Illinois Department of Transportation

To:	Keith Roberts	Attn: Kirk H. Brown	
From:	Jack A. Elston	By: Michael Brand	Michael Brand
Subject:	Pavement Design Approval		
Date:	December 19, 2019		

Route: FAP 310 (US 67)
Section: 42-2
County: Jersey
Contract: 76568
Limits: New Delhi Bypass

We have reviewed the pavement design for the above referenced project which was most recently submitted on December 18, 2019. The scope of the project involves constructing a new 2.5 mile, 4-lane bypass of New Delhi on new alignment.

Considering the large increase in multi-unit trucks associated with the proposed multi-modal development just to the north of New Delhi, we concur with the district it is most appropriate to treat this as a "special design". We also concur with using a rigid pavement as it would best handle the high volume of truck turning at the intersections at each end of the project. Further, the designed thickness of the rigid pavement is less variable in relation to the volume of trucks so would best able to handle additional truck traffic if the size of the development increases over time.

In summary the approved pavement designs are as follows:

<u>US 67 New Construction</u>
10.5" PCC w/ 10.5" Tied PCC Shoulders
4" Stabilized Subbase
12" Aggregate Subgrade Improvement

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

Illinois Department of Transportation

Memorandum

To:	Jack Elston	Attn.:	Michael Brand
From:	Keith Roberts	By:	Kirk H. Brown
Subject:	Pavement Design Review – Special Design		
Date:	December 18, 2019		

FAP Route 310 (US 67)
Section 42-2
Jersey County
Contract 76568

Grading, Drainage & Paving on New Alignment for New Delhi Bypass

This project consists of constructing four lanes of US Route 67 along a new alignment to bypass New Delhi. Therefore, Mechanistic Rigid and Flexible pavement designs were performed and evaluated for the new pavement to be constructed.

Project Information

- US Route 67 is designed as "Other Marked State Route"
- Total length of project is approximately 13,030 feet
- Approximate areas
  - Pavement: 77,415 square yards
  - Shoulder: 40,540 square yards
- Traffic data was taken from IDOT's ADT webpage
- Traffic assumptions:
  - Assume 12,500 MU from the projection of a full development
  - Assume 25% of the full development traffic, we would have PV 11,800 (74.5%), SU 925 (5.8%), MU 3,125 (19.7%)
  - This results in 703 MUs in the design lane, which qualifies as high-stress
- The adjacent pavement structure south of the proposed bypass is 14" full-depth HMA over 12" lime modified soil
- The subgrade support ratio (SSR) for this location is "poor"
- RGR recommends the subgrade be modified with lime with areas requiring an aggregate subgrade due to the soil in these areas not conductive with lime

The Mechanistic designs resulted in:

- 10 ½" JPC pavement
- 14 ¼" Full-Depth HMA pavement.

The District is requesting this to be considered a Special Design. There is the potential for a Multi-Modal Business Park will be built just north of this new roadway alignment. This new facility will tie into the Delhi Bypass as one of the primary routes in and out of the area. The new facility has just begun planning and final traffic studies are not available. So as not to delay our IDOT project, the District is moving forward with this Rebuild Illinois project. Once the Multi-Modal Business Park has provided sufficient traffic data, District 8 and Jersey County Highway Department will work together to best address any additional traffic and safety improvements to this new alignment.

The District is proposing the rigid design with an aggregate subgrade improvement (reasons shown below) and is recommending the following pavement design:

- 10 ½" JPC pavement with same depth PCC shoulders
- 4" Stabilized subbase
- 12" Aggregate Base

The rigid design will allow widening for any turn lanes or other lanes as necessary which would be tied into the mainline pavement. The District proposes using an Aggregate Subgrade Improvement instead of Lime Modified Soil due to constructability issues with the previous south sections of US 67. Many wet pockets in the subgrade were encountered and had to be removed and replaced with an aggregate base. The District would like the subgrade to be uniform throughout the project and provide additional strength for the potential future development.

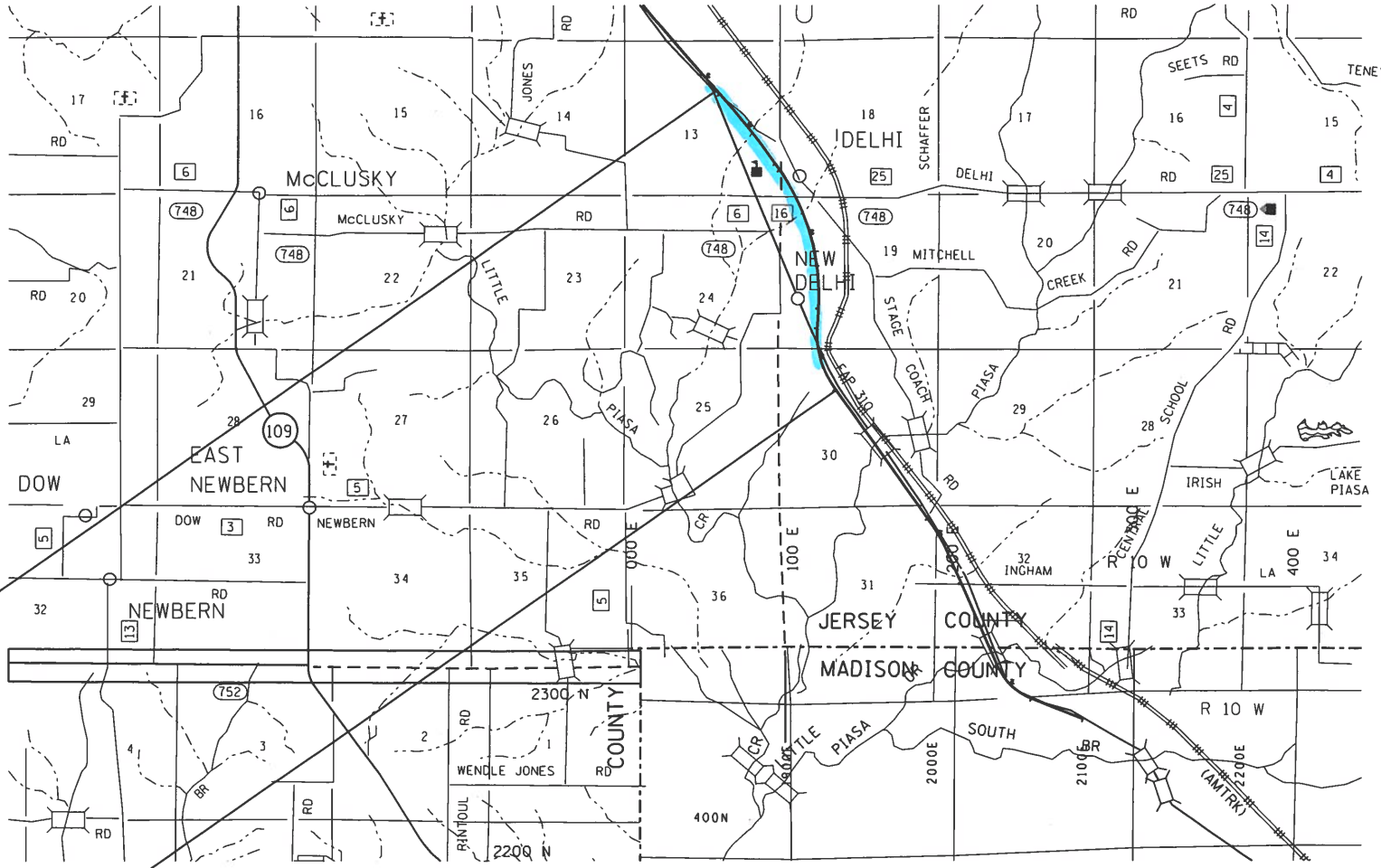
If you have any questions or comments, please contact Rob Harbaugh (618) 346-3195 or Tiffany Brase at (618) 346-3175.

Kirk H. Brown, P.E.
Program Development Engineer

Attachments

RDH/S:\Squad_6\Pavement Design Reviews\10 - Jersey County\New Delhi bypass\Pavement Design (updated) to BDE for review.docx

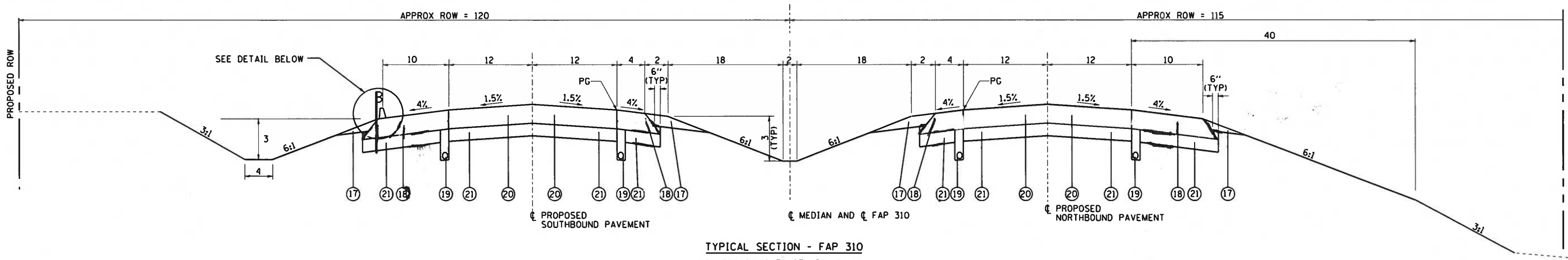
END CONSTRUCTION
STA 463+50



BEGIN CONSTRUCTION
STA 337+00.00

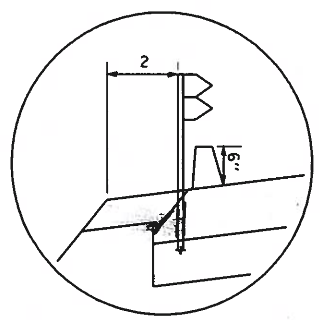
FAP ROUTE	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
310	42-2	JERSEY	393	10
STA		TO STA		
EXISTING CONDITIONS:				

CONTRACT NO. 76568



TYPICAL SECTION - FAP 310

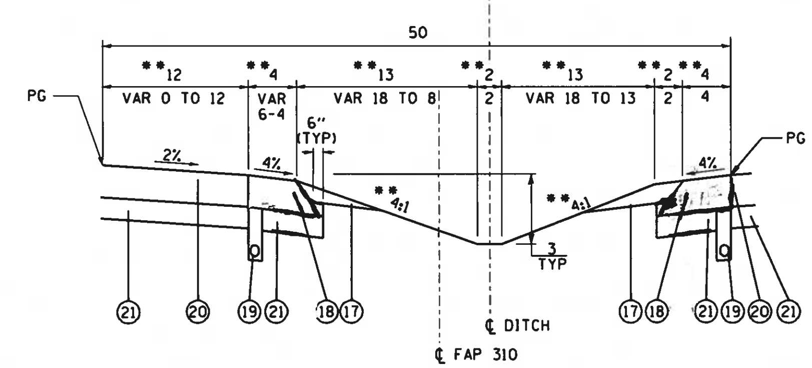
STA 360+20.49 TO STA 361+64.40
STA 418+16.54 TO STA 463+50.00 (NB)
STA 418+16.54 TO STA 470+00.00 (SB)



DETAIL OF SHOULDER CURB

(STD 610001)
(NOT TO SCALE)

STA 346+86 TO STA 351+40 LT
STA 434+92 TO STA 440+25 LT
STA 345+00 TO STA 351+40 RT
STA 401+87 TO STA 402+09 RT
STA 435+87 TO STA 440+25 RT



TYPICAL SECTION - FAP 310

** DIMENSIONS WHERE FULL LEFT TURN HAS DEVELOPED
STA 355+36.13 TO STA 358+90.49

STRUCTURAL DESIGN TRAFFIC: Year [redacted]
PV: [redacted] SU: [redacted] MU: [redacted]
ROAD/STREET CLASSIFICATION: Class: 1
PERCENT OF STRUCTURAL DESIGN TRAFFIC IN DESIGN LANE:
P: --- S: [redacted] M: [redacted]
TRAFFIC FACTOR: Actual TF: ____ AC Type: ____
Minimum TF: [redacted]
PG GRADE: Binder: ____ Surface: ____
SUBGRADE SUPPORT RATING:
SSR: POOR (Sta. ____ to ____)
SSR: ____ (Sta. ____ to ____)

MATERIAL LEGEND:

(17) AGGREGATE SHOULDERS, TYPE B
(18) SHOULDERS,
(19) PIPE UNDERDRAIN 4"
(20) PROPOSED PAVEMENT
(21) IMPROVED SUBGRADE
(22) COMBINATION CONCRETE CURB AND GUTTER, TYPE M4.24
(23) COMBINATION CONCRETE CURB AND GUTTER, TYPE M4.06
(24) CONCRETE MEDIAN SURFACE 6"
(25) SUBBASE GRANULAR MATERIAL, TYPE C 6"
(26) HOT-MIX ASPHALT SURFACE COURSE, MIX "C", N70, 1½
(27) LEVELING BINDER (MACHINE METHOD), N70, 1½"
(28) AGGREGATE BASE COURSE, TYPE B, 8"
(29) AGGREGATE BASE COURSE, TYPE B, 11"
(30) AGGREGATE SHOULDERS, TYPE A, 6"
(31) CONCRETE MEDIAN, TYPE SM
(32) SUBBASE GRANULAR MATERIAL, TYPE B, 12"
(33) SUBBASE GRANULAR MATERIAL, TYPE B, 4"
(34) HOT-MIX ASPHALT BINDER COURSE, IL 19.0, N70, 12"
(35) AGGREGATE SURFACE COURSE, TYPE A, 15"

NOTE:
SAW CUT AND REMOVE HMA WEDGE PRIOR TO INSTALLATION OF PIPE UNDERDRAINS, 4"

ALL UNITS ARE IN FEET UNLESS OTHERWISE SHOWN

REVISIONS	
NAME	DATE

ILLINOIS DEPARTMENT OF TRANSPORTATION

PROPOSED TYPICAL SECTIONS

FAP ROUTE 310 (US 67)
SECTION 42-2
JERSEY COUNTY

DRAWN BY: LBM CHECKED BY: CAS

PLAN		BY	DATE
NOTE BOOK NO. ____	SURVEYED		
	PLOTTED		
	ALIGNMENT CHECKED		
	RT. OF WAY CHECKED		
	CADD FILE NAME		

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CONSULTING ENGINEERS
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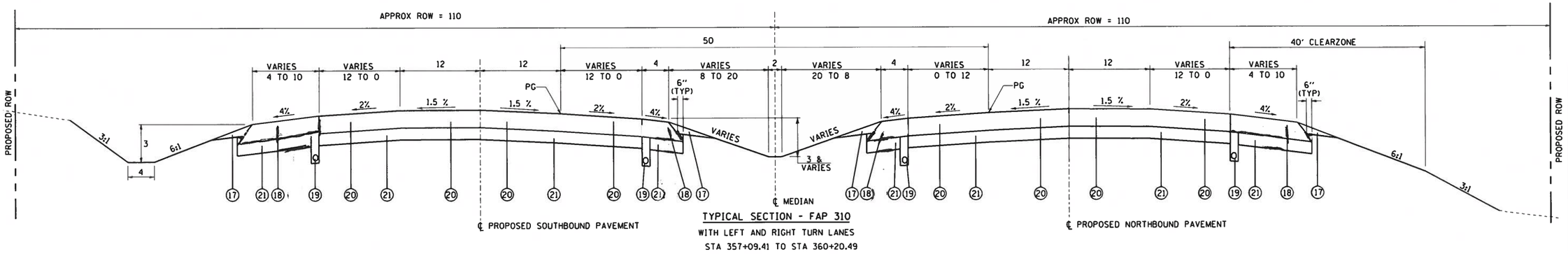
CHICAGO (773) 714-0050
ROCKFORD (815) 489-0050
184-001397

FAP ROUTE	SECTION	COUNTY	TOTAL SHEETS	SHEET NO
310	42-2	JERSEY	393	11
STA	TO STA			
EXISTING CONDITIONS:				

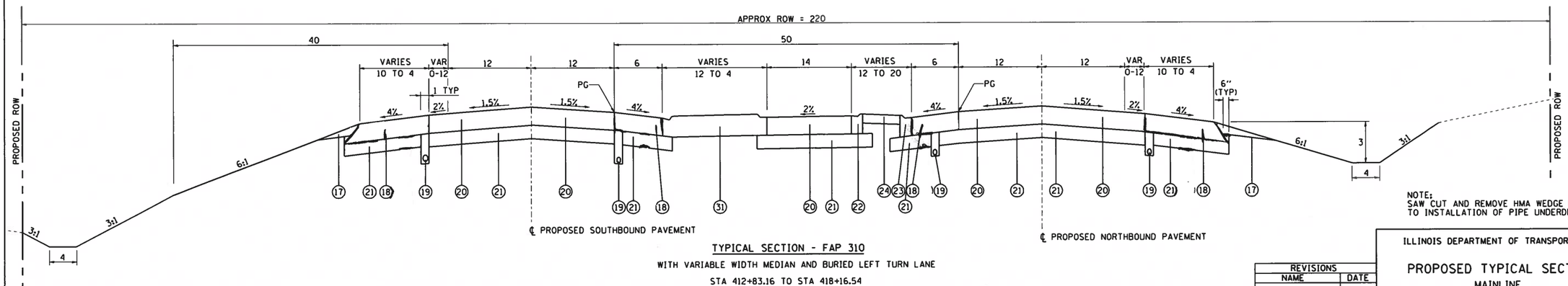
CONTRACT NO. 76568



TYPICAL SECTION - FAP 310
WITH LEFT AND RIGHT TURN LANES
STA 357+09.41 TO STA 360+20.49

MATERIAL LEGEND:

(17) AGGREGATE SHOULDERS, TYPE B
(18) SHOULDERS,
(19) PIPE UNDERDRAIN 4"
(20) PROPOSED PAVEMENT
(21) IMPROVED SUBGRADE
(22) COMBINATION CONCRETE CURB AND GUTTER, TYPE M4.24
(23) COMBINATION CONCRETE CURB AND GUTTER, TYPE M4.06
(24) CONCRETE MEDIAN SURFACE 6"
(25) SUBBASE GRANULAR MATERIAL, TYPE C 6"
(26) HOT-MIX ASPHALT SURFACE COURSE, MIX "C", N70, 1½
(27) LEVELING BINDER (MACHINE METHOD), N70, 1½"
(28) AGGREGATE BASE COURSE, TYPE B, 8"
(29) AGGREGATE BASE COURSE, TYPE B, 11"
(30) AGGREGATE SHOULDERS, TYPE A, 6"
(31) CONCRETE MEDIAN, TYPE SM
(32) SUBBASE GRANULAR MATERIAL, TYPE B, 12"
(33) SUBBASE GRANULAR MATERIAL, TYPE B, 4"
(34) HOT-MIX ASPHALT BINDER COURSE, IL 19.0, N70, 12"
(35) AGGREGATE SURFACE COURSE, TYPE A, 15"



TYPICAL SECTION - FAP 310
WITH VARIABLE WIDTH MEDIAN AND BURIED LEFT TURN LANE
STA 412+83.16 TO STA 418+16.54

NOTE:
SAW CUT AND REMOVE HMA WEDGE PRIOR TO INSTALLATION OF PIPE UNDERDRAINS, 4"

ALL UNITS ARE IN FEET UNLESS OTHERWISE SHOWN

REVISIONS	
NAME	DATE

ILLINOIS DEPARTMENT OF TRANSPORTATION

PROPOSED TYPICAL SECTIONS
MAINLINE

FAP ROUTE 310 (US 67)
SECTION 42-2
JERSEY COUNTY

DRAWN BY: LBM CHECKED BY: CAS

PLAN
SURVEYED
PLOTTED
NOTE BOOK
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ALIGNMENT CHECKED
PLANS MICROFILMED
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DATE

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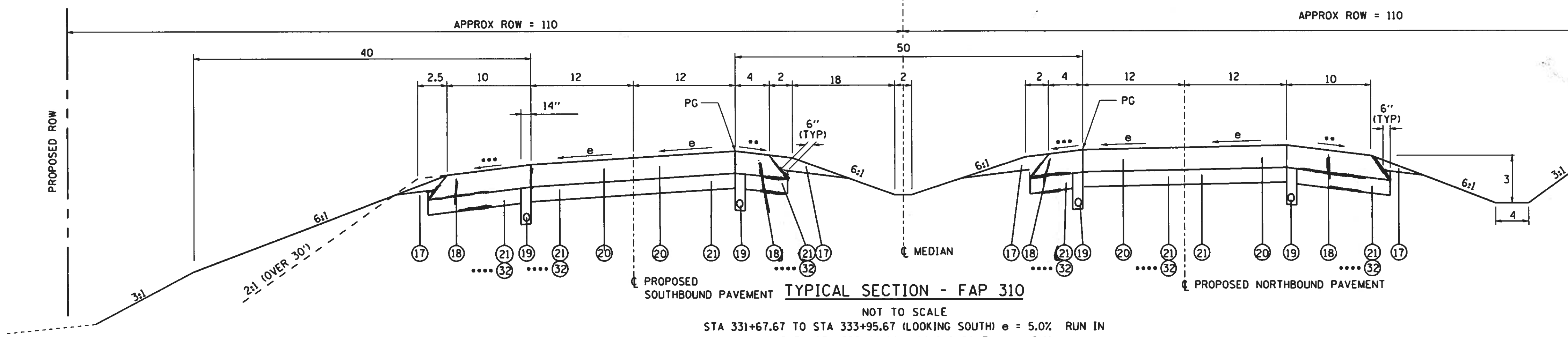
ROCKFORD (815) 489-9060
184+001397

FAP ROUTE	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
310	42-2	JERSEY	393	12

STA TO STA

EXISTING CONDITIONS:

CONTRACT NO. 76568

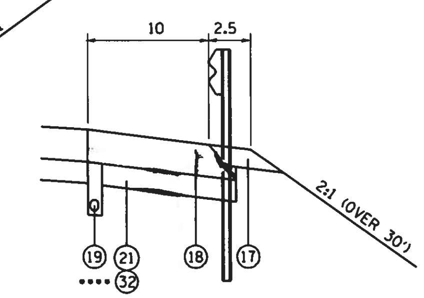


TYPICAL SECTION - FAP 310

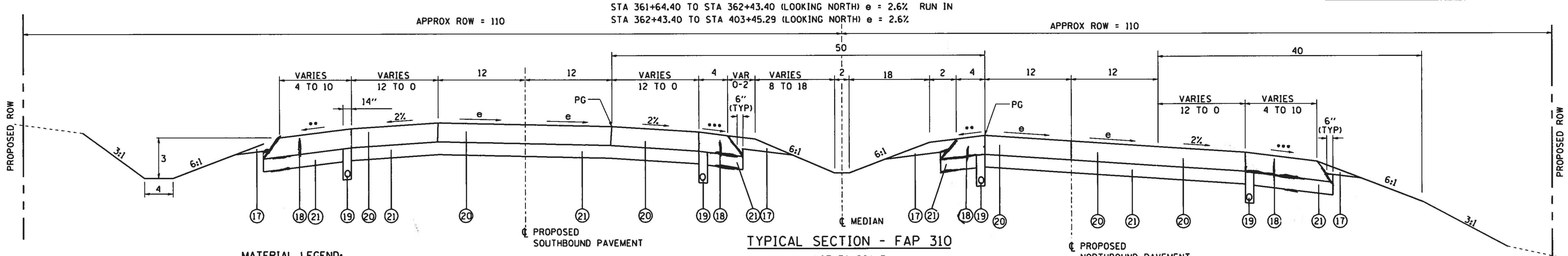
NOT TO SCALE

STA 331+67.67 TO STA 333+95.67 (LOOKING SOUTH) e = 5.0% RUN IN
STA 333+95.67 TO STA 335+00.00 (LOOKING SOUTH) e = 5.0%
•••• STA 335+00.00 TO STA 345+00.00 (LOOKING SOUTH) e = 5.0%
STA 345+00.00 TO STA 347+98.37 (LOOKING SOUTH) e = 5.0%
STA 361+64.40 TO STA 362+43.40 (LOOKING NORTH) e = 2.6% RUN IN
STA 362+43.40 TO STA 403+45.29 (LOOKING NORTH) e = 2.6%

CONSTRUCT NB LANES ONLY STA 331+32.50 TO STA 337+00.00



DETAIL OF SHOULDER WITH GUARDRAIL



TYPICAL SECTION - FAP 310

NOT TO SCALE

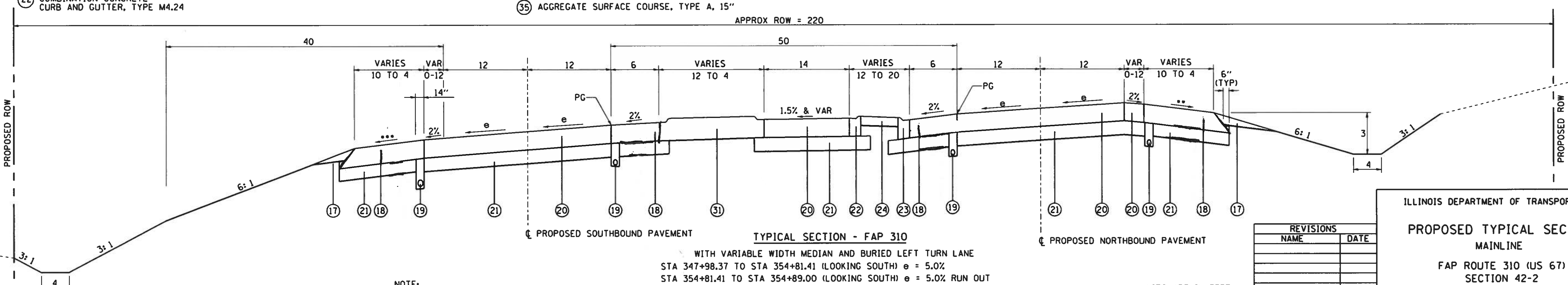
STA 354+89.00 TO STA 357+09.41 (LOOKING NORTH) e=5.0% RUN OUT

MATERIAL LEGEND:

(17) AGGREGATE SHOULDERS, TYPE B
(18) SHOULDERS
(19) PIPE UNDERDRAIN 4"
(20) PROPOSED PAVEMENT
(21) IMPROVED SUBGRADE
(22) COMBINATION CONCRETE CURB AND GUTTER, TYPE M4.24
(23) COMBINATION CONCRETE CURB AND GUTTER, TYPE M4.06
(24) CONCRETE MEDIAN SURFACE 6"
(25) SUBBASE GRANULAR MATERIAL, TYPE C 6"
(26) HOT-MIX ASPHALT SURFACE COURSE, MIX "C", N70, 1½"
(27) LEVELING BINDER (MACHINE METHOD), N70, 1½"
(28) AGGREGATE BASE COURSE, TYPE B, 8"
(29) AGGREGATE BASE COURSE, TYPE B, 11"
(30) AGGREGATE SHOULDERS, TYPE A, 6"
(31) CONCRETE MEDIAN, TYPE SM
(32) SUBBASE GRANULAR MATERIAL, TYPE B, 12"
(33) SUBBASE GRANULAR MATERIAL, TYPE B, 4"
(34) HOT-MIX ASPHALT BINDER COURSE, IL 19.0, N70, 12"
(35) AGGREGATE SURFACE COURSE, TYPE A, 15"

•• 4% OR 8% MINUS THE RATE OF SUPER, WHICHEVER IS MINIMUM.

••• 4% MINIMUM OR RATE OF SUPER, WHICHEVER IS GREATER.



TYPICAL SECTION - FAP 310

WITH VARIABLE WIDTH MEDIAN AND BURIED LEFT TURN LANE

STA 347+98.37 TO STA 354+81.41 (LOOKING SOUTH) e = 5.0%
STA 354+81.41 TO STA 354+89.00 (LOOKING SOUTH) e = 5.0% RUN OUT
STA 403+45.29 TO STA 412+04.16 (LOOKING NORTH) e = 2.6%
STA 412+04.16 TO STA 412+83.16 (LOOKING NORTH) e = 2.6% RUN OUT

NOTE:
SAW CUT AND REMOVE HMA WEDGE PRIOR TO INSTALLATION OF PIPE UNDERDRAINS, 4"

ALL UNITS ARE IN FEET UNLESS OTHERWISE SHOWN

REVISIONS	
NAME	DATE

ILLINOIS DEPARTMENT OF TRANSPORTATION

PROPOSED TYPICAL SECTIONS
MAINLINE

FAP ROUTE 310 (US 67)
SECTION 42-2
JERSEY COUNTY

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NOTE BOOK NO.	PLOTTED		
	ALIGNMENT CHECKED		
	R.O.W. OF WAY CHECKED		
	CADD FILE NAME		

BDE 5401 Template (Rev. 11/22/2019) **IDOT MECHANISTIC PAVEMENT DESIGN** Printed: 12/18/2019

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

Route: FAP 310 (US67)
Section: 42-2
County: Jersey
Location: New Delhi by-pass
Facility Type: Other Marked State Route
# of Lanes = 4
Road Class: I
Subgrade Support Rating (SSR): Poor
Construction Year: 2022
Design Period (DP) = 20 years

Comments: Previous Pavement Design was done more than 5 years ago. ADT and truck traffic projections also have changed. Traffic Data from IDOT's ADT webpage.
Design Date: <-- BY
Modify Date: <-- BY

	ADT	Year
Current:	11,200	2017
Future:	20,000	2032

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
PV =	0	15,950	79.8%	P = 32%
SU =	250	925	4.6%	S = 45%
MU =	750	3,125	15.6%	M = 45%
Struct. Design ADT =		20,000	(2032)	

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT			RIGID PAVEMENT		
Cpv =	0.15		Cpv =	0.15	
Csu =	132.5		Csu =	143.81	
Cmu =	482.53		Cmu =	696.42	
TF flexible (Actual) =	14.69	(Actual ADT)	TF rigid (Actual) =	20.80	(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

Full-Depth HMA Pavement

Use TF flexible = 14.69
PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.O)
Goto Map
HMA Mixture Temp. = 79.0 deg. F (Fig. 54-5.C)
Design HMA Mixture Modulus (E_{HMA}) = 580 ksi (Fig. 54-5.D)
Design HMA Strain (ε_{HMA}) = 56 (Fig. 54-5.E)
Full Depth HMA Design Thickness = 14.25 in. (Fig. 54-5.F)
Goto Map
Limiting Strain Criterion Thickness = 16.25 in. (Fig. 54-5.I)

Use Full-Depth HMA Thickness = 14.25 inches

JPC Pavement

Use TF rigid = 20.80
Edge Support = Tied Shoulder or C&G

Rigid Pavt Thick. = 10.50 in. (Fig. 54-4.E)

CRC Pavement

Use TF rigid = 20.80
IBR value = 3

CRCP Thickness = 10.00 in. (Fig. 54-4.M)

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Pavement Over Rubblized PCC

Use TF flexible = 14.69
HMA Overlay Design Thickness = 11.00 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 RESEARCH 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%