

TO OFFICE: District 5, District Engineer

DATE: Nov. 13, 2018

ATTENTION: Jim Armstrong

REF. NO.: 500

FROM: Jim Phillips

County: Lee

Project: HSIPX-002-9(39)- -3L-56

NHSX-002-9(38)- -3H-56

PIN 19-56-002-010

OFFICE: District 5 Design

SUBJECT: FY'20 - HSIPX and 3R Project Concept - FINAL

DATE OF REVIEW: May 22 2018; **PARTICIPANTS:** District – Jim Phillips

PROJECT DATA

ROUTE: NHS, IA 2, 2 lanes, Lee Co., beginning at US 218 (MP 248.77), then east to US 61 (MP 257.57). Length 8.80 miles

PLANNING CLASSIFICATION: 3;

MAINTENANCE SERVICE LEVEL: C;

TRAFFIC: Est. No. 3346 dated August 16, 2018

2020 --- 3,500 AADT with 10% trucks;

2040 --- 4,100 AADT with 11% trucks.

PAVEMENT HISTORY:

The data below is from Deighton's Total Infrastructure Management System (dTIMS) Feb 2018

MP to MP	Dir.	Type	PCI-2	IRI	RUT	FRICT	FAULT
248.77 - 254.18	B	PCC	56*	174	-	51	0.09
254.18 - 257.57	B	PCC	53*	194	0.13	51	.09

*per June 5, 2018 Quick Look Trend for 2017.

MP 248.77 – MP 254.18 (31' b-b Urban and 24' ft. Rural w/ 8" PCC)

ORIGINAL PAVEMENT: 31' b-b and 24 ft. wide, 8 inch PCC; 1 12 ft. wide climbing lane, 10 ft wide **stabilized earth shoulder** Proj F-2-9(11)--20-56

COARSE AGGREGATE SOURCE: Farmington-Com, C. Lst., Dur. I,

YEAR CONSTRUCTED: 1979

MP 254.18 – MP 257.57 (24' ft. Rural w/ 8" PCC)

ORIGINAL PAVEMENT: 24 ft. wide, 8 inch PCC; 2 12 ft. wide climbing lane, 10 ft wide **stabilized earth shoulder** Proj FN-2-9(17)--20-56

COARSE AGGREGATE SOURCE: Farmington-Com, C. Lst., Dur. I,

YEAR CONSTRUCTED: 1979

YEAR CONSTRUCTED: 1972 Proj FN-2-9(12)--20-56 1612 ft. Reconstruction

PAVEMENT HISTORY cont'd:

MP 257.57 – MP 257.95 (44' ft. 3 Lane Rural w/ 10" PCC at Jct. US 61)
 ORIGINAL PAVEMENT: 44 ft. wide, 10 inch PCC; widens 28 ft. to 44 ft,
 8 ft wide granular shoulder Proj NHSX-061-1(117)—3H-56
 YEAR CONSTRUCTED: 2011

EXISTING CONDITIONS AND CAUSES OF DISTRESS:

This two lane corridor has edge-of-pavement, granular shoulder edge rutting.
 The PCC pavement is 24' wide. This roadway has no locations where 1- 2 ft. wide edge rut
 treatment / HMA widening unit exists.

In general, the pavement appears generally durable and sound. **Pavement cores** were
 obtained at transverse joints and found no significant from the bottom, to the top PCC
 deterioration. Here is a ProjectWise directory to the core photographs:

pw:\projectwise.dot.int.lan:PWMain\Documents\Projects\5600201019\DistrictDesign\DOCS\PD and Traffic
 and Map\IA 2 Lee Cores at transverse joints 9 18 18\20180918_145642 core 1 259+094 EB 8 inch.jpg

Pavement Cores at Transverse Joints to observe lower deterioration, and DBR potential Sept. 18, 2018 and Oct. 11, 2018 and Oct. 18,2018						
Highway Iowa 2 Lee MP 248.77 to 257.77	Core No	Milepost	Direction	Thickness, in.	comment	photo
	1	249.094	EB	8		642
	2	249.123	WB	6.75	broken	117
	3	250.564	EB	8	along trans. Jt., not at jt.	417,421
	4	255.34	EB	7.87		228,229,230
		255.798	WB	7.87	at longitud. Fatigue crack	848
	5	252	EB	8.25	inside trav. way	222,328
	6	253	EB	9	inside trav. Way at Jt.	441, 624
	7	253	EB	8.25	inside trav. Way at Jt.	734, 852
	8	256.62	EB	8.75	long. Cracking on slope, at Jt.	834,122,804
	9	256.86	EB	8.75	long. Cracking on slope, at Jt.	350,440,006
	10	256.87	EB	8.5+1.5	exist composite transverse jt.	584,585,593,594

A metal detector indicated that dowel bars exist along the longitudinal joint, but no dowel
 bars along the transverse joints. Some faulting is occurring along the transverse joints and
 it adversely affects the ride smoothness. **The existing pavement has too thin of PCC
 thickness at the joints for a dowel bar retrofit** – which, if thicker, could have helped to
 stabilize the pavement slabs from further faulting at the existing sawed transverse joints.
 There are 3 – 12 ft. wide **climbing lanes**. MP 253.41-253.94, MP 254.35-255.01, MP
 256.35-256.81. Diamond grinding of the first 2 lanes is to be included in grinding.

Fatigue cracking of PCC slabs is occurring along slope from MP 256.39 – 256.83. A 1”
 HMA Interlayer and a 1.5” **HMA surface course**, 36 ft wide, is proposed and includes the
 3rd climbing lane. In addition, 1.5” mill and similarly HMA overlay from MP 256.83 –
 256.94, west of Bridge Maint. No. 5657.1S002

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SAFETY CONSIDERATIONS: Design Manual Section 1C-1

ACCEPTABLE VALUES FOR 3R ROADWAY FEATURES

Per Design Manual Section 1C-1

Design Element	Acceptable Value	Actual Value	Meets Criteria
1. Regulatory Speed (mph)	55	55	Yes
2. Min. Vertical Curve Crest k value = 114 pass sight dist Sag min k value = 115 headlight sight dist. (35 mph) L=KA	49	49 mph	Yes
3. Max. Horizontal Curve (degrees)	6	3 deg	Yes
4. Max. Gradient	6%	4.65%	Yes
5. Lane Width (feet)	11	12	Yes
6. Parking Lane Width (feet)	---	---	---
7. Shoulder Width (feet)	6	10	Yes
8. Foreslopes	3:1	6:1	Yes
9. Transverse Slopes	6:1	<6:1	unknown
10. Horizontal Clearance (feet)	---	N/A	N/A
11. Bridge Width (feet)	24+6+6=36	N/A	N/A
12. Vertical Clearance-Over NHS (feet)	16.5	N/A	N/A
13. Vertical Clearance-Over Local (feet)	14.5	N/A	N/A

3 : There are eleven (11) Superelevated, horizontal curve locations. See sh.6 of 1975 plans RF-218-1(8)- -35-56 and Sh 6 of 1975 plans, FN-218-1(9)—21-56. The original cross slopes and superelevations will be maintained since they are below 8% and no problems exist per Design Manual 2A-2.

7.) Paved shoulders

The existing shoulders are less than 10 ft. at no locations: The crash rate is above the statewide average. The traffic volume is mostly below 3000 vpd and the horizontal alignment is generally straight. 4 ft paved shoulders with rumble strips are to be included. See pg.4-5 for the proposed shoulders for this project.

8.) The majority of the foreslopes are 6:1 or flatter on the project, unless noted in the plan and profile. See sh. 2A of 1978 plans RF-2-9(9)- -35-56 and Sh 2A of 1978 plans, RF-2-9(16)- -35-56.

9.) Transverse slopes at entrances, dikes, and sideroads may be steeper than 6:1 at some locations on the project. Since this is a NHS route, these will be flattened and the pipes extended to the current guidelines of 8:1 with drainage structures and 10:1 without drainage structures. See Design Manual 3F-3. Apron guards are to be included on entrance pipes, 24 inches or greater in diameter.

10 : Horizontal Clearance: Clearing and Grubbing -There are a number of mature trees within the clear zone / clear runout width that should be removed- especially those on the outside of horizontal curves. These trees will be removed as directed by the engineer. Prior to removal, the trees are to be reviewed for environmental clearances (Office of Location and Environment).

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SAFETY CONSIDERATION cont'd.:

1-Oct-18

CRASH HISTORY ON FY 2020 (Amendment) 3R PROJECT, by JRP

Ia 2, Lee (38) 3R NHSX-002-9(38)- -3H-56 Safety HSIPX-002-9(39)--3L-56 PIN 19-56-002-010

Location	Roadway Miles	2020 ADT		Crash History Years	Crashes, per ICAT			Rates		
		All Vehicles	Trucks		Total Crashes	Run Off the Road (ROR)	Non-Collision Related	Total Crashes (crashes/ /HMVMT)	Rate for Intersections (crashes/ /MEV)	Average Statewide Rate
MP 248.77 to 257.57	8.8	3500	10%	5 yr. 2013 - 2017	99	7	65	176		93

The Statewide roadway Rural average is 93 Crashes / One Hundred Million Vehicle Miles of Travel (HMVMT).

The 5 year crash history from Jan. 2013 to Dec. 2017 shows that there were 99 total accidents of various types. The more frequent major causes were animal (65 of 99), run off the road (7 of 99), crossing the centerline (5 of 99), and running a stop sign (4 of 99). A total rate of 176/HMVM which is higher than the statewide rural average of 93/HMVM. There were 4 fatalities and 4 major injuries. Of the 8 fatalities / major injuries, 4 were due to running off the road to the right, 2 were due to crossing the centerline, 1 ran a stop sign, and 1 lost control.

The **Safety Program** is seeking to achieve more 4 ft. paved shoulders on 2-lane roadways. This segment of highway have been identified as a part of the Ia. 2 NHS highway system that would benefit by the addition of 4 ft paved shoulders with rumble strips. Centerline rumble strips could also help to alleviate the frequency of crossing the centerline accidents.

The existing outside shoulder cross-slope has been field checked at a few random locations and found to have an average cross slope of 4%, and an average width of 12.5 ft., rather than the design width of 10 ft. It is anticipated that additional virgin aggregate material will be needed to “top-off” the remaining **granular shoulder** after the addition of the **4 foot paved shoulders**. In various locations, the existing shoulder is graded wider than the design width. The shoulder will be extended / tapered wider, outside the design width, with Cl. 13 excavated material (granular), and rolled down to match the existing foreslope.

FULL WIDTH HMA PAVED SHOULDER AT GUARDRAIL

Additional cost for full width x 9” deep paved shoulders (“beyond” the 4 ft fundamental cost) will be added for all guardrail, per detail 7156, to maintain safety height criteria and improve long-term maintenance of the shoulder cross section. The estimate includes additional costs to accommodate temporary removal and reinstallation of the existing guardrail during HMA placement of the paved shoulder.

The 4 existing cable rails are to be removed and replaced with High Tension cable rail and full width x 9” deep paved shoulders. The locations are: MP 249.81 - 249.936 N. side; MP 252.9 - 252.99 S. side; MP 255.67 - 255.85 N. side; and MP 256.06 - 256.26 N. side.

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HMA PAVED SHOULDER

Construct 4 ft. x 6 inch deep HMA paved shoulders along both sides of US 218. UAC 4 ft. of the 7 existing, 7-12' wide HMA surface fillets, at residential gravel entrances, per Typical 7139. The existing HMA **fillets at entrances**, beyond 4 ft are to be quantified and removed with Class 13 excavation. Construction of new 4 ft. fillets, via the mainline 4 ft paved shoulder, is needed at the other entrances where none currently exist.

With the exception of gravel public side road intersections that Lee County may want paved, also include 10' wide by 6" thick HMA **fillets at all non-paved county side roads**. (The proposed typical 4' wide paved shoulder will be gapped and replaced with the wider 10' HMA fillets).

Lee County was contacted and declined to participate in the funding, within the project limits, HMA paved approaches (6" or 9" in depth) of approximately 50' in length at non-paved side roads (beyond the proposed 4 ft. paved shoulder). The county appreciates the 10 ft. HMA fillets.

There are no (0) side road T-intersections that do not have a **safety dike**.

STRUCTURES (Bridges):

The following bridges are located within the project limits and do not require concrete bridge rail retrofits but one requires guardrail updates as indicated. The guardrail length will be upgraded (extended to current clear zone requirements).

MP 254.4 (Sta. 774+31.9) Maint. Bridge No. 5654.4S002 (FHWA No. 033261)

44' x 291' pretensioned concrete beam bridge carrying IA 2 over Big Sugar Creek, located 3.4 mi. W. of Jct. US 61

Official Sufficiency Rating: 96.3

This bridge (built in 1979) has stub concrete abutments on H pile (not moveable). W-beam style bolted guardrail connections at the concrete bridge end posts are in place, and they need updated to the currently approved asymmetric style (Road Standard, BA-200 series). Remove the existing 250 lf of guardrail and install approximately 450 lf of new guardrail per road standard, BA-250, grade the foreslope per EW-301, and pave the shoulder per Std. detail 7156. Plus, for the traffic control of future bridge work, a thickened 4 ft. x 9" paved shoulder is to be extended 300 ft from the bridge ends. The existing concrete rail is 34" tall.

MP 257.1 (Sta. 918+00) Maint. Bridge No. 5657.1S002 (FHWA No. 033271)

44' x 242' prestressed concrete bridge carrying IA 2 over DevilCreek, located 0.5 mi. W. of Jct. US 61

Official Sufficiency Rating: 91.7

This bridge (built in 1973) has integral concrete abutments supported on H friction piling. (moveable). An HMA leveling course has been placed on both bridge approaches. This bridge had a deck overlay, and new guardrails constructed in 2018 per Proj. BRFN-002-9(28)- -39-56. Therefore, UAC the existing guardrail and paved shoulders.

The existing concrete rail is 35" tall.

STRUCTURES (Bridges) cont'd:

MP 257.4 Ia 2 Maint. Bridge No. 5657.4O002 (FHWA No. 609570)
60' x 272' carrying IA 2 over US 61, located at the Jct. of Ia 2 Milepost 57.4 and US 61
Milepost 18.6

Official Sufficiency Rating: 100

This bridge (built in 2011) has integral concrete abutments (moveable).
 The existing guardrail includes approved asymmetric style thrie beams (Road Standard, BA-200 series). The 106.25 lf guardrail at the approach ends will be UAC and not be improved as a part of this project. There is no existing guardrail in the trailing ends and none are needed.

LARGE CULVERTS

There are 4 large box culverts (5'x5' or larger) on this project:

- 8'x 8' MP 248.4 (Sta. 521+80) with 10'x 8' tapered inlet,
- 5'x5' MP 248.8 (Sta 542+50) with 6' x 5' tapered inlet,
- 6'x5' MP 251.7 (Sta 692+85) with 6'x5' tapered inlet,
- 4'x5.5' Stockpass MP 252.8 (Sta 751+02) that also conveys 12 Ac. of drainage.

These sites have no existing guard rail. There is suitable foreslope grading. No guard rail is needed.

SMALL CULVERT REPAIR

There are 11 flumes, and 32 small culverts (5' x 5' or smaller) within the project that may be considered for extension or repair within existing right of way.

FEASIBLE ALTERNATES:

Structural analysis 8/20/18, based on 8/16/18 Traffic Est. No. 3346 :

Estimate: Lee, 2, Est# 3346, Dated 8/16/18

Est. Location From ECL of Donnellson to US 61

Date: 8/20/18

FWD

MP	MP	Dir.	TESTED	AVG K (psi/in)	STRUC Needed	80% SR	20 Year Overlay Based on 80% SR (in)	PAVEMENT (TEST SECTION BOOK)
248.77	254.18	B	05/15/2012	97	5.1	2.99	5.0	1979 F-2-9(11)--20-56 PCC 8.0
254.18	257.57	B	08/25/2015	91	5.14	2.74	5.7	1979 FN-2-9(17)--21-56 PCC 8.0
257.57	257.77	B	05/06/2014	165	5	4.87	0	2000 NHS-61-1(103)--3H-56 PCC 9.5 GSB 11.0

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PROPOSED CONCEPT:

MP 248.77 to 257.77 Rural, Ia 2 from the US 218 Jct. , east to the US 61 Interchange:

For this Concept, a holding strategy will be implemented to diamond grind the pavement surface to improve the ride (IRI) – which may also be a benefit for a future year HMA overlay to provide the needed additional pavement structure.

This concept includes diamond grinding of the 24 ft. wide pavement, 4 ft. wide x 6 inch HMA (PG 58-28S, 3/4” Standard Base) paved shoulders, 6 ft. wide x 1 inch Type B granular shoulders, subdrains, milled HMA shoulder and milled PCC centerline rumble strips.

The Soils Office indicates that this project has 81% existing subdrain coverage per 1993 Proj. FN-2-9(11)- -21-56. Subdrain gaps seem to coincide with areas that include shallow ditches and/or development near the road. This project includes 15% additional subdrain coverage.

Right of way is not required for this project. Traffic will be maintained during construction (no detour).

3R, Pavement and roadside

Clearing and grubbing, pg.3 note 10	\$ 3,000
Pipe Repairs, pg. 6	\$ 25,000
Transverse slope flattening at entrances, pg.3 note 9	\$ 20,000
Full Depth patching	\$ 75,000
Pavement grinding, limestone, incl. 2 climbing lanes	\$ 438,200
MP 256.39 – 256.83 Hill, Interlayer, 1” x 36 ft incl. climb lane, pg. 2	\$ 39,900
HMA Surface, 1.5” x 44 ft, incl. paved shld.	\$ 59,100
MP 256.83 – 256.94 W. Appr. to bridge, Scarify HMA 1.5”, pg. 2	\$ 1,500
Interlayer and Binder PG 58-34E, 1” x 24 ft incl.	\$ 6,700
HMA Surface, PG 58-28H, 1.5” x 32 ft, incl. paved shld.	\$ 10,800
Milled PCC Centerline Rumble strips	\$ 4,300
Milled HMA Centerline Rumble strips, MP 256.39-256.94	\$ 300
Remove cable rail and place High Tension Cable rail, pg. 4	\$ 23,400
9” Paved shoulder at cable rail, pg. 4	\$ 137,100
Longitudinal subdrains, pg 7	\$ 44,600
	<u>3R Subtotal</u>
	\$ 888,900
Traffic Control 1.2%, Mobilization 5%, Contingency 10%	\$ 144,000
	3R Total
	\$1,032,900

HSIPX, Safety, Paved Shoulders

Cl. 13 Excavation	\$ 88,900
HMA base widening, PG 58-28S pg. 4	\$ 868,800
Milled HMA Shoulder Rumble strips, pg. 3 note 7	\$ 16,500
Granular Shoulders, pg. 4	\$ 76,100
W-beam Guardrail updates, and 9” paved shld. pg. 5	\$ 121,200
	<u>HSIPX Subtotal</u>
	\$1,171,500
Traffic Control 1.2%, Mobilization 5%, Contingency 4.76%	\$ 128,500
	HSIPX Total
	\$1,300,000
	Total 3R and HSIPX
	\$2,332,900
	Lee County side roads, pg. 5
	\$ 0
	TOTAL
	\$2,332,900

FUNDS PROGRAMMED, pending:

This project is proposed as FY 2020 candidate.

3R Program	\$ 1,032,900
HSIPX Program	\$ 1,300,000
Lee County Funding	\$ 0
Total	\$ 2,332,900

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SCHEDULE: The letting date is pending the program funding. Plans are to be prepared for a December 2019 letting.

3R PROJECT SCHEDULE SYSTEM TRIGGERS & NEEDS	YES	NO
TRIGGERS:		
Metric Project - plans will convert to English stations		X
Consultant Involved		X
Lighting		X
Traffic Signals		X
Traffic Signs		X
Railroad, pg. 5		X
Access Control		X
NEEDS:		
Survey (topographic, borrow site, property lines)		X
Geotechnical / Borrow Site / Slope stabilization		X
Right of Way		X
Structures		X
Utility Relocations		X
County Agreement (pave 50 ft. at gravel side roads)		X

cc:

J. R. Selmer	C. Purcell	M. J. Kennerly
K. D. Nicholson	D. L. Maifield	C. B. Brakke
S. J. Megivern	M. D. Masteller	B. R. Smith
F. W. Todey	A. A. Welch	N. M. Miller
C. C. Poole	J. Nelson	G. A. Novey
M. A. Swenson	P. C. Keen	R. A. Younie
S. P. Anderson	D. R. Tebben	B. D. Hofer
K. Brink	D. L. Newell	B. E. Azeltine
W. Musgrove	T. D. Hanson	FHWA (Program.Delivery- IA@dot.gov)
S. J. Gent	T. D. Crouch	J.W. Laaser-Webb
W.A. Sorenson	D. E. Sprengeler	E. C. Wright
M. Van Dyke	J. R. Webb	T. Quam
J. Woodcock	M. Hobbs (Rail)	A.J. Klein E. Engle (Rail)
J. R. Phillips	B. M. Clancy	M. E. Ross
R. Porter	L. Finarty	L. Giarmo J. Garton

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