

IOWA DEPARTMENT OF TRANSPORTATION

TO OFFICE: District 5 **DATE:** December 12, 2017 Rev 5-31-18

ATTENTION: James V. Armstrong **PROJECT:** Keokuk County
STPN-021-1(38)- -2J-54 N. Delta
STPN-021-1(39)- -2J-54 Delta
STPN-021-1(36)--2J-54Delta ADA
STPN-021-1(34)- -2J-54 S. Delta
PIN: 01-54-021-010

FROM: James R. Phillips

OFFICE: District 5 Design

SUBJECT: 2019, '20, '23 Final Concept: HMA Paved Shoulders/ HMA Resurfacing / PCC Reconstruction

PROJECT MAP: Page 13

DATE OF REVIEW: February 22, 2017

PARTICIPANTS:

District – Jim Phillips,

PROJECT DATA

ROUTE: IA 21; From Ia. 149 Jct. (MP 0.00), north to Ia. 92 Jct. (MP 13.00)

LENGTH: 13.0 mi. a Non-NHS route

PLANNING CLASSIFICATION: 3 (Area Development)

MAINTENANCE SERVICE LEVEL: C

RURAL TRAFFIC: Traffic count no, 3239a, 2/14/17

From Ia. 149, north to Co. Rd G48 (7.19 mi).

2019 --- 776 ADT with 16% trucks

2039 --- 809 ADT with 16% trucks

From Co. Rd G48 to 1st Street (3.34 mi).

2019 --- 858 ADT with 15% trucks

2039 --- 894 ADT with 15% trucks

From 1st Street to 6th Street (0.35 mi).

2019 --- 959 ADT with 13% trucks

2039 --- 1000 ADT with 13% trucks

From 6th Street to Ia. 92 (1.43 mi).

2019 --- 878 ADT with 14% trucks

2039 --- 915 ADT with 14% trucks

PAVEMENT HISTORY:

MP 0.62 (C/L Ia. 149 Jct.) to 11.56 (NCL Delta)

ORIGINAL PAVEMENT: Rural - 22 ft. wide, 6 in. PCC (2008 photos show 4.25 to 6" PCC)

PRESENT PAVEMENT WIDTH: 22 ft.

PRESENT SHOULDER WIDTH: 6 ft.; TYPE: Earth (measures 6.5 ft. avg.@5%)

COARSE AGGREGATE SOURCE: Ollie, C. Lst.; CLASS: 2

YEAR CONSTRUCTED: 1965 – Keokuk Co. Project No. S-269(5); (former County Rd.)

PAVEMENT HISTORY cont'd:

Within the above segment(MP 0.62-11.56), 3 bridges were constructed in 1988-1989. Also Grading and PCC Paving of the roadway and bridge approaches occurred:

MP 3.037 to 3.245 Bridge at Sugar Creek Br. 5403.7S021

MP 5.762 to 6.00 and 6.38 to 6.672 at South Skunk River Br. 5406.8S021

MP 8.912 to 9.380 at North Skunk River Br. 5409.8

ORIGINAL PAVEMENT: Rural – 24 ft. wide, 9.5” PCC

PRESENT PAVEMENT WIDTH: 24 ft.

PRESENT SHOULDER WIDTH: 8 ft.; TYPE: 6 in. Granular (measures 8.5 ft. avg. @5.5%)

COARSE AGGREGATE SOURCE: unknown

YEAR CONSTRUCTED: 1989 – Project No. BRF-F-21-1(27)- -2P-54

Also within the above segment (MP 0.62-11.56), the Ia 21 street was HMA resurfaced in 1987, per FN-21-1(14)- -21-54:

MP 11.21 to 11.57

ORIGINAL PAVEMENT SURFACE: 8” Type B Asphalt Cement Concrete and 12 in. Special Backfill

PRESENT PAVEMENT WIDTH: varies 31 ft. b-b to 47.7 ft. b-b (incl. 8.35 ft. parking)

PRESENT SHOULDER WIDTH: 2.5 ft Curb and Gutter

COARSE AGGREGATE SOURCE: unknown

YEAR CONSTRUCTED: 1989 – Project No. FN-21-1(14)- -21-54

MP 11.56 (NCL Delta) to 13.0 (Ia 92 Jct.)

ORIGINAL PAVEMENT: Rural - 22 ft. wide, 7 in. PCC

PRESENT PAVEMENT WIDTH: 22 ft.

PRESENT SHOULDER WIDTH: 9 ft.; TYPE: Earth (measures 7.5 ft. avg.@ 3%, 2 in. edge rut)

COARSE AGGREGATE SOURCE: Ollie, C. Lst.; CLASS: 2

YEAR CONSTRUCTED: 1975 – Project No. SN-1832(2)- -51-54;

MP to MP	Dir.	Type	PCI-2	IRI in./mi.	RUT in.	FRIC	FAULT in.	20-Year Overlay (inch)
0.55 to 11.56	1	6” PCC	26	219	0.09	55	.0238	7.5
11.56 to 13.00	1	7”PCC	60	215	0.12	50	.0257	7.0

EXISTING CONDITIONS AND CAUSES OF DISTRESS:

South of Delta

The existing rural pavement is PCC and was originally a County Road that was transferred to the State of Iowa. The original 22’ wide PCC pavement was constructed in 1965. The existing measured pavement thickness varies from 4.25” to 6”.

A closed limestone mine, Lyle Mine, operated by Douds Stone used to provide additional truck traffic and may have contributed to pavement fatigue.

An IRI of under 140 is desirable. The IRI on this roadway provides for a relatively rough ride. The Class 2 Aggregate is generally strong.

EXISTING CONDITIONS AND CAUSES OF DISTRESS Cont'd:

South of Delta cont'd.

The roadway has been receiving frequent patching with Maintenance Patching (MP) Projects. In general, a **maintenance effort** has been underway of patching the pavement.

Here is a summary of Maintenance projects in ERMS from the last 10 years:

Let June 2006, MP-21-5(702)1--76-54	1,508 SY,	64 Count	6" and 9" PCC
Emerg. Patches 2008, Sigourney Garage	745 SY	(2008 photos show 4.25-6" Ex. thick)	
Let Aug. 2009, MP-21-5(703)0--76-54	3,508 SY,	206 Count	9" PCC
Let Jan. 2011, MP-21-5(704)0--76-54	1,127 SY,	95 Count	9" PCC
Let Dec. 2012 MP-21-5(705)1--76-54	4,756 SY,	268 Count,	9" PCC
Let Dec. 2013 MP-21-5(706)1--76-54	2,427 SY,	117 Count,	9" PCC \$215,000 (\$88.5/SY)
Let Aug. 2017 MP-21-5(708)0--76-54	1,142 SY	61 Count,	9" PCC
	15,213 SY,	811 Count	

Total 22 ft. wide Roadway Surface is 51,843 ft x 22 ft wide / 9 = 126,727 SY

The **percent (%) patched** since 2006, 15,213 / 126727 x 100 = **12%**

There are 16 segments, South of Delta, in the 22 ft wide pavement locations, that also have existing spot HMA overlays totaling 9930 ft. of the 51,843 lin. ft. The spot HMA overlays are in very poor condition.

South of Delta the earth shoulders are 6 ft. wide.

At the 3 bridges, there are 3 incongruent, 400 to 2000 ft. long segments, north of south of each bridge, 24 ft. wide, 9.5 inch PCC pavement and 10 ft. wide granular shoulders. That 24 ft. pavement, approximately totaling 8,986 lf, not including bridges and approach slabs, is in good condition but it is not recorded in the Pavement Test Section book.

In City of Delta

In the City of Delta, there is 8 inch HMA pavement. Those pavement segments are in generally good condition. They are not included in the Pavement Test Section book.

North of Delta

The original 22' wide PCC pavement was constructed in 1975. This segment is in relatively better condition than South of Delta.

An IRI of under 140 is desirable. The IRI on this roadway provides for a relatively rough ride. The Class 2 Aggregate is generally strong. The earth shoulders are 9 ft. wide.

BRIDGES:

Sta. 164+53.5, 98' x 40' Prestressed Concrete Beam over Sugar Creek, Integral abutment (fixed) **Maint. No. 5403.7S021**, FHWA No. 210121, Design No.587, Proj.BRF-21-1(25)-38-54

Built in 1989, has a sufficiency rating of 90.3 (official),

Per SIIMS, 8/4/2016, Both Concrete Approaches look good. Near Pressure relief joint is less than 2 inches at 60 ft. Far Pressure relief joint is less than 2 inches but sealed.

Concrete barrier rail height 35 inches. All BCT end terminals and guardrail are in good condition.

Existing guardrail length: 62.5 x 4 =250 LF with RE-52 end terminals. Update Guardrail per Std. Road Plan BA-250 including unsymmetrical thrie beam connections, 300 ft. of full width paved shoulder per Std. 7156 and grading per EW-301. **Est. Cost \$22,700**

BRIDGES cont'd:

Sta 325+90, 482'x 40' Prestressed Concrete Beam over South Skunk River, Stub Concrete abutment (fixed) **Maint. No. 5406.8S021**, FHWA No. 211161, Design No. 687, Proj. BRF-21-1(26)- -38-54

Built in 1989, has a sufficiency rating of 91.1 (official),

Per SIIMS, 8/4/2016, Both Concrete Approaches look good. Pressure relief joints are less than 2 inches at 75 ft.

Concrete barrier rail height 33 inches. All BCT end terminals and guardrail are in good condition with these exceptions: Near right BCT end terminal has collision damage. Far right BCT end terminal has collision damage.

Existing guardrail length: 62.5 x 4 =250 LF with RE-52 end terminals. Update Guardrail per Std. Road Plan BA-250 including unsymmetrical thrie beam connections, 300 ft. of full width paved shoulder per Std. 7156 and grading per EW-301. **Est. Cost \$22,700**

Sta. 484+28, 382'x 40' Prestressed Concrete Beam over North Skunk River, Stub Concrete abutment (moveable), **Maint. No. 5409.8S021**, FHWA No. 211041, Design No. 787, Proj. BRF-21-1(26)- -38-54

Built in 1988, has a sufficiency rating of 88.6 (official)

Per SIIMS, 8/4/2016, the pavement at both ends are in need of repair. Settlement / sagging in center of approach is occurring. An HMA overlay has been placed on both approaches.

There is a **Bridge Approach Repair project** scheduled for Dec. 2020,

MB-021-5(501)7—77-54, PIN 17-54-021-010 **By others Est Cost \$150,000**

Concrete barrier rail height 33 inches. All BCT end terminals and guardrail are in good condition. Existing guardrail length: 62.5 x 4 = 250 LF with RE-52 end terminals. The Guardrail will be updated with the (501) project and per Std. Road Plan BA-250 including unsymmetrical thrie beam connections, full width paved shoulder per Std. 7156 and grading per EW-301. **By others Est. Cost \$22,700**

The concrete barrier rail heights at the 3 bridges meet current safety standards.

Per SIIMS, none of the bridges are functionally obsolete or structurally deficient.

CULVERTS:

There are 6 Large Culverts and 43 small culverts. The RCE office is investigating culvert repairs.

- The 5 x 5 RCB at MP 4.79, Sta 220+56 is marked by a Type 2, OM2-1V object marker / button delineator. Guard Rail Est. Cost \$ 12,800
- The 54" RCP at MP 12.07, Sta 49+03 has a pipe separation and slide near the shoulder edge. It is marked by a OM3-R object marker panel.
Other pipe repairs, estimated at 10% of 43 small culverts Est. Cost \$ 17,200
- 11 CMP culverts flowlines rusted. Slip Line the culverts Est. Cost \$ 132,000

A combination field and record drawing summary of Culverts may be found at:
PW:/Documents/Projects/5402101001/DistrictDesign/Docs/Culverts/Ia 21 Station
Milepost Detailed Culvert Guard Rail Estimate.xlsx

A further review to determine if any of the small culverts need repaired, or erosion stone / riprap on the project is underway by the Mt. Pleasant RCE and Sigourney garage. Repairs will typically be for slip lining rusted CMP cross road pipes or removing and resetting dropped/separated sections.

CRASH DATA:

During the five-year study period from January 1, 2012 through December 31, 2016, there were 25 crashes including, 0 fatal crashes, 1 major injuries, 5 minor injury crashes, 1 possible/unknown injury crashes, and 18 property damage only crashes in the entire project. The crash rate is 127 /HMVM which is higher than the statewide rural average of 93/HMVM. The crash rate in the City of Delta is 106 /HMVM which is lower than the statewide urban average of 309/HMVM.

SAFETY CONSIDERATIONS:

RURAL ACCEPTABLE VALUES FOR 3R ROADWAY FEATURES

Per Design Manual Section 1C-1.

Design Element	Acceptable Value	Revised Acceptable Value 12/8/2016	Actual Value	Meets Criteria
1. Regulatory Speed (mph)	55	55	55	Yes
2. Min. Vertical Curve – Sag (35 mph)	K=49	35 mph, K =29 crest 49 sag	K=44, 17 urban	Yes
3. Max. Horizontal Curve (degrees)	6.0	6.0	25	Yes
4. Max. Gradient	6.0%	6.0%	7%	No
5. Lane Width (feet)	12	11, 12 if NHS	11	Yes
6. Parking Lane Width (feet)	---	---	---	---
7. Shoulder Width (feet)	6	6	6	Yes
8. Foreslopes	3:1	3:1	≥ 3:1	Yes
9. Transverse Slopes, Entrances	6:1	6:1, 8:1/10:1 if modifying	≤ 6:1	No
10. Horizontal Clearance (feet)	---	---	---	---
11. Bridge Widths (feet), 3 bridges	24+6+6=36	24+6+6=36	40	Yes
12. Vertical Clearance-Over NHS (feet)	16.5	16.5	N/A	N/A
13. Vertical Clearance-Over Local (feet)	14.5	14.5	N/A	N/A

2.) The crest and sag vertical curves in the **rural** section are above the design criteria for 35 mph. The lowest k value is 65 (46 mph) at sag curve Sta 207+50, MP 4.5. No changes to the vertical curves are planned on the project as they meet the minimum 35 mph 3R criteria in the rural locations.

Within the **urban**, City of Delta per Proj. S-269(4):

Sag curve Sta 548+50, K=44 (40 mph) in a Posted Speed of 35 mph zone, and Crest curve Sta 558+00, K=17 (20 mph), in a Posted Speed of 25 mph zone.

3.) The horizontal curves on this project are superelevated.

South of Delta: Max. Dc = 5 deg. Sta 280+38, MP 4.9

North of Delta:

Per 1975 plans SN-1832(2): Sta. 72+54 MP 11.7 posted speed 45 mph, **Dc=12** degrees, superelevated

Per 1965 plans SN-1832(1): Sta. 5+22.5 MP 12.8 posted speed 35 mph, **Dc=25** degrees, superelevated (unable to find 1975 record drawing, that may show flatter Dc)

SAFETY CONSIDERATIONS cont'd:

4.) MP 7.4, Sta. 358 to 361+00, the grade is 7%; Otherwise, the maximum is 6%.

7.) There is a desire to convert the 22 ft. wide pavement to 24 ft. wide with 4 ft. paved shoulder.

Unless Reconstructed, the 22 ft wide existing pavement segments, Five foot widening will occur including 2 ft of full depth pavement and 3 ft of 6 in. pavement. 12 foot lanes will be marked with paint, and an effective 4 foot wide paved shoulder will be in place.

In the 24 ft wide existing pavement segments at bridges, this project will include four feet wide HMA shoulders to meet the general requirements of Design Manual 3C-4.

The remaining shoulder, South of Delta: (6 ft - 5ft = 1 Granular) North of Delta (9 ft – 5 = 4ft. Granular and at 3 Bridge sites (10 ft. -4 = 6 ft granular) in 3 different types of segments to provide a 5- 10 foot effective shoulder width.

The thicker PCC pavement alternates may result in an approximate 7.5 foot effective shoulder width, pending final design.

8.) For Non-NHS Design Exceptions for maintaining the existing foreslopes:

- this 3R project is not purchasing right of way for foreslope flattening,
- there are 0 run-off-the-road incidents in the accident history – in last 5 years,
- this is a lower volume road,
- **Milled shoulder rumble strips** help reduce run-off-the-road (ROR) incidents and will be included in the project,
- **Centerline Milled Rumble Strips** – Design manual 3C-5, This segment is not on the 5% cross centerline crash corridor list. C/L rumbles are planned for this project.
- guard rail can add a safety measure, but it can also reduce horizontal road width for agriculture equipment and passing vehicles. Culvert drop-offs at shoulder or pavement edge is included in the review.
- 2.5:1 slope are located at bridge berms.
- **Clearing and grubbing** will be included to remove trees within the clear zone and/or to bottom of the fore slope and ditch bottoms when applicable.

9.) Any **transverse slopes** at entrances, dikes, and sideroads that are steeper than 6:1 on the project will NOT be flattened, nor the entrance pipes extended, to meet current RL-8 guidelines on this project due to being an Non-NHS route and for exceptions indicated in note 8.

11.) There are 43 small culverts. 2 culverts are marked with Type 2 / Type 3 object markers. More information is available in the **Culverts Section**.

Auxiliary lane warrants were reviewed and no additional right or left turn lanes are warranted for this non-NHS route.

No **Safety dikes** are needed.

OTHER CONSIDERATIONS:

Subdrains

Dynamic Cone Penetrometer (DCP) testing was also performed to verify that the subgrade will support the rubblizing process.

7,297 LF (14% existing South of Delta, per Proj. BRF-F-21-1(27)- -2P-54) and 5,835 LF (78% existing North of Delta, per Proj. FN-21-1(14)- -21-54) lin. ft of subdrain exists.

100% subdrain coverage (86% more S. of Delta and 22% more N. of Delta, respectively) is recommended with each of the Alternates pavement treatments. In the case of Alternate 4a, rubblization or 4b, crack and seat, it would be, if rubblizing, helpful to complete the subdrains several months, to a year, in advance to ensure the subbase is dry, firm so that pavement breaking could be effectively be performed. Subdrains are included in the following Alternates.

Widening Pavement from 22 to 24 ft.

In the 22 ft wide existing PCC segments, the one (1) foot min. widening unit, along both sides, needs to be 8.5" HMA or PCC over 9" of special backfill. The pavement type of the widening will need to match the pavement type of the selected alternate treatment.

The 3 existing 24 ft. x 9.5" PCC segments near the 3 bridges will be Used As Constructed in each of the Alternates, with the addition of retrofitting Paved Shoulders.

South of Delta: The recommended PCC inlay reconst. pavement width is to be 24 ft.

North of Delta: The existing 22 ft. pavement will be used as constructed, diamond grinded, and **5 ft. x 6 inch HMA** shoulders (and 2 ft. x 3" widening unit) are to be retrofitted - for future HMA overlay and 12 ft lane pavement markings, and 4 ft. paved shoulder. See Alternate 6.

Paved Shoulders

A minimum of 4 ft. wide x 6" thick HMA paved shoulders and shoulder rumble strips is included in each alternate. Since Ia. 21 has 22 ft pavement and 11 ft. lanes, consideration is given to provide **5 ft. x 6" thick (and 2 ft. x 3" widening unit) HMA paved shoulders**. A future full width HMA overlay could then place pavement markings for 12 ft. lanes. See Alternate 6b.

Granular Shoulders

After paved shoulders, the remaining granular widths will vary from 1 to 6 feet. See note 7 of the Safety Considerations.

Full-width paved HMA shoulders will be included in front of the guardrail at 2 bridge sites within this project.

HMA fillets will be included only at non-paved public gravel sideroads and **not** at entrances per Design Manual 7D-8. Existing HMA fillets will be removed. The proposed paved shoulder will function as entrance fillets.

For public safety consideration during maintenance of side roads, **Keokuk County** was contacted and declined to have the gravel side road intersections paved with HMA, at the Counties participatory cost. **Est. Cost \$ 0**

OTHER CONSIDERATIONS cont'd:

MP 10.51, Sta 555+70, South of 1st St. Abandoned Railroad Crossing No. 8176. There are existing tranverse cracks. Remove possible subsurface **anchor lug**. **Est. Cost \$10,000**

The **ADA Ramps** within the City of Delta are anticipated to be improved in the year 2020. Project number: STPN-021-1(36)- -2J-54, PIN 17-54-021-030 with (37) for right of way. The existing gravel sideroad approaches in the City are to be paved for the crosswalks.

FEASIBLE ALTERNATES:

Pavement Special Investigation

Nondestructive, FWD evaluation and pavement cores of the existing pavement occurred in early 2017. The distresses in the pavement are significant and include: transverse cracks, longitudinal fatigue cracks, material related distress, and significant patching and spot overlays.

The earlier 2017 dTIMs structural analysis, that had erroneously been proposed, only showed 0.5” structural need.

However, the subsequent FWD evaluation, based on the condition of the pavement with extensive fatigue cracking that has been partly full depth patched and yet there remains all of the remaining fatigue cracks, this pavement is clearly structurally deficient and the earlier 2017 dTIMS analysis was not valid for this pavement.

Pavement Determination:

A 6/27/2017 Structural and 10/6/17 Subgrade analysis indicates:

						Alt. 2	Alt. 3	Alt. 5	
FWD						20 -Year Overlay over Exist. Pav't	20 -Year Overlay over Rubblized Pavm't	20 -Year PCC over 12 in. Special backfill (incl. Recycle 6" PCC)	
MP	MP	Dir.	TESTED	80% SR	AVG K (psi/in)	(in)	(in)	(in)	PAVEMENT (TEST SECTION BOOK)
0.55	11.56	B	2017	1.35	84	>6.0" use 6.0"	7.5" w/ early subdrains	9.0"	1965 S-269(4) & S-269(5) PCC 6.0 South of Delta
11.56	13.00	B	2017	1.97	57	>6.0", or use 5.0" w/ 1" Interlayer	7.0"	9.0"	1975 SN-1832(2)-51-54 PC7 7.0 North of Delta

Due to funding availability, the project has 3 Phases and separate construction years:

Phase A – North of Delta, FY 2019

Phase B – In City of Delta, FY 2020

Phase C – South of Delta, FY 2023 (possibly advance to FY 2021)

Several of the Phases, have Alternative rehabilitations.

FEASIBLE ALTERNATES cont'd:

North of Delta

Phase A, Alternate 2: 6" HMA Overlay: 3 lifts - 1 inch of Interlayer and 5 inches of HMA

The 6" PCC segment south of Delta is severely patched (approx. 12% of surface area) and contains many random cracks. An HMA overlay may not be very effective and it may experience the same surface distresses long before the 20 year design life is reached. If we use HMA overlay in this segment, it is suggested to include an HMA interlayer (7.5% binder with polymer) to delay the cracking. This layer isn't considered a structural layer so the HMA thickness needed remains at 6", inclusive of placing an interlayer. The PCC segment north of Delta is in better existing condition.

Est. Cost Alt. 2 Rural, Apply to North of Delta only \$ 1,195,035

Phase A, Alternate 6b, (38) Paved shoulders and Diamond Grind pavement:

Diamond Grind the existing 22 ft. wide pavement and place subdrains and 2 ft. x 3 in. HMA widening unit topped with a 5 ft. x 6 inch HMA paved shoulders and place pavement markings for 11 ft. lanes (allows for future overlay and 12 ft. lanes.)

Est. Cost, Alt. 6b Rural, North of Delta \$ 516,400

Delta

Phase B: Urban (39) 1.5 inch mill and 1.5 inch HMA Overlay

In the City of Delta, each of the 3 Alternates includes a 1.5 inch mill and 1.5 inch HMA overlay of the existing 8 inch thick HMA surface. Urban Est. Cost \$ 49,530

The City has expressed interest in participating in the resurfacing of the paved parallel parking. City Est. Cost \$ 7,750

South of Delta

Phase C, Alternate 1 Holding Strategy: 3" HMA Overlay: 2 lifts

If we use HMA overlay south of Delta, it is suggested to include an HMA interlayer (7.5% binder with polymer) to delay the cracking. This layer isn't considered a structural layer so the HMA overlay thickness needed remains at 3" including placing the 1" interlayer.

Rural Est. Cost, combined both North and South of Delta \$ 4,630,000

***Phase C, Alternate 3: Rubblize existing pavement, choke stone and 7.5 in. HMA Overlay**

South of Delta. Rubblize and 7.5 in. HMA overlay:

Place and compact 3" of choke stone or rap over the rubblized or pavement for smoother final surface.

Considering the minimal difference between the HMA thickness required for overlay and rubblization, then rubblization may be a more effective approach since it may experience fewer distresses and provides a better level of service within the design life. The Pavement Determination recommends rubblization and a 7.5 inch HMA overlay, south of Delta,

Est. Cost, Alt. 3 Rural, Apply to South of Delta only \$ 8,730,400

FEASIBLE ALTERNATES cont'd:

South of Delta cont'd.

***Phase C, Alternate 4: HMA Bond breaker and 6 in. PCC unbonded Overlay (UBOL)**

An HMA bond breaker of 1.0" to 1.5" thick is needed over the existing PCC pavement. The HMA should be placed in a manner to improve the existing profile and reduce overrun in the PCC overlay. Use 6.0 inches as the preliminary unbonded PCC overlay thickness for the concept development.

Representatives from the National Concrete Pavement Technology Center Association reviewed the roadway on 3-7-17 with District 5 management and expressed in a April 6, 2017 report that the existing concrete is a good base for an unbonded PCC overlay.

Additional testing was obtained to assess the suitability of PCC overlay approach for this pavement and to do a more accurate thickness design. The testing included coring and FWD testing of the pavement. **FWD Testing** was requested Feb. 27, 2017. FWD was completed May 11th and pavement cores completed June 26th. See page 8.

The Iowa DOT Pavement Management Engineer, Chris Brakke, **does not recommend** a PCC overlay.

Est. Cost, **Alt. 4** Rural, combined both North and South of Delta \$ 8,940,000

***Phase C, Alternate 5, (34) South of Delta only:**

Remove existing pavement, **Construct new 9 in. x 24 ft. PCC inlay** with 6 in. x 30 ft. granular subbase and 12 in. x 30 ft. Special Backfill - including the recycling of the existing pavement as part of the special backfill.

This segment is deteriorating and has been patched multiple times, see pg. 3.

Compared to Alternates 3 and 4 which raise the centerline profile:

- Constructing Alternate 5 to the elevation of the existing centerline profile would;
retain more of the existing shoulder widths,
and the side road profiles may be matched in more easily,

Est. Cost, **Alt. 5** Rural, **South of Delta \$ 12,325,000**

***Traffic Control**

For Phase C, Alternates 3, 4, and 5 Iowa 21 could be closed to through traffic. Local traffic would be allowed. A through traffic detour route would be along Iowa 149, from Ia 78 to Ia. 92. (See Map) The out of distance travel along the detour route is 14 miles.

*** Notes** For Phase C, Alternates 3, 4 and 5 if chosen may result in the need for an adjustment in the project survey / design schedule and program funds. Also it may require:

- A. A 3 line survey (EP, C/L, EP) every 50 ft. and mainline design profile,
- B. Cross slopes measured at 500 ft. intervals,
- C. Sideroad profiles, joint layouts in plans,
- D. Reference ties / benchmarks and G sheets for x,y,z paving control,
- E. Traffic control coordination with the County and property owners along the corridor.

Summary of Alternatives – rural alternatives include paved shlds.

Rehabilitation Alternative	Design Life	Rdwy Mod.	Paving Thickness	Subbase Layer Requirement	Est. Cost
Phase C, SOUTH OF DELTA (34), 8.40 mi. UAC 3 bridge sites incl. exist PCC approaches. See map and detour. FY 2023					
Alt. 1, 3" HMA incl. 1" interlayer	Holding Strategy		3" HMA	Subdrains	\$3,960,000
*Alt. 3, Rubblize and 7.5 in. HMA	20	Rubblize Exist. PCC	3" Chokestone, 7.5" HMA	1 yr. Early Subdrains, Phase A \$ 301,000	\$8,730,400 incl. subdrains
*Alt. 4, PCC overlay	limited				\$8,940,000
*Alt. 5, PCC inlay Reconstruction	20	Recycle PCC	9.0" PCC 6" Mod. Subbase	12" Special Backfill (Recycled PCC) and Subdrains	\$12,325,000
Phase B, In CITY OF DELTA (39), .35 mi. , FY 2020					
Mill and Overlay (39)		1.5" Mill	1.5" HMA		\$49,530
City Parking		1.5" Mill	1.5" HMA		\$7,750
ADA ramps (36), R/W (37)					\$310,000
Phase A, NORTH OF CITY OF DELTA (38), 1.42 mi., FY 2019					
Alt. 1, 3" HMA incl. 1" interlayer	Holding Strategy		3" HMA	Subdrains	\$669,000
Alt. 2, 6" HMA incl. Interlayer			6" HMA: 1" Interlayer, 3" Intermed., 2" Surface	Subdrains, \$ 11,000	\$1,195,035 incl. subdrains
Alt. 6a, Diamond Grind w/ 4 ft. x 6 in. paved shlds. Allows exist. 11 ft. travel lane and 4 ft. shld.			Existing	Subdrains	\$420,000 incl. subdrains
Alt. 6b, Diamond Grind w/ 2 ft x 3 in. widening topped with 5 ft. x 6 in. paved shlds. Allows for future HMA overlay and 12 ft. travel lanes and 4 ft paved shld.			Existing	Subdrains	\$516,400 incl. subdrains
Legend					
Recommendation					

RECOMMENDATIONS:

South of Delta

Based on the recent Falling Weight Deflectometer (FWD) structural data from June 2017 that showed a 6+” structural need, it was initially recommended to rubblize and 7.5” HMA overlay the existing 1965 6” PCC pavement (south of Delta) – See Alternate 3. Other Alternatives were also considered, pending funding availability. **Alternate 5, a PCC inlay reconstruction, was chosen.** Also see Pg. 11-12.

North of Delta

A 6” HMA overlay of the existing 1975 7” PCC pavement (**north of Delta**), no Rubblizing was initially recommended – See Alternate 3. However the existing pavement looks in good condition, so, to improve the ride, **Alternate 6b, diamond grinding of the 22 ft. wide surface, plus including 5 ft. x 6 inch paved shoulders is recommended for a future 24 ft. roadway and 4 ft paved shoulders.**

The recommended method of rehabilitation for this project is a combination of Alternate 6b for North of Delta and Alt. 5 South of Delta. In summary:

Phase A, FY '19, Project No. STPN-021-1(38)- -2J-54	
Alt. 6b <u>North of Delta</u> , paved shld. and grinding, pg. 10, 12	\$ 516,400
Phase B, FY '20 Project No. STPN-021-1 (39)- -2J-54	
City of Delta 1.5” mill and 1.5” overlay, pg. 10, 12	\$ 49,530
City of Delta ADA ramps (36)	\$ 310,000
Subtotal Phase B	\$ 359,530
Phase C, FY '23 Project No. STPN-021-1(34)- -2J-54	
*Alternate 5: <u>South of Delta</u> , 9” PCC Inlay, pg. 11-12	\$12,325,000
Subtotal A, B, C	\$13,200,930
Resurfacing of parking, City of Delta (City Participation) pg.10	\$ 7,750
TOTAL	\$13,208,680

PROJECT AGREEMENTS:

1. Right of Way WILL BE required for ADA (37).
2. A City Agreement WILL be required (paved parking).
3. A County Agreement will NOT be required.
4. A Railroad Agreement will NOT be required.

Keokuk County

STPN-021-1(38)- -2J-54 STPN-021-1(39)- -2J-54 STPN-021-1(36)(37)- -2J-54 ADA

and STPN-021-1(34)- -2J-54

PIN: 01-54-021-010

Page 14

FUNDS PROGRAMMED:

Phase A

Proj. No. STPN-021-1(38)- -2J-54

FY '19 (38), N. of Delta paved shlds, and pavement diamond grinding is recommended for programming in FY '19 using 3R funding. \$ 398,000 Let Feb. 2019

Phase B; 2 Tied Projects (39) (36)

Proj. No. STPN-021-1(39)- -2J-54

Phase B, FY '20 (39) City of Delta Resurfacing, 3R funding, \$ 49,530 Let Dec. 17, 2019 and

Proj. No. STPN-021-1(36)- -2J-54 and ADA R/W STPN-021-1(37)- -2J-54

Phase B, FY'20 ADA sidewalk and ADA funding, \$310,00 Let Dec. 17, 2019 Concept by others.

Proj. MB-021-5(501)7- -77-54 PIN 17-54-021-010

FY '20 Bridge Approach Repair, See pg. 4, Concept by others.

Phase C

Proj. STPN-021-1(34)- -2J-54

FY '23 (34), S. of Delta PCC Inlay Reconst. is being considered for FY '23, \$ 14,698,000, including inflation, Let March 2023. This project could be advanced to FY 2021.

A schedule of events for plan development will be determined following approval of the Project Concept.

3R PROJECT SCHEDULE SYSTEM TRIGGERS & NEEDS	YES	NO
TRIGGERS:		
Consultant Involved: Phase C Yes	Phase C	Ph. A B
Lighting		X
Traffic Signals		X
Traffic Sign updates	X FY '23	
Abandoned Railroad Crossing No. 8176, pg. 8	X	
Access Control		X
Subdrains, pg. 9	X	
Plan development, by District - FY '19	Ph. A	
Plan development, by District and Ames - FY '20	Ph. B	
NEEDS:		
Survey, pg. 10	X	
Geotechnical / Borrow Site		X
Right of Way, ADA ramps, pg. 8	2020	
Structures, pg. 3-4		X
Exist. pavement FWD and DCP testing pg. 8, 9,11	done	
Utility Relocations		X
City Agreement, Delta, paved parking, pg. 10	X	
County Agreement (Keokuk), see pg. 8		X

cc:

- | | | |
|-----------------|------------------|------------------------------------|
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| D. Swan | L. Finarty | L. Giarmo J. Garton |

IA 21, Keokuk County Map

3R from IA 149 Jct. (MP 0.0) to IA 92 Jct. (MP 13.00)

