Illinois Department of Transportation

To:	John Fortmann	Attn: District One
From:	John D. Baranzelli	
Subject:	Pavement Design	
Date:	October 14, 2014	

FAI Route 55 (US 45)
Lake County
From Grass Lake Road to Country Place

The project, submitted to BDE by memo dated November 6, 2014, will reconstruct US 45 from Country Place to north of Independence Boulevard. Old US 45 will remain connected to the new western alignment of US 45. Grass Lake Road will be realigned and reconstructed to form the west leg of the intersection of US 45 with Millburn Road. US 45 is under IDOT jurisdiction, while Grass Lake Road and Independence Boulevard are local jurisdiction. Old US 45 may be subject to jurisdictional transfer to a local entity, and will be designed as an unmarked state route. The LCCA favored a rigid design for US 45 by greater than 10%.

The approved pavement design is as follows:

US 45 (Pavement Reconstruction)

9.5 inches of Jointed PCC Pavement with Tied PCC Curb & Gutter
12 inches of Aggregate Subgrade Improvement

Old US 45 (Pavement Reconstruction)

7.75 inches of Full Depth HMA Pavement with HMA Shoulders
- 2 inches of HMA Surface Course, Mix "D", N70
- 5.75 inches of HMA Base Course, IL-19.0, N70

12 inches of Aggregate Subgrade Improvement

Grass Lake Road (Pavement Reconstruction)

7.75 inches of Full Depth HMA Pavement with HMA Shoulders
- 2 inches of HMA Surface Course, Mix "D", N70
- 5.75 inches of HMA Base Course, IL-19.0, N70

12 inches of Aggregate Subgrade Improvement

Independence Boulevard (Pavement Reconstruction)

6.75 inches of Full Depth HMA Pavement with HMA Shoulders
- 2 inches of HMA Surface Course, Mix "D", N70
- 4.75 inches of HMA Base Course, IL-19.0, N70

12 inches of Aggregate Subgrade Improvement

US 45 (Temporary Pavement)

Option 1

10 inches of Full Depth Temporary HMA Pavement
- 2 inches of HMA Surface Course, Mix "D", N50
- 8 inches of HMA Binder Course, IL-19.0, N50

4 inches of Subgrade Granular Material Type B (CA-6)

Option 2

8 inches of Temporary PCC Pavement

4 inches of Subgrade Granular Material Type B (CA-6)

Grass Lake Road (Temporary Pavement)

Option 1

8 inches of Full Depth Temporary HMA Pavement
- 2 inches of HMA Surface Course, Mix "D", N50
- 6 inches of HMA Binder Course, IL-19.0, N50

4 inches of Subgrade Granular Material Type B (CA-6)

Option 2

8 inches of Temporary PCC Pavement

4 inches of Subgrade Granular Material Type B (CA-6)

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: Melchor Mangoba / Ojas Patel

Subject: Pavement Analysis*

Date: November 6, 2014

*Route: US Route 45
Limits: n/o Grass Lake Rd to County Pl
Section: 39R
Current target: 01CY16

County: Lake
Contract No.: 60T75
Job No.: D-91-424-12

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 exceeds 4,750 Square Yards. NOTE: Review is only required for US Route 45 and Old US Route 45 as these roadways are under IDOT jurisdiction. Grass Lake Road and Independence Boulevard are local jurisdiction and are included for your information. The following is the scope of the project:

US 45 - New construction of a western bypass from Country Place to north of Independence Boulevard. Old US 45 will maintain connectivity to the new western alignment of US 45.

Grass Lake Road – Realign and reconstruct to form the west leg of the intersection of US 45 and Millburn Road.

A 20-year pavement analysis was performed on the above segments. We recommend a mechanistic-rigid pavement design based on the life cycle cost analysis which favors PCC pavement by 11% for US 45 and a mechanistic-flexible pavement design based on the life cycle cost analysis which favors HMA pavement by 25.8% for Old US 45. Grass Lake Road and Independence Boulevard favor HMA pavement based on life cycle cost analysis.

Our recommendation is as follows:

<u>US 45</u>
New Construction / Reconstruction
PCC Curb and Gutter (Tied)
- 9 ½" PCC Pavement[1]
- 12" Aggregate Subgrade Improvement[5]

OLD US 45
Reconstruction
HMA Shoulder[7]
- 7 ¾" Full Depth HMA[6]
  - 2" HMA Surface Course, Mix "D", N70[2]
  - 5 ¾" HMA Base Course, IL-19.0, N70[3]
- 12" Aggregate Subgrade Improvement[5]

Grass Lake Road[8]
Reconstruction
PCC Curb and Gutter/Portions HMA Shoulder[7]
- 7 ¾" Full Depth HMA[6]
  - 2" HMA Surface Course, Mix "D", N70[2]
  - 5 ¾" HMA Base Course, IL-19.0, N70[3]
- 12" Aggregate Subgrade Improvement[5]

Independence Blvd[8]
Reconstruction
PCC Curb and Gutter
- 6 ¾" Full Depth HMA[6]
  - 2" HMA Surface Course, Mix "D", N70[2]
  - 4 ¾" HMA Base Course, IL-19.0, N70[4]
- 12" Aggregate Subgrade Improvement[5]

US 45 (Temporary Pavement)

Option 1[9]
- 10" Full Depth Temporary HMA Pavement[10]
  - 2" HMA Surface Course, Mix "D", N50
  - 6" HMA Binder Course, IL-19.0, N50
- 4" Subbase Granular Material Type B (CA-6)[11]

Option 2[9]
- 8" Temporary PCC Pavement[10]
- 4" Subbase Granular Material Type B (CA-6)[11]

Grass Lake Road (Temporary Pavement)[8]

Option 1[9]
- Temporary Pavement
  - 8" Full Depth Temporary HMA Pavement[10]
    - 2" HMA Surface Course, Mix "D", N50
    - 6" HMA Binder Course, IL-19.0, N50
  - 4" Subbase Granular Material Type B (CA-6)[11]

Option 2[9]
- Temporary Pavement
  - 8" Temporary PCC Pavement[10]
  - 4" Subbase Granular Material Type B (CA-6)[11]

[1]Designer Note 1: Use pay item **42000411, PORTLAND CEMENT CONCRETE PAVEMENT 9 ½" (JOINTED),** paid for in square yards.

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

[3]Designer Note 3: Use pay item **35501307, HOT-MIX ASPHALT BASE COURSE, 5 ¾",** paid for in square yards.

[4]Designer Note 4: Use pay item **35501303, HOT-MIX ASPHALT BASE COURSE, 4 ¾",** paid for in square yards.

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

[6]Designer 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.

[7]Designer Note 7: The designer shall utilize IDOT Highway Standards in conjunction with guidelines in BDE Manual 34-2.02 if necessary for shoulder thicknesses.

[8]Designer Note 8: Grass Lake Road and Independence Boulevard are subject to local jurisdictional approval and concurrence.

[9]Designer Note 9: The contractor shall have the option of constructing either material type if both Portland cement concrete and HMA are shown in the plans. For quantity estimation purposes, excavation quantities should be estimated assuming the thicker design if both options are shown in the plans.

[10]Designer Note 10: Use pay item **Z0062456, TEMPORARY PAVEMENT**, paid in square yards.

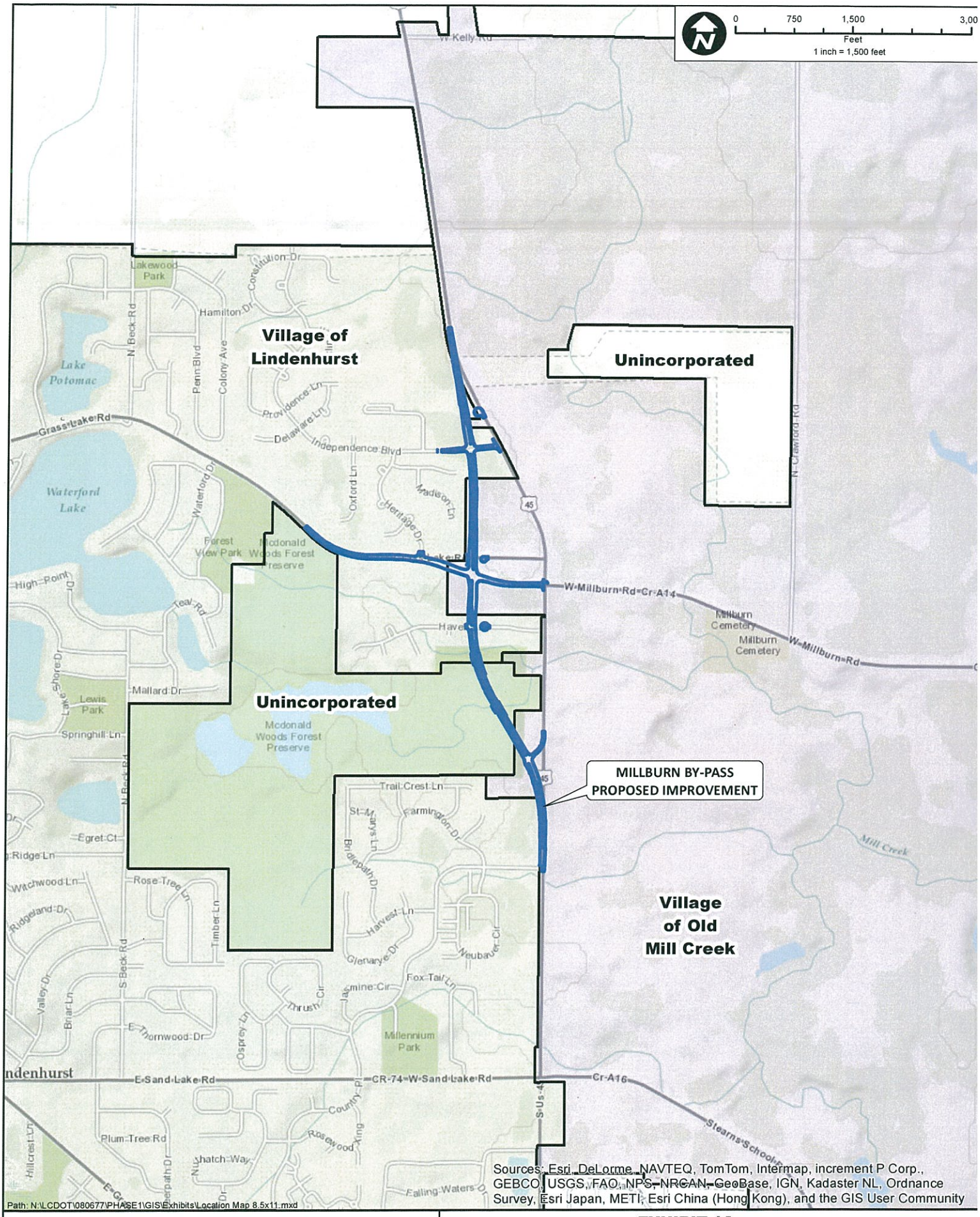
The HMA temporary pavement shall consist of two items, HMA binder course and HMA surface course. Include both items in the HMA mix table requirements.

When PC Temp Pavement is used as an option, the following note shall appear on the plans adjacent to the HMA mix table: "PC Concrete temporary pavement shall consist of Class PV Concrete meeting the requirements of Art.1020 of the Standard Specifications. Temporary PCC pavement does not require dowel bars.

[11]Designer Note 11: Use pay item **31101200, SUBBASE GRANULAR MATERIAL, TYPE B 4"**, paid in square yards

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

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



Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

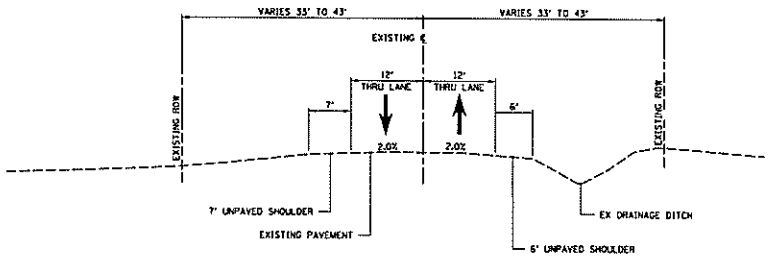
Path: N:\LCDOT\080677\PHASE1\GIS\Exhibits\Location Map 8.5x11.mxd

ILLINOIS DEPARTMENT OF TRANSPORTATION

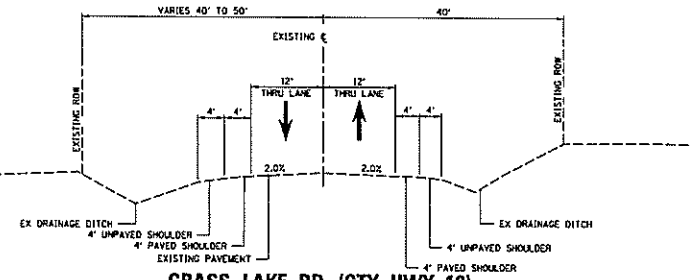
EXHIBIT 1A
US ROUTE 45 - MILLBURN BYPASS
LOCATION MAP

Scope of Work

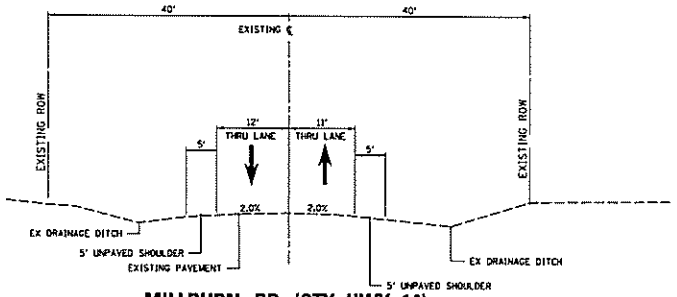
The U.S. Route 45 Bypass will be constructed form Country Place on the south to 1,500 feet north of Independence Boulevard on the north, a distance of 7,200 feet. The U.S. Route 45 Bypass will consist of two lanes in each direction with curb and gutter, a raised median, and channelized turn lanes at intersections. In addition, Grass Lake Road will be realigned south of its current location to form the west leg of the intersection of U.S. Route 45 and Millburn Road. The project is located within the Villages of Lindenhurst and Old Mill Creek, as well as unincorporated portions of Lake County within Lake Villa and Newport Townships.



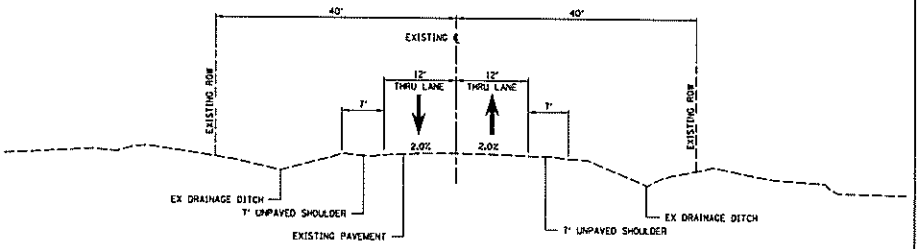
U.S. ROUTE 45



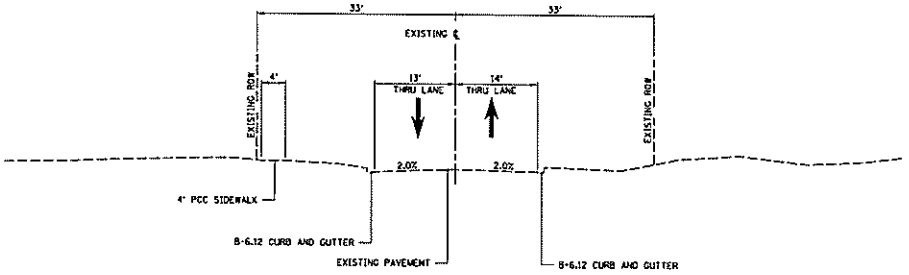
GRASS LAKE RD (CTY HWY 18)



MILLBURN RD (CTY HWY 14)



EXISTING U.S. ROUTE 45
(LOCATION OF OLD U.S. ROUTE 45)



INDEPENDENCE BOULEVARD

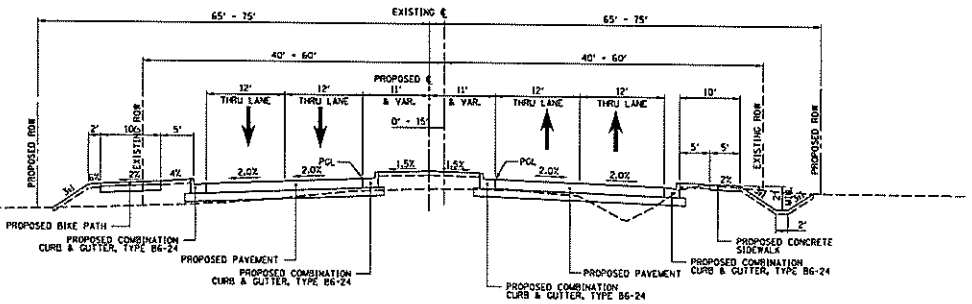
EXHIBIT 9a

DESIGNED MJH/MCW	REVISED	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	EXISTING TYPICAL SECTIONS U.S. ROUTE 45 /GRASS LAKE ROAD /MILLBURN ROAD
DRAWN MJH/MCW	REVISED		
CHECKED MJH	REVISED		
DATE NOVEMBER 2013	REVISED		SCALE: SHEET NO.3 OF 17 SHEETS STA. TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
344	05-00262-06-RO	LAKE	3	17

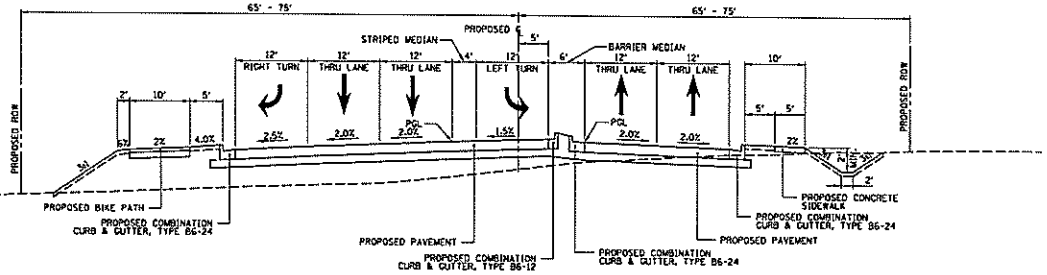
CONTRACT NO.
ILLINOIS FED. AID PROJECT

STA. 111+40 TO STA. 115+02
STA. 124+88 TO STA. 134+38
STA. 151+70 TO STA. 156+79
STA. 166+76 TO STA. 177+48



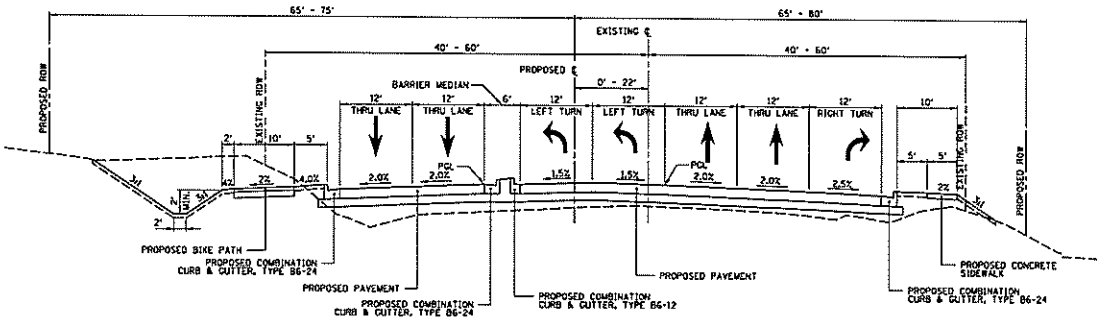
U.S. ROUTE 45

STA. 101+68 TO STA. 111+40
STA. 115+02 TO STA. 124+88
STA. 156+79 TO STA. 166+76



U.S. ROUTE 45 AT INTERSECTION (SINGLE LEFT)

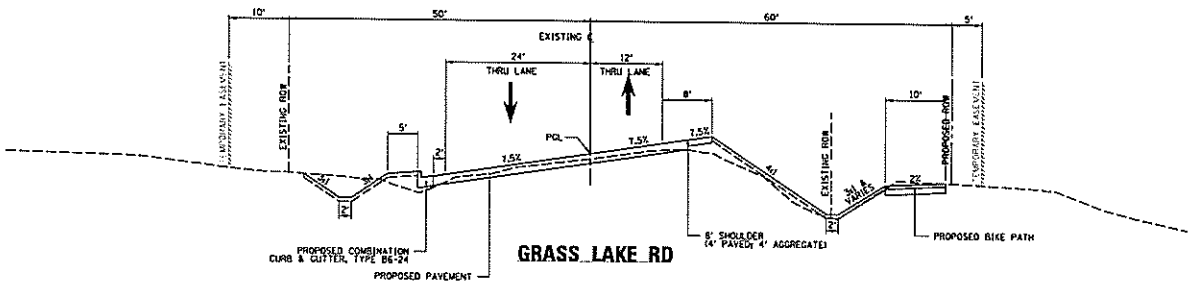
STA. 134+38 TO STA. 151+70



U.S. ROUTE U.S. 45 AT INTERSECTION (DUAL LEFT)

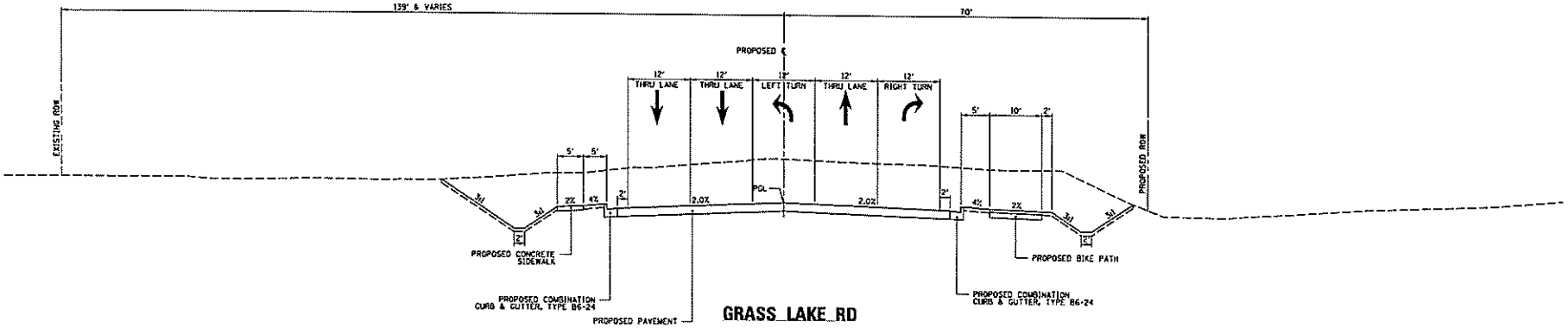
EXHIBIT 9b

	DESIGNED MJH/MCW	REVISED	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	PROPOSED TYPICAL SECTIONS U.S. ROUTE 45	F.A. RTE. 344 · SECTION 05-00252-06-RO · COUNTY LAKE · TOTAL SHEETS 4 · SHEET NO. 17
	DRAWN MJH/MCW	REVISED			CONTRACT NO.
	CHECKED MJH	REVISED		SCALE: SHEET NO.4 OF 17 SHEETS STA. TO STA.	ILLINOIS FED. AID PROJECT
	DATE NOVEMBER 2013	REVISED			



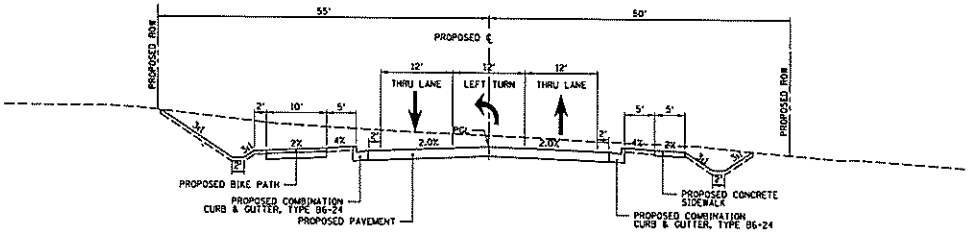
GRASS LAKE RD

STA. 295+00 TO 299+00



GRASS LAKE RD

STA. 308+50
(TYPICAL VARIES DUE TO AUXILARY TURN LANES)

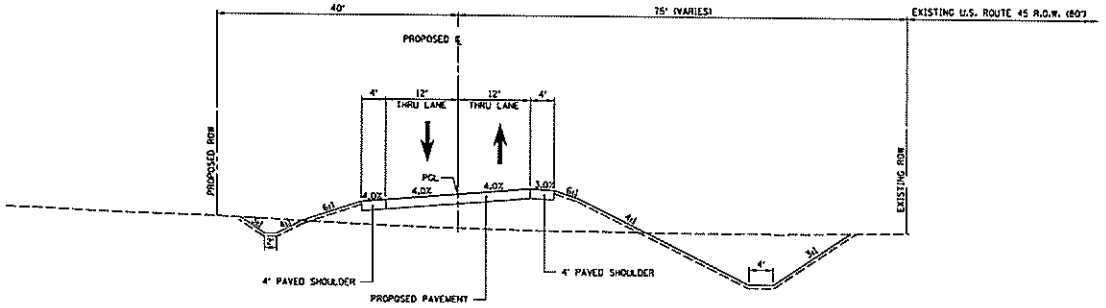


GRASS LAKE RD

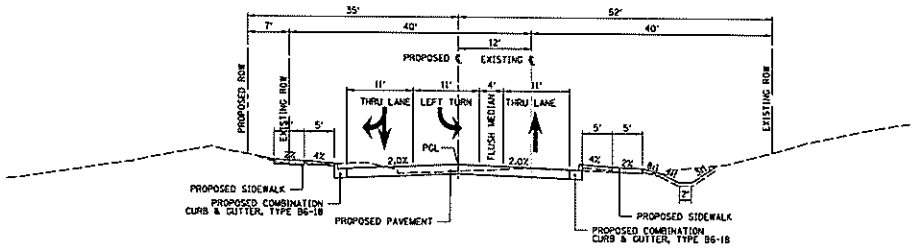
STA. 316+84 TO 319+00

EXHIBIT 9c

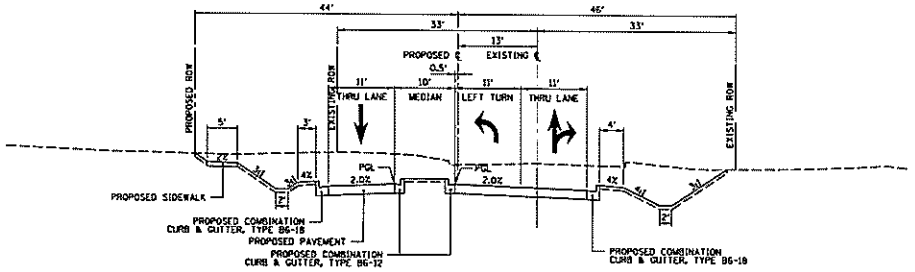
[illegible]	[illegible]	DESIGNED	MJH/MCW	REVISED	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	PROPOSED TYPICAL SECTIONS GRASS LAKE ROAD	F.A. RTE. 344	SECTION 05-00262-06-RD	COUNTY LAKE	TOTAL SHEETS 5	SHEET NO. 17
		DRAWN	MJH/MCW	REVISED					CONTRACT NO.		
		CHECKED	MJM	REVISED		SCALE: SHEET NO.5 OF 17 SHEETS STA. TO STA.			ILLINOIS FED. AID PROJECT		
		DATE	NOVEMBER 2013	REVISED							



OLD U.S. ROUTE 45



INDEPENDENCE BOULEVARD
STA. 651 + 50



INDEPENDENCE BOULEVARD
STA. 648 + 50

EXHIBIT 9d

FILE NAME	USER NAME = mcw/dean	DESIGNED	MJH/MCW	REVISED	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	PROPOSED TYPICAL SECTIONS OLD U.S. ROUTE 45 & INDEPENDENCE BOULEVARD	F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		DRAWN	MJH/MCW	REVISED			344	05-00262-06-RO	LAKE	6	17
	PLOT SCALE = 10'	CHECKED	MJH	REVISED					CONTRACT NO.		
	PLOT DATE = 10/14/2013	DATE	NOVEMBER 2013	REVISED		SCALES SHEET NO. 6 OF 17 SHEETS STA. TO STA.			ILLINOIS FED. AID PROJECT		

BDE 5401 Template (Rev. 09/05/2013)

IDOT MECHANISTIC PAVEMENT DESIGN

Printed: 11/13/2014

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route:	OLD US 45	Comments:	US 45 @ Millburn Bypass
Section:	39R		
County:	Lake	Design Date:	10/21/2014 ONP
Location:	Millburn Bypass	Modify Date:	

	ADT	Year
<-- BY		
<-- BY		
Current:	5,000	2009
Future:	5,000	2040

Facility Type: Unmarked State Route

# 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:	2016
Design Period (DP) =	20 years

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane	
PV =	No Min	4,560	91.2%	P =	50%
SU =	No Min	250	5.0%	S =	50%
MU =	No Min	190	3.8%	M =	50%
Struct. Design ADT =		5,000	(2026)		

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT

Cpv =	0.15	
Csu =	112.06	
Cmu =	385.44	
TF flexible (Actual) =	1.02	(Actual ADT)
TF flexible (Min) =	No Min	(Min ADT Fig. 54-2.C)

RIGID PAVEMENT

Cpv =	0.15	
Csu =	135.78	
Cmu =	567.21	
TF rigid (Actual) =	1.42	(Actual ADT)
TF rigid (Min) =	No Min	(Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement

Use TF flexible =	1.02	
PG Grade Lower Binder Lifts =	PG 64-22	(Fig. 53-4.R)
HMA Mixture Temp. =	73.0	deg. F (Fig. 54-5.C)
Design HMA Mixture Modulus (E_{HMA}) =	760	ksi (Fig. 54-5.D)
Design HMA Strain (ε_{HMA}) =	120	(Fig. 54-5.E)
Full Depth HMA Design Thickness =	7.75	in. (Fig. 54-5.F)
Limiting Strain Criterion Thickness =	14.00	in. (Fig. 54-5.I)
Use Full-Depth HMA Thickness =	**7.75**	**inches**

Goto Map

Goto Map

JPC Pavement

Use TF rigid =	1.42	
Edge Support =	Tied	Shoulder or C.&G.
Rigid Pavt Thick. =	**8.00**	**in. (Fig. 54-4.E)**

CRC Pavement

Use TF rigid =	1.42	
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

Use TF flexible =	1.02	
HMA Overlay Design Thickness =	5.50	in. (Fig. 54-5.U)
Limiting Strain Criterion Thickness =		in. (Fig. 54-5.V)
Use HMA Overlay Thickness =	**999.00**	**inches**

Goto Map

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

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)

	Min. Str. Design Traffic (Fig 54-2.C)		
Facility Type	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

	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4.C)		Flexible (Fig. 54-5.B)	
Class	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

	Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)					
	Rural			Urban		
Number of Lanes	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%

BDE 5401 Template (Rev. 09/05/2013) Printed: 11/13/2014

LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT

Standard Design

ROUTE	OLD US 45
SECTION	39R
COUNTY	Lake
LOCATION	Millburn Bypass
FACILITY TYPE	NON-INTERSTATE

PROJECT LENGTH		360 FT	==> 0.07 Miles
# OF CENTERLINES		1 CL	
# OF LANES		2 LANES	
# OF EDGES		2 EP	
LANE WIDTH - AVERAGE		12 FT	
SHOULDER WIDTH	HMA Left	4 FT	
	HMA Right	4 FT	
	Total Width of Paved Shoulders	8 FT	

PAVEMENT THICKNESS (FLEXIBLE)	7.75 IN	14.00 IN MAX
SHOULDER THICKNESS	8.00 IN	HMA_SD Standard Design
POLICY OVERLAY THICKNESS	2.25 IN	

FLEX PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	No Min	1.02	1.02

Read Me!

HMA COST PER TON	UNIT PRICE
HMA SURFACE	$96.09 / TON
HMA TOP BINDER	$59.71 / TON
HMA LOWER BINDER	$59.71 / TON
HMA BINDER (LEVELING)	$77.90 / TON
HMA SHOULDER	$72.00 / TON

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
HMA PAVEMENT (FULL-DEPTH)	(7.75")	960	SQ YD *	$30.10 / SQ YD	$28,896 ~
HMA SURFACE COURSE	(2.00")	108	TONS	$96.09 / TON	$0
HMA TOP BINDER COURSE	(2.25")	124	TONS	$59.71 / TON	$0
HMA LOWER BINDER COURSE	(3.50")	196	TONS	$59.71 / TON	$0
HMA SHOULDER	(8.00")	143	TONS	$72.00 / TON	$10,322 ~
CURB & GUTTER		0	LIN FT	$30.00 / LIN FT	$0
SUBBASE GRAN MATL TY C (TONS)		0	TONS	$25.00 / TON	$0
IMPROVED SUBGRADE:	Aggregate	1,372	SQ YD	$7.00 / SQ YD	$9,604
Reserved For User Supplied Item		0	UNITS	$0.00 / UNITS	$0
Reserved For User Supplied Item		0	UNITS	$0.00 / UNITS	$0
PAVEMENT REMOVAL		960	SQ YD	$15.00 / SQ YD	$14,400
SHOULDER REMOVAL		320	SQ YD	$10.00 / SQ YD	$3,200

Note: * Denotes User Supplied Quantity

FLEXIBLE CONSTRUCTION INITIAL COST	$66,422
FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE	$39,732

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	UNIT COST
ROUTINE MAINTENANCE ACTIVITY			$0.00 LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	Surface Mix	$10.84 / SQ YD
HMA OVERLAY PVMT	(2.25")		$11.43 / SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	$8.11 / SQ YD
HMA BINDER MIX	(0.75")	eling Binder Mix	$3.31 / 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	$80.76 / 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	$78.72 / 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	$96,238
FLEXIBLE TOTAL ANNUAL COST PER MILE	$57,568

HMA_SD

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

11/13/14

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%	720	LIN FT	$2.00		$1,440	
	CNTR LINE JOINT R&S	100.00%	360	LIN FT	$2.00		$720	
	RNDM / THRM CRACK R&S	50.00%	396	LIN FT	$2.00		$792	
	PD PVMT PATCH M&F SURF	0.10%	1	SQ YD	$80.76		$81	
	PWFn =	0.8626		PW =	0.8626	X	$3,033	$2,616
YEAR 10								
	LONG SHLD JT R&S	100.00%	720	LIN FT	$2.00		$1,440	
	CNTR LINE JOINT R&S	100.00%	360	LIN FT	$2.00		$720	
	RNDM / THRM CRACK R&S	50.00%	396	LIN FT	$2.00		$792	
	PD PVMT PATCH M&F SURF	0.50%	5	SQ YD	$80.76		$404	
	PWFn =	0.7441		PW =	0.7441	X	$3,356	$2,497
YEAR 15								
	MILL PVMT & SHLD 2.00"	100.00%	1,280	SQ YD	$3.00		$3,840	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	10	SQ YD	$78.72		$787	
	HMA OVERLAY PVMT 2.00"	100.00%	960	SQ YD	$10.84		$10,403	
	HMA OVERLAY SHLD 2.00 "	100.00%	320	SQ YD	$8.06		$2,580	
	PWFn =	0.6419		PW =	0.6419	X	$17,610	$11,303
YEAR 20								
	LONG SHLD JT R&S	100.00%	720	LIN FT	$2.00		$1,440	
	CNTR LINE JOINT R&S	100.00%	360	LIN FT	$2.00		$720	
	RNDM / THRM CRACK R&S	50.00%	396	LIN FT	$2.00		$792	
	PD PVMT PATCH M&F SURF	0.10%	1	SQ YD	$80.76		$81	
	PWFn =	0.5537		PW =	0.5537	X	$3,033	$1,679
YEAR 25								
	LONG SHLD JT R&S	100.00%	720	LIN FT	$2.00		$1,440	
	CNTR LINE JOINT R&S	100.00%	360	LIN FT	$2.00		$720	
	RNDM / THRM CRACK R&S	50.00%	396	LIN FT	$2.00		$792	
	PD PVMT PATCH M&F SURF	0.50%	5	SQ YD	$80.76		$404	
	PWFn =	0.4776		PW =	0.4776	X	$3,356	$1,603
	HMA_SD							
YEAR 30	NON-INTERSTATE							
	MILL PVMT & SHLD 2.00"	100.00%	1,280	SQ YD	$3.00		$3,840	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	19	SQ YD	$78.72		$1,496	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	3	SQ YD	$78.06		$234	
	HMA OVERLAY PVMT 2.25 "	100.00%	960	SQ YD	$11.43		$10,971	
	HMA OVERLAY SHLD 2.25 "	100.00%	320	SQ YD	$9.07		$2,903	
	PWFn =	0.4120		PW =	0.4120	X	$19,444	$8,011
YEAR 35								
	LONG SHLD JT R&S	100.00%	720	LIN FT	$2.00		$1,440	
	CNTR LINE JOINT R&S	100.00%	360	LIN FT	$2.00		$720	
	RNDM / THRM CRACK R&S	50.00%	396	LIN FT	$2.00		$792	
	PD PVMT PATCH M&F SURF	0.10%	1	SQ YD	$80.76		$81	
	PWFn =	0.3554		PW =	0.3554	X	$3,033	$1,078
YEAR 40								
	LONG SHLD JT R&S	100.00%	720	LIN FT	$2.00		$1,440	
	CNTR LINE JOINT R&S	100.00%	360	LIN FT	$2.00		$720	
	RNDM / THRM CRACK R&S	50.00%	396	LIN FT	$2.00		$792	
	PD PVMT PATCH M&F SURF	0.50%	5	SQ YD	$80.76		$404	
	PWFn =	0.3066		PW =	0.3066	X	$3,356	$1,029
								$29,816
	ROUTINE MAINTENANCE ACTIVITY		0.14	Lane Miles	0.00		$0	$0
					MAINTENANCE LIFE-CYCLE COST			$29,816
45	YEAR LIFE CYCLE	CRFn = 0.0407852			MAINTENANCE ANNUAL COST PER MILE			$17,835

PCC PAVEMENT

JPCP

ROUTE	OLD US 45
SECTION	39R
COUNTY	Lake
LOCATION	Millburn Bypass
FACILITY TYPE	NON-INTERSTATE

PROJECT LENGTH			360 FT	= = > 0.07 Miles
# OF CENTERLINES			1 CL	
# OF LANES			2 LANES	
# OF EDGES			2 EP	
LANE WIDTH - AVERAGE			12 FT	
SHOULDER WIDTH	PCC	Left	4 FT	
	PCC	Right	4 FT	
	Total Width of Paved Shoulders		8 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
	No Min	1.42	1.42
Worksheet Construction Type is Reconstruction		The Pavement Type is	JPCP

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE		COST
JPC PAVEMENT	(8.00")	960	SQ YD	$44.48	/ SQ YD	$42,701
PAVEMENT REINFORCEMENT		0	SQ YD	$22.00	/ SQ YD	$0
STABILIZED SUBBASE	(4.00")	1,080	SQ YD	$19.00	/ SQ YD	$20,520
PCC SHOULDERS	(8.00" to 8.00")	320	SQ YD	$40.00	/ SQ YD	$12,800
CURB & GUTTER		0	LIN FT	$30.00	/ LIN FT	$0
SUBBASE GRAN MATL TY C	(~ 1.72")	43	TONS	$25.00	/ TON	$1,075
IMPROVED SUBGRADE:	Aggregate	1,320	SQ YD	$7.00	/ SQ YD	$9,240
Reserved For User Supplied Item		0	UNITS	$0.00	/ UNITS	$0
Reserved For User Supplied Item		0	UNITS	$0.00	/ UNITS	$0
PAVEMENT REMOVAL		960	SQ YD	$15.00	/ SQ YD	$14,400
SHOULDER REMOVAL		320	SQ YD	$10.00	/ SQ YD	$3,200

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION INITIAL COST	$103,936
RIGID CONSTRUCTION ANNUAL COST PER MILE	$62,173

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	T	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY				$0.00	/ LANE-MILE / YEAR
HMA POLICY OVERLAY	(2.50")		2.50		
HMA POLICY OVERLAY PVMT	(2.50")		2.50	$12.54	/ SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	1.50	$8.11	/ SQ YD
HMA BINDER MIX	(1.00")	eling Binder Mix	1.00	$4.42	/ SQ YD
HMA POLICY OVERLAY SHLD	(2.50")	Shoulder Mix	2.50	$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	$78.07	/ SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.50")		Surface Mix	2.50	$83.45	/ 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	$121,063
RIGID TOTAL ANNUAL COST PER MILE	$72,418

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE 11/13/14

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%	1	SQ YD	$150.00		$150	
	PWFn =	0.7441		PW =	0.7441	X	$150	$112
YEAR 15								
	PAVEMENT PATCH CLASS B	0.20%	2	SQ YD	$150.00		$300	
	PWFn =	0.6419		PW =	0.6419	X	$300	$193
YEAR 20								
	PAVEMENT PATCH CLASS B	2.00%	19	SQ YD	$150.00		$2,850	
	SHOULDER PATCH CLASS C	0.50%	2	SQ YD	$145.00		$290	
	LONGITUDINAL SHLD JT R&S	100.00%	720	LIN FT	$2.00		$1,440	
	CENTERLINE JT R&S	100.00%	360	LIN FT	$2.00		$720	
	PWFn =	0.5537		PW =	0.5537	X	$5,300	$2,934
YEAR 25								
	PAVEMENT PATCH CLASS B	3.00%	29	SQ YD	$150.00		$4,350	
	SHOULDER PATCH CLASS C	1.00%	3	SQ YD	$145.00		$435	
	PWFn =	0.4776		PW =	0.4776	X	$4,785	$2,285
YEAR 30	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	38	SQ YD	$150.00		$5,700	
	SHOULDER PATCH CLASS C	1.50%	5	SQ YD	$145.00		$725	
	HMA POLICY OVERLAY 2.5" (PVMT)	100.00%	960	SQ YD	$12.54		$12,035	
	HMA POLICY OVERLAY 2.5" (SHLD)	100.00%	320	SQ YD	$10.08		$3,226	
	PWFn =	0.4120		PW =	0.4120	X	$21,686	$8,934
YEAR 35	NON-INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	720	LIN FT	$2.00		$1,440	
	CENTERLINE JT R&S	100.00%	360	LIN FT	$2.00		$720	
	RANDOM CRACK R&S	50.00%	360	LIN FT	$2.00		$720	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	230	LIN FT	$2.00		$460	
	PD PVMT PATCH M&F HMA 2.50"	0.10%	1	SQ YD	$83.45		$83	
	PWFn =	0.3554		PW =	0.3554	X	$3,423	$1,216
YEAR 40	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	5	SQ YD	$150.00		$750	
	LONGITUDINAL SHLD JT R&S	100.00%	720	LIN FT	$2.00		$1,440	
	CENTERLINE JT R&S	100.00%	360	LIN FT	$2.00		$720	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	346	LIN FT	$2.00		$692	
	RANDOM CRACK R&S	50.00%	360	LIN FT	$2.00		$720	
	PD PVMT PATCH M&F HMA 2.50"	0.50%	5	SQ YD	$83.45		$417	
	PWFn =	0.3066		PW =	0.3066	X	$4,739	$1,453
								$17,127
	ROUTINE MAINTENANCE ACTIVITY		0.14	Lane Miles	$0.00		$0	$0
					MAINTENANCE LIFE-CYCLE COST			$17,127
45	YEAR LIFE CYCLE	CRFn = 0.0407852			MAINTENANCE ANNUAL COST PER MILE			$10,245

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : 11/5/14 10:27 AM

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	$103,936	$66,422
		ANNUAL COST PER MILE	$62,173	$39,732
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	$17,127	$29,816
		ANNUAL COST PER MILE	$10,245	$17,835
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	$121,063	$96,238
		ANNUAL COST PER MILE	$72,418	$57,568

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	==========>	**HMA**	**$57,568**	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PERCENTAGE	**JPCP**	**$72,418**	**25.8%**

P:\Pavement Design Stuff\D-1\US 45 from Grass Lake Road to County Place\US 45 from Grass Lake Road to County Place Pavement Design Files\[US 45 from Gra

BDE 3401 Template (Rev. 09/05/2013)

IDOT MECHANISTIC PAVEMENT DESIGN

Printed: 11/13/2014

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route:	Grass Lake Road/W. Millburn Road	Comments:	US 45 @ Millburn Bypass
Section:	39R		Used higher traffic to/from Grass Lake Road to design new connection.
County:	Lake	Design Date:	10/21/2014 ONP <-- BY
Location:	at US 45	Modify Date:	<-- BY

	ADT	Year
Current:	9,700	2009
Future:	18,000	2040

Facility Type: Unmarked State Route

# 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:	2016
Design Period (DP) =	20 years

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane	
PV =	No Min	13,710	96.2%	P =	50%
SU =	No Min	385	2.7%	S =	50%
MU =	No Min	157	1.1%	M =	50%
Struct. Design ADT =		14,252	(2026)		

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT

Cpv =	0.15	
Csu =	112.06	
Cmu =	385.44	
TF flexible (Actual) =	1.06	(Actual ADT)
TF flexible (Min) =	No Min	(Min ADT Fig. 54-2.C)

RIGID PAVEMENT

Cpv =	0.15	
Csu =	135.78	
Cmu =	567.21	
TF rigid (Actual) =	1.43	(Actual ADT)
TF rigid (Min) =	No Min	(Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement

Use TF flexible =	1.06	
PG Grade Lower Binder Lifts =	PG 64-22	(Fig. 53-4.R)
HMA Mixture Temp. =	73.0	deg. F (Fig. 54-5.C)
Design HMA Mixture Modulus (E_{HMA}) =	760	ksi (Fig. 54-5.D)
Design HMA Strain (ε_{HMA}) =	118	(Fig. 54-5.E)
Full Depth HMA Design Thickness =	7.75	in. (Fig. 54-5.F)
Limiting Strain Criterion Thickness =	14.00	in. (Fig. 54-5.I)
Use Full-Depth HMA Thickness =	**7.75**	**inches**

Goto Map

Goto Map

JPC Pavement

Use TF rigid =	1.43	
Edge Support =	Tied	Shoulder or C.&G.
Rigid Pavt Thick. =	**8.00**	**in. (Fig. 54-4.E)**

CRC Pavement

Use TF rigid =	1.43	
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

Use TF flexible =	1.06	
HMA Overlay Design Thickness =	5.50	in. (Fig. 54-5.U)
Limiting Strain Criterion Thickness =		in. (Fig. 54-5.V)
Use HMA Overlay Thickness =	**999.00**	**inches**

Goto Map

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

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) Csu	Rigid Cmu	Flexible (Fig. 54-5.B) Csu	Flexible 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 P	Rural S	Rural M	Urban P	Urban S	Urban 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%

BDE 5401 Template (Rev. 09/05/2013) Printed: 11/13/2014

LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT

Standard Design

ROUTE	Grass Lake Road/W. Millburn Road
SECTION	39R
COUNTY	Lake
LOCATION	at US 45

FACILITY TYPE: NON-INTERSTATE

PROJECT LENGTH		2835 FT	==> 0.54 Miles
# OF CENTERLINES		2 CL	
# OF LANES		2 LANES	
# OF EDGES		2 EP	
LANE WIDTH - AVERAGE		12 FT	
SHOULDER WIDTH	HMA Left	4 FT	
	HMA Right	4 FT	
	Total Width of Paved Shoulders	8 FT	

PAVEMENT THICKNESS (FLEXIBLE)	7.75 IN	14.00 IN MAX
SHOULDER THICKNESS	8.00 IN	HMA_SH Standard Design
POLICY OVERLAY THICKNESS	2.25 IN	

FLEX PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	No Min	1.06	1.06

Read Me!

HMA COST PER TON	UNIT PRICE
HMA SURFACE	$76.66 / TON
HMA TOP BINDER	$56.84 / TON
HMA LOWER BINDER	$56.84 / TON
HMA BINDER (LEVELING)	$66.75 / TON
HMA SHOULDER	$72.00 / TON

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT		UNIT PRICE		COST	
HMA PAVEMENT (FULL-DEPTH)	(7.75")	7,560	SQ YD	*	$26.93	/ SQ YD	$203,591	~
HMA SURFACE COURSE	(2.00")	853	TONS		$76.66	/ TON	$0	
HMA TOP BINDER COURSE	(2.25")	973	TONS		$56.84	/ TON	$0	
HMA LOWER BINDER COURSE	(3.50")	1,544	TONS		$56.84	/ TON	$0	
HMA SHOULDER	(8.00")	1,129	TONS		$72.00	/ TON	$81,285	~
CURB & GUTTER		3,760	LIN FT	*	$30.00	/ LIN FT	$112,800	
SUBBASE GRAN MATL TY C (TONS)		0	TONS		$25.00	/ TON	$0	
IMPROVED SUBGRADE:	Aggregate	10,802	SQ YD		$7.00	/ SQ YD	$75,614	
Reserved For User Supplied Item		0	UNITS		$0.00	/ UNITS	$0	
Reserved For User Supplied Item		0	UNITS		$0.00	/ UNITS	$0	
PAVEMENT REMOVAL		7,560	SQ YD		$15.00	/ SQ YD	$113,400	
SHOULDER REMOVAL		2,520	SQ YD		$10.00	/ SQ YD	$25,200	

Note: * Denotes User Supplied Quantity

FLEXIBLE CONSTRUCTION INITIAL COST	$611,890
FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE	$46,479

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY			$0.00	LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	Surface Mix	$8.65	/ SQ YD
HMA OVERLAY PVMT	(2.25")		$9.31	/ SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	$6.47	/ SQ YD
HMA BINDER MIX	(0.75")	eling Binder Mix	$2.84	/ 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	$78.59	/ 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	$77.48	/ 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	$847,688
FLEXIBLE TOTAL ANNUAL COST PER MILE	$64,390

HMA_SD

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

11/13/14

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%	5,670	LIN FT	$2.00		$11,340	
	CNTR LINE JOINT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	RNDM / THRM CRACK R&S	50.00%	3,119	LIN FT	$2.00		$6,238	
	PD PVMT PATCH M&F SURF	0.10%	8	SQ YD	$78.59		$629	
	PWFn =	0.8626		PW =	0.8626	X	$29,547	$25,488
YEAR 10								
	LONG SHLD JT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	CNTR LINE JOINT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	RNDM / THRM CRACK R&S	50.00%	3,119	LIN FT	$2.00		$6,238	
	PD PVMT PATCH M&F SURF	0.50%	38	SQ YD	$78.59		$2,986	
	PWFn =	0.7441		PW =	0.7441	X	$31,904	$23,740
YEAR 15								
	MILL PVMT & SHLD 2.00"	100.00%	10,080	SQ YD	$3.00		$30,240	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	76	SQ YD	$77.48		$5,888	
	HMA OVERLAY PVMT 2.00"	100.00%	7,560	SQ YD	$8.65		$65,360	
	HMA OVERLAY SHLD 2.00 "	100.00%	2,520	SQ YD	$8.06		$20,321	
	PWFn =	0.6419		PW =	0.6419	X	$121,809	$78,185
YEAR 20								
	LONG SHLD JT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	CNTR LINE JOINT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	RNDM / THRM CRACK R&S	50.00%	3,119	LIN FT	$2.00		$6,238	
	PD PVMT PATCH M&F SURF	0.10%	8	SQ YD	$78.59		$629	
	PWFn =	0.5537		PW =	0.5537	X	$29,547	$16,359
YEAR 25								
	LONG SHLD JT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	CNTR LINE JOINT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	RNDM / THRM CRACK R&S	50.00%	3,119	LIN FT	$2.00		$6,238	
	PD PVMT PATCH M&F SURF	0.50%	38	SQ YD	$78.59		$2,986	
	PWFn =	0.4776		PW =	0.4776	X	$31,904	$15,238
	HMA_SD							
YEAR 30	NON-INTERSTATE							
	MILL PVMT & SHLD 2.00"	100.00%	10,080	SQ YD	$3.00		$30,240	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	151	SQ YD	$77.48		$11,699	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	25	SQ YD	$78.06		$1,952	
	HMA OVERLAY PVMT 2.25 "	100.00%	7,560	SQ YD	$9.31		$70,406	
	HMA OVERLAY SHLD 2.25 "	100.00%	2,520	SQ YD	$9.07		$22,861	
	PWFn =	0.4120		PW =	0.4120	X	$137,158	$56,507
YEAR 35								
	LONG SHLD JT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	CNTR LINE JOINT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	RNDM / THRM CRACK R&S	50.00%	3,119	LIN FT	$2.00		$6,238	
	PD PVMT PATCH M&F SURF	0.10%	8	SQ YD	$78.59		$629	
	PWFn =	0.3554		PW =	0.3554	X	$29,547	$10,501
YEAR 40								
	LONG SHLD JT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	CNTR LINE JOINT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	RNDM / THRM CRACK R&S	50.00%	3,119	LIN FT	$2.00		$6,238	
	PD PVMT PATCH M&F SURF	0.50%	38	SQ YD	$78.59		$2,986	
	PWFn =	0.3066		PW =	0.3066	X	$31,904	$9,780
								$235,798
	ROUTINE MAINTENANCE ACTIVITY		1.07	Lane Miles	0.00		$0	$0
					MAINTENANCE LIFE-CYCLE COST			$235,798
45	YEAR LIFE CYCLE	CRFn = 0.0407852			MAINTENANCE ANNUAL COST PER MILE			$17,911

PCC PAVEMENT

JPCP

ROUTE		Grass Lake Road/W. Millburn Road	
SECTION		39R	
COUNTY		Lake	
LOCATION		at US 45	
FACILITY TYPE		NON-INTERSTATE	
PROJECT LENGTH		2835 FT	= = > 0.54 Miles
# OF CENTERLINES		2 CL	
# OF LANES		2 LANES	
# OF EDGES		2 EP	
LANE WIDTH - AVERAGE		12 FT	
SHOULDER WIDTH	PCC Left	4 FT	
	PCC Right	4 FT	
	Total Width of Paved Shoulders	8 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
	No Min	1.43	1.43
Worksheet Construction Type is Reconstruction		The Pavement Type is	JPCP

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT		UNIT PRICE		COST
JPC PAVEMENT	(8.00")	7,560	SQ YD		$50.00	/ SQ YD	$378,000
PAVEMENT REINFORCEMENT		0	SQ YD		$22.00	/ SQ YD	$0
STABILIZED SUBBASE	(4.00")	2,700	SQ YD	*	$19.00	/ SQ YD	$51,300
PCC SHOULDERS	(8.00" to 6.00")	2,520	SQ YD		$40.00	/ SQ YD	$100,800
CURB & GUTTER		3,760	LIN FT	*	$30.00	/ LIN FT	$112,800
SUBBASE GRAN MATL TY C	(~ 1.72")	340	TONS		$25.00	/ TON	$8,500
IMPROVED SUBGRADE:	Aggregate Width = 35.0'	10,395	SQ YD		$7.00	/ SQ YD	$72,765
Reserved For User Supplied Item		0	UNITS		$0.00	/ UNITS	$0
Reserved For User Supplied Item		0	UNITS		$0.00	/ UNITS	$0
PAVEMENT REMOVAL		7,560	SQ YD		$15.00	/ SQ YD	$113,400
SHOULDER REMOVAL		2,520	SQ YD		$10.00	/ SQ YD	$25,200

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION INITIAL COST	$862,765
RIGID CONSTRUCTION ANNUAL COST PER MILE	$65,535

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	T	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY				$0.00	/ LANE-MILE / YEAR
HMA POLICY OVERLAY	(2.50")		2.50		
HMA POLICY OVERLAY PVMT	(2.50")	1.5097	2.50	$10.26	/ SQ YD
HMA SURFACE MIX	(1.50")	1.5052	Surface Mix 1.50	$6.47	/ SQ YD
HMA BINDER MIX	(1.00")	1.0150	ling Binder Mix 1.00	$3.79	/ SQ YD
HMA POLICY OVERLAY SHLD	(2.50")		Shoulder Mix 2.50	$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	$76.44	/ SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.50")		Surface Mix	2.50	$80.73	/ 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	$997,243
RIGID TOTAL ANNUAL COST PER MILE	$75,750

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE 11/13/14

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%	8	SQ YD	$150.00		$1,200	
	PWFn =	0.7441		PW =	0.7441	X	$1,200	$893
YEAR 15								
	PAVEMENT PATCH CLASS B	0.20%	15	SQ YD	$150.00		$2,250	
	PWFn =	0.6419		PW =	0.6419	X	$2,250	$1,444
YEAR 20								
	PAVEMENT PATCH CLASS B	2.00%	151	SQ YD	$150.00		$22,650	
	SHOULDER PATCH CLASS C	0.50%	13	SQ YD	$145.00		$1,885	
	LONGITUDINAL SHLD JT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	CENTERLINE JT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	PWFn =	0.5537		PW =	0.5537	X	$47,215	$26,142
YEAR 25								
	PAVEMENT PATCH CLASS B	3.00%	227	SQ YD	$150.00		$34,050	
	SHOULDER PATCH CLASS C	1.00%	25	SQ YD	$145.00		$3,625	
	PWFn =	0.4776		PW =	0.4776	X	$37,675	$17,994
YEAR 30	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	302	SQ YD	$150.00		$45,300	
	SHOULDER PATCH CLASS C	1.50%	38	SQ YD	$145.00		$5,510	
	HMA POLICY OVERLAY 2.5" (PVMT)	100.00%	7,560	SQ YD	$10.26		$77,587	
	HMA POLICY OVERLAY 2.5" (SHLD)	100.00%	2,520	SQ YD	$10.08		$25,402	
	PWFn =	0.4120		PW =	0.4120	X	$153,799	$63,363
YEAR 35	NON-INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	CENTERLINE JT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	RANDOM CRACK R&S	50.00%	2,835	LIN FT	$2.00		$5,670	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	1,814	LIN FT	$2.00		$3,628	
	PD PVMT PATCH M&F HMA 2.50"	0.10%	8	SQ YD	$80.73		$646	
	PWFn =	0.3554		PW =	0.3554	X	$32,624	$11,594
YEAR 40	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	38	SQ YD	$150.00		$5,700	
	LONGITUDINAL SHLD JT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	CENTERLINE JT R&S	100.00%	5,670	LIN FT	$2.00		$11,340	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	2,722	LIN FT	$2.00		$5,444	
	RANDOM CRACK R&S	50.00%	2,835	LIN FT	$2.00		$5,670	
	PD PVMT PATCH M&F HMA 2.50"	0.50%	38	SQ YD	$80.73		$3,068	
	PWFn =	0.3066		PW =	0.3066	X	$42,562	$13,048
								$134,478
	ROUTINE MAINTENANCE ACTIVITY		1.07	Lane Miles	$0.00		$0	$0
					MAINTENANCE LIFE-CYCLE COST			$134,478
45	YEAR LIFE CYCLE	CRFn = 0.0407852			MAINTENANCE ANNUAL COST PER MILE			$10,215

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : **11/5/14 10:15 AM**

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	$862,765	$611,890
		ANNUAL COST PER MILE	$65,535	$46,479
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	$134,478	$235,798
		ANNUAL COST PER MILE	$10,215	$17,911
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	$997,243	$847,688
		ANNUAL COST PER MILE	$75,750	$64,390

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	==========>	**HMA**	**$64,390**	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PERCENTAGE	**JPCP**	**$75,750**	**17.6%**

P:\Pavement Design Stuff\D-1\US 45 from Grass Lake Road to County Place\US 45 from Grass Lake Road to County Place Pavement Design Files\[US 45 from Gra

BDE 5401 Template (Rev. 09/05/2013)

IDOT MECHANISTIC PAVEMENT DESIGN

Printed: 11/13/2014

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route:	Independence Boulevard	Comments:	US 45 @ Millburn Bypass
Section:	39R		Used higher traffic to/from Grass Lake Road to design new connection.
County:	Lake	Design Date:	10/21/2014 ONP <-- BY
Location:	at US 45	Modify Date:	<-- BY

	ADT	Year
Current:	1,000	2009
Future:	1,000	2040

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:	2016
Design Period (DP) =	20 years

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane	
PV =	No Min	880	88.0%	P =	50%
SU =	No Min	70	7.0%	S =	50%
MU =	No Min	50	5.0%	M =	50%
Struct. Design ADT =		1,000	(2026)		

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT

Cpv =	0.15	
Csu =	109.14	
Cmu =	384.35	
TF flexible (Actual) =	0.27	(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) =	0.37	(Actual ADT)
TF rigid (Min) =	No Min	(Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement

Use TF flexible =	0.50	Per BDE 54-5.01(i)-1g
PG Grade Lower Binder Lifts =	PG 64-22	(Fig. 53-4.R)
HMA Mixture Temp. =	73.0	deg. F (Fig. 54-5.C)
Design HMA Mixture Modulus (E_{HMA}) =	760	ksi (Fig. 54-5.D)
Design HMA Strain (ε_{HMA}) =	147	(Fig. 54-5.E)
Full Depth HMA Design Thickness =	6.75	in. (Fig. 54-5.F)
Limiting Strain Criterion Thickness =	14.25	in. (Fig. 54-5.I)
Use Full-Depth HMA Thickness =	**6.75**	**inches**

Goto Map

Goto Map

JPC Pavement

Use TF rigid =	0.37	
Edge Support =	Tied	Shoulder or C.&G.
Rigid Pavt Thick. =	**7.75**	**in. (Fig. 54-4.E)**

CRC Pavement

Use TF rigid =	0.37	
IBR value =	3	
CRCP Thickness =	**5.25**	**in. (Fig. 54-4.N)**

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC

Use TF flexible =	0.50	
HMA Overlay Design Thickness =	4.75	in. (Fig. 54-5.U)
Limiting Strain Criterion Thickness =		in. (Fig. 54-5.V)
Use HMA Overlay Thickness =	**999.00**	**inches**

Goto Map

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

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) Csu	Rigid Cmu	Flexible (Fig. 54-5.B) Csu	Flexible 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 P	Rural S	Rural M	Urban P	Urban S	Urban 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%

BDE 5401 Template (Rev. 09/05/2013) Printed: 11/13/2014

LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT

Standard Design

ROUTE	Independence Boulevard
SECTION	39R
COUNTY	Lake
LOCATION	at US 45

FACILITY TYPE: NON-INTERSTATE

PROJECT LENGTH		520 FT	==> 0.10 Miles
# OF CENTERLINES		1 CL	
# OF LANES		2 LANES	
# OF EDGES		2 EP	
LANE WIDTH - AVERAGE		11 FT	
SHOULDER WIDTH	HMA Left	0 FT	
	HMA Right	0 FT	
	Total Width of Paved Shoulders	0 FT	

PAVEMENT THICKNESS (FLEXIBLE)	6.75 IN	14.25 IN MAX
SHOULDER THICKNESS	8.00 IN	Standard Design
POLICY OVERLAY THICKNESS	2.25 IN	

FLEX PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	No Min	0.27	0.27

Read Me!

HMA COST PER TON	UNIT PRICE
HMA SURFACE	$70.56 / TON
HMA TOP BINDER	$62.25 / TON
HMA LOWER BINDER	$62.25 / TON
HMA BINDER (LEVELING)	$66.41 / TON
HMA SHOULDER	$0.00 / TON

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
HMA PAVEMENT (FULL-DEPTH)	(6.75")	1,271	SQ YD *	$24.49 / SQ YD	$31,130 ~
HMA SURFACE COURSE	(2.00")	143	TONS	$70.56 / TON	$0
HMA TOP BINDER COURSE	(2.25")	164	TONS	$62.25 / TON	$0
HMA LOWER BINDER COURSE	(2.50")	185	TONS	$62.25 / TON	$0
HMA SHOULDER	(8.00")	0	TONS	$0.00 / 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:	Aggregate	1,394	SQ YD	$7.00 / SQ YD	$9,758
Reserved For User Supplied Item		0	UNITS	$0.00 / UNITS	$0
Reserved For User Supplied Item		0	UNITS	$0.00 / UNITS	$0
PAVEMENT REMOVAL		1,271	SQ YD	$15.00 / SQ YD	$19,065
SHOULDER REMOVAL		0	SQ YD	$0.00 / SQ YD	$0

Note: * Denotes User Supplied Quantity

FLEXIBLE CONSTRUCTION INITIAL COST	$59,953
FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE	$24,828

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	UNIT COST
ROUTINE MAINTENANCE ACTIVITY			$0.00 LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	Surface Mix	$7.96 / SQ YD
HMA OVERLAY PVMT	(2.25")		$8.79 / SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	$5.96 / SQ YD
HMA BINDER MIX	(0.75")	eling Binder Mix	$2.83 / SQ YD
HMA OVERLAY SHLD (Year 30)	(2.25")	Shoulder Mix	$0.00 / SQ YD
HMA OVERLAY SHLD	(2.00")	Shoulder Mix	$0.00 / SQ YD
MILLING (2.00 IN)			$3.00 / SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill Surf)	Surface Mix	$77.90 / SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)	Shoulder Mix	$70.00 / SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill +2.00 ")	Leveling Binder Mix	$77.44 / SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ")	Shoulder Mix	$70.00 / 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	$91,437
FLEXIBLE TOTAL ANNUAL COST PER MILE	$37,866

HMA_SD

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

11/13/14

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%	1,040	LIN FT	$2.00		$2,080	
	CNTR LINE JOINT R&S	100.00%	520	LIN FT	$2.00		$1,040	
	RNDM / THRM CRACK R&S	50.00%	572	LIN FT	$2.00		$1,144	
	PD PVMT PATCH M&F SURF	0.10%	1	SQ YD	$77.90		$78	
	PWFn =	0.8626		PW =	0.8626	X	$4,342	$3,745
YEAR 10								
	LONG SHLD JT R&S	100.00%	1,040	LIN FT	$2.00		$2,080	
	CNTR LINE JOINT R&S	100.00%	520	LIN FT	$2.00		$1,040	
	RNDM / THRM CRACK R&S	50.00%	572	LIN FT	$2.00		$1,144	
	PD PVMT PATCH M&F SURF	0.50%	6	SQ YD	$77.90		$467	
	PWFn =	0.7441		PW =	0.7441	X	$4,731	$3,520
YEAR 15								
	MILL PVMT & SHLD 2.00"	100.00%	1,271	SQ YD	$3.00		$3,813	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	13	SQ YD	$77.44		$1,007	
	HMA OVERLAY PVMT 2.00"	100.00%	1,271	SQ YD	$7.96		$10,121	
	HMA OVERLAY SHLD 2.00 "	100.00%	0	SQ YD	$0.00		$0	
	PWFn =	0.6419		PW =	0.6419	X	$14,941	$9,590
YEAR 20								
	LONG SHLD JT R&S	100.00%	1,040	LIN FT	$2.00		$2,080	
	CNTR LINE JOINT R&S	100.00%	520	LIN FT	$2.00		$1,040	
	RNDM / THRM CRACK R&S	50.00%	572	LIN FT	$2.00		$1,144	
	PD PVMT PATCH M&F SURF	0.10%	1	SQ YD	$77.90		$78	
	PWFn =	0.5537		PW =	0.5537	X	$4,342	$2,404
YEAR 25								
	LONG SHLD JT R&S	100.00%	1,040	LIN FT	$2.00		$2,080	
	CNTR LINE JOINT R&S	100.00%	520	LIN FT	$2.00		$1,040	
	RNDM / THRM CRACK R&S	50.00%	572	LIN FT	$2.00		$1,144	
	PD PVMT PATCH M&F SURF	0.50%	6	SQ YD	$77.90		$467	
	PWFn =	0.4776		PW =	0.4776	X	$4,731	$2,260
HMA_SD								
YEAR 30	NON-INTERSTATE							
	MILL PVMT & SHLD 2.00"	100.00%	1,271	SQ YD	$3.00		$3,813	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	25	SQ YD	$77.44		$1,936	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	0	SQ YD	$70.00		$0	
	HMA OVERLAY PVMT 2.25 "	100.00%	1,271	SQ YD	$8.79		$11,173	
	HMA OVERLAY SHLD 2.25 "	100.00%	0	SQ YD	$0.00		$0	
	PWFn =	0.4120		PW =	0.4120	X	$16,922	$6,972
YEAR 35								
	LONG SHLD JT R&S	100.00%	1,040	LIN FT	$2.00		$2,080	
	CNTR LINE JOINT R&S	100.00%	520	LIN FT	$2.00		$1,040	
	RNDM / THRM CRACK R&S	50.00%	572	LIN FT	$2.00		$1,144	
	PD PVMT PATCH M&F SURF	0.10%	1	SQ YD	$77.90		$78	
	PWFn =	0.3554		PW =	0.3554	X	$4,342	$1,543
YEAR 40								
	LONG SHLD JT R&S	100.00%	1,040	LIN FT	$2.00		$2,080	
	CNTR LINE JOINT R&S	100.00%	520	LIN FT	$2.00		$1,040	
	RNDM / THRM CRACK R&S	50.00%	572	LIN FT	$2.00		$1,144	
	PD PVMT PATCH M&F SURF	0.50%	6	SQ YD	$77.90		$467	
	PWFn =	0.3066		PW =	0.3066	X	$4,731	$1,450
								$31,484
	ROUTINE MAINTENANCE ACTIVITY		0.20	Lane Miles	0.00		$0	$0
					MAINTENANCE LIFE-CYCLE COST			$31,484
45	YEAR LIFE CYCLE	CRFn = 0.0407852			MAINTENANCE ANNUAL COST PER MILE			$13,038

PCC PAVEMENT

JPCP

ROUTE	Independence Boulevard
SECTION	39R
COUNTY	Lake
LOCATION	at US 45
FACILITY TYPE	NON-INTERSTATE

PROJECT LENGTH			520 FT	==> 0.10 Miles
# OF CENTERLINES			1 CL	
# OF LANES			2 LANES	
# OF EDGES			2 EP	
LANE WIDTH - AVERAGE			11 FT	
SHOULDER WIDTH	PCC	Left	0 FT	
	PCC	Right	0 FT	
	Total Width of Paved Shoulders		0 FT	

PAVEMENT THICKNESS (RIGID)	JPCP	7.75	IN	TIED SHLD
SHOULDER THICKNESS		7.75	IN	
POLICY OVERLAY THICKNESS		2.50	IN	

RIGID PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	No Min	0.37	0.37
Worksheet Construction Type is Reconstruction		The Pavement Type is	JPCP

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT		UNIT PRICE		COST
JPC PAVEMENT	(7.75")	1,271	SQ YD		$40.50	/ SQ YD	$51,476
PAVEMENT REINFORCEMENT		0	SQ YD		$22.00	/ SQ YD	$0
STABILIZED SUBBASE	(4.00")	0	SQ YD	*	$19.00	/ SQ YD	$0
PCC SHOULDERS	(7.75" to 7.75")	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:	Aggregate	1,329	SQ YD		$7.00	/ SQ YD	$9,303
Reserved For User Supplied Item		0	UNITS		$0.00	/ UNITS	$0
Reserved For User Supplied Item		0	UNITS		$0.00	/ UNITS	$0
PAVEMENT REMOVAL		1,271	SQ YD		$15.00	/ SQ YD	$19,065
SHOULDER REMOVAL		0	SQ YD		$0.00	/ SQ YD	$0

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION INITIAL COST	$79,844
RIGID CONSTRUCTION ANNUAL COST PER MILE	$33,066

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	T	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY				$0.00	/ LANE-MILE / YEAR
HMA POLICY OVERLAY	(2.50")		2.50		
HMA POLICY OVERLAY PVMT	(2.50")		2.50	$9.74	/ SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	1.50	$5.96	/ SQ YD
HMA BINDER MIX	(1.00")	eling Binder Mix	1.00	$3.78	/ SQ YD
HMA POLICY OVERLAY SHLD	(2.50")	Shoulder Mix	2.50	$0.00	/ 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	$75.93	/ SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.50")		Surface Mix	2.50	$79.88	/ 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	$98,728
RIGID TOTAL ANNUAL COST PER MILE	$40,886

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE 11/13/14

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%	1	SQ YD	$150.00		$150	
	PWFn =	0.7441		PW =	0.7441	X	$150	$112
YEAR 15								
	PAVEMENT PATCH CLASS B	0.20%	3	SQ YD	$150.00		$450	
	PWFn =	0.6419		PW =	0.6419	X	$450	$289
YEAR 20								
	PAVEMENT PATCH CLASS B	2.00%	25	SQ YD	$150.00		$3,750	
	SHOULDER PATCH CLASS C	0.50%	0	SQ YD	$145.00		$0	
	LONGITUDINAL SHLD JT R&S	100.00%	1,040	LIN FT	$2.00		$2,080	
	CENTERLINE JT R&S	100.00%	520	LIN FT	$2.00		$1,040	
	PWFn =	0.5537		PW =	0.5537	X	$6,870	$3,804
YEAR 25								
	PAVEMENT PATCH CLASS B	3.00%	38	SQ YD	$150.00		$5,700	
	SHOULDER PATCH CLASS C	1.00%	0	SQ YD	$145.00		$0	
	PWFn =	0.4776		PW =	0.4776	X	$5,700	$2,722
YEAR 30	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	51	SQ YD	$150.00		$7,650	
	SHOULDER PATCH CLASS C	1.50%	0	SQ YD	$145.00		$0	
	HMA POLICY OVERLAY 2.5" (PVMT)	100.00%	1,271	SQ YD	$9.74		$12,376	
	HMA POLICY OVERLAY 2.5" (SHLD)	100.00%	0	SQ YD	$0.00		$0	
	PWFn =	0.4120		PW =	0.4120	X	$20,026	$8,250
YEAR 35	NON-INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	1,040	LIN FT	$2.00		$2,080	
	CENTERLINE JT R&S	100.00%	520	LIN FT	$2.00		$1,040	
	RANDOM CRACK R&S	50.00%	520	LIN FT	$2.00		$1,040	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	308	LIN FT	$2.00		$616	
	PD PVMT PATCH M&F HMA 2.50"	0.10%	1	SQ YD	$79.88		$80	
	PWFn =	0.3554		PW =	0.3554	X	$4,856	$1,726
YEAR 40	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	6	SQ YD	$150.00		$900	
	LONGITUDINAL SHLD JT R&S	100.00%	1,040	LIN FT	$2.00		$2,080	
	CENTERLINE JT R&S	100.00%	520	LIN FT	$2.00		$1,040	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	462	LIN FT	$2.00		$924	
	RANDOM CRACK R&S	50.00%	520	LIN FT	$2.00		$1,040	
	PD PVMT PATCH M&F HMA 2.50"	0.50%	6	SQ YD	$79.88		$479	
	PWFn =	0.3066		PW =	0.3066	X	$6,463	$1,981
								$18,884
	ROUTINE MAINTENANCE ACTIVITY		0.20	Lane Miles	$0.00		$0	$0
					MAINTENANCE LIFE-CYCLE COST			$18,884
45	YEAR LIFE CYCLE	CRFn = 0.0407852			MAINTENANCE ANNUAL COST PER MILE			$7,820

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : **11/5/14 10:23 AM**

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	$79,844	$59,953
		ANNUAL COST PER MILE	$33,066	$24,828
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	$18,884	$31,484
		ANNUAL COST PER MILE	$7,820	$13,038
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	$98,728	$91,437
		ANNUAL COST PER MILE	$40,886	$37,866

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	==========>	**HMA**	**$37,866**	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PERCENTAGE	**JPCP**	**$40,886**	8.0%

P:\Pavement Design Stuff\D-1\US 45 from Grass Lake Road to County Place\US 45 from Grass Lake Road to County Place Pavement Design Files\[US 45 from Gra

BDE 5401 Template (Rev. 09/05/2013)

IDOT MECHANISTIC PAVEMENT DESIGN

Printed: 11/13/2014

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: US 45
Section: 39R
County: Lake
Location: Millburn Bypass

Comments: US 45 @ Millburn Bypass

Design Date: 10/21/2014 ONP <-- BY
Modify Date: <-- BY

	ADT	Year
Current:	16,600	2009
Future:	34,000	2040

Facility Type: Unmarked State Route

# of Lanes = 4

Road Class: I

Subgrade Support Rating (SSR): Poor
Construction Year: 2016
Design Period (DP) = 20 years

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane	
PV =	No Min	23,841	91.2%	P =	32%
SU =	No Min	1,307	5.0%	S =	45%
MU =	No Min	993	3.8%	M =	45%

Struct. Design ADT = 26,142 (2026)

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT

Cpv = 0.15
Csu = 132.5
Cmu = 482.53
TF flexible (Actual) = 5.90 (Actual ADT)
TF flexible (Min) = No Min (Min ADT Fig. 54-2.C)

RIGID PAVEMENT

Cpv = 0.15
Csu = 143.81
Cmu = 696.42
TF rigid (Actual) = 7.94 (Actual ADT)
TF rigid (Min) = No Min (Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement

Use TF flexible = 5.90
PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.R)
Goto Map
HMA Mixture Temp. = 73.0 deg. F (Fig. 54-5.C)
Design HMA Mixture Modulus (E_{HMA}) = 760 ksi (Fig. 54-5.D)
Design HMA Strain (ε_{HMA}) = 72 (Fig. 54-5.E)
Full Depth HMA Design Thickness = 10.75 in. (Fig. 54-5.F)
Goto Map
Limiting Strain Criterion Thickness = 14.00 in. (Fig. 54-5.I)

Use Full-Depth HMA Thickness = 10.75 inches

JPC Pavement

Use TF rigid = 7.94
Edge Support = Tied Shoulder or C.&G.

Rigid Pavt Thick. = 9.50 in. (Fig. 54-4.E)

CRC Pavement

Use TF rigid = 7.94
IBR value = 3

CRCP Thickness = 8.50 in. (Fig. 54-4.M)

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC

Use TF flexible = 5.90
HMA Overlay Design Thickness = 8.25 in. (Fig. 54-5.U)
Goto Map
Limiting Strain Criterion Thickness = in. (Fig. 54-5.V)

Use HMA Overlay Thickness = 999.00 inches

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

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) Csu	Rigid Cmu	Flexible (Fig. 54-5.B) Csu	Flexible 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 P	Rural S	Rural M	Urban P	Urban S	Urban 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%

BDE 5401 Template (Rev. 09/05/2013) Printed: 11/13/2014

LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT

Standard Design

ROUTE	US 45
SECTION	39R
COUNTY	Lake
LOCATION	Millburn Bypass

FACILITY TYPE: NON-INTERSTATE

PROJECT LENGTH		7200 FT	==> 1.36 Miles
# OF CENTERLINES		2 CL	
# OF LANES		4 LANES	
# OF EDGES		4 EP	
LANE WIDTH - AVERAGE		12 FT	
SHOULDER WIDTH	HMA Inside	0 FT	
	HMA Outside	0 FT	
	Total Width of Paved Shoulders	0 FT	

PAVEMENT THICKNESS (FLEXIBLE)	10.75 IN	14.00 IN MAX
SHOULDER THICKNESS	8.00 IN	HMA SH **Standard Design**
POLICY OVERLAY THICKNESS	2.25 IN	

FLEX PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	No Min	5.90	5.90

Read Me!

HMA COST PER TON	UNIT PRICE
HMA SURFACE	$79.75 / TON
HMA TOP BINDER	$57.35 / TON
HMA LOWER BINDER	$57.35 / TON
HMA BINDER (LEVELING)	$68.55 / TON
HMA SHOULDER	$0.00 / TON

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT		UNIT PRICE		COST	
HMA PAVEMENT (FULL-DEPTH)	(10.75")	38,400	SQ YD	*	$40.64	/ SQ YD	$1,560,576	~
HMA SURFACE COURSE	(2.00")	4,331	TONS		$79.75	/ TON	$0	
HMA TOP BINDER COURSE	(2.25")	4,943	TONS		$57.35	/ TON	$0	
HMA LOWER BINDER COURSE	(6.50")	14,706	TONS		$57.35	/ TON	$0	
HMA SHOULDER	(8.00")	0	TONS		$0.00	/ TON	$0	~
CURB & GUTTER		14,400	LIN FT	*	$30.00	/ LIN FT	$432,000	
SUBBASE GRAN MATL TY C (TONS)		218	TONS		$25.00	/ TON	$5,450	
IMPROVED SUBGRADE:	Aggregate	42,867	SQ YD		$7.00	/ SQ YD	$300,069	
Reserved For User Supplied Item		0	UNITS		$0.00	/ UNITS	$0	
Reserved For User Supplied Item		0	UNITS		$0.00	/ UNITS	$0	
PAVEMENT REMOVAL		38,400	SQ YD		$0.00	/ SQ YD	$0	
SHOULDER REMOVAL		0	SQ YD		$0.00	/ SQ YD	$0	

Note: * Denotes User Supplied Quantity

FLEXIBLE CONSTRUCTION INITIAL COST	$2,298,095
FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE	$68,734

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY			$0.00	LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	Surface Mix	$8.99	/ SQ YD
HMA OVERLAY PVMT	(2.25")		$9.65	/ SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	$6.73	/ SQ YD
HMA BINDER MIX	(0.75")	eling Binder Mix	$2.92	/ SQ YD
HMA OVERLAY SHLD (Year 30)	(2.25")	Shoulder Mix	$0.00	/ SQ YD
HMA OVERLAY SHLD	(2.00")	Shoulder Mix	$0.00	/ SQ YD
MILLING (2.00 IN)			$3.00	/ SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill Surf)	Surface Mix	$78.93	/ SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)	Shoulder Mix	$70.00	/ SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill +2.00 ")	Leveling Binder Mix	$77.68	/ SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ")	Shoulder Mix	$70.00	/ 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	$3,255,704
FLEXIBLE TOTAL ANNUAL COST PER MILE	$97,375

HMA_SD

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

11/13/14

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%	28,800	LIN FT	$2.00		$57,600	
	CNTR LINE JOINT R&S	100.00%	14,400	LIN FT	$2.00		$28,800	
	RNDM / THRM CRACK R&S	50.00%	15,840	LIN FT	$2.00		$31,680	
	PD PVMT PATCH M&F SURF	0.10%	38	SQ YD	$78.93		$2,999	
	PWFn =	0.8626		PW =	0.8626	X	$121,079	$104,444
YEAR 10								
	LONG SHLD JT R&S	100.00%	28,800	LIN FT	$2.00		$57,600	
	CNTR LINE JOINT R&S	100.00%	14,400	LIN FT	$2.00		$28,800	
	RNDM / THRM CRACK R&S	50.00%	15,840	LIN FT	$2.00		$31,680	
	PD PVMT PATCH M&F SURF	0.50%	192	SQ YD	$78.93		$15,155	
	PWFn =	0.7441		PW =	0.7441	X	$133,235	$99,139
YEAR 15								
	MILL PVMT & SHLD 2.00"	100.00%	38,400	SQ YD	$3.00		$115,200	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	384	SQ YD	$77.68		$29,828	
	HMA OVERLAY PVMT 2.00"	100.00%	38,400	SQ YD	$8.99		$345,371	
	HMA OVERLAY SHLD 2.00 "	100.00%	0	SQ YD	$0.00		$0	
	PWFn =	0.6419		PW =	0.6419	X	$490,399	$314,768
YEAR 20								
	LONG SHLD JT R&S	100.00%	28,800	LIN FT	$2.00		$57,600	
	CNTR LINE JOINT R&S	100.00%	14,400	LIN FT	$2.00		$28,800	
	RNDM / THRM CRACK R&S	50.00%	15,840	LIN FT	$2.00		$31,680	
	PD PVMT PATCH M&F SURF	0.10%	38	SQ YD	$78.93		$2,999	
	PWFn =	0.5537		PW =	0.5537	X	$121,079	$67,039
YEAR 25								
	LONG SHLD JT R&S	100.00%	28,800	LIN FT	$2.00		$57,600	
	CNTR LINE JOINT R&S	100.00%	14,400	LIN FT	$2.00		$28,800	
	RNDM / THRM CRACK R&S	50.00%	15,840	LIN FT	$2.00		$31,680	
	PD PVMT PATCH M&F SURF	0.50%	192	SQ YD	$78.93		$15,155	
	PWFn =	0.4776		PW =	0.4776	X	$133,235	$63,634
	HMA_SD							
YEAR 30	NON-INTERSTATE							
	MILL PVMT & SHLD 2.00"	100.00%	38,400	SQ YD	$3.00		$115,200	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	768	SQ YD	$77.68		$59,656	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	0	SQ YD	$70.00		$0	
	HMA OVERLAY PVMT 2.25 "	100.00%	38,400	SQ YD	$9.65		$370,578	
	HMA OVERLAY SHLD 2.25 "	100.00%	0	SQ YD	$0.00		$0	
	PWFn =	0.4120		PW =	0.4120	X	$545,434	$224,712
YEAR 35								
	LONG SHLD JT R&S	100.00%	28,800	LIN FT	$2.00		$57,600	
	CNTR LINE JOINT R&S	100.00%	14,400	LIN FT	$2.00		$28,800	
	RNDM / THRM CRACK R&S	50.00%	15,840	LIN FT	$2.00		$31,680	
	PD PVMT PATCH M&F SURF	0.10%	38	SQ YD	$78.93		$2,999	
	PWFn =	0.3554		PW =	0.3554	X	$121,079	$43,029
YEAR 40								
	LONG SHLD JT R&S	100.00%	28,800	LIN FT	$2.00		$57,600	
	CNTR LINE JOINT R&S	100.00%	14,400	LIN FT	$2.00		$28,800	
	RNDM / THRM CRACK R&S	50.00%	15,840	LIN FT	$2.00		$31,680	
	PD PVMT PATCH M&F SURF	0.50%	192	SQ YD	$78.93		$15,155	
	PWFn =	0.3066		PW =	0.3066	X	$133,235	$40,844
								$957,609
	ROUTINE MAINTENANCE ACTIVITY		5.45	Lane Miles	0.00		$0	$0
					MAINTENANCE LIFE-CYCLE COST			$957,609
45	YEAR LIFE CYCLE	CRFn = 0.0407852			MAINTENANCE ANNUAL COST PER MILE			$28,641

PCC PAVEMENT

JPCP

ROUTE		US 45	
SECTION		39R	
COUNTY		Lake	
LOCATION		Millburn Bypass	
FACILITY TYPE		NON-INTERSTATE	
PROJECT LENGTH		7200 FT	==> 1.36 Miles
# OF CENTERLINES		2 CL	
# OF LANES		4 LANES	
# OF EDGES		4 EP	
LANE WIDTH - AVERAGE		12 FT	
SHOULDER WIDTH	PCC Inside	0 FT	
	PCC Outside	0 FT	
	Total Width of Paved Shoulders	0 FT	
PAVEMENT THICKNESS (RIGID)	JPCP	9.50 IN	TIED SHLD
SHOULDER THICKNESS		9.50 IN	
POLICY OVERLAY THICKNESS		2.50 IN	

RIGID PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	No Min	7.94	7.94
Worksheet Construction Type is New Construction		The Pavement Type is	JPCP

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT		UNIT PRICE		COST
JPC PAVEMENT	(9.50")	38,400	SQ YD		$42.89	/ SQ YD	$1,646,976
PAVEMENT REINFORCEMENT		0	SQ YD		$22.00	/ SQ YD	$0
STABILIZED SUBBASE	(4.00")	0	SQ YD	*	$19.00	/ SQ YD	$0
PCC SHOULDERS	(9.50" to 9.50")	0	SQ YD		$40.00	/ SQ YD	$0
CURB & GUTTER		14,400	LIN FT	*	$30.00	/ LIN FT	$432,000
SUBBASE GRAN MATL TY C	(~ 0.00")	0	TONS		$25.00	/ TON	$0
IMPROVED SUBGRADE:	Aggregate	40,000	SQ YD		$7.00	/ SQ YD	$280,000
Reserved For User Supplied Item		0	UNITS		$0.00	/ UNITS	$0
Reserved For User Supplied Item		0	UNITS		$0.00	/ UNITS	$0
PAVEMENT REMOVAL		38,400	SQ YD		$0.00	/ SQ YD	$0
SHOULDER REMOVAL		0	SQ YD		$0.00	/ SQ YD	$0

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION INITIAL COST	$2,358,976
RIGID CONSTRUCTION ANNUAL COST PER MILE	$70,555

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	T	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY				$0.00	/ LANE-MILE / YEAR
HMA POLICY OVERLAY	(2.50")		2.50		
HMA POLICY OVERLAY PVMT	(2.50")	1.0027	2.50	$10.63	/ SQ YD
HMA SURFACE MIX	(1.50")	1.0052	1.50	$6.73	/ SQ YD
HMA BINDER MIX	(1.00")	1.0189	1.00	$3.89	/ SQ YD
HMA POLICY OVERLAY SHLD	(2.50")	Shoulder Mix	2.50	$0.00	/ 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	$76.70	/ SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.50")		Surface Mix	2.50	$81.17	/ 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	$2,933,794
RIGID TOTAL ANNUAL COST PER MILE	$87,747

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE 11/13/14

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%	38	SQ YD	$150.00		$5,700	
	PWFn =	0.7441		PW =	0.7441	X	$5,700	$4,241
YEAR 15								
	PAVEMENT PATCH CLASS B	0.20%	77	SQ YD	$150.00		$11,550	
	PWFn =	0.6419		PW =	0.6419	X	$11,550	$7,414
YEAR 20								
	PAVEMENT PATCH CLASS B	2.00%	768	SQ YD	$150.00		$115,200	
	SHOULDER PATCH CLASS C	0.50%	0	SQ YD	$145.00		$0	
	LONGITUDINAL SHLD JT R&S	100.00%	28,800	LIN FT	$2.00		$57,600	
	CENTERLINE JT R&S	100.00%	14,400	LIN FT	$2.00		$28,800	
	PWFn =	0.5537		PW =	0.5537	X	$201,600	$111,621
YEAR 25								
	PAVEMENT PATCH CLASS B	3.00%	1,152	SQ YD	$150.00		$172,800	
	SHOULDER PATCH CLASS C	1.00%	0	SQ YD	$145.00		$0	
	PWFn =	0.4776		PW =	0.4776	X	$172,800	$82,530
YEAR 30	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	1,536	SQ YD	$150.00		$230,400	
	SHOULDER PATCH CLASS C	1.50%	0	SQ YD	$145.00		$0	
	HMA POLICY OVERLAY 2.5" (PVMT)	100.00%	38,400	SQ YD	$10.63		$408,039	
	HMA POLICY OVERLAY 2.5" (SHLD)	100.00%	0	SQ YD	$0.00		$0	
	PWFn =	0.4120		PW =	0.4120	X	$638,439	$263,028
YEAR 35	NON-INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	28,800	LIN FT	$2.00		$57,600	
	CENTERLINE JT R&S	100.00%	14,400	LIN FT	$2.00		$28,800	
	RANDOM CRACK R&S	50.00%	14,400	LIN FT	$2.00		$28,800	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	9,216	LIN FT	$2.00		$18,432	
	PD PVMT PATCH M&F HMA 2.50"	0.10%	38	SQ YD	$81.17		$3,084	
	PWFn =	0.3554		PW =	0.3554	X	$136,716	$48,587
YEAR 40	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	192	SQ YD	$150.00		$28,800	
	LONGITUDINAL SHLD JT R&S	100.00%	28,800	LIN FT	$2.00		$57,600	
	CENTERLINE JT R&S	100.00%	14,400	LIN FT	$2.00		$28,800	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	13,824	LIN FT	$2.00		$27,648	
	RANDOM CRACK R&S	50.00%	14,400	LIN FT	$2.00		$28,800	
	PD PVMT PATCH M&F HMA 2.50"	0.50%	192	SQ YD	$81.17		$15,584	
	PWFn =	0.3066		PW =	0.3066	X	$187,232	$57,397
								$574,818
	ROUTINE MAINTENANCE ACTIVITY		5.45	Lane Miles	$0.00		$0	$0
					MAINTENANCE LIFE-CYCLE COST			$574,818
45	YEAR LIFE CYCLE	CRFn = 0.0407852			MAINTENANCE ANNUAL COST PER MILE			$17,192

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : **11/5/14 10:10 AM**

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	$2,358,976	$2,298,095
		ANNUAL COST PER MILE	$70,555	$68,734
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	$574,818	$957,609
		ANNUAL COST PER MILE	$17,192	$28,641
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	$2,933,794	$3,255,704
		ANNUAL COST PER MILE	$87,747	$97,375

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	==========>	**JPCP**	**$87,747**	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PERCENTAGE	**HMA**	**$97,375**	**11.0%**

P:\Pavement Design Stuff\D-1\US 45 from Grass Lake Road to County Place\US 45 from Grass Lake Road to County Place Pavement Design Files\[US 45 from Gra