



# Illinois Department of Transportation

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To: Masood Ahmad                      Attn: Dave Broviak  
From: Jack Elston                      By: Michael Brand  
Subject: Pavement Design Approval  
Date: December 18, 2020

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*Michael Brand*

Route: IL 50                              Job No.: P-93-010-05  
Section: 140N                            Contract No.: 66957  
County: Kankakee                      Target Letting: 2021  
Limits: IL 50 and Armour Road Intersection

We have reviewed the pavement design for the above referenced project which was submitted on December 17, 2020. The scope of the project involves widening and resurfacing to add turn lanes at the intersection.

A composite pavement was not feasible for the wideing so the pavement design compared mechanistic full-depth HMA and modified AASHTO HMA designs. The mechanistic option resulted in the lowest cost.

In summary, the approved pavement designs are as follows:

<u>IL 50 Widening</u>	<u>Armour Road - Widening</u>
11.25" Full-Depth HMA	10" Full Depth HMA
12" Agg. Subgrade Improvement	12" Agg. Subgrade Improvement

If you have any questions, please contact Mike Brand at (217) 782-7651.



Jack Elston Attn: Mike Brand  
December 15, 2020  
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create additional complications with staging that work on the widening. We agree with that assessment, so the cost for that item was not pursued. The mechanistic designs for IL 50 and Armour Road for full depth asphalt were determined to be 11.25 inches and 10 inches respectively. When looking at the modified AASHTO options, we considered matching the proposed overlay mixes for the surface and binder lifts. Matching the proposed resurfacing lifts and thicknesses for the mainline did not leave room for options on the remaining widening materials. Using a 12" aggregate base, similar to what is proposed with the mechanistic design, the total thickness of the modified design came up with 11.75 inches of asphalt and, therefore, more expensive than the mechanistic design.

Calculations to determine pavement thicknesses are attached.

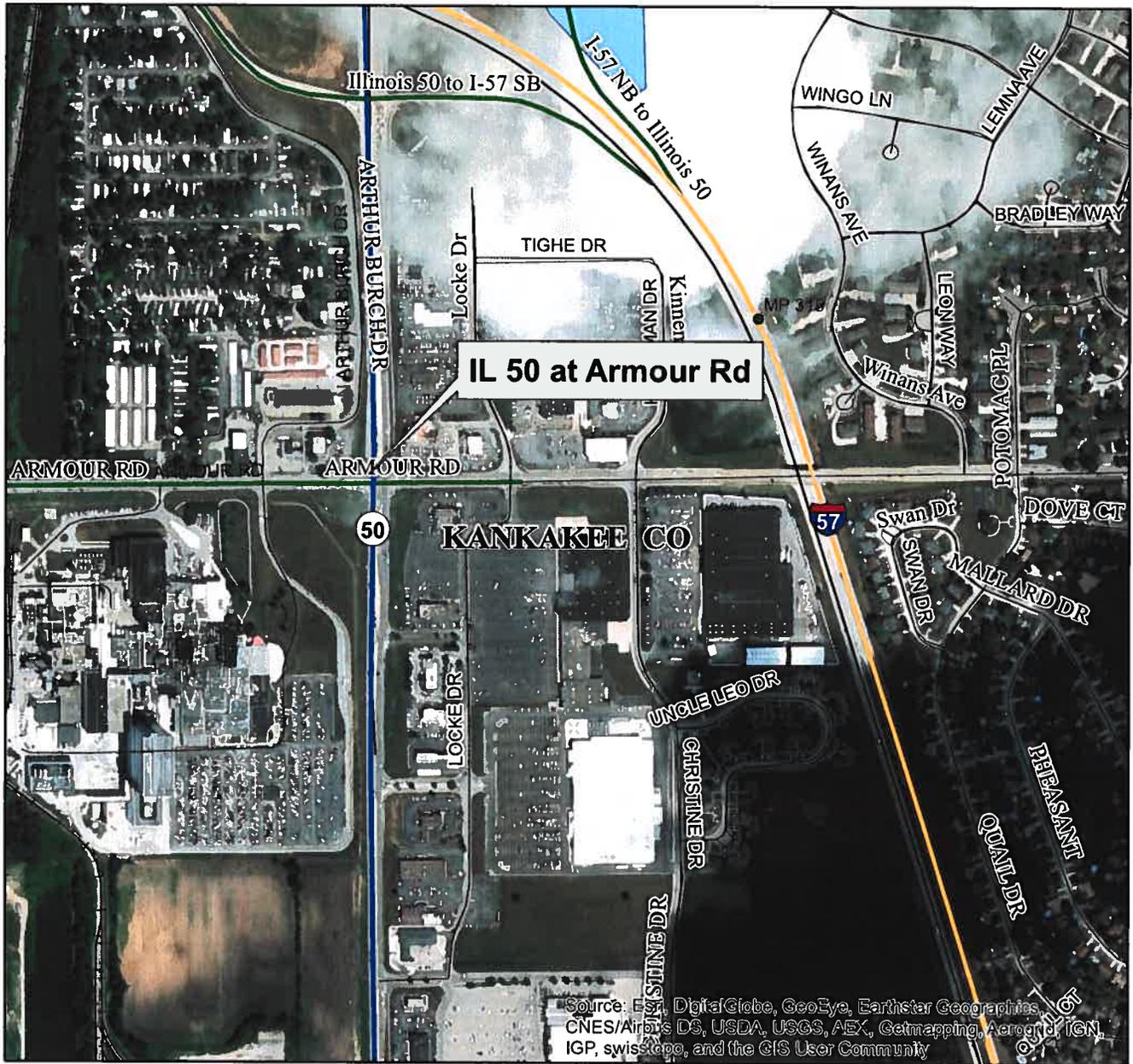
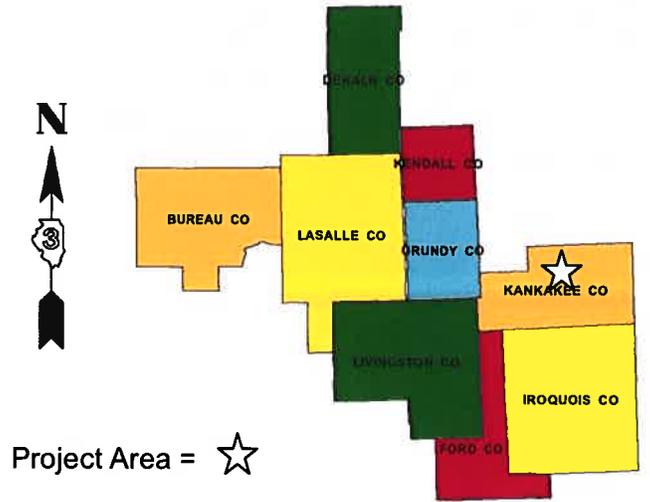
The pavement was designed using Chapter 54 of the Bureau of Design and Environment Manual. The following facts and assumptions were used in the design:

- Design Traffic was based on 2039 projections.
- Design Period of 20 years
- Poor Subgrade.
- PG 70-28 for the top lift of binder and the surface course.
- PG 64-22 for the lower binder lifts.

If you have any questions, please contact Joe Kannel at 815-434-8454.

# Project Location Map

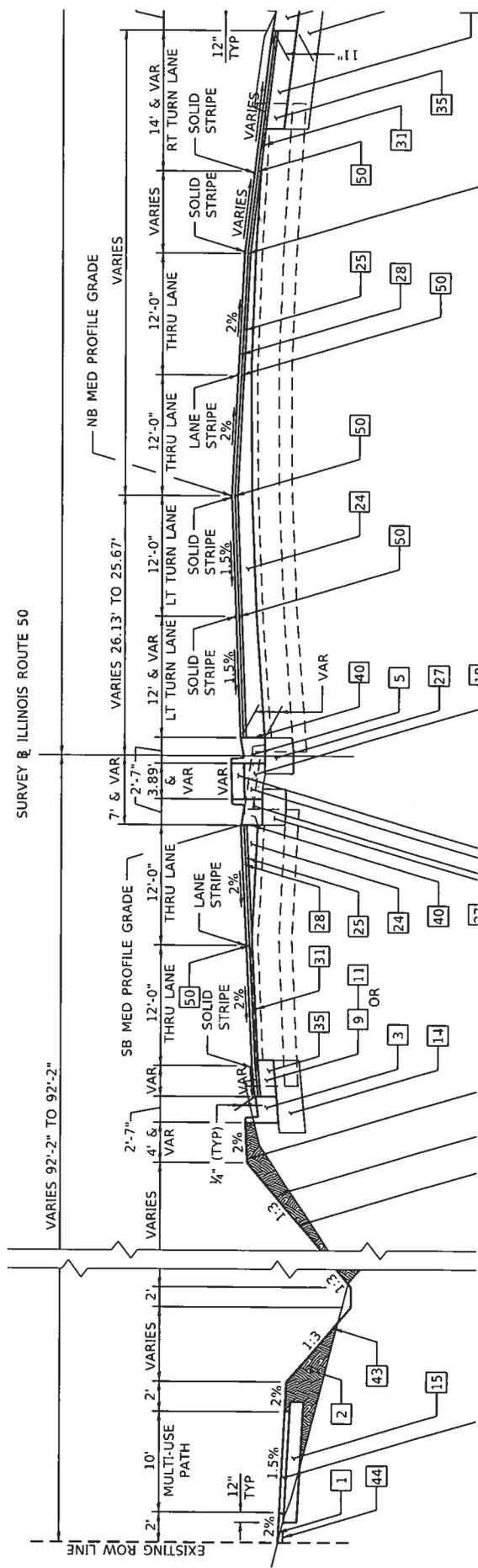
FAP 840 (IL 50)  
Section 140N  
Kankakee County  
Armour Road Intersection Improvements  
Contract No.66957



# LEGEND

- 1 EARTH SHOULDER
- 2 EARTH EMBANKMENT
- 3 COMBINATION CONCRETE CURB AND GUTTER, TYPE B-6.24
- 5 COMBINATION CONCRETE CURB AND GUTTER, TYPE B-6.24 (ABUTTING EXISTING PAVEMENT)
- 9 HOT-MIX ASPHALT BASE COURSE 7 1/4" > THAN 4' WIDTH
- 10 HOT-MIX ASPHALT BASE COURSE 8 1/2" > THAN 4' WIDTH
- 11 PORTLAND CEMENT CONCRETE BASE COURSE 7 1/4" = TO OR < 4' WIDTH
- 12 PORTLAND CEMENT CONCRETE BASE COURSE 8 1/2" = TO OR < THAN 4' WIDTH
- 13 SUBBASE GRANULAR MATERIAL, TYPE B 6"
- 14 SUBBASE GRANULAR MATERIAL, TYPE B 12"
- 15 AGGREGATE BASE COURSE, TYPE A 6"
- 18 COURSE AGGREGATE FILL (SEE STANDARD 606301)
- 20 CONCRETE MEDIAN SURFACE, 4 INCH
- 21 PORTLAND CEMENT CONCRETE SIDEWALK 6 INCH
- 23 PAVED DITCH, TYPE A-15 (SEE STANDARD 606401)
- 24 POLYMERIZED HOT-MIX ASPHALT BINDER COURSE (VARIABLE DEPTH)
- 25 1 1/2" POLYMERIZED HOT-MIX ASPHALT BINDER CO
- 27 SUBBASE GRANULAR MATERIAL, TYPE B
- 28 1 1/2" POLYMERIZED HOT-MIX ASPHALT SURFACE C
- 29 2" HOT-MIX ASPHALT SURFACE COURSE, IL-9.5, B
- 31 HOT-MIX ASPHALT SURFACE REMOVAL, VARIABLE
- 35 COMBINATION CURB & GUTTER REMOVAL
- 38 MEDIAN SURFACE REMOVAL
- 40 SAW CUT EXISTING HMA RESURFACING
- 43 SEEDING, CLASS 1A & EROSION CONTROL BLANK
- 44 SODDING
- 49 EXISTING 12" SANITARY SEWER
- 50 LONGITUDINAL JOINT SEALANT

 HOT-MIX ASPHALT SURFACE REMOVAL  
 VARIABLE DEPTH (SEE TABLE FOR DEPTHS)





PROJECT AND TRAFFIC INPUTS				(Enter Data in Gray Shaded Cells)		
Route: <b>IL 50</b>	Comments: <b>Traffic Data matches IDS Revision with CSL Behring forecasted traffic considered.</b>					
Section: <b>140N</b>	Truck % Estimated from hourly counts - 2019					
County: <b>Kankakee</b>	Design Date: <b>12/03/2019</b>	<b>JEK</b>	<- BY			
Location: <b>Armour Rd Intersection</b>	Modify Date:		<- BY	ADT	Year	
			Current:	<b>27,100</b>	<b>2017</b>	
			Future:	<b>48,950</b>	<b>2039</b>	
Facility Type: <b>Other Marked State Route</b>	# of Lanes = <b>4</b>					
Road Class: <b>I</b>	<b>Structural Design Traffic</b>					
Subgrade Support Rating (SSR): <b>Poor</b>		Minimum ADT	Actual ADT	Actual % of Total ADT	% of ADT in Design Lane	
Construction Year: <b>2021</b>		PV = 0	39,241	95.7%	P = 32%	
Design Period (DP) = <b>20</b> years		SU = 250	779	1.9%	S = 45%	
		MU = 750	984	2.4%	M = 45%	
		Struct. Design ADT = 41,005 (2031)				
<b>TRAFFIC FACTOR CALCULATION</b>						
<b>FLEXIBLE PAVEMENT</b>			<b>RIGID PAVEMENT</b>			
Cpv = 0.15	Cpv = 0.15					
Csu = <b>132.5</b>	Csu = <b>143.81</b>					
Cmu = <b>482.53</b>	Cmu = <b>696.42</b>					
TF flexible (Actual) = 5.24 (Actual ADT)	TF rigid (Actual) = 7.21 (Actual ADT)					
TF flexible (Min) = 3.56 (Min ADT Fig. 54-2.C)	TF rigid (Min) = 5.02 (Min ADT Fig. 54-2.C)					

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS					
<b>Full-Depth HMA Pavement</b>			<b>JPC Pavement</b>		
Use TF flexible = 5.24	Use TF rigid = 7.21				
PG Grade Lower Binder Lifts = <b>PG 64-22</b> (Fig. 53-4.O)	Edge Support = <b>Tied</b> Shoulder or C&G				
HMA Mixture Temp. = <b>76.0</b> deg. F (Fig. 54-5.C)	<b>Rigid Pavt Thick. = 9.50</b> in. (Fig. 54-4.E)				
Design HMA Mixture Modulus (E <sub>HMA</sub> ) = 660 ksi (Fig. 54-5.D)					
Design HMA Strain (ε <sub>HMA</sub> ) = 75 (Fig. 54-5.E)	<b>CRC Pavement</b>				
Full Depth HMA Design Thickness = 11.25 in. (Fig. 54-5.F)	Use TF rigid = 7.21				
Limiting Strain Criterion Thickness = <b>15.00</b> in. (Fig. 54-5.I)	IBR value = <b>3</b>				
<b>Use Full-Depth HMA Thickness = 11.25</b> inches	<b>CRCP Thickness = 8.50</b> in. (Fig. 54-4.M)				
<b>TF MUST BE &gt; 60 FOR CRCP</b>					

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS					
<b>HMA Pavement Over Rubblized PCC</b>			<b>Unbonded Concrete Overlay</b>		
Use TF flexible = 5.24	Review 54-4.03 for limitations and special considerations.				
HMA Overlay Design Thickness = 8.50 in. (Fig. 54-5.U)					
Limiting Strain Criterion Thickness = in. (Fig. 54-5.V)					
<b>Use HMA Overlay Thickness = 999.00</b> inches	<b>JPCP Thickness = NA</b> inches				
<b>CONTACT RESEARCH FOR ASSISTANCE</b>					

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN						
<b>Class I Roads</b> 4 lanes or more Part of a future 4 lanes or more One-way Streets with ADT > 3500	<b>Class II Roads</b> 2 lanes with ADT > 2000 One way Street with ADT <= 3500		<b>Class III Roads</b> 2 Lanes (ADT 750 -2000)	<b>Class IV Roads</b> 2 Lanes (ADT < 750)		
<b>Min. Str. Design Traffic (Fig 54-2.C)</b>						
Facility Type	PV	SU	MU	<b>Class Table for One-Way Streets</b>		
Interstate or Freeway	0	500	1500	ADT	Class	
Other Marked State Route	0	250	750	0 - 3500	II	
Unmarked State Route	No Min	No Min	No Min	>3501	I	
<b>Traffic Factor ESAL Coefficients</b>						
Class	<b>Rigid (Fig. 54-4.C)</b>		<b>Flexible (Fig. 54-5.B)</b>			
	Csu	Cmu	Csu	Cmu		
I	143.81	696.42	132.50	482.53	<b>Class Table for 2 or 3 lanes (not future 4 lane &amp; not one-way street)</b>	
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		
<b>Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)</b>						
Number of Lanes	<b>Rural</b>			<b>Urban</b>		
	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 IL 50  
 SECTION 140N  
 COUNTY Kankakee  
 LOCATION At Armour Road

FACILITY TYPE NON-INTERSTATE

PROJECT LENGTH 1720 FT ==> 0.33 Miles USER  
 # OF CENTERLINES 2 CL OVERWRITE  
 # OF LANES 4 LANES COLUMN  
 # 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) 11.25 IN 15.00 IN MAX  
 SHOULDER THICKNESS 8.00 IN HMA\_SD Standard Design  
 HMA OVERLAY THICKNESS 2.00 IN

FLEX PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE	On User Override
		0.00	5.24	5.24	

Read Me!

HMA COST PER TON	UNIT PRICE
HMA SURFACE	\$97.95 / TON
HMA TOP BINDER	\$89.96 / TON
HMA LOWER BINDER	\$84.91 / TON
HMA BINDER (IL-9.5FG or IL-4.75)	/ TON
HMA SHOULDER	\$0.00 / TON

INITIAL COSTS ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST	USER SUPPLIED QUANTITY	USER SUPPLIED UNIT PRICE
HMA PAVEMENT ( FULL-DEPTH )	( 11.25" )	3,100	3,100 SQ YD *	\$57.70 / SQ YD	\$178,881	3,100	
HMA SURFACE COURSE	( 2.00" )	1,035	1,035 TONS	\$97.95 / TON	\$0		
HMA TOP BINDER COURSE	( 2.25" )	1,181	1,181 TONS	\$89.96 / TON	\$0		
HMA LOWER BINDER COURSE	( 7.00" )	3,789	3,789 TONS	\$84.91 / TON	\$0		
HMA SHOULDER	( 8.00" )	0	0 TONS	\$0.00 / TON	\$0		
CURB & GUTTER		0	0 LIN FT	\$25.00 / LIN FT	\$0		
SUBBASE GRAN MATL TY C (TONS)		63	63 TONS	\$25.00 / TON	\$1,575		
IMPROVED SUBGRADE: Aggregate Width = 24.0		4,260	4,260 SQ YD *	\$19.00 / SQ YD	\$80,940	4,260	
Reserved For User Supplied Item		0	0 UNITS	\$0.00 / UNITS	\$0		
Reserved For User Supplied Item		0	0 UNITS	\$0.00 / UNITS	\$0		
PAVEMENT REMOVAL		9,173	9,173 SQ YD	\$0.00 / SQ YD	\$0		
SHOULDER REMOVAL		0	0 SQ YD	\$0.00 / SQ YD	\$0		

Note: \* Denotes User Supplied Quantity

FLEXIBLE CONSTRUCTION INITIAL COST \$261,396  
 FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE \$32,727

PROJECT AND TRAFFIC INPUTS						(Enter Data in Gray Shaded Cells)			
Route: <b>Armour Road</b>	Comments: <b>Traffic Data matches IDS Revision with CSL Behring forecasted traffic considered.</b>								
Section: <b>140N</b>	Truck % Estimated from hourly counts - 2019								
County: <b>Kankakee</b>	Design Date: <b>12/03/2019</b>	<b>JEK</b>	<- BY						
Location: <b>IL 50 Intersection</b>	Modify Date:		<- BY	ADT	Year				
Facility Type: <b>Unmarked State Route</b>					Current:	<b>20,800</b>	<b>2017</b>		
# of Lanes = <b>4</b>					Future:	<b>30,910</b>	<b>2039</b>		
Road Class: <b>I</b>					Structural Design Traffic				
Subgrade Support Rating (SSR): <b>Poor</b>					Minimum ADT	Actual ADT	Actual % of Total ADT	% of ADT in Design Lane	
Construction Year: <b>2021</b>					PV = No Min	26,280	96.5%	P = <b>32%</b>	
Design Period (DP) = <b>20</b> years					SU = No Min	409	1.5%	S = <b>45%</b>	
					MU = No Min	545	2.0%	M = <b>45%</b>	
					Struct. Design ADT = <b>27,234</b>		(2031)		

TRAFFIC FACTOR CALCULATION			
<b>FLEXIBLE PAVEMENT</b>		<b>RIGID PAVEMENT</b>	
Cpv =	0.15	Cpv =	0.15
Csu =	<b>132.5</b>	Csu =	<b>143.81</b>
Cmu =	<b>482.53</b>	Cmu =	<b>696.42</b>
TF flexible (Actual) =	2.88 (Actual ADT)	TF rigid (Actual) =	3.97 (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			
<b>Full-Depth HMA Pavement</b>		<b>JPC Pavement</b>	
Use TF flexible =	2.88	Use TF rigid =	3.97
PG Grade Lower Binder Lifts =	<b>PG 64-22</b> (Fig. 53-4.O)	Edge Support =	<b>Tied</b> Shoulder or C&G
HMA Mixture Temp. =	<b>76.0</b> deg. F (Fig. 54-5.C)	<b>Rigid Pavt Thick. =</b>	<b>8.75</b> in. (Fig. 54-4.E)
Design HMA Mixture Modulus (E <sub>HMA</sub> ) =	660 ksi (Fig. 54-5.D)	<b>CRC Pavement</b>	
Design HMA Strain (ε <sub>HMA</sub> ) =	89 (Fig. 54-5.E)	Use TF rigid =	3.97
Full Depth HMA Design Thickness =	10.00 in. (Fig. 54-5.F)	IBR value =	<b>3</b>
Limiting Strain Criterion Thickness =	<b>15.00</b> in. (Fig. 54-5.I)	<b>CRCP Thickness =</b>	<b>7.75</b> in. (Fig. 54-4.M)
<b>Use Full-Depth HMA Thickness =</b>	<b>10.00</b> inches	<b>TF MUST BE &gt; 60 FOR CRCP</b>	

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS			
<b>HMA Pavement Over Rubblized PCC</b>		<b>Unbonded Concrete Overlay</b>	
Use TF flexible =	2.88	Review 54-4.03 for limitations and special considerations.	
HMA Overlay Design Thickness =	7.25 in. (Fig. 54-5.U)		
Limiting Strain Criterion Thickness =	in. (Fig. 54-5.V)		
<b>Use HMA Overlay Thickness =</b>	<b>999.00</b> inches	<b>JPCP Thickness =</b>	<b>NA</b> inches
<b>CONTACT RESEARCH FOR ASSISTANCE</b>			

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN							
<b>Class I Roads</b>	<b>Class II Roads</b>			<b>Class III Roads</b>		<b>Class IV Roads</b>	
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)				Class Table for One-Way Streets			
Facility Type	PV	SU	MU	ADT	Class		
Interstate or Freeway	0	500	1500	0 - 3500	II		
Other Marked State Route	0	250	750	>3501	I		
Unmarked State Route	No Min	No Min	No Min				
Traffic Factor ESAL Coefficients							
Rigid (Fig. 54-4.C)							
Flexible (Fig. 54-5.B)				Class Table for 2 or 3 lanes (not future 4 lane & not one-way street)			
Class	Csu	Cmu	Csu	Cmu	ADT	Class	
I	<b>143.81</b>	<b>696.42</b>	<b>132.50</b>	<b>482.53</b>	0 - 749	IV	
II	<b>135.78</b>	<b>567.21</b>	<b>112.06</b>	<b>385.44</b>	750 - 2000	III	
III	<b>129.58</b>	<b>562.47</b>	<b>109.14</b>	<b>384.35</b>	>2000	II	
IV	<b>129.58</b>	<b>562.47</b>	<b>109.14</b>	<b>384.35</b>			
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	<b>32%</b>	<b>45%</b>	<b>45%</b>	<b>32%</b>	<b>45%</b>	<b>45%</b>	
6 or more	<b>20%</b>	<b>40%</b>	<b>40%</b>	<b>8%</b>	<b>37%</b>	<b>37%</b>	

# LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

## FULL-DEPTH HMA PAVEMENT

Standard Design

ROUTE SECTION COUNTY LOCATION  
 Armour Road  
 140N  
 Kankakee  
 IL 50 Intersection

FACILITY TYPE NON-INTERSTATE

PROJECT LENGTH 1950 FT ==> 0.37 Miles USER  
 # OF CENTERLINES 2 CL OVERWRITE  
 # OF LANES 4 LANES COLUMN  
 # 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) 10.00 IN 15.00 IN MAX  
 SHOULDER THICKNESS 8.00 IN HMA\_SD Standard Design  
 HMA OVERLAY THICKNESS 2.00 IN

FLEX PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE	On User Override
		0.00	2.88	2.88	

HMA COST PER TON	UNIT PRICE
HMA SURFACE	\$97.95 / TON
HMA TOP BINDER	\$89.96 / TON
HMA LOWER BINDER	\$84.91 / TON
HMA BINDER (IL-9.5FG or IL-4.75)	/ TON
HMA SHOULDER	\$0.00 / TON

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INITIAL COSTS	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST	USER SUPPLIED QUANTITY	USER SUPPLIED UNIT PRICE
HMA PAVEMENT ( FULL-DEPTH )	( 10.00" )	3,200	3,200 SQ YD *	\$51.32 / SQ YD	\$164,228	3,200	
HMA SURFACE COURSE	( 2.00" )	1,004	1,173 TONS	\$97.95 / TON	\$0		
HMA TOP BINDER COURSE	( 2.25" )	1,021	1,339 TONS	\$89.96 / TON	\$0		
HMA LOWER BINDER COURSE	( 5.75" )	1,045	3,514 TONS	\$84.91 / TON	\$0		
HMA SHOULDER	( 8.00" )	0	0 TONS	\$0.00 / TON	\$0		
CURB & GUTTER		0	0 LIN FT	\$25.00 / LIN FT	\$0		
SUBBASE GRAN MATL TY C (TONS)			41 TONS	\$25.00 / TON	\$1,025		
IMPROVED SUBGRADE:	Aggregate	4,306	4,306 SQ YD *	\$19.00 / SQ YD	\$81,814	4,306	
Reserved For User Supplied Item			0 UNITS	\$0.00 / UNITS	\$0		
Reserved For User Supplied Item			0 UNITS	\$0.00 / UNITS	\$0		
PAVEMENT REMOVAL			10,400 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 \$247,067  
 FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE \$27,285