST	FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE	USER QUANTITY	UNIT PRICE	USER COST
MAINTENANCE COSTS:						\$783,082
ROUTINE MAINTENANCE ACTIVITY						\$80,699
MAINTENANCE COSTS:						\$1,027,467
FLEXIBLE TOTAL ANNUAL COST PER MILE						\$80,699

ROUTINE MAINTENANCE ACTIVITY

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST	USER QUANTITY	UNIT PRICE	USER COST
HMA OVERLAY PAINT SURF (2.00")	(2.00")	12,951	SQ YD	\$10.64 / SQ YD	\$137,850			\$137,850
HMA SURFACE PAINT (2.25")	(2.25")	12,951	SQ YD	\$11.55 / SQ YD	\$149,550			\$149,550
HMA TOP BINDER (0.75")	(0.75")	12,951	SQ YD	\$3.50 / SQ YD	\$45,330			\$45,330
HMA BINDER MIX (0.75")	(0.75")	12,951	SQ YD	\$0.07 / SQ YD	\$907			\$907
HMA OVERLAY SHLD (2.00")	(2.00")	12,951	SQ YD	\$0.07 / SQ YD	\$907			\$907
HMA OVERLAY SHLD (2.00")	(2.00")	12,951	SQ YD	\$0.06 / SQ YD	\$777			\$777
MILLING (2.00 IN)		0	LN FT	\$3.00 / LN FT	\$0			\$0
PARTIAL DEPTH PAINT PATCH (HMA SURFACE MIX)	(HMA SURFACE MIX)	0	LN FT	\$91.64 / LN FT	\$0			\$0
PARTIAL DEPTH SHLD PATCH (HMA BINDER MIX)	(HMA BINDER MIX)	0	LN FT	\$78.06 / LN FT	\$0			\$0
PARTIAL DEPTH PAINT PATCH (HMA BINDER)	(HMA BINDER)	0	LN FT	\$79.52 / LN FT	\$0			\$0
PARTIAL DEPTH SHLD PATCH (HMA BINDER MIX)	(HMA BINDER MIX)	0	LN FT	\$78.06 / LN FT	\$0			\$0
LONGITUDINAL SHOULDER JOINT ROUT & SEAL		0	LN FT	\$2.00 / LN FT	\$0			\$0
CENTERLINE JOINT ROUT & SEAL		0	LN FT	\$2.00 / LN FT	\$0			\$0
RANDOM / THERMAL CRACK ROUT & SEAL (100% Healed = 1000' / Shoulder/Lane)		0	LN FT	\$2.00 / LN FT	\$0			\$0

RIGID TOTAL LIFE-CYCLE COST: \$1,027,467
 FLEXIBLE TOTAL ANNUAL COST PER MILE: \$80,699

PCC PAVEMENT

Dixie Hwy/Western Ave
 1414.2B
 Cook
 147th Street

JPCP

PROJECT TYPE: NONINTERSTATE
 PROJECT LENGTH: 2840 FT = 0.53 Miles
 # OF CENTERLINES: 2 EP
 # OF EDGES: 4 LINES
 LANE WIDTH - AVERAGE: 11 FT
 SHOULDER WIDTH: PCC Inside
 Outside

PAVEMENT THICKNESS (RIGID): JPCP 14.00 IN
 SHOULDER THICKNESS: 10.00 IN
 POLICY OVERLAY THICKNESS: 2.50 IN

TRAFFIC FACTORS: MINIMUM: 3.50 ACTUAL: 1.50 USER: 3.50
 On User

Note: * Denotes User Supplied Quantity

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST	USER QUANTITY	UNIT PRICE	USER COST
JPC PAVEMENT	(10.00")	12,951	SQ YD	\$40.56 / SQ YD	\$525,001			\$525,001
PAVEMENT REINFORCEMENT	(4.00")	13,834	SQ YD	\$0.00 / SQ YD	\$0			\$0
STABILIZED SUBBASE		0	LN FT	\$40.00 / LN FT	\$0			\$0
PCC SHOULDER	(10.00" to 10.00")	0	LN FT	\$30.00 / LN FT	\$0			\$0
CHRG & GUTTER		32	TONS	\$25.00 / TON	\$800			\$800
SUBBASE GRAN. M/LTY. C	Aggregate	16,166	SQ YD	\$7.00 / SQ YD	\$113,162			\$113,162
IMPROVED SUBGRADE:		0	SQ YD	\$0.00 / SQ YD	\$0			\$0
Reserved For User Supplied Item		0	SQ YD	\$0.00 / SQ YD	\$0			\$0
Reserved For User Supplied Item		0	LN FT	\$0.00 / LN FT	\$0			\$0
PAVEMENT REMOVAL		12,951	SQ YD	\$0.00 / SQ YD	\$0			\$0
SHOULDER REMOVAL		2,443	SQ YD	\$0.00 / SQ YD	\$0			\$0

RIGID CONSTRUCTION INITIAL COST: \$882,017
 RIGID CONSTRUCTION ANNUAL COST PER MILE: \$55,413

ROUTINE MAINTENANCE ACTIVITY

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST	USER QUANTITY	UNIT PRICE	USER COST
HMA POLICY OVERLAY (2.50")	(2.50")	12,951	SQ YD	\$27.62 / SQ YD	\$357,800			\$357,800
HMA SURFACE MIX (1.90")	(1.90")	12,951	SQ YD	\$4.78 / SQ YD	\$61,700			\$61,700
HMA BINDER MIX (1.90")	(1.90")	12,951	SQ YD	\$4.78 / SQ YD	\$61,700			\$61,700
HMA POLICY OVERLAY SHLD (2.50")	(2.50")	12,951	SQ YD	\$10.08 / SQ YD	\$130,800			\$130,800
CLASS A PAVEMENT PATCHING		0	LN FT	\$195.00 / LN FT	\$0			\$0
CLASS B PAVEMENT PATCHING		0	LN FT	\$160.00 / LN FT	\$0			\$0
CLASS C SHOULDER PATCHING		0	LN FT	\$146.00 / LN FT	\$0			\$0
PARTIAL DEPTH PAINT PATCH (HMA SURFACE MIX)	(HMA SURFACE MIX)	0	LN FT	\$72.88 / LN FT	\$0			\$0
PARTIAL DEPTH PAINT PATCH (HMA SURFACE MIX)	(HMA SURFACE MIX)	0	LN FT	\$53.30 / LN FT	\$0			\$0
LONGITUDINAL SHOULDER JOINT ROUT & SEAL		0	LN FT	\$2.00 / LN FT	\$0			\$0
CENTERLINE JOINT ROUT & SEAL		0	LN FT	\$2.00 / LN FT	\$0			\$0
REFLECTIVE TRANSVERSE CRACK ROUT & SEAL		0	LN FT	\$2.00 / LN FT	\$0			\$0
RANDOM CRACK ROUT & SEAL (100% Healed = 1000' / Shoulder/Lane)		0	LN FT	\$2.00 / LN FT	\$0			\$0

RIGID TOTAL LIFE-CYCLE COST: \$878,228
 RIGID TOTAL ANNUAL COST PER MILE: \$71,384

RECONSTRUCTION - HMA OVER RUBBLIZED PAVEMENT
RECONSTRUCTION - PCC UNBONDED OVERLAY

LIFE-CYCLE COST ANALYSIS: NEW DESIGN
 Calculated / Revised: 2:48 PM 07/16/12

CONSTRUCTION	INITIAL COST	JPCP	HMA
PRESENT WORTH	\$882,017	\$783,082	\$1,027,467
ANNUAL COST PER MILE	\$55,413	\$53,443	\$83,859
MAINTENANCE	LIFE-CYCLE COST	\$106,299	\$234,405
ANNUAL COST PER MILE	\$15,590	\$15,950	\$26,372
TOTAL	LIFE-CYCLE COST	\$878,228	\$1,107,487
ANNUAL COST PER MILE	\$71,384	\$69,031	\$90,031

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	HMA	JPCP
OTHER OPTIONS (LOWEST TO HIGHEST)	\$90,031	\$71,384
TYPE / PERCENTAGE	HMA	26.1%

FULL-DEPTH HMA PAVEMENT
HMA OVERLAY OF RUBBLIZED PCC PAVEMENT
 Figure 54-7-C
 STANDARD DESIGN

ROUTINE MAINTENANCE ACTIVITY SCHEDULE

YEAR	ITEM	% QUANTITY	UNIT COST	COST	PRESENT WORTH
YEAR 5	LONG SHLD JT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	CENTR LINE JOINT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	RNDM / THERM CRACK RAS	LN FT 50.00%	5.828	\$2.00	\$11,659
YEAR 10	LONG SHLD JT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	CENTR LINE JOINT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	RNDM / THERM CRACK RAS	LN FT 50.00%	5.828	\$2.00	\$11,659
YEAR 15	LONG SHLD JT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	CENTR LINE JOINT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	RNDM / THERM CRACK RAS	LN FT 50.00%	5.828	\$2.00	\$11,659
YEAR 20	LONG SHLD JT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	CENTR LINE JOINT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	RNDM / THERM CRACK RAS	LN FT 50.00%	5.828	\$2.00	\$11,659
YEAR 25	LONG SHLD JT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	CENTR LINE JOINT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	RNDM / THERM CRACK RAS	LN FT 50.00%	5.828	\$2.00	\$11,659
YEAR 30	LONG SHLD JT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	CENTR LINE JOINT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	RNDM / THERM CRACK RAS	LN FT 50.00%	5.828	\$2.00	\$11,659
YEAR 40	LONG SHLD JT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	CENTR LINE JOINT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	RNDM / THERM CRACK RAS	LN FT 50.00%	5.828	\$2.00	\$11,659
YEAR 50	LONG SHLD JT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	CENTR LINE JOINT RAS	LN FT 100.00%	5.288	\$2.00	\$10,586
	RNDM / THERM CRACK RAS	LN FT 50.00%	5.828	\$2.00	\$11,659

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE
JOINTED PLAN CONCRETE PAVEMENT
UNBONDED JOINTED PLAN CONCRETE OVERLAY
 Figure 54-7-A

YEAR	ITEM	% QUANTITY	UNIT COST	COST	PRESENT WORTH
YEAR 10	PAVEMENT PATCH CLASS B	SQ YD 0.10%	13	\$150.00	\$1,650
	PAVEMENT PATCH CLASS B	PW/FM = 0.7441			\$1,950
YEAR 15	PAVEMENT PATCH CLASS B	SQ YD 0.20%	26	\$150.00	\$3,900
	PAVEMENT PATCH CLASS B	PW/FM = 0.6419			\$2,203
YEAR 20	PAVEMENT PATCH CLASS B	SQ YD 0.30%	39	\$150.00	\$5,850
	PAVEMENT PATCH CLASS B	PW/FM = 0.5597			\$3,244
YEAR 25	PAVEMENT PATCH CLASS B	SQ YD 0.40%	52	\$150.00	\$8,100
	PAVEMENT PATCH CLASS B	PW/FM = 0.4776			\$2,768
YEAR 30	PAVEMENT PATCH CLASS B	SQ YD 0.50%	65	\$150.00	\$11,250
	PAVEMENT PATCH CLASS B	PW/FM = 0.4120			\$80,988
YEAR 35	PAVEMENT PATCH CLASS B	LN FT 100.00%	5.288	\$2.00	\$10,586
	PAVEMENT PATCH CLASS B	PW/FM = 0.3554			\$13,886
YEAR 40	PAVEMENT PATCH CLASS B	LN FT 100.00%	5.288	\$2.00	\$10,586
	PAVEMENT PATCH CLASS B	PW/FM = 0.3089			\$17,259
YEAR 45	PAVEMENT PATCH CLASS B	LN FT 100.00%	5.288	\$2.00	\$10,586
	PAVEMENT PATCH CLASS B	PW/FM = 0.2624			\$21,209
YEAR 50	PAVEMENT PATCH CLASS B	LN FT 100.00%	5.288	\$2.00	\$10,586
	PAVEMENT PATCH CLASS B	PW/FM = 0.2159			\$25,929

ROUTINE MAINTENANCE ACTIVITY: 2.01
 MAINTENANCE ANNUAL COST PER MILE: \$18,209

UNBONDED JOINTED PLAN CONCRETE OVERLAY: 0.040785
 MAINTENANCE ANNUAL COST PER MILE: \$15,500