



Illinois Department of Transportation

To: John Fortmann Attn: District One
From: John D. Baranzelli
Subject: Pavement Design
Date: July 9, 2014

A handwritten signature in black ink, appearing to be 'JDB', enclosed in a hand-drawn oval.

Wolf Road
Cook County
From IL 21 to north of Hintz Road

The project, submitted to BDE by email memo dated January 15, 2014, will reconstruct Wolf Road to a 3 lane cross-section. Based on the LCCA, a rigid pavement will be provided. Both IL 68 (Dundee Road) and Highland Avenue will be widened. Based on first cost, the widening will be accomplished with a flexible design. The approved pavement design is as follows:

Wolf Road (Reconstruction)

8 inches of PCC Jointed Pavement with tied PCC Curb & Gutter
12 inches of Aggregate Subgrade Improvement

IL 68 (Dundee Road)(Pavement Widening)

9.75 inches of Full Depth HMA Pavement
2 inches of HMA Surface Course, Mix "D", N70
7.75 inches of HMA Binder Course, IL-19.0, N70
12 inches of Aggregate Subgrade Improvement

Highland Avenue (Pavement Widening & Resurfacing)

7 inches of Full Depth HMA Pavement
2 inches of HMA Surface Course, Mix "D", N70
5 inches of HMA Binder Course, IL-19.0, N70
12 inches of Aggregate Subgrade Improvement

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: Jose A. Dominguez By: M. Mangoba/O. Patel
Subject: Pavement Analysis* Date: January 30, 2014

*Route: Wolf Road Contract No.: 60T05
Limits: IL 21 to n/o Hintz Road Job No.: D-91-280-12
Section: 3941-R Current target: 09CY14
County: Cook

We have completed the pavement analysis for the above captioned location. Review by the Central Office is required since the total pavement area for reconstruction and widening exceeds 4,750 Square Yards. The following is the scope of the project:

Wolf Road – Reconstruction to provide a 3 lane cross-section.

IL 68 (Dundee Road) @ Wolf Road – Widening to provide an eastbound right turn lane.

Highland Avenue @ Wolf Road – Widening at the intersection to accommodate the geometric improvements near the radius returns.

A 20-year pavement analysis was performed on above segments. For Wolf Road, we recommend a mechanistic rigid pavement design based on the life cycle cost analysis which favors PCC by 10.9%. For IL 68 and Highland Avenue, our recommendations are based on the mechanistic pavement design procedure using a first cost analysis. The recommended pavement is:

Wolf Road

Reconstruction
PCC Curb and Gutter (Tied)
8" PCC Pavement (Jointed)¹
12" Aggregate Subgrade Improvement⁵

IL 68 (Dundee Road)

Widening
9 ¾" Full Depth HMA⁶
 2" HMA Surface Course, Mix "D", N70²
 7 ¾" HMA Binder Course, IL-19.0, N70³
12" Aggregate Subgrade Improvement⁵

Highland Avenue⁷

Widening and Resurfacing

7" Full Depth HMA⁶

2" HMA Surface Course, Mix "D", N70²

5" HMA Binder Course, IL-19.0, N70⁴

12" Aggregate Subgrade Improvement⁵

¹Designer Note 1: Use pay item **42000301, PORTLAND CEMENT CONCRETE PAVEMENT 8" (JOINTED)**, paid for in square yards.

²Designer Note 2: Use pay item **40603340, HOT-MIX ASPHALT SURFACE COURSE, MIX "D", N70** paid for in tons.

³Designer Note 3: For widening of six feet or less use pay item **35600707, HOT-MIX ASPHALT BASE COURSE WIDENING, 7 ¾"**, paid for in square yards. For widening of greater than six feet use pay item **35501315, HOT-MIX ASPHALT BASE COURSE, 7 ¾"**, paid for in square yards.

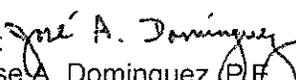
⁴Designer Note 4: For widening of six feet or less use pay item **#1009860, HOT-MIX ASPHALT BASE COURSE WIDENING, 5"**, paid for in square yards. For widening of greater than six feet use pay item **35501304, HOT-MIX ASPHALT BASE COURSE, 5"**, paid for in square yards.

⁵Designer Note 5: Use pay item **30300112, "AGGREGATE SUBGRADE IMPROVEMENT, 12" "** paid for in square yards.

⁶Designer Note 6: Refer to the District One, Bureau of Materials' "Hot-Mix Asphalt – Mix Selection" tables to determine the corresponding HMA mix table requirements for the plans.

⁷Designer Note 7: Highland Avenue is subject to local jurisdictional approval and concurrence.

If you have any questions or need additional information, please contact Ojas Patel, Pavement Engineer, at (847) 705-4550.

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

PROJECT AND TRAFFIC INPUTS (Enter Data in Gray Shaded Cells)

Route: **Wolf Road** Comments: **Wolf Road (IL 21 to north of Hintz Road)**

Section: _____ Design Date: **12/18/2013** ONP <-- BY

County: **Cook** Modify Date: _____ <-- BY

Location: **from IL 21 to n/o Hintz Rd.** Current: **13,300** 2011

Facility Type: **Unmarked State Route** Future: **16,600** 2035

of Lanes = **2 or 3**

Part of future 4 lanes or more? **No**

One Way Street? **No**

Road Class: **II**

Subgrade Support Rating (SSR): **Poor**

Construction Year: **2014**

Design Period (DP) = **20** years

Structural Design Traffic			
Minimum ADT	Actual ADT	Actual % of Total ADT	% of ADT in Design Lane
PV = No Min	14,484	96.0%	P = 50%
SU = No Min	453	3.0%	S = 50%
MU = No Min	151	1.0%	M = 50%
Struct. Design ADT = 15,088		(2024)	

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT		RIGID PAVEMENT	
Cpv = 0.15	Csu = 112.06	Cpv = 0.15	Csu = 135.78
Cmu = 385.44		Cmu = 567.21	
TF flexible (Actual) = 1.11 (Actual ADT)		TF rigid (Actual) = 1.49 (Actual ADT)	
TF flexible (Min) = No Min (Min ADT Fig. 54-2.C)		TF rigid (Min) = No Min (Min ADT Fig. 54-2.C)	

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement	JPC Pavement
Use TF flexible = 1.11	Use TF rigid = 1.49
PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.R)	Edge Support = Tied Shoulder or C.&G.
HMA Mixture Temp. = 73.5 deg. F (Fig. 54-5.C)	Rigid Pavt Thick. = 8.00 in. (Fig. 54-4.E)
Design HMA Mixture Modulus (E _{HMA}) = 740 ksi (Fig. 54-5.D)	
Design HMA Strain (ε _{HMA}) = 117 (Fig. 54-5.E)	
Full Depth HMA Design Thickness = 8.00 in. (Fig. 54-5.F)	CRC Pavement
Limiting Strain Criterion Thickness = 14.25 in. (Fig. 54-5.I)	Use TF rigid = 1.49
Use Full-Depth HMA Thickness = 8.00 inches	IBR value = 3
	CRCP Thickness = 6.50 in. (Fig. 54-4.N)

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC	Unbonded Concrete Overlay
Use TF flexible = 1.11	Review 54-4.03 for limitations and special considerations.
HMA Overlay Design Thickness = 5.50 in. (Fig. 54-5.U)	
Limiting Strain Criterion Thickness = 10.75 in. (Fig. 54-5.V)	
Use HMA Overlay Thickness = 5.50 inches	JPCP Thickness = NA inches

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 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 **Wolf Road**
 SECTION
 COUNTY **Cook**
 LOCATION **from IL 21 to n/o Hintz Rd.**

FACILITY TYPE **NON-INTERSTATE**

PROJECT LENGTH **7120 FT ==> 1.35 Miles**
 # OF CENTERLINES **1 CL**
 # OF LANES **2 LANES**
 # OF EDGES **2 EP**
 LANE WIDTH - AVERAGE **12 FT**
 SHOULDER WIDTH HMA Left **0 FT**
 HMA Right **0 FT**
 Total Width of Paved Shoulders **0 FT**

PAVEMENT THICKNESS (FLEXIBLE) **8.00 IN 14.25 IN MAX**
 SHOULDER THICKNESS **8.00 IN HMA_SE Standard Design**
 POLICY OVERLAY THICKNESS **2.25 IN**

FLEX PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
		No Min	1.11	1.11

Read Me!

HMA	COST PER TON	UNIT PRICE
HMA SURFACE		\$95.00 / TON
HMA TOP BINDER		\$95.00 / TON
HMA LOWER BINDER		\$80.00 / TON
HMA BINDER (LEVELING)		\$85.00 / TON
HMA SHOULDER		\$72.00 / TON

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
HMA PAVEMENT (FULL-DEPTH)	(8.00")	18,987	SQ YD *	\$30.49 / SQ YD	\$578,903 ~
HMA SURFACE COURSE	(2.00")	2,141	TONS	\$95.00 / TON	\$0
HMA TOP BINDER COURSE	(2.25")	2,444	TONS	\$95.00 / TON	\$0
HMA LOWER BINDER COURSE	(3.75")	4,157	TONS	\$80.00 / TON	\$0
HMA SHOULDER	(8.00")	0	TONS	\$72.00 / TON	\$0 ~
CURB & GUTTER		0	LIN FT	\$30.00 / LIN FT	\$0
SUBBASE GRAN MATL TY C (TONS)		0	TONS	\$25.00 / TON	\$0
IMPROVED SUBGRADE: Modified Soil	Worn = 25.3	20,833	SQ YD	\$7.00 / SQ YD	\$145,831
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
PAVEMENT REMOVAL		18,987	SQ YD	\$15.00 / SQ YD	\$284,805
SHOULDER REMOVAL		0	SQ YD	\$0.00 / SQ YD	\$0
Note: * Denotes User Supplied Quantity					
FLEXIBLE CONSTRUCTION INITIAL COST					\$1,009,539
FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE					\$30,534

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	UNIT COST
ROUTINE MAINTENANCE ACTIVITY			\$0.00 LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	Surface Mix	\$8.33 / SQ YD
HMA OVERLAY PVMT	(2.25")	Surface Mix	\$9.37 / SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	\$6.25 / SQ YD
HMA BINDER MIX	(0.75")	Leveling Binder Mix	\$3.12 / SQ YD
HMA OVERLAY SHLD (Year 30)	(2.25")	Shoulder Mix	\$9.07 / SQ YD
HMA OVERLAY SHLD	(2.00")	Shoulder Mix	\$8.06 / SQ YD
MILLING (2.00 IN)			\$3.00 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill Surf)		Surface Mix	\$80.64 / SQ YD
PARTIAL DEPTH SHLD PATCH (Mill & Fill Surf)		Shoulder Mix	\$78.06 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill +2.00")		Leveling Binder Mix	\$79.52 / SQ YD
PARTIAL DEPTH SHLD PATCH (Mill & Fill +2.00")		Shoulder Mix	\$78.06 / SQ YD
LONGITUDINAL SHOULDER JOINT ROUT & SEAL			\$2.00 / LIN FT
CENTERLINE JOINT ROUT & SEAL			\$2.00 / LIN FT
RANDOM / THERMAL CRACK ROUT & SEAL (100% Rehab = 110.00' / Station / Lane)			\$2.00 / LIN FT

FLEXIBLE TOTAL LIFE-CYCLE COST	\$1,473,610
FLEXIBLE TOTAL ANNUAL COST PER MILE	\$44,570

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

MAINTENANCE COSTS:	ITEM	%	QUANTITY	UNIT	UNIT COST	COST	PRESENT WORTH
YEAR 5							
	LONG SHLD JT R&S	100.00%	14,240	LIN FT	\$2.00	\$28,480	
	CNTR LINE JOINT R&S	100.00%	7,120	LIN FT	\$2.00	\$14,240	
	RNDM / THRM CRACK R&S	50.00%	7,832	LIN FT	\$2.00	\$15,664	
	PD PVMT PATCH M&F SURF	0.10%	19	SQ YD	\$80.64	\$1,532	
		PWF _n = 0.8626			PW = 0.8626 X	\$59,916	\$51,684
YEAR 10							
	LONG SHLD JT R&S	100.00%	14,240	LIN FT	\$2.00	\$28,480	
	CNTR LINE JOINT R&S	100.00%	7,120	LIN FT	\$2.00	\$14,240	
	RNDM / THRM CRACK R&S	50.00%	7,832	LIN FT	\$2.00	\$15,664	
	PD PVMT PATCH M&F SURF	0.50%	95	SQ YD	\$80.64	\$7,661	
		PWF _n = 0.7441			PW = 0.7441 X	\$66,045	\$49,144
YEAR 15							
	MILL PVMT & SHLD 2.00"	100.00%	18,987	SQ YD	\$3.00	\$56,961	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	190	SQ YD	\$79.52	\$15,109	
	HMA OVERLAY PVMT 2.00"	100.00%	18,987	SQ YD	\$8.33	\$158,159	
	HMA OVERLAY SHLD 2.00"	100.00%	0	SQ YD	\$8.06	\$0	
		PWF _n = 0.6419			PW = 0.6419 X	\$230,229	\$147,775
YEAR 20							
	LONG SHLD JT R&S	100.00%	14,240	LIN FT	\$2.00	\$28,480	
	CNTR LINE JOINT R&S	100.00%	7,120	LIN FT	\$2.00	\$14,240	
	RNDM / THRM CRACK R&S	50.00%	7,832	LIN FT	\$2.00	\$15,664	
	PD PVMT PATCH M&F SURF	0.10%	19	SQ YD	\$80.64	\$1,532	
		PWF _n = 0.5537			PW = 0.5537 X	\$59,916	\$33,174
YEAR 25							
	LONG SHLD JT R&S	100.00%	14,240	LIN FT	\$2.00	\$28,480	
	CNTR LINE JOINT R&S	100.00%	7,120	LIN FT	\$2.00	\$14,240	
	RNDM / THRM CRACK R&S	50.00%	7,832	LIN FT	\$2.00	\$15,664	
	PD PVMT PATCH M&F SURF	0.50%	95	SQ YD	\$80.64	\$7,661	
		PWF _n = 0.4776			PW = 0.4776 X	\$66,045	\$31,543
YEAR 30							
	HMA_SD NON-INTERSTATE						
	MILL PVMT & SHLD 2.00"	100.00%	18,987	SQ YD	\$3.00	\$56,961	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	380	SQ YD	\$79.52	\$30,218	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	0	SQ YD	\$78.06	\$0	
	HMA OVERLAY PVMT 2.25"	100.00%	18,987	SQ YD	\$9.37	\$177,905	
	HMA OVERLAY SHLD 2.25"	100.00%	0	SQ YD	\$9.07	\$0	
		PWF _n = 0.4120			PW = 0.4120 X	\$265,084	\$109,211
YEAR 35							
	LONG SHLD JT R&S	100.00%	14,240	LIN FT	\$2.00	\$28,480	
	CNTR LINE JOINT R&S	100.00%	7,120	LIN FT	\$2.00	\$14,240	
	RNDM / THRM CRACK R&S	50.00%	7,832	LIN FT	\$2.00	\$15,664	
	PD PVMT PATCH M&F SURF	0.10%	19	SQ YD	\$80.64	\$1,532	
		PWF _n = 0.3554			PW = 0.3554 X	\$59,916	\$21,293
YEAR 40							
	LONG SHLD JT R&S	100.00%	14,240	LIN FT	\$2.00	\$28,480	
	CNTR LINE JOINT R&S	100.00%	7,120	LIN FT	\$2.00	\$14,240	
	RNDM / THRM CRACK R&S	50.00%	7,832	LIN FT	\$2.00	\$15,664	
	PD PVMT PATCH M&F SURF	0.50%	95	SQ YD	\$80.64	\$7,661	
		PWF _n = 0.3066			PW = 0.3066 X	\$66,045	\$20,247
							\$464,071
	ROUTINE MAINTENANCE ACTIVITY		2.70	Lane Miles	0.00	\$0	\$0
							MAINTENANCE LIFE-CYCLE COST \$464,071
45	YEAR LIFE CYCLE	CRF _n = 0.0407852					MAINTENANCE ANNUAL COST PER MILE \$14,036

PCC PAVEMENT

JPCP

ROUTE **Wolf Road**
 SECTION **0**
 COUNTY **Cook**
 LOCATION **from IL 21 to n/o Hintz Rd.**

FACILITY TYPE **NON-INTERSTATE**

PROJECT LENGTH **7120 FT ==> 1.35 Miles**
 # OF CENTERLINES **1 CL**
 # OF LANES **2 LANES**
 # OF EDGES **2 EP**
 LANE WIDTH - AVERAGE **12 FT**
 SHOULDER WIDTH **PCC Left 0 FT**
 PCC Right 0 FT
 Total Width of Paved Shoulders **0 FT**

PAVEMENT THICKNESS (RIGID) **JPCP 8.00 IN TIED SHLD**
 SHOULDER THICKNESS **8.00 IN**

POLICY OVERLAY THICKNESS **2.50 IN**

RIGID PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
Worksheet Construction Type is	Reconstruction	No Min	1.49	JPCP
			The Pavement Type is	JPCP

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
JPC PAVEMENT	(8.00")	18,987	SQ YD	\$32.79 /SQ YD	\$622,584
PAVEMENT REINFORCEMENT		0	SQ YD	\$22.00 /SQ YD	\$0
STABILIZED SUBBASE	(4.00")	0	SQ YD	\$19.00 /SQ YD	\$0
PCC SHOULDERS	(8.00" to 8.00")	0	SQ YD	\$40.00 /SQ YD	\$0
CURB & GUTTER		0	LIN FT	\$30.00 /LIN FT	\$0
SUBBASE GRAN MATL TY C	(~ 0.00")	0	TONS	\$25.00 /TON	\$0
IMPROVED SUBGRADE:	Modified Soil <i>(Rehab = 25.0')</i>	19,778	SQ YD	\$7.00 /SQ YD	\$138,446
Reserved For User Supplied Item		0	UNITS	\$0.00 /UNITS	\$0
Reserved For User Supplied Item		0	UNITS	\$0.00 /UNITS	\$0
PAVEMENT REMOVAL		18,987	SQ YD	\$15.00 /SQ YD	\$284,805
SHOULDER REMOVAL		0	SQ YD	\$0.00 /SQ YD	\$0

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION INITIAL COST \$1,045,835
RIGID CONSTRUCTION ANNUAL COST PER MILE \$31,631

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	UNIT	UNIT COST
ROUTINE MAINTENANCE ACTIVITY				\$0.00 /LANE-MILE /YEAR
HMA POLICY OVERLAY	(2.50")		2.50	
HMA POLICY OVERLAY PVMT	(2.50")	1.0087	2.50	\$10.41 /SQ YD
HMA SURFACE MIX	(1.50")	1.0062	Surface Mix	\$6.25 /SQ YD
HMA BINDER MIX	(1.00")	1.0139	elng Binder Mix	\$4.16 /SQ YD
HMA POLICY OVERLAY SHLD	(2.50")		Shoulder Mix	\$10.08 /SQ YD
CLASS A PAVEMENT PATCHING				\$195.00 /SQ YD
CLASS B PAVEMENT PATCHING				\$150.00 /SQ YD
CLASS C SHOULDER PATCHING				\$145.00 /SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA Surf)		Surface Mix	1.50	\$77.98 /SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.50")		Surface Mix	2.50	\$83.30 /SQ YD
LONGITUDINAL SHOULDER JOINT ROUT & SEAL				\$2.00 /LIN FT
CENTERLINE JOINT ROUT & SEAL				\$2.00 /LIN FT
REFLECTIVE TRANSVERSE CRACK ROUT & SEAL				\$2.00 /LIN FT
RANDOM CRACK ROUT & SEAL	(100% Rehab = 100.00' / Station / Lane)			\$2.00 /LIN FT

RIGID TOTAL LIFE-CYCLE COST \$1,328,493
RIGID TOTAL ANNUAL COST PER MILE \$40,181

JOINTED PLAIN CONCRETE PAVEMENT
UNBONDED JOINTED PLAIN CONCRETE OVERLAY
Figure 54-7.A

MAINTENANCE COSTS:	ITEM	%	QUANTITY	UNIT	UNIT COST	COST	PRESENT WORTH
YEAR 10							
	PAVEMENT PATCH CLASS B	0.10%	19	SQ YD	\$150.00	\$2,850	
		PWFn = 0.7441			PW = 0.7441 X	\$2,850	\$2,121
YEAR 15							
	PAVEMENT PATCH CLASS B	0.20%	38	SQ YD	\$150.00	\$5,700	
		PWFn = 0.6419			PW = 0.6419 X	\$5,700	\$3,659
YEAR 20							
	PAVEMENT PATCH CLASS B	2.00%	380	SQ YD	\$150.00	\$57,000	
	SHOULDER PATCH CLASS C	0.50%	0	SQ YD	\$145.00	\$0	
	LONGITUDINAL SHLD JT R&S	100.00%	14,240	LIN FT	\$2.00	\$28,480	
	CENTERLINE JT R&S	100.00%	7,120	LIN FT	\$2.00	\$14,240	
		PWFn = 0.5537			PW = 0.5537 X	\$99,720	\$55,213
YEAR 25							
	PAVEMENT PATCH CLASS B	3.00%	570	SQ YD	\$150.00	\$85,500	
	SHOULDER PATCH CLASS C	1.00%	0	SQ YD	\$145.00	\$0	
		PWFn = 0.4776			PW = 0.4776 X	\$85,500	\$40,835
YEAR 30 NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	759	SQ YD	\$150.00	\$113,850	
	SHOULDER PATCH CLASS C	1.50%	0	SQ YD	\$145.00	\$0	
	HMA POLICY OVERLAY 2.5" (PVMT)	100.00%	18,987	SQ YD	\$10.41	\$197,651	
	HMA POLICY OVERLAY 2.5" (SHLD)	100.00%	0	SQ YD	\$10.08	\$0	
		PWFn = 0.4120			PW = 0.4120 X	\$311,501	\$128,334
YEAR 35 NON-INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	14,240	LIN FT	\$2.00	\$28,480	
	CENTERLINE JT R&S	100.00%	7,120	LIN FT	\$2.00	\$14,240	
	RANDOM CRACK R&S	50.00%	7,120	LIN FT	\$2.00	\$14,240	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	4,560	LIN FT	\$2.00	\$9,120	
	PD PVMT PATCH M&F HMA 2.50"	0.10%	19	SQ YD	\$83.30	\$1,583	
		PWFn = 0.3554			PW = 0.3554 X	\$67,663	\$24,046
YEAR 40 NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	95	SQ YD	\$150.00	\$14,250	
	LONGITUDINAL SHLD JT R&S	100.00%	14,240	LIN FT	\$2.00	\$28,480	
	CENTERLINE JT R&S	100.00%	7,120	LIN FT	\$2.00	\$14,240	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	6,840	LIN FT	\$2.00	\$13,680	
	RANDOM CRACK R&S	50.00%	7,120	LIN FT	\$2.00	\$14,240	
	PD PVMT PATCH M&F HMA 2.50"	0.50%	95	SQ YD	\$83.30	\$7,914	
		PWFn = 0.3066			PW = 0.3066 X	\$92,804	\$28,450
							\$282,658
	ROUTINE MAINTENANCE ACTIVITY		2.70	Lane Miles	\$0.00	\$0	\$0
							MAINTENANCE LIFE-CYCLE COST \$282,658
45	YEAR LIFE CYCLE	CRFn = 0.0407852					MAINTENANCE ANNUAL COST PER MILE \$8,549

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : 1/14/14 10:51 AM

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	\$1,045,835	\$1,009,539
		ANNUAL COST PER MILE	\$31,631	\$30,534
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$282,658	\$464,071
		ANNUAL COST PER MILE	\$8,549	\$14,036
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	\$1,328,493	\$1,473,610
		ANNUAL COST PER MILE	\$40,181	\$44,570

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=====>	JPCP	\$40,181	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PERCENTAGE	HMA	\$44,570	10.9%

PROJECT AND TRAFFIC INPUTS (Enter Data in Gray Shaded Cells)

Route: **IL 68 (Dundee Road)** Comments: **Wolf Road (IL 21 to north of Hintz Road)**

Section: _____ Design Date: **12/18/2013** ONP

County: **Cook** Modify Date: _____

Location: **from IL 21 to n/o Hintz Rd.**

Facility Type: **Other Marked State Route** # of Lanes = **4**

Road Class: **I**

Subgrade Support Rating (SSR): **Poor**

Construction Year: **2014**

Design Period (DP) = **20** years

<-- BY	ADT	Year
Current:	27,600	2011
Future:	34,445	2035

Structural Design Traffic			
Minimum ADT	Actual ADT	Actual % of Total ADT	% of ADT in Design Lane
PV = 0	30,055	96.0%	P = 32%
SU = 250	626	2.0%	S = 45%
MU = 750	626	2.0%	M = 45%
Struct. Design ADT = 31,308		(2024)	

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT

C_{pv} = 0.15
 C_{su} = **132.5**
 C_{mu} = **482.53**
 TF flexible (Actual) = 3.49 (Actual ADT)
 TF flexible (Min) = 3.56 (Min ADT Fig. 54-2.C)

RIGID PAVEMENT

C_{pv} = 0.15
 C_{su} = **143.81**
 C_{mu} = **696.42**
 TF rigid (Actual) = 4.76 (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	PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.R)	Use TF rigid = 5.02	Edge Support = Tied Shoulder or C.&G.
Goto Map	HMA Mixture Temp. = 73.5 deg. F (Fig. 54-5.C)	Rigid Pavt Thick. = 9.00 in. (Fig. 54-4.E)	
Design HMA Mixture Modulus (E _{HMA}) = 740 ksi (Fig. 54-5.D)	Design HMA Strain (ε _{HMA}) = 84 (Fig. 54-5.E)	CRC Pavement	
Goto Map	Full Depth HMA Design Thickness = 9.75 in. (Fig. 54-5.F)	Use TF rigid = 5.02	IBR value = 3
Limiting Strain Criterion Thickness = 14.25 in. (Fig. 54-5.I)	Use Full-Depth HMA Thickness = 9.75 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	HMA Overlay Design Thickness = 7.25 in. (Fig. 54-5.U)	Review 54-4.03 for limitations and special considerations.	
Goto Map	Limiting Strain Criterion Thickness = 10.75 in. (Fig. 54-5.V)	JPCP Thickness = NA inches	
Use HMA Overlay Thickness = 7.25 inches			

CONTACT BMPR FOR ASSISTANCE

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN

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

Facility Type	Min. Str. Design Traffic (Fig 54-2.C)		
	PV	SU	MU
Interstate or 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%

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: **Highland Avenue** Comments: **Wolf Road (IL 21 to north of Hintz Road)**
 Section: _____
 County: **Cook** Design Date: **12/18/2013** ONP
 Location: **from IL 21 to n/o Hintz Rd.** Modify Date: _____

<-- BY	ADT	Year
Current:	1,500	2011
Future:	2,070	2035

Facility Type: **Unmarked State Route**
 # of Lanes = **2 or 3**
 Part of future 4 lanes or more? **No**
 One Way Street? **No**
 Road Class: **III**
 Subgrade Support Rating (SSR): **Poor**
 Construction Year: **2014**
 Design Period (DP) = **20** years

	Structural Design Traffic			% of ADT in Design Lane
	Minimum ADT	Actual ADT	Actual % of Total ADT	
PV =	No Min	1,764	97.5%	P = 50%
SU =	No Min	36	2.0%	S = 50%
MU =	No Min	9	0.5%	M = 50%
Struct. Design ADT =	1,809 (2024)			

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT

Cpv = 0.15
 Csu = **109.14**
 Cmu = **384.35**
 TF flexible (Actual) = 0.08 (Actual ADT)
 TF flexible (Min) = No Min (Min ADT Fig. 54-2.C)

RIGID PAVEMENT

Cpv = 0.15
 Csu = **129.58**
 Cmu = **562.47**
 TF rigid (Actual) = 0.10 (Actual ADT)
 TF rigid (Min) = No Min (Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement		JPC Pavement	
Use TF flexible = 0.50	Per BDE 54-5.01(i)-1g	Use TF rigid = 0.10	
PG Grade Lower Binder Lifts = PG 64-22	(Fig. 53-4.R)	Edge Support = Tied	Shoulder or C.&G.
HMA Mixture Temp. = 73.5	deg. F (Fig. 54-5.C)	Rigid Pavt Thick. = 7.50 in.	(Fig. 54-4.E)
Design HMA Mixture Modulus (E _{HMA}) = 740	ksi (Fig. 54-5.D)		
Design HMA Strain (ε _{HMA}) = 147	(Fig. 54-5.E)		
Full Depth HMA Design Thickness = 7.00 in.	(Fig. 54-5.F)		
Limiting Strain Criterion Thickness = 14.25	in. (Fig. 54-5.I)		
Use Full-Depth HMA Thickness = 7.00 inches		CRCP Thickness = 4.25 in.	(Fig. 54-4.N)

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC		Unbonded Concrete Overlay	
Use TF flexible = 0.50		Review 54-4.03 for limitations and special considerations.	
HMA Overlay Design Thickness = 4.75 in.	(Fig. 54-5.U)		
Limiting Strain Criterion Thickness = 10.75	in. (Fig. 54-5.V)		
Use HMA Overlay Thickness = 4.75 inches		JPCP Thickness = NA inches	

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 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%

First Cost Analysis of Widening Project

Date: 1/13/2014
 Quantities by: ONP
 Unit prices by: MM

Checked by:
 Checked by:
 Net Length

Route IL 68
 Section 3941-R
 County Cook
 Project Wolf Road (IL 21 to Hintz Rd)
 Contract 62254

Mechanistic Flexible							
Area (Sq. Yd.)	Height (inches)	Weight (Tons)	Material		Unit Cost	Total	ITEM #
		0	HMA Surface Course, MIX "D" N50	@		\$0.00	40603335
611	2	68	HMA Surface Course, MIX "D" N70	@	\$80	\$5,474.56	40603340
		0	Poly HMA Surface Course, MIX "F" N90	@		\$0.00	40603595
		0	Poly HMA Surface Course, SMA N80	@		\$0.00	40603153
		0	HMA Binder course, IL-19, N50	@		\$0.00	40603080
611	7.75	265	HMA Binder course, IL-19, N70	@	\$70	\$18,562.18	40603085
		0	HMA Binder course, IL-19, N90	@		\$0.00	40603090
		0	Poly HMA Binder course, IL-19, N90	@		\$0.00	40603240
		0	HMA Binder course, SMA, N80	@		\$0.00	40603148
	NA	NA	12" Aggregate Subgrade	@		\$0.00	30300112
Total						\$24,036.74	

Modified AASHTO							
Area (Sq. Yd.)	Height (inches)	Weight (Tons)	Material		Unit Cost	Total	ITEM #
		0	HMA Surface Course, MIX "D" N50	@		\$0.00	40603335
611	2	68	HMA Surface Course, MIX "D" N70	@	\$80	\$5,474.56	40603340
		0	Poly HMA Surface Course, MIX "F" N90	@		\$0.00	40603595
		0	Poly HMA Surface Course, SMA N80	@		\$0.00	40603153
		0	HMA Binder course, IL-19, N50	@		\$0.00	40603080
611	11	376	HMA Binder course, IL-19, N70	@	\$70	\$26,346.32	40603085
		0	HMA Binder course, IL-19, N90	@		\$0.00	40603090
		0	Poly HMA Binder course, IL-19, N90	@		\$0.00	40603240
		0	HMA Binder course, SMA, N80	@		\$0.00	40603148
	NA	NA	12" Aggregate Subgrade	@		\$0.00	30300112
Total						\$31,820.88	

Composite							
Area (Sq. Yd.)	Height (inches)	Weight (Tons)	Material		Unit Cost	Total	ITEM #
		0	HMA Surface Course, MIX "D" N50	@		\$0.00	40603335
611	2	68	HMA Surface Course, MIX "D" N70	@	\$80	\$5,474.56	40603340
		0	Poly HMA Surface Course, MIX "F" N90	@		\$0.00	40603595
		0	Poly HMA Surface Course, SMA N80	@		\$0.00	40603153
611	10	NA	PCC Base Course	@	\$55	\$33,605.00	35300410
	NA	NA	12" Aggregate Subgrade	@		\$0.00	30300112
Total						\$39,079.56	

First Cost Analysis of Widening Project

Date: 1/13/2014
 Quantities by: ONP
 Unit prices by: MM

Checked by:
 Checked by:
 Net Length

Route Highland Ave.
 Section 3941-R
 County Cook
 Project Wolf Road (IL 21 to Hintz Rd)
 Contract 62254

Mechanistic Flexible							
Area (Sq. Yd.)	Height (inches)	Weight (Tons)	Material		Unit Cost	Total	ITEM #
		0	HMA Surface Course, MIX "D" N50	@		\$0.00	40603335
200	2	22	HMA Surface Course, MIX "D" N70	@	\$80	\$1,792.00	40603340
		0	Poly HMA Surface Course, MIX "F" N90	@		\$0.00	40603595
		0	Poly HMA Surface Course, SMA N80	@		\$0.00	40603153
		0	HMA Binder course, IL-19, N50	@		\$0.00	40603080
200	5	56	HMA Binder course, IL-19, N70	@	\$70	\$3,920.00	40603085
		0	HMA Binder course, IL-19, N90	@		\$0.00	40603090
		0	Poly HMA Binder course, IL-19, N90	@		\$0.00	40603240
		0	HMA Binder course, SMA, N80	@		\$0.00	40603148
	NA	NA	12" Aggregate Subgrade	@		\$0.00	30300112
Total						\$5,712.00	

Modified AASHTO							
Area (Sq. Yd.)	Height (inches)	Weight (Tons)	Material		Unit Cost	Total	ITEM #
		0	HMA Surface Course, MIX "D" N50	@		\$0.00	40603335
200	2	22	HMA Surface Course, MIX "D" N70	@	\$80	\$1,792.00	40603340
		0	Poly HMA Surface Course, MIX "F" N90	@		\$0.00	40603595
		0	Poly HMA Surface Course, SMA N80	@		\$0.00	40603153
		0	HMA Binder course, IL-19, N50	@		\$0.00	40603080
200	6.5	73	HMA Binder course, IL-19, N70	@	\$70	\$5,096.00	40603085
		0	HMA Binder course, IL-19, N90	@		\$0.00	40603090
		0	Poly HMA Binder course, IL-19, N90	@		\$0.00	40603240
		0	HMA Binder course, SMA, N80	@		\$0.00	40603148
	NA	NA	12" Aggregate Subgrade	@		\$0.00	30300112
Total						\$6,888.00	

Composite							
Area (Sq. Yd.)	Height (inches)	Weight (Tons)	Material		Unit Cost	Total	ITEM #
		0	HMA Surface Course, MIX "D" N50	@		\$0.00	40603335
200	2	22	HMA Surface Course, MIX "D" N70	@	\$80	\$1,792.00	40603340
		0	Poly HMA Surface Course, MIX "F" N90	@		\$0.00	40603595
		0	Poly HMA Surface Course, SMA N80	@		\$0.00	40603153
200	5	NA	PCC Base Course	@	\$40	\$8,000.00	35300410
	NA	NA	12" Aggregate Subgrade	@		\$0.00	30300112
Total						\$9,792.00	