REDACTED COPY

RESPONSE TO THE REQUEST FOR PROPOSALS TO DESIGN AND CONSTRUCT THE

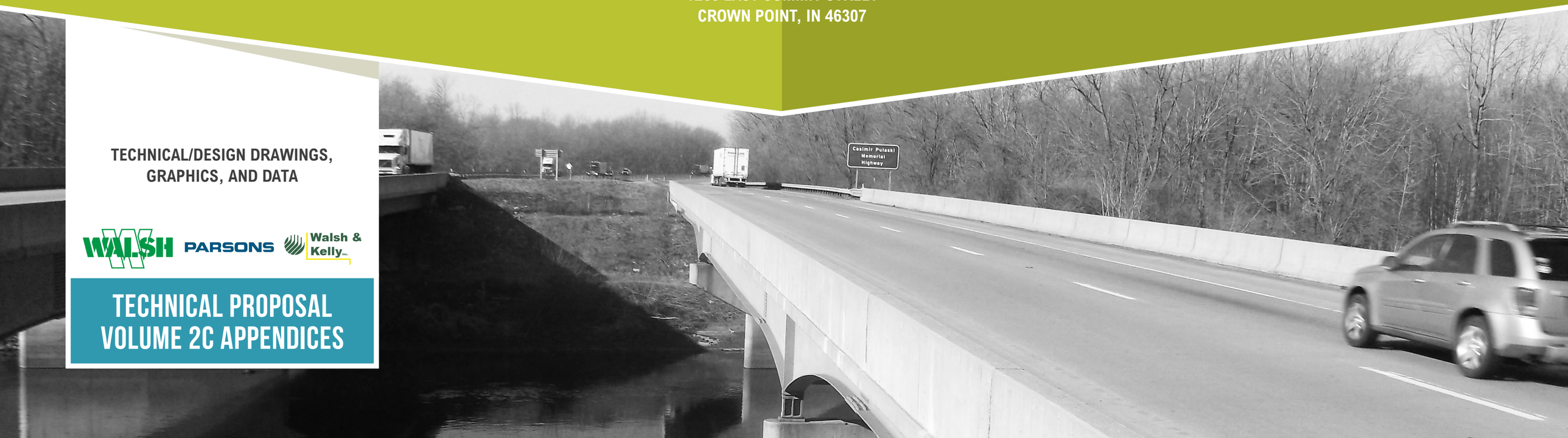
I-65 NORTHWEST INDIANA

MAJOR MOVES 2020 EXPANSION PROJECT

SUBMITTED BY: THE WALSH DESIGN-BUILD TEAM

1260 EAST SUMMIT STREET

CROWN POINT, IN 46307



TECHNICAL/DESIGN DRAWINGS,
GRAPHICS, AND DATA

WALSH PARSONS Walsh & Kelly

TECHNICAL PROPOSAL VOLUME 2C APPENDICES

Exhibit E

SUMMARY AND ORDER OF PROPOSAL CONTENTS

Technical Proposal – Volumes 1 and 2		
Technical Proposal Component	**Form (if any)**	**ITP Section Cross-Reference**
Volume 1		
A. Executive Summary		
Executive Summary **(Exclude price information)**	No forms are provided	Exhibit B, Section 3.1
B. Proposer Information, Certifications and Documents		
Proposal Letter	Form A	Exhibit B, Section 3.2.1
Authorization Documents	No forms are provided	Exhibit B, Section 3.2.1
Identification of Proposer and Equity Members	Form B-1	Exhibit B, Section 3.2.2
Information About Proposer Organization	Form B-2	Exhibit B, Section 3.2.2
Information About Major Participants and Identified Contractors	Form B-3	Exhibit B, Section 3.2.2
Letter accepting joint and several liability, if applicable	No forms are provided	Exhibit B, Section 3.2.2
Responsible Proposer and Major Participant Questionnaire	Form C	Exhibit B, Section 3.2.3
Industrial Safety Record for Proposer, Equity Members and Major Participants	Form D (as applicable)	Exhibit B, Section 3.2.4
Personnel Work Assignment Form and Commitment of Availability	Form E	Exhibit B, Section 3.2.5
Letter(s) Regarding Pre-Proposal Submittals	No forms are provided	Exhibit B, Section 3.2.6
Non-Collusion Affidavit	Form F	Exhibit B, Section 3.2.7
DBE Certification	Form G No forms are provided for the DBE Performance Plan or Job Training Plan	Exhibit B, Section 3.2.8
Surety/Financial Institution Information	No forms are provided	Exhibit C, Section 2.1

Technical Proposal – Volumes 1 and 2		
Technical Proposal Component	**Form (if any)**	**ITP Section Cross-Reference**
Conflict of Interest Disclosure	Form H	Exhibit B, Section 3.2.9
Certification regarding Buy America	Form R	Exhibit B, Section 3.2.10
Certification regarding Equal Employment Opportunity	Form S	Exhibit B, Section 3.2.11
Use of Contract Funds for Lobbying Certification	Form T	Exhibit B, Section 3.2.12
Debarment and Suspension Certification	Form U	Exhibit B, Section 3.2.13
Insurance	No forms are provided	Exhibit B, Section 3.2.14
Confidential Contents Index	No forms are provided	Exhibit B, Section 3.2.15
C. Proposal Security (Proposal Bond)		
Proposal Security	Form J (if in the form of a bond); no forms provided for certified check	Exhibit C, Section 2.2
D. Proposal		
Stipend Agreement	Form O	Exhibit B, Section 3.3
Volume 2		
E. Omitted	Form K	
F. Preliminary Performance Plans		
Preliminary Project Management Plan	No forms are provided	Exhibit B, Section 5.1
Preliminary Project Baseline Schedule for Design and Construction	No forms are provided	Exhibit B, Section 5.1.2
Completion Deadlines	Form L	Exhibit B, Section 5.1.2
Preliminary Design-Build Plan	No forms are provided	Exhibit B, Section 5.2
G. Volume 1 Appendices		
Copies of Organizational Documents	No forms are provided	Exhibit B, Section 3.2.2

Technical Proposal – Volumes 1 and 2		
Technical Proposal Component	**Form (if any)**	**ITP Section Cross-Reference**
Proposer Teaming Agreement or Key Terms	No forms are provided	Exhibit B, Section 3.2.2
Executed Contracts or Term Sheets/Heads of Terms	No forms are provided	Exhibit B, Section 3.2.2
H. Volume 2 Appendices		
Key Personnel Resumes	No forms are provided	Exhibit B, Section 3.2.5
Technical/Design Drawings, Graphs and Data	No forms are provided	Exhibit B, Section 2.0

Price Proposal – Volume 3
Proposers shall follow the order of the Price Proposal Checklist in their submissions. A referenced copy of this document shall be submitted with the Price Proposal.

Price Proposal Component	Form (if any)	ITP Section Cross-Reference
Proposal Price Form	Form I	Exhibit C, Section 2.0
Summary Cost Table Form	Form M	Exhibit C, Section 2.0

Preliminary Plan Sheets

BRIDGE STRUCTURES

- Bridge No. 1
- Bridge No. 3 and 4
- Bridge No. 5 and 6
- Bridge No. 7
- Bridge No. 8 and 9
- Bridge No. 10
- Bridge No. 11 and 12
- Bridge No. 13
- Bridge No. 14 and 15

INTELLIGENT TRANSPORTATION SYSTEM

Pavement Design Report

TECHNICAL PROPOSAL
VOLUME 2C APPENDICES
Technical/Design Drawings, Graphs and Data

VOLUME 2C APPENDICES: TECHNICAL/DESIGN DRAWINGS, GRAPHS AND DATA

I-65

WALSH PARSONS Walsh & Kelly

PRELIMINARY PLAN SHEETS

PRELIMINARY PLAN SHEETS

I-65

WALSH PARSONS Walsh & Kelly

BRIDGE STRUCTURES

I-65

WALSH PARSONS Walsh & Kelly

BRIDGE NO. 1

I-65

WALSH PARSONS Walsh & Kelly

R-37450
SECTION A

PROJECT	DESIGNATION
1172430	1601115
CONTRACT	BRIDGE FILE
R-37450	I65-259-08308A

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE REHABILITATION PLANS

FOR SPANS OVER 20 FEET

ROUTE: 93RD AVE. AT: RP 250+91

PROJECT NO. 1172430 P.E.

NO ADDITIONAL RIGHT-OF-WAY REQUIRED FOR THIS PROJECT

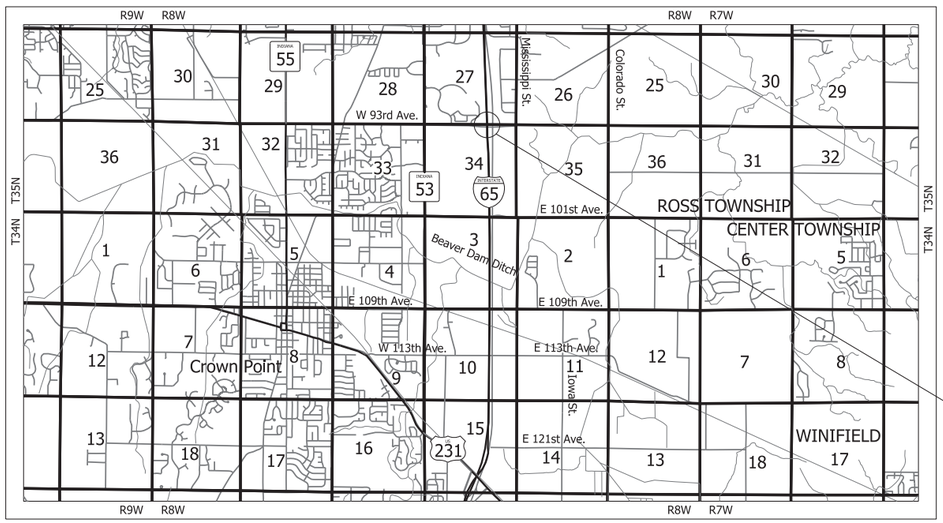
R/W

1172430 CONST.

Bridge Deck Overlay on 93rd Ave. over I-65 Located 1.70 Miles South of U.S. 30
in Section 34, T-35-N, R-8-W,
Ross Township, Lake County, Indiana

STRUCTURE INFORMATION				
STRUCTURE	TYPE	SPAN AND SKEW	OVER	STATION
I65-259-08308A	Continuous Composite Prestrssed Concrete Bulb-Tee Beam	2 Spans @ 117'-9" Skew: Square	I-65	203+01.00 "PR-A"

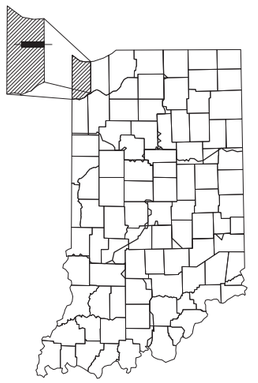
KIN DES. NUMBERS	DESCRIPTION	TYPE
1172430	I-65 ADDED TRAVEL LANES U.S. 231 TO U.S. 30	ROADWAY
1400349	I-65 ADDED TRAVEL LANES S.R. 2 TO U.S. 231	ROADWAY
1006741	PIPE LINER 2,64 MILES N OF S.R. 10	ROADWAY
1600332	I-65 S.B. OVER BEAVER DAM	BRIDGE
1600331	I-65 N.B. OVER BEAVER DAM	BRIDGE
1600329	I-65 N.B. OVER 109TH AVE.	BRIDGE
1600330	I-65 S.B. OVER 109TH AVE.	BRIDGE
1601116	113TH AVE. OVER I-65	BRIDGE
1600327	I-65 N.B. OVER U.S. 231	BRIDGE
1600328	I-65 S.B. OVER U.S. 231	BRIDGE
1601117	137TH AVE. OVER I-65	BRIDGE
1382203	I-65 N.B. OVER WIRTZ DITCH	BRIDGE
1382204	I-65 S.B. OVER WIRTZ DITCH	BRIDGE
1298545	153RD AVE. OVER I-65	BRIDGE
1382207	I-65 N.B. OVER S.R. 2	BRIDGE
1382208	I-65 S.B. OVER S.R. 2	BRIDGE
0101469	I-65 N.B. OVER KANKAKEE RIVER	BRIDGE
0200140	I-65 S.B. OVER KANKAKEE RIVER	BRIDGE



SCALE: 1" = 4000'

TRAFFIC DATA		I-65 N.B.L.	I-65 S.B.L.
A.A.D.T.	(2015)	35,847 V.P.D.	27,043 V.P.D.
A.A.D.T.	(2035)	38,418 V.P.D.	28,982 V.P.D.
D.H.V	(2035)	3,073 V.P.H.	2,319 V.P.H.
DIRECTIONAL DISTRIBUTION		57 %	43 %
TRUCKS		28 % A.A.D.T.	28 % A.A.D.T.
		28 % D.H.V.	28 % D.H.V.

DESIGN DATA	
DESIGN SPEED	70 M.P.H.
PROJECT DESIGN CRITERIA	PARTIAL RECONSTRUCTION 4R (FREEWAY)
FUNCTIONAL CLASSIFICATION	INTERSTATE
RURAL/URBAN	RURAL
TERRAIN	LEVEL
ACCESS CONTROL	FULL



PROJECT LOCATION SHOWN BY
Lake County

LATITUDE: 41°26'56" N LONGITUDE: 87°19'17" W

BRIDGE LENGTH: 0.045 MI.
ROADWAY LENGTH: 0.013 MI.
TOTAL LENGTH: 0.058 MI.
MAX. GRADE: 4.00 %

MajorMoves 2020

INDIANA DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS DATED 2016
TO BE USED WITH THESE PLANS.

PARSONS
101 W. Ohio St., Suite 2121
Indianapolis, IN 46204
Bus (317) 616-1000
Fax (317) 616-1033

PLANS PREPARED BY: PARSONS 317-616-1000 PHONE NUMBER

CERTIFIED BY: _____ DATE

APPROVED FOR LETTING: _____ INDIANA DEPARTMENT OF TRANSPORTATION DATE

BRIDGE FILE
I65-259-08308A
DESIGNATION
1601115

SURVEY BOOK	SHEETS
ELECTRONIC	1 of 4
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B1_BRIDGE TITLE SHEET.01.dgn
21-JUL-2016

UTILITIES

ELECTRIC

NIPSCO Electric
MArk Lindsley
Phone: 219-647-4198

American Electric Power
Ngoc Alex KUrtz
Phone: 614-552-1332

GAS / PIPELINES

NIPSCO Gas
Neil Arndt
Phone: 219-647-4779

Buckeye Pipe Line Co., LP
Michael Norris
Phone: 219-313-5321

Enbridge Energy Company, Inc.
Michael Price
Phone: 219-922-7015

WATER

IN American Water Company, Inc.
Michael Seals
Phone: 317-885-2444

TELECOMMUNICATIONS

AT&T Indiana (Dist)
Angelo LaMantia
Phone: 219-662-4418

AT&T Transmission (LD)
Carl Donahue
Phone: 630-552-9785
Dean Norwich
Phone: 574-344-0833

Comcast Cable
Robert Schulter
Phone: 630-600-6307

Zayo Bandwidth LLC
Jason Gilpin
Phone: 260-570-5677

Northwest Indiana Telephone Co. Inc.
Don Schoenbeck
Phone: 219-996-0216

Indiana Fiber Network LLC
Jim Royer
Phone: 317-777-7115
317-280-4636

MISCELLANEOUS AGENCIES

Merrillville Conservancy Dist.
Charles Stojakovich
Phone: 219-980-5220

City of Crown Point
Jay Olson
Phone: 219-662-3252
Kent Swinehart
Phone: 219-661-2287

INDOT ITS
Technology Deployment Division
Ed Cox
Phone: 317-899-8601

INDOT LaPorte District
(Signals Lighting)
Andy Costello
Phone: 219-325-7483

Indiana811 Know what's below. Call before you dig.

REVISIONS

SHEET NO.	DATE	REVISED

INDEX

SHEET NO.	SUBJECT
1	TITLE
2	INDEX
3-4	GENERAL PLAN

Note:

For Detour Route Details, see Maintenance Of Traffic Plans.

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: EWM DRAWN: EWM

CHECKED: MJK CHECKED: MJK

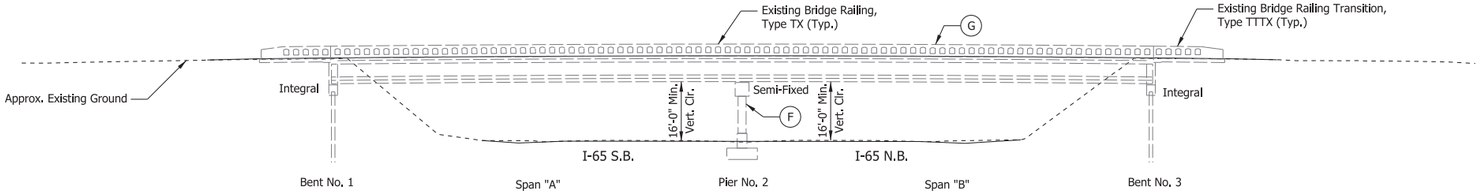
INDIANA
DEPARTMENT OF TRANSPORTATION

INDEX SHEET

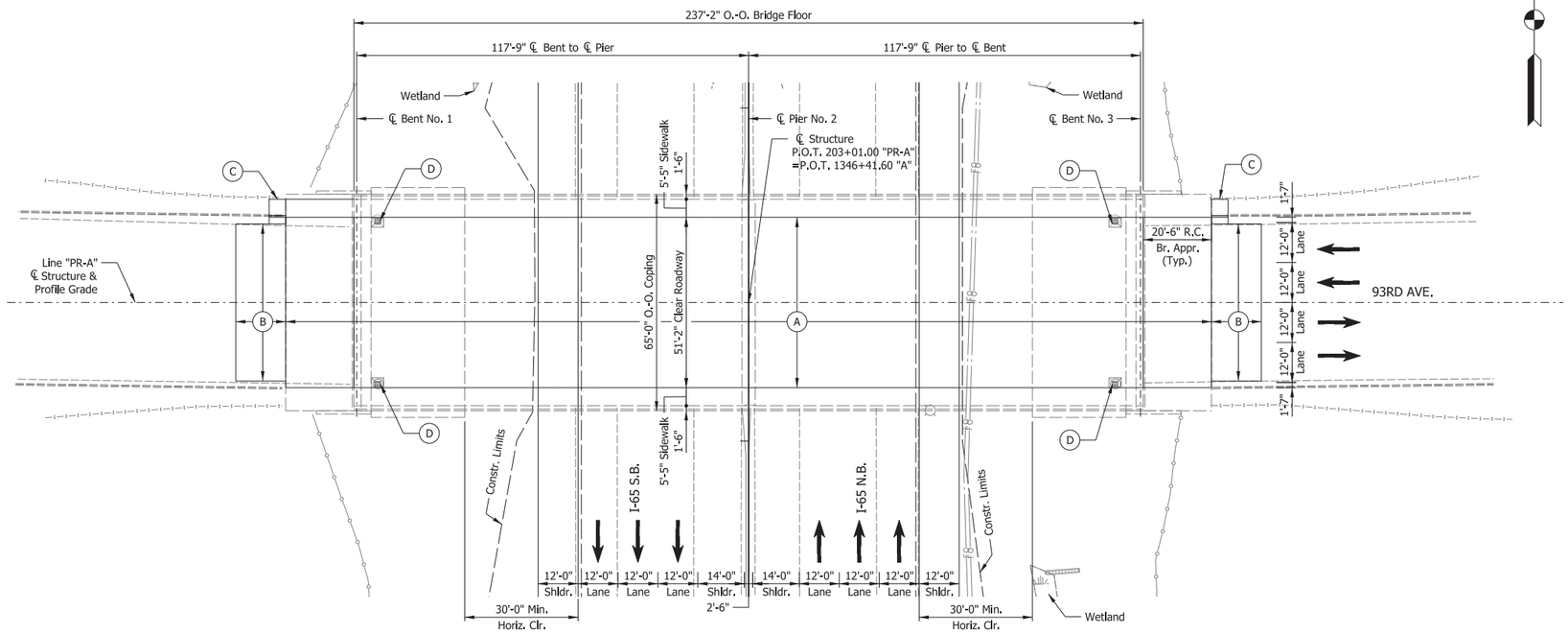
HORIZONTAL SCALE	BRIDGE FILE
NONE	I65-259-08308A
VERTICAL SCALE	DESIGNATION
NONE	1601115
SURVEY BOOK	SHEETS
ELECTRONIC	2 of 4
CONTRACT	PROJECT
R-37450	1172430

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22-JUL-2016

STRUCTURE IS BUILT TO A 918' VERTICAL CURVE



ELEVATION



PLAN

GENERAL NOTES

Reinforcing steel covering shall be 2½" in Top and 1" min. In bottom of floor slabs, 3" in footing except bottom steel which shall be 4", and 2" in all other parts, unless noted.

All New Reinforcement Shall be Epoxy Coated.

Plans for the Existing Structure are on file in the Central Office, Indiana Dept. of Transportation as Bridge File No. I65-259-8308 (A.K.A. Lake 10339), and are available upon request.

DESIGN DATA

Designed for HS-20 Loading, in accordance with AASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002, and its subsequent interims.

DEAD LOAD

Actual weight plus 35 psf. of future wearing surface and 15 psf for SIP Metal deck forms.

FLOOR SLAB

Designed with a 7½" structural depth, and a ½" integral wearing surface.

DESIGN STRESSES

CONCRETE

Class "A" Concrete	f'c = 3,500 p.s.i.
Class "B" Concrete	f'c = 3,000 p.s.i.
Class "C" Concrete	f'c = 4,000 p.s.i.

REINFORCING STEEL

Grade 60	f'y = 60,000 p.s.i.

LEGEND

(A) Place a polymeric concrete bridge deck overlay on the bridge deck and approach slabs in accordance with the RSPs.

(B) Mill and resurface 15 feet of the approach roadway pavement at each approach.

(C) On the north side of the bridge, replace the first panel of concrete sidewalk on the approach roadway, approximately 5 feet long each. Place compression joint material between the existing bridge sidewalk on the approach slab and new sidewalk.

(D) Clean end bent and gutter drain pipes and their inlet and outlet structures.

(E) Pedestrian traffic shall be maintained across the bridge on the north side during all stages of construction.

(F) Perform pier patching to areas of delamination and spalling. (Est. Qty.= 80 Sft.)

(G) Surface Seal existing bridge railings and copings.

93RD AVENUE OVER I-65
CONTINUOUS COMPOSITE PRESTRESSED
CONCRETE BULB-TEE BEAM BRIDGE
2 SPANS @ 117'-9"
SKEW: SQUARE
CLEAR ROADWAY: 51'-2"
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: RAM DRAWN: ALF

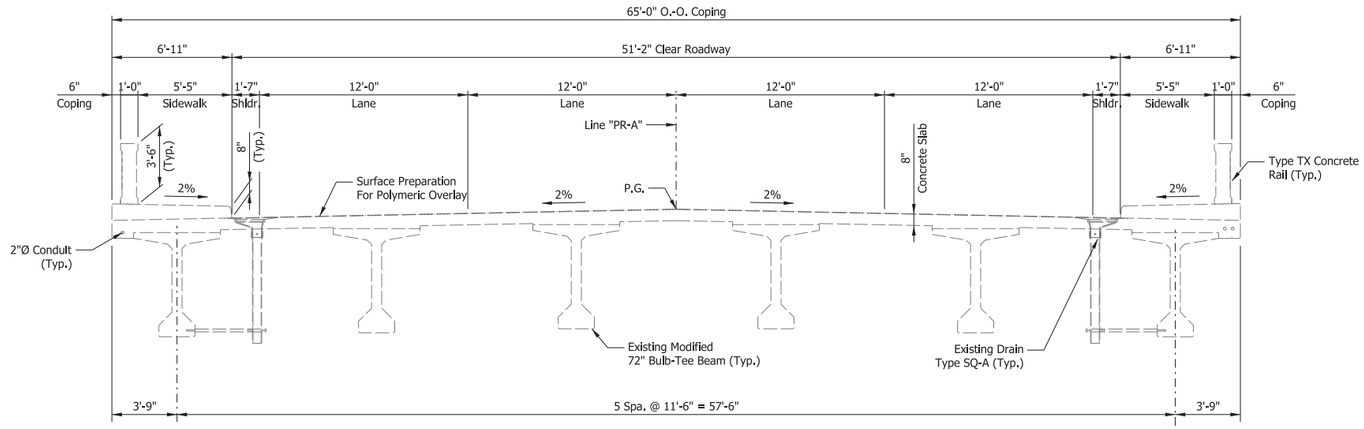
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INDIANA
DEPARTMENT OF TRANSPORTATION

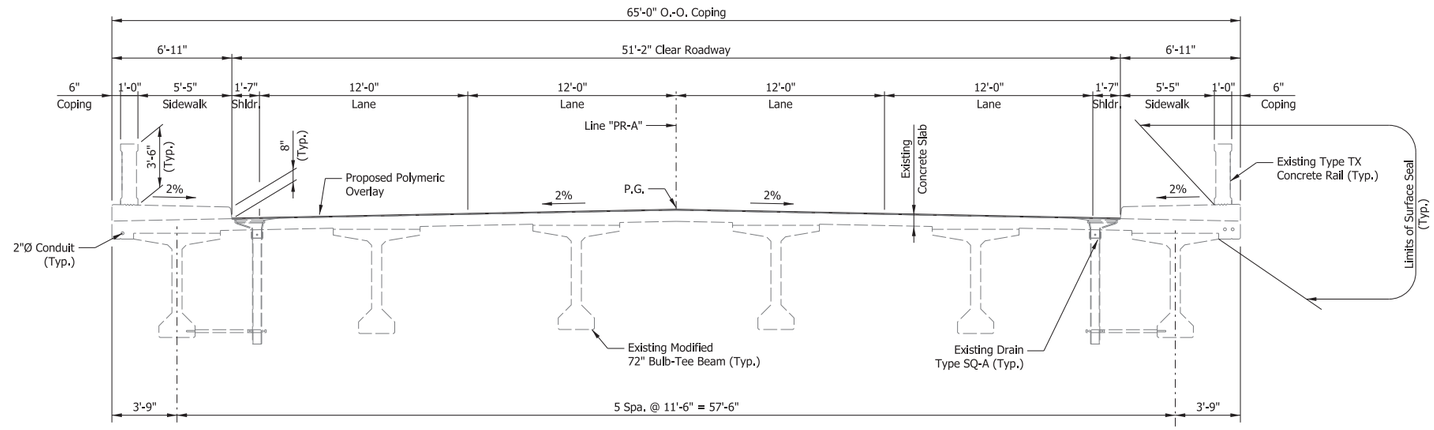
GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
1" = 20'	I65-259-08308A
VERTICAL SCALE	DESIGNATION
1" = 20'	1601115
SURVEY BOOK	SHEETS
ELECTRONIC	3 of 4
CONTRACT	PROJECT
R-37450	1172430

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21-JUL-2016



EXISTING TYPICAL SECTION



PROPOSED TYPICAL SECTION

93RD AVENUE OVER I-65
CONTINUOUS COMPOSITE PRESTRESSED
CONCRETE BULB-TEE BEAM BRIDGE
2 SPANS @ 117'-9"
SKEW: SQUARE
CLEAR ROADWAY: 51'-2"
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER _____ DATE

DESIGNED: RAM | DRAWN: EWM

CHECKED: MJK | CHECKED: MJK

INDIANA
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
3/16" = 1'-0"	I65-259-08308A
VERTICAL SCALE	DESIGNATION
3/16" = 1'-0"	1601115
SURVEY BOOK	SHEETS
ELECTRONIC	4 of 4
CONTRACT	PROJECT
R-37450	1172430

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21-JUL-2016

BRIDGE NO. 3 AND 4

I-65

WALSH PARSONS Walsh & Kelly

R-37450
SECTION A

PROJECT	DESIGNATION
1172430	1600332 (N.B.) & 1600331 (S.B.)
CONTRACT	BRIDGE FILE
R-37450	I65-257-04901DNBL & I65-257-04901JDSBL

STRUCTURE INFORMATION				
STRUCTURES	TYPE	SPAN AND SKEW	OVER	STATION
I65-257-04901 DNBL I65-257-04901 JDSBL	Continuous Reinforced Concrete Slab Bridges	3 Spans: 27'-0", 36'-0" & 27'-0" Skew: 23° Rt.	Beaver Dam Ditch	1256+84.00 "A"

KIN DES. NUMBERS	DESCRIPTION	TYPE
1172430	I-65 ADDED TRAVEL LANES U.S. 231 TO U.S. 30	ROADWAY
1400349	I-65 ADDED TRAVEL LANES S.R. 2 TO U.S. 231	ROADWAY
1006741	PIPE LINER 2,64 MILES N OF S.R. 10	ROADWAY
1601115	93RD AVE. OVER I-65	BRIDGE
1600329	I-65 N.B. OVER 109TH AVE.	BRIDGE
1600330	I-65 S.B. OVER 109TH AVE.	BRIDGE
1601116	113TH AVE. OVER I-65	BRIDGE
1600327	I-65 N.B. OVER U.S. 231	BRIDGE
1600328	I-65 S.B. OVER U.S. 231	BRIDGE
1601117	137TH AVE. OVER I-65	BRIDGE
1382203	I-65 N.B. OVER WIRTZ DITCH	BRIDGE
1382204	I-65 S.B. OVER WIRTZ DITCH	BRIDGE
1298545	153RD AVE. OVER I-65	BRIDGE
1382207	I-65 N.B. OVER S.R. 2	BRIDGE
1382208	I-65 S.B. OVER S.R. 2	BRIDGE
0101469	I-65 N.B. OVER KANKAKEE RIVER	BRIDGE
0200140	I-65 S.B. OVER KANKAKEE RIVER	BRIDGE

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE REHABILITATION PLANS

FOR SPANS OVER 20 FEET

ROUTE: I-65 AT: RP 249+51

PROJECT NO. 1172430 P.E.

NO ADDITIONAL RIGHT-OF-WAY REQUIRED FOR THIS PROJECT

R/W

1172430 CONST.

Bridge Deck Overlay on I-65 over Beaver Dam Ditch Located 2.16 Miles North of U.S. 231
in Section 3, T-34-N, R-8-W,
Center Township, Lake County, Indiana

Structures I65-257-4901 DNBL &
I65-257-4901 JDSBL Over Beaver Dam Ditch
1256+84.00 "A"

SCALE: 1" = 4000'

TRAFFIC DATA		I-65 N.B.L.	I-65 S.B.L.
A.A.D.T.	(2015)	35,847 V.P.D.	27,043 V.P.D.
A.A.D.T.	(2035)	38,418 V.P.D.	28,982 V.P.D.
D.H.V	(2035)	3,073 V.P.H.	2,319 V.P.H.
DIRECTIONAL DISTRIBUTION		57 %	43 %
TRUCKS		28 % A.A.D.T.	28 % A.A.D.T.
		28 % D.H.V.	28 % D.H.V.

DESIGN DATA	
DESIGN SPEED	70 M.P.H.
PROJECT DESIGN CRITERIA	PARTIAL RECONSTRUCTION 4R (FREEWAY)
FUNCTIONAL CLASSIFICATION	INTERSTATE
RURAL/URBAN	RURAL
TERRAIN	LEVEL
ACCESS CONTROL	FULL



PROJECT LOCATION SHOWN BY
Lake County

LATITUDE: 41°25'28" N LONGITUDE: 87°19'17" W

BRIDGE LENGTH:	0.017	MI.
ROADWAY LENGTH:	0.008	MI.
TOTAL LENGTH:	0.025	MI.
MAX. GRADE:	0.476%	%

MajorMoves 2020

INDIANA DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS DATED 2016
TO BE USED WITH THESE PLANS.

PARSONS
101 W. Ohio St., Suite 2121
Indianapolis, IN 46204
Bus (317) 616-1000
Fax (317) 616-1033

PLANS PREPARED BY: PARSONS 317-616-1000 PHONE NUMBER

CERTIFIED BY: _____ DATE

APPROVED FOR LETTING: _____ INDIANA DEPARTMENT OF TRANSPORTATION DATE

BRIDGE FILE	
I65-257-04901DNBL & 04901JDSBL	
DESIGNATION	
1600332 & 1600331	
SURVEY BOOK	SHEETS
ELECTRONIC	1 of 7
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B3-B4_BRIDGE TITLE SHEET.01.dgn
21-JUL-2016

UTILITIES

ELECTRIC

NIPSCO Electric
MArk Lindsley
Phone: 219-647-4198

American Electric Power
Ngoc Alex KUrtz
Phone: 614-552-1332

GAS / PIPELINES

NIPSCO Gas
Neil Arndt
Phone: 219-647-4779

Buckeye Pipe Line Co., LP
Michael Norris
Phone: 219-313-5321

Enbridge Energy Company, Inc.
Michael Price
Phone: 219-922-7015

WATER

IN American Water Company, Inc.
Michael Seals
Phone: 317-885-2444

TELECOMMUNICATIONS

AT&T Indiana (Dist)
Angelo LaMantia
Phone: 219-662-4418

AT&T Transmission (LD)
Carl Donahue
Phone: 630-552-9785
Dean Norwich
Phone: 574-344-0833

Comcast Cable
Robert Schulter
Phone: 630-600-6307

Zayo Bandwidth LLC
Jason Gilpin
Phone: 260-570-5677

Northwest Indiana Telephone Co. Inc.
Don Schoenbeck
Phone: 219-996-0216

Indiana Fiber Network LLC
Jim Royer
Phone: 317-777-7115
317-280-4636

MISCELLANEOUS AGENCIES

Merrillville Conservancy Dist.
Charles Stojakovich
Phone: 219-980-5220

City of Crown Point
Jay Olson
Phone: 219-662-3252
Kent Swinehart
Phone: 219-661-2287

INDOT ITS
Technology Deployment Division
Ed Cox
Phone: 317-899-8601

INDOT LaPorte District
(Signals Lighting)
Andy Costello
Phone: 219-325-7483

Indiana811
Know what's below. Call before you dig.

INDEX

SHEET NO.	SUBJECT
1	TITLE
2	INDEX
3-4	MAINTENANCE OF TRAFFIC
5-7	GENERAL PLAN

REVISIONS

SHEET NO.	DATE	REVISED

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: EWM DRAWN: EWM

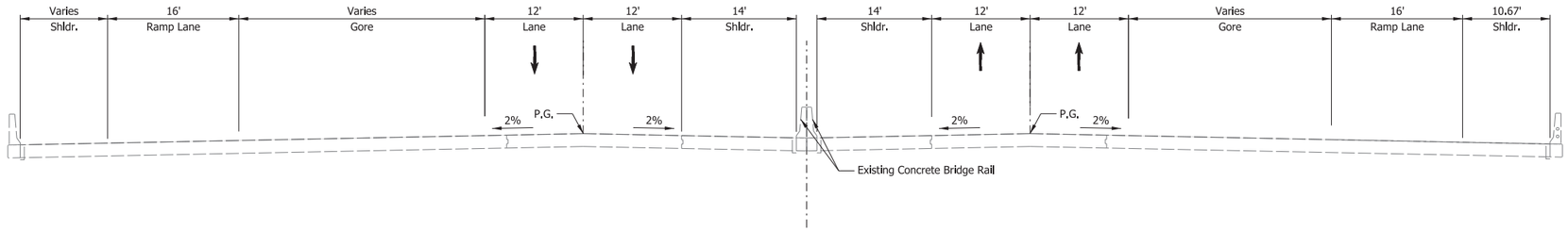
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INDIANA
DEPARTMENT OF TRANSPORTATION

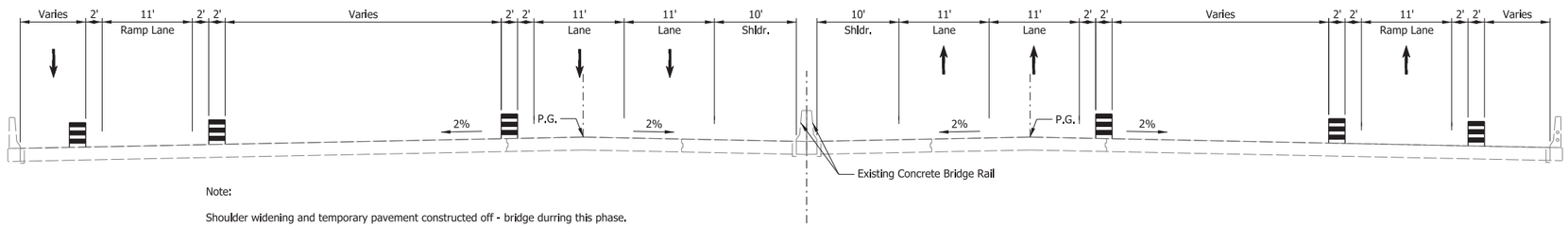
INDEX SHEET

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ELECTRONIC	2 of 7
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B3-B4_INDEX.01.dgn
22-JUL-2016



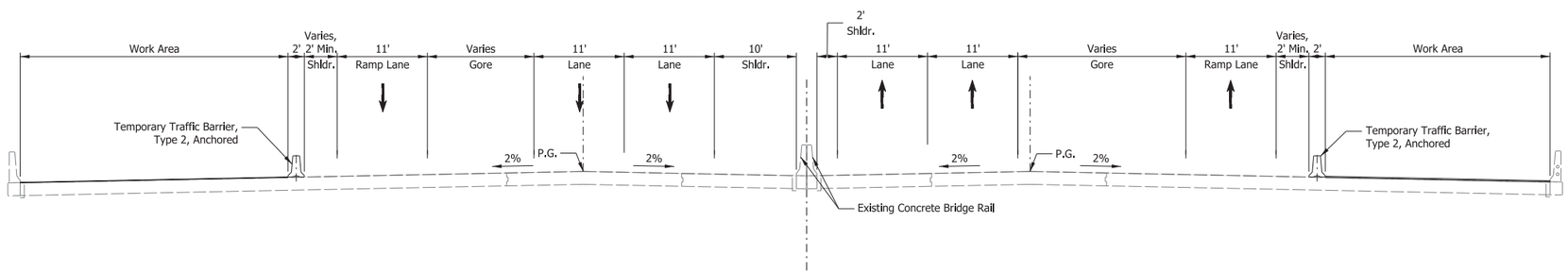
EXISTING TYPICAL SECTION



Note:

Shoulder widening and temporary pavement constructed off - bridge durring this phase.

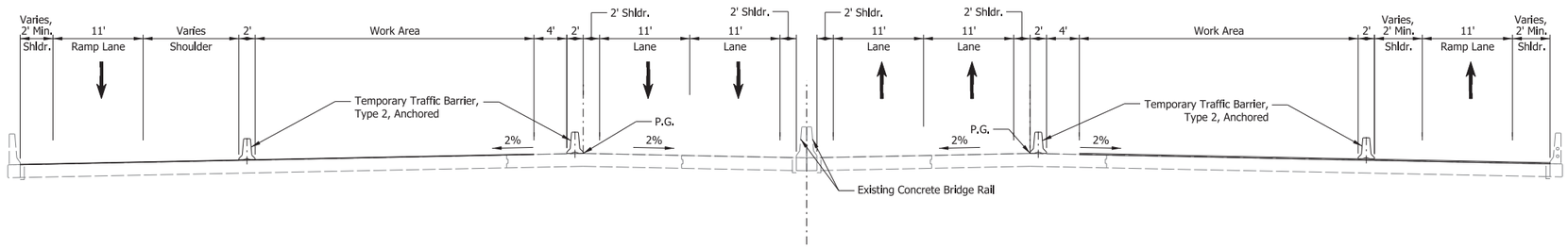
PHASE 1



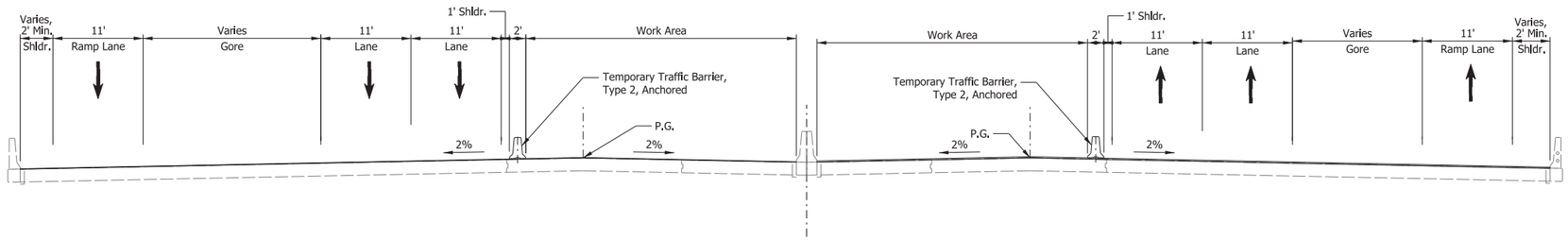
PHASE 2

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 1/8" = 1'-0"	BRIDGE FILE I65-257-04901DNBL & 04901JDSBL
				VERTICAL SCALE 1/8" = 1'-0"	DESIGNATION 1600332 & 1600331
		DESIGNED: RAM DRAWN: EWM	MAINTENANCE OF TRAFFIC	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	3 of 7
				CONTRACT R-37450	PROJECT 1172430

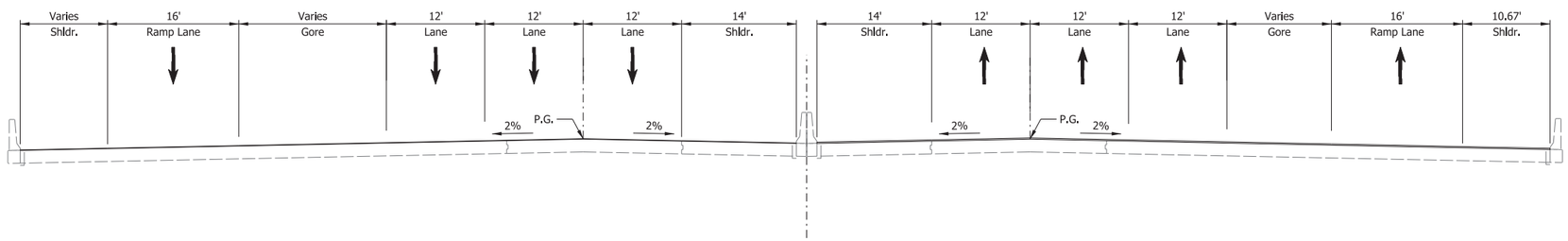
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21-JUL-2016



PHASE 3



PHASE 4

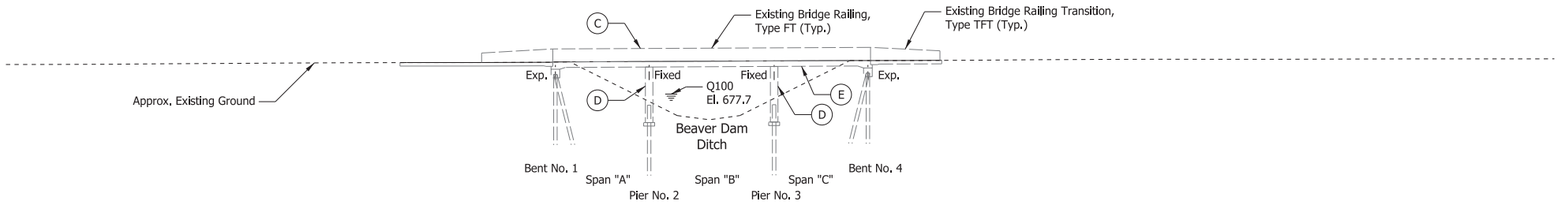


PROPOSED TYPICAL SECTION

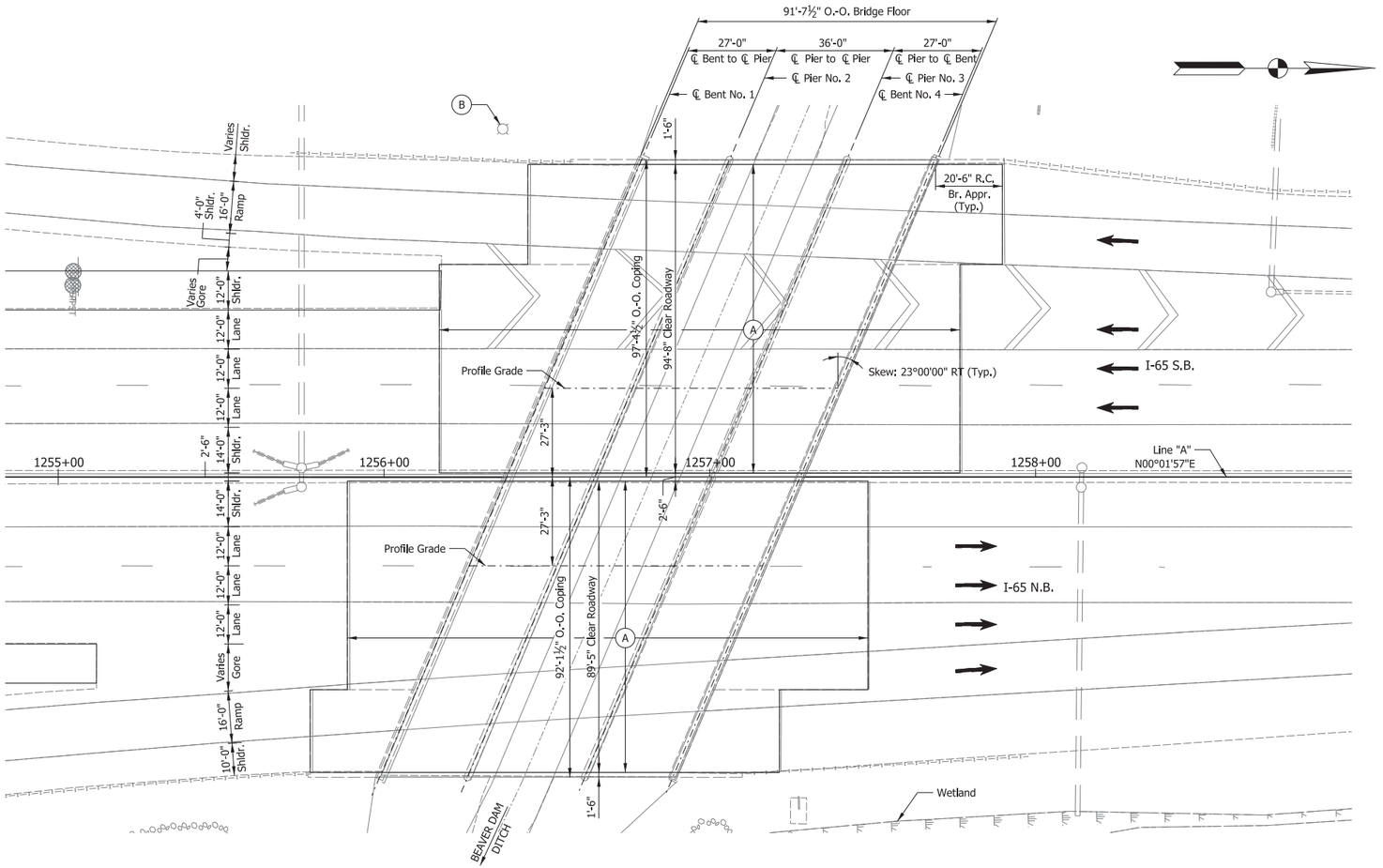
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				VERTICAL SCALE: 1/8" = 1'-0"	DESIGNATION: 1600332 & 1600331
		DESIGNED: RAM / DRAWN: EWM	MAINTENANCE OF TRAFFIC	SURVEY BOOK	SHEETS
		CHECKED: MJK / CHECKED: MJK		ELECTRONIC	4 of 7
				CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13737\I65_NORTHWEST_B3-B4_MOT.02.dgn
21-JUL-2016

STRUCTURE IS BUILT TO A 0.476% GRADE



ELEVATION



PLAN

GENERAL NOTES

Reinforcing steel covering shall be 2½" in Top and 1" min. in bottom of floor slabs, 3" in footing except bottom steel which shall be 4", and 2" in all other parts, unless noted.

All New Reinforcement Shall be Epoxy Coated.

Plans for the Existing Structure are on file in the Central Office, Indiana Dept. of Transportation as Bridge File No. I65-257-4901C, and are available upon request.

DESIGN DATA

Designed for HS-20 Loading, in accordance with AASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002, and its subsequent interims.

DEAD LOAD

Actual weight plus 35 psf. of future wearing surface and 15 psf for SIP Metal deck forms.

FLOOR SLAB

Designed with a 7½" structural depth, and a ½" integral wearing surface.

DESIGN STRESSES

CONCRETE

Class "A" Concrete	f'c = 3,500 p.s.i.
Class "B" Concrete	f'c = 3,000 p.s.i.
Class "C" Concrete	f'c = 4,000 p.s.i.

LEGEND

(A) Place a polymeric concrete bridge deck overlay on the bridge deck and approach slabs in accordance with the RSPs. Transition overlay to match existing at ends of approach slabs.

(B) Fill the existing erosion hole located at the overhead light foundation.

(C) Surface seal existing bridge railings and copings and install ITS conduits on outside face of rail.

(D) Perform pier patching to areas of delamination and spalling. (Est. Qty. = 340 Sft. Total, 170 Sft. per structure)

(E) Patch underside of deck (Est. Qty. = 1100 Sft. Total, 550 Sft. per structure)

SCOUR DATA

Q100	= 1430 Cfs.
Q100 Elev.	= 677.7 Ft.
Contraction Scour	= 6.01 Ft.
Total Scour	= 10.43 Ft.
Q100 Scour Depth (Flowline Elev. 664.37)	= 653.94 Ft.

I-65 OVER BEAVER DAM DITCH
CONTINUOUS REINFORCED CONCRETE SLAB BRIDGES
3 SPANS: 27'-0", 36'-0", 27'-0"
SKEW: 23° RT.
2 CLEAR ROADWAYS: 89'-5" N.B., 94'-8" S.B.
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER _____ DATE

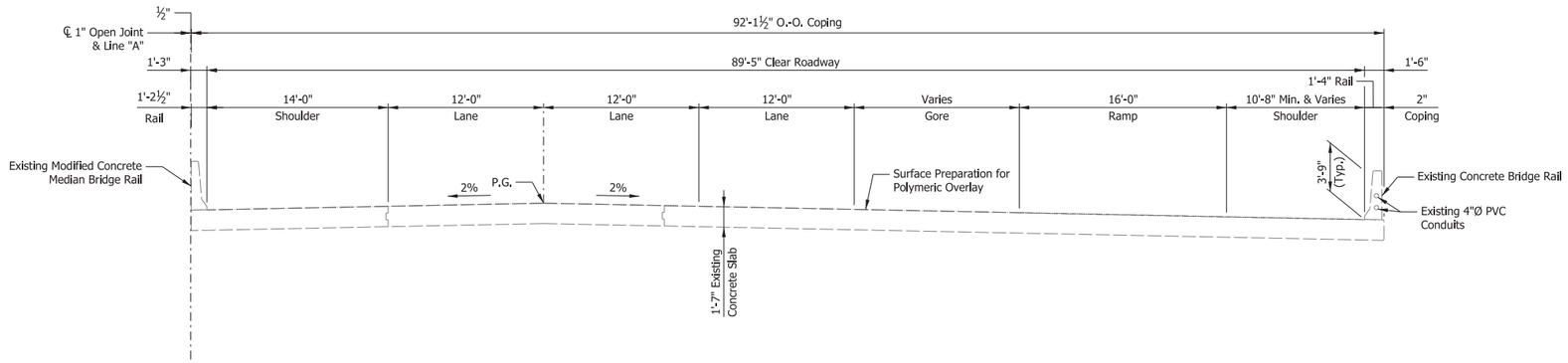
DESIGNED: RAM | DRAWN: ALF | CHECKED: MJK | CHECKED: MJK

INDIANA DEPARTMENT OF TRANSPORTATION

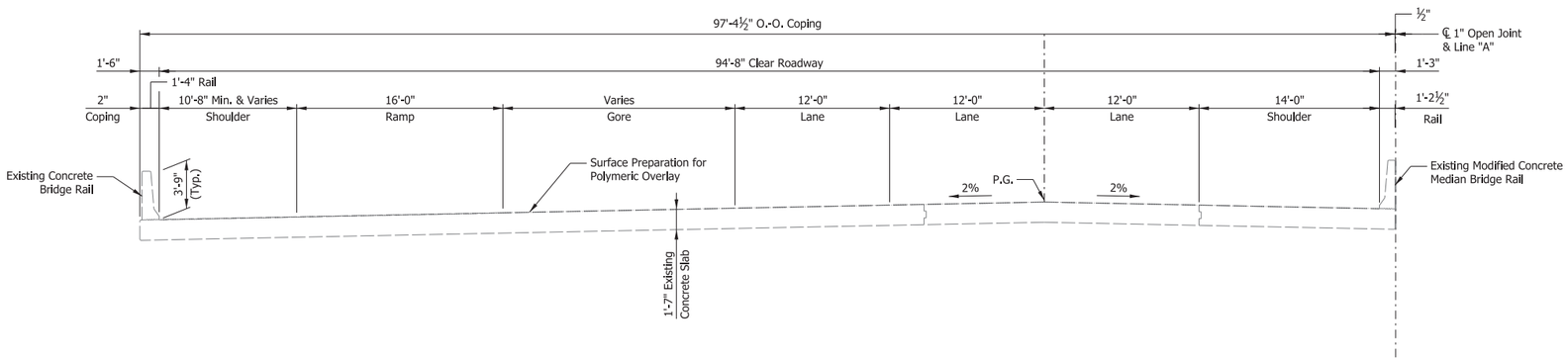
GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
1" = 20'	I65-257-04901DNBL & 04901JDSBL
VERTICAL SCALE	DESIGNATION
1" = 20'	1600332 & 1600331
SURVEY BOOK	SHEETS
ELECTRONIC	5 of 7
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B3-B4_GENERAL PLAN.01.dgn
21-JUL-2016



EXISTING TYPICAL SECTION
(N.B.L. Shown)



EXISTING TYPICAL SECTION
(S.B.L. Shown)

I-65 OVER BEAVER DAM DITCH
CONTINUOUS REINFORCED CONCRETE SLAB BRIDGES
3 SPANS: 27'-0", 36'-0", 27'-0"
SKEW: 23° RT.
2 CLEAR ROADWAYS: 89'-5" N.B., 94'-8" S.B.
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

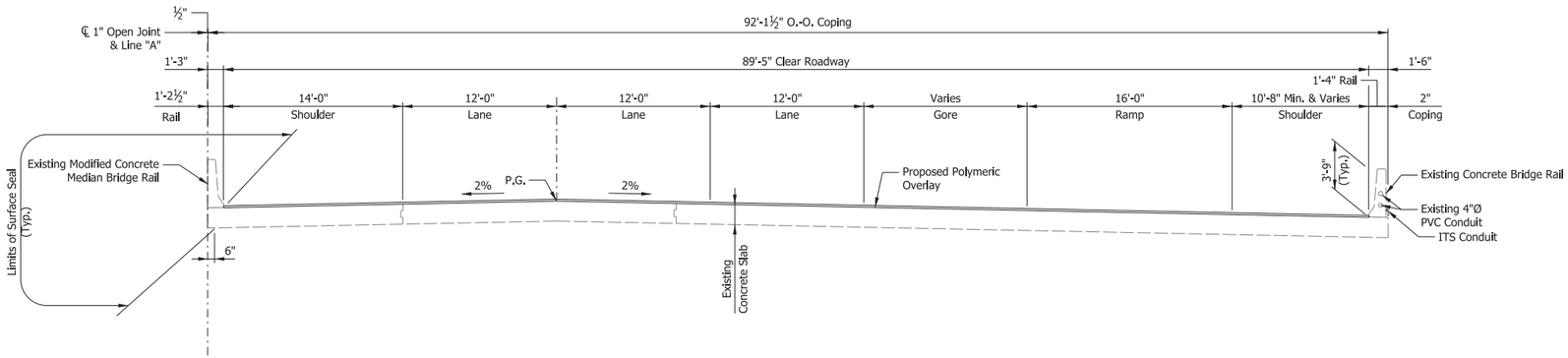
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CHECKED: MJK | CHECKED: MJK

INDIANA
DEPARTMENT OF TRANSPORTATION

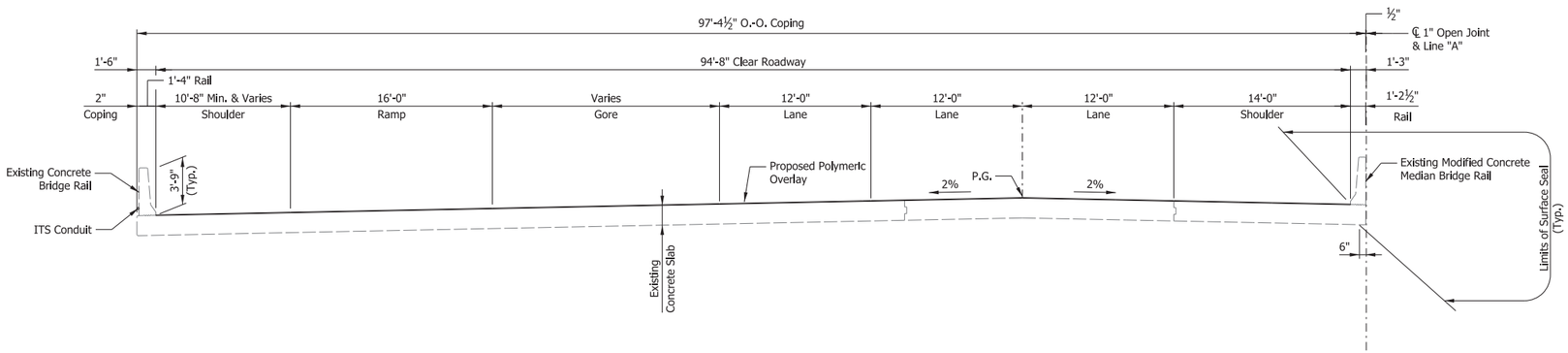
GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
3/16" = 1'-0"	I65-257-04901DNBL & 04901JDSBL
VERTICAL SCALE	DESIGNATION
3/16" = 1'-0"	1600332 & 1600331
SURVEY BOOK	SHEETS
ELECTRONIC	6 of 7
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B3-B4_GENERAL PLAN.02.dgn
21-JUL-2016



PROPOSED TYPICAL SECTION
(N.B.L. Shown)



PROPOSED TYPICAL SECTION
(S.B.L. Shown)

I-65 OVER BEAVER DAM DITCH
CONTINUOUS REINFORCED CONCRETE SLAB BRIDGES
3 SPANS: 27'-0", 36'-0", 27'-0"
SKEW: 23° RT.
2 CLEAR ROADWAYS: 89'-5" N.B., 94'-8" S.B.
LAKE COUNTY

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 3/16" = 1'-0"	BRIDGE FILE: I65-257-04901DNBL & 04901JDSBL
				VERTICAL SCALE: 3/16" = 1'-0"	DESIGNATION: 1600332 & 1600331
		DESIGNED: RAM DRAWN: EWM	GENERAL PLAN	SURVEY BOOK: ELECTRONIC	SHEETS: 7 of 7
		CHECKED: MJK CHECKED: MJK		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13737\I65_NORTHWEST_B3-B4_GENERAL PLAN.03.dgn
21-JUL-2016

BRIDGE NO. 5 AND 6

I-65

WALSH PARSONS Walsh & Kelly

R-37450
SECTION A

PROJECT	DESIGNATION
1172430	1600329 (N.B.) & 1600330 (S.B.)
CONTRACT	BRIDGE FILE
R-37450	I-65-257-4900 BNBL & I-65-257-4900 BSBL

STRUCTURE INFORMATION				
STRUCTURES	TYPE	SPAN AND SKEW	OVER	STATION
I-65-257-4900 BNBL I-65-257-4900 BSBL	Continuous Composite Steel Beam Bridge	3 Spans: 34'-6", 45'-0" & 34'-6" Skew: Square	109th Ave.	1241+07.50 "A"

KIN DES. NUMBERS	DESCRIPTION	TYPE
1172430	I-65 ADDED TRAVEL LANES U.S. 231 TO U.S. 30	ROADWAY
1400349	I-65 ADDED TRAVEL LANES S.R. 2 TO U.S. 231	ROADWAY
1006741	PIPE LINER 2,64 MILES N OF S.R. 10	ROADWAY
1601115	93RD AVE. OVER I-65	BRIDGE
1600332	I-65 N.B. OVER BEAVER DAM	BRIDGE
1600331	I-65 S.B. OVER BEAVER DAM	BRIDGE
1601116	113TH AVE. OVER I-65	BRIDGE
1600327	I-65 N.B. OVER U.S. 231	BRIDGE
1600328	I-65 S.B. OVER U.S. 231	BRIDGE
1601117	137TH AVE. OVER I-65	BRIDGE
1382203	I-65 N.B. OVER WIRTZ DITCH	BRIDGE
1382204	I-65 S.B. OVER WIRTZ DITCH	BRIDGE
1298545	153RD AVE. OVER I-65	BRIDGE
1382207	I-65 N.B. OVER S.R. 2	BRIDGE
1382208	I-65 S.B. OVER S.R. 2	BRIDGE
0101469	I-65 N.B. OVER KANKAKEE RIVER	BRIDGE
0200140	I-65 S.B. OVER KANKAKEE RIVER	BRIDGE

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE REHABILITATION PLANS

FOR SPANS OVER 20 FEET

ROUTE: I-65 AT: RP 249+21

PROJECT NO. 1172430 P.E.

NO ADDITIONAL RIGHT-OF-WAY REQUIRED FOR THIS PROJECT

R/W

1172430 CONST.

Bridge Deck Overlay on I-65 over 109th Ave. Located 1.86 Miles North of U.S. 231
in Sections 3 & 10, T-34-N, R-8-W,
Center Township, Lake County, Indiana

Structures I65-257-04900BNBL &
I65-257-04900BSBL Over 109th Ave.
1241+07.50 "A"

SCALE: 1" = 4000'

TRAFFIC DATA		I-65 N.B.L.	I-65 S.B.L.
A.A.D.T.	(2015)	35,847 V.P.D.	27,043 V.P.D.
A.A.D.T.	(2035)	38,418 V.P.D.	28,982 V.P.D.
D.H.V	(2035)	3,073 V.P.H.	2,319 V.P.H.
DIRECTIONAL DISTRIBUTION		57 %	43 %
TRUCKS		28 % A.A.D.T.	28 % A.A.D.T.
		28 % D.H.V.	28 % D.H.V.

DESIGN DATA	
DESIGN SPEED	70 M.P.H.
PROJECT DESIGN CRITERIA	PARTIAL RECONSTRUCTION 4R (FREEWAY)
FUNCTIONAL CLASSIFICATION	INTERSTATE
RURAL/URBAN	RURAL
TERRAIN	LEVEL
ACCESS CONTROL	FULL



PROJECT LOCATION SHOWN BY
Lake County

LATITUDE: 41°25'12" N LONGITUDE: 87°19'17" W

BRIDGE LENGTH: 0.022 MI.
ROADWAY LENGTH: 0.008 MI.
TOTAL LENGTH: 0.030 MI.
MAX. GRADE: -3.00% %

MajorMoves 2020

INDIANA DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS DATED 2016
TO BE USED WITH THESE PLANS.

PARSONS
101 W. Ohio St., Suite 2121
Indianapolis, IN 46204
Bus (317) 616-1000
Fax (317) 616-1033

PLANS PREPARED BY: PARSONS 317-616-1000 PHONE NUMBER

CERTIFIED BY: _____ DATE

APPROVED FOR LETTING: _____ INDIANA DEPARTMENT OF TRANSPORTATION DATE

BRIDGE FILE	
I65-257-04900BNBL & 04900BSBL	
DESIGNATION	
1600329 & 1600330	
SURVEY BOOK	SHEETS
ELECTRONIC	1 of 6
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B5-B6_BRIDGE TITLE SHEET.01.dgn
21-JUL-2016

UTILITIES

ELECTRIC

NIPSCO Electric
MArk Lindsley
Phone: 219-647-4198

American Electric Power
Ngoc Alex KUrtz
Phone: 614-552-1332

GAS / PIPELINES

NIPSCO Gas
Neil Arndt
Phone: 219-647-4779

Buckeye Pipe Line Co., LP
Michael Norris
Phone: 219-313-5321

Enbridge Energy Company, Inc.
Michael Price
Phone: 219-922-7015

WATER

IN American Water Company, Inc.
Michael Seals
Phone: 317-885-2444

TELECOMMUNICATIONS

AT&T Indiana (Dist)
Angelo LaMantia
Phone: 219-662-4418

AT&T Transmission (LD)
Carl Donahue
Phone: 630-552-9785
Dean Norwich
Phone: 574-344-0833

Comcast Cable
Robert Schulter
Phone: 630-600-6307

Zayo Bandwidth LLC
Jason Gilpin
Phone: 260-570-5677

Northwest Indiana Telephone Co. Inc.
Don Schoenbeck
Phone: 219-996-0216

Indiana Fiber Network LLC
Jim Royer
Phone: 317-777-7115
317-280-4636

MISCELLANEOUS AGENCIES

Merrillville Conservancy Dist.
Charles Stojakovich
Phone: 219-980-5220

City of Crown Point
Jay Olson
Phone: 219-662-3252
Kent Swinehart
Phone: 219-661-2287

INDOT ITS
Technology Deployment Division
Ed Cox
Phone: 317-899-8601

INDOT LaPorte District
(Signals Lighting)
Andy Costello
Phone: 219-325-7483

Indiana811 Know what's below. Call before you dig.

INDEX

SHEET NO.	SUBJECT
1	TITLE
2	INDEX
3	MAINTENANCE OF TRAFFIC
4-6	GENERAL PLAN

REVISIONS

SHEET NO.	DATE	REVISED

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

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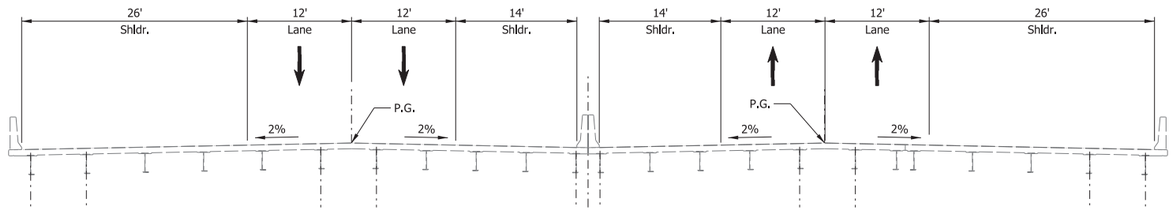
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INDIANA
DEPARTMENT OF TRANSPORTATION

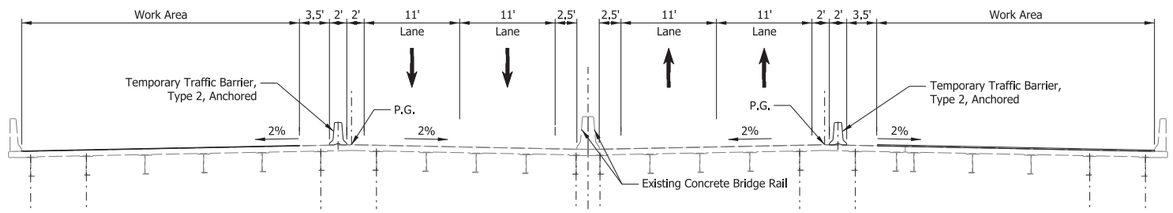
INDEX SHEET

HORIZONTAL SCALE	BRIDGE FILE
NONE	I65-257-04900BNBL & 04900BSBL
VERTICAL SCALE	DESIGNATION
NONE	1600329 & 1600330
SURVEY BOOK	SHEETS
ELECTRONIC	2 of 6
CONTRACT	PROJECT
R-37450	1172430

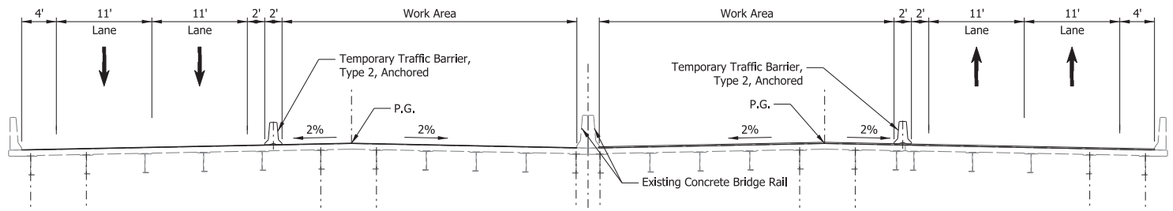
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22-JUL-2016



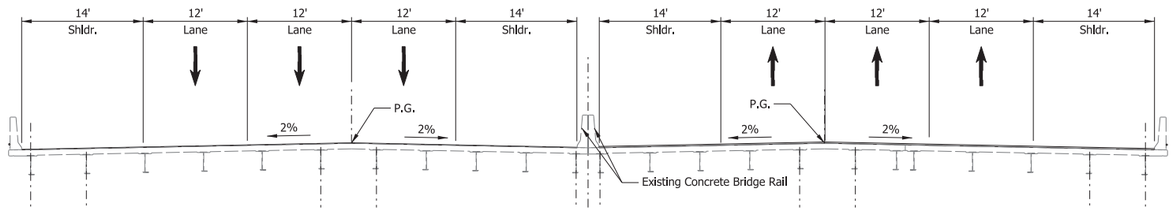
EXISTING TYPICAL SECTION



PHASE 1



PHASE 2

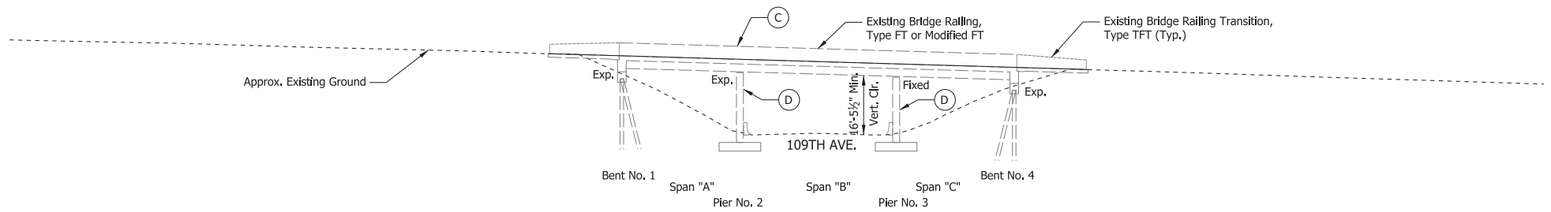


PROPOSED TYPICAL SECTION

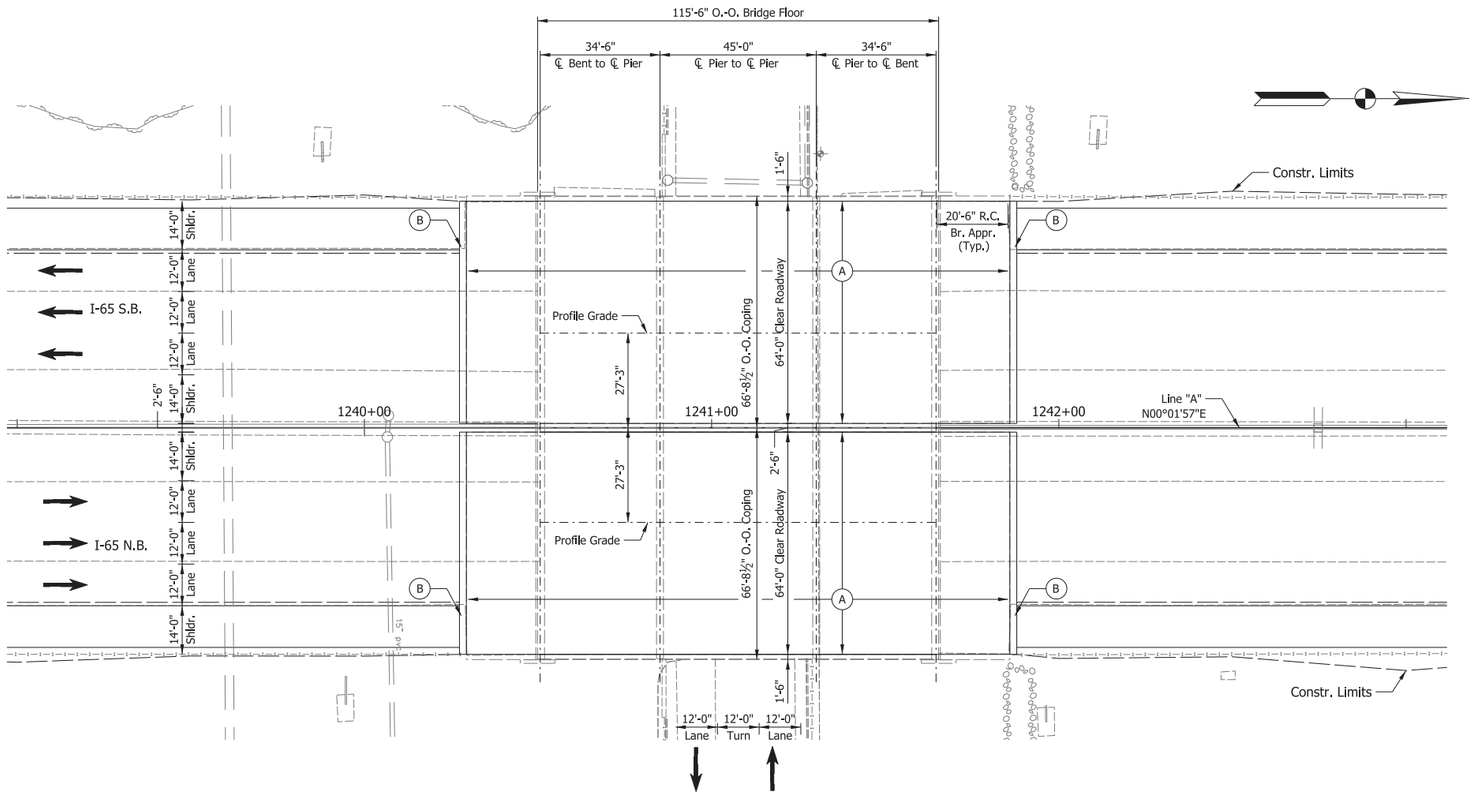
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				VERTICAL SCALE: 1/8" = 1'-0"	DESIGNATION: 1600329 & 1600330
		DESIGNED: RAM DRAWN: ALF	MAINTENANCE OF TRAFFIC	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	3 of 6
				CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13737\I65_NORTHWEST_B5-B6_MOT.01.dgn
21-JUL-2016

STRUCTURE IS BUILT TO A -3.00% GRADE



ELEVATION



PLAN

GENERAL NOTES

Reinforcing steel covering shall be 2½" in Top and 1" min. in bottom of floor slabs, 3" in footing except bottom steel which shall be 4", and 2" in all other parts, unless noted.

All New Reinforcement Shall be Epoxy Coated.

Plans for the Existing Structure are on file in the Central Office, Indiana Dept. of Transportation as Bridge File No. 165-257-4900B, and are available upon request.

DESIGN DATA

Designed for HS-20 Loading, in accordance with AASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002, and its subsequent interims.

DEAD LOAD

Actual weight plus 35 psf. of future wearing surface and 15 psf for SIP Metal deck forms.

FLOOR SLAB

Designed with a 7½" structural depth, and a ½" integral wearing surface.

DESIGN STRESSES

CONCRETE

Class "A" Concrete	f'c = 3,500 p.s.i.
Class "B" Concrete	f'c = 3,000 p.s.i.
Class "C" Concrete	f'c = 4,000 p.s.i.

REINFORCING STEEL

Grade 60 f'y = 60,000 p.s.i.

LEGEND

(A) Place a polymeric concrete bridge deck overlay on the bridge deck and approach slabs in accordance with the RSPs. Transition overlay to match existing at ends of approach slabs.

(B) Replace HMA portion of existing terminal joints. Widen terminal joints to match the proposed bridge clear roadway width.

(C) Surface seal existing bridge railings and copings and install ITS conduits on outside face of rail.

(D) Perform pier patching to areas of delamination and spalling. (Est. Qty.= 340 Sft. Total, 170 Sft. per structure)

I-65 OVER 109TH AVENUE
CONTINUOUS COMPOSITE STEEL BEAM BRIDGE
3 SPANS: 34'-6", 45'-0", 34'-6"
SKEW: SQUARE
CLEAR ROADWAY: 64'-0"
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: RAM DRAWN: ALF

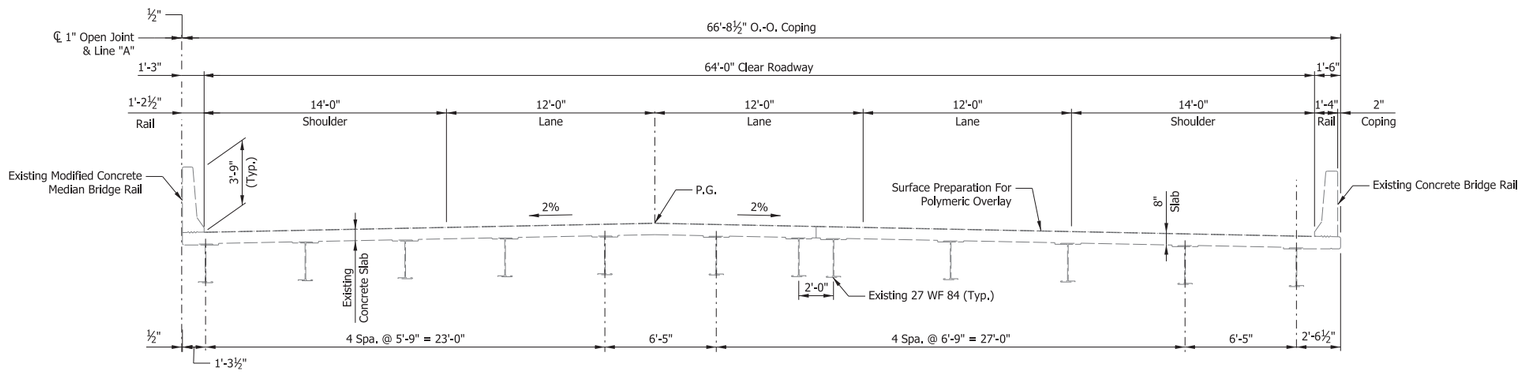
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INDIANA DEPARTMENT OF TRANSPORTATION

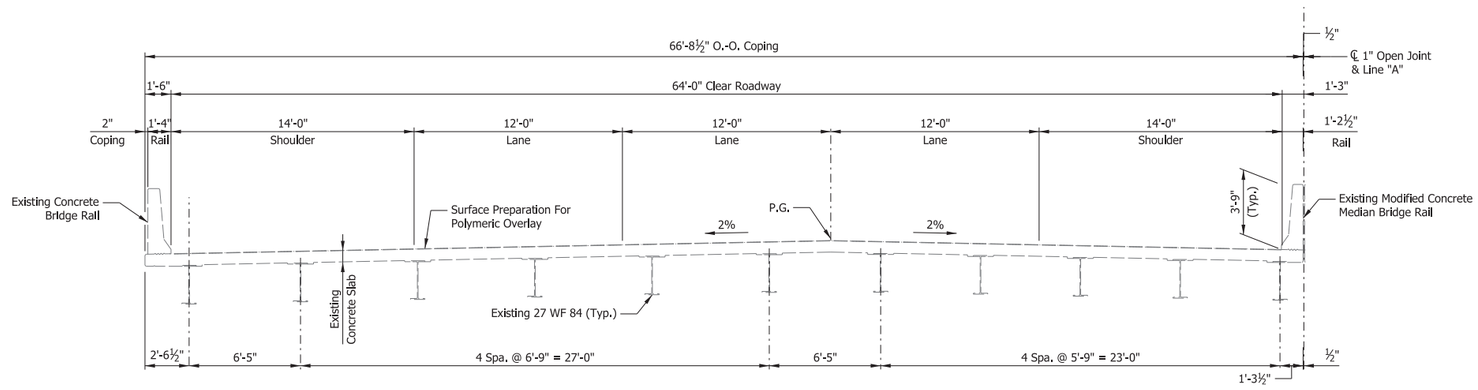
GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
1" = 20'	I65-257-04900BNBL & 04900BSBL
VERTICAL SCALE	DESIGNATION
1" = 20'	1600329 & 1600330
SURVEY BOOK	SHEETS
ELECTRONIC	4 of 6
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B5-B6_GENERAL PLAN.01.dgn
21-JUL-2016



EXISTING TYPICAL SECTION
(N.B. Shown)



EXISTING TYPICAL SECTION
(S.B. Shown)

I-65 OVER 109TH AVENUE
CONTINUOUS COMPOSITE STEEL BEAM BRIDGE
3 SPANS: 34'-6", 45'-0", 34'-6"
SKEW: SQUARE
CLEAR ROADWAY: 64'-0"
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: RAM | DRAWN: EWM

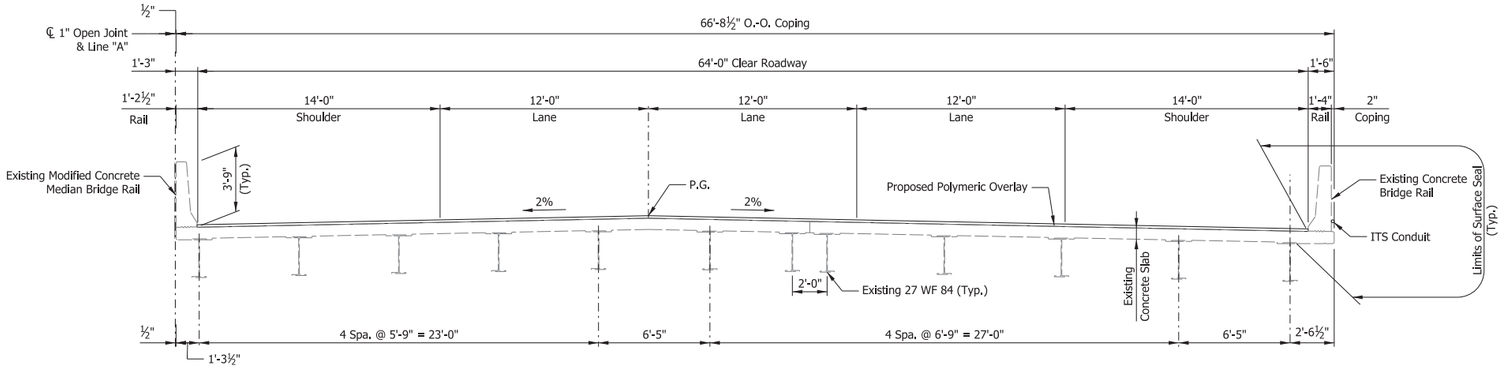
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INDIANA
DEPARTMENT OF TRANSPORTATION

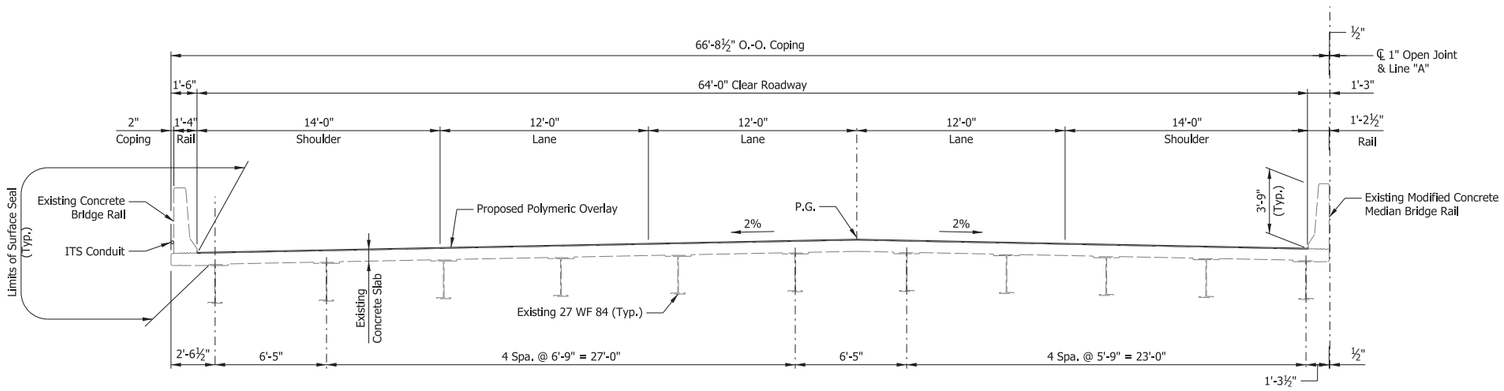
GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
3/16" = 1'-0"	I65-257-04900BNBL & 04900BSBL
VERTICAL SCALE	DESIGNATION
3/16" = 1'-0"	1600329 & 1600330
SURVEY BOOK	SHEETS
ELECTRONIC	5 of 6
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B5-B6_GENERAL PLAN.02.dgn
21-JUL-2016



PROPOSED TYPICAL SECTION
(N.B. Shown)



PROPOSED TYPICAL SECTION
(S.B. Shown)

I-65 OVER 109TH AVENUE
CONTINUOUS COMPOSITE STEEL BEAM BRIDGE
3 SPANS: 34'-6", 45'-0", 34'-6"
SKEW: SQUARE
CLEAR ROADWAY: 64'-0"
LAKE COUNTY

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 3/16" = 1'-0"	BRIDGE FILE I65-257-04900BNBL & 04900BSBL
				VERTICAL SCALE 3/16" = 1'-0"	DESIGNATION 1600329 & 1600330
		DESIGNED: RAM DRAWN: EWM	GENERAL PLAN	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	6 of 6
				CONTRACT R-37450	PROJECT 1172430

IP_PWP:dms13737\I65_NORTHWEST_B5-B6_GENERAL PLAN.03.dgn
21-JUL-2016

BRIDGE NO. 7

I-65

WALSH PARSONS Walsh & Kelly

R-37450
SECTION A

PROJECT	DESIGNATION
1172430	1601116
CONTRACT	BRIDGE FILE
R-37450	I65-256-04899B

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE REHABILITATION PLANS

FOR SPANS OVER 20 FEET

ROUTE: 113TH AVE. AT: RP 248+71

PROJECT NO. 1172430 P.E.

NO ADDITIONAL RIGHT-OF-WAY REQUIRED FOR THIS PROJECT — R/W

1172430 CONST.

Bridge Joint Replacement on 113th Ave. over I-65 Located 1.36 Miles North of U.S. 231
in Section 10, T-34-N, R-8-W,
Center Township, Lake County, Indiana

STRUCTURE INFORMATION				
STRUCTURE	TYPE	SPAN AND SKEW	OVER	STATION
I65-256-04899B	R.C. Girder & Steel Beam	4 Spans: 35'-0", 2 @ 65'-0", 35'-0" Skew: Square	I-65	50+00.00 "S-16-A"

KIN DES. NUMBERS	DESCRIPTION	TYPE
1172430	I-65 ADDED TRAVEL LANES U.S. 231 TO U.S. 30	ROADWAY
1400349	I-65 ADDED TRAVEL LANES S.R. 2 TO U.S. 231	ROADWAY
1006741	PIPE LINER 2,64 MILES N OF S.R. 10	ROADWAY
1601115	93RD AVE. OVER I-65	BRIDGE
1600332	I-65 N.B. OVER BEAVER DAM	BRIDGE
1600331	I-65 S.B. OVER BEAVER DAM	BRIDGE
1600329	I-65 N.B. OVER 109TH AVE.	BRIDGE
1600330	I-65 S.B. OVER 109TH AVE.	BRIDGE
1600327	I-65 N.B. OVER U.S. 231	BRIDGE
1600328	I-65 S.B. OVER U.S. 231	BRIDGE
1601117	137TH AVE. OVER I-65	BRIDGE
1382203	I-65 N.B. OVER WIRTZ DITCH	BRIDGE
1382204	I-65 S.B. OVER WIRTZ DITCH	BRIDGE
1298545	153RD AVE. OVER I-65	BRIDGE
1382207	I-65 N.B. OVER S.R. 2	BRIDGE
1382208	I-65 S.B. OVER S.R. 2	BRIDGE
0101469	I-65 N.B. OVER KANKAKEE RIVER	BRIDGE
0200140	I-65 S.B. OVER KANKAKEE RIVER	BRIDGE



PROJECT LOCATION SHOWN BY
Lake County

SCALE: 1" = 4000'

TRAFFIC DATA		I-65 N.B.L.	I-65 S.B.L.
A.A.D.T.	(2015)	28,977 V.P.D.	21,860 V.P.D.
A.A.D.T.	(2035)	29,526 V.P.D.	22,274 V.P.D.
D.H.V	(2035)	2,362 V.P.H.	1,782 V.P.H.
DIRECTIONAL DISTRIBUTION		57 %	43 %
TRUCKS		34 % A.A.D.T.	34 % A.A.D.T.
		34 % D.H.V.	34 % D.H.V.

DESIGN DATA	
DESIGN SPEED	70 M.P.H.
PROJECT DESIGN CRITERIA	PARTIAL RECONSTRUCTION 4R (FREEWAY)
FUNCTIONAL CLASSIFICATION	INTERSTATE
RURAL/URBAN	RURAL
TERRAIN	LEVEL
ACCESS CONTROL	FULL

LATITUDE: 41°24'46" N LONGITUDE: 87°19'17" W

BRIDGE LENGTH:	0.039	MI.
ROADWAY LENGTH:	0.008	MI.
TOTAL LENGTH:	0.047	MI.
MAX. GRADE:	4.00	%

MajorMoves 2020

INDIANA DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS DATED 2016
TO BE USED WITH THESE PLANS.

PARSONS
101 W. Ohio St., Suite 2121
Indianapolis, IN 46204
Bus (317) 616-1000
Fax (317) 616-1033

PLANS PREPARED BY: PARSONS 317-616-1000 PHONE NUMBER

CERTIFIED BY: _____ DATE

APPROVED FOR LETTING: _____ INDIANA DEPARTMENT OF TRANSPORTATION DATE

BRIDGE FILE	
I65-256-04899B	
DESIGNATION	
1601116	
SURVEY BOOK	SHEETS
ELECTRONIC	1 of 3
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B7_BRIDGE TITLE SHEET.01.dgn
21-JUL-2016

UTILITIES

ELECTRIC

NIPSCO Electric
MArk Lindsley
Phone: 219-647-4198

American Electric Power
Ngoc Alex KUrtz
Phone: 614-552-1332

GAS / PIPELINES

NIPSCO Gas
Neil Arndt
Phone: 219-647-4779

Buckeye Pipe Line Co., LP
Michael Norris
Phone: 219-313-5321

Enbridge Energy Company, Inc.
Michael Price
Phone: 219-922-7015

WATER

IN American Water Company, Inc.
Michael Seals
Phone: 317-885-2444

TELECOMMUNICATIONS

AT&T Indiana (Dist)
Angelo LaMantia
Phone: 219-662-4418

AT&T Transmission (LD)
Carl Donahue
Phone: 630-552-9785
Dean Norwich
Phone: 574-344-0833

Comcast Cable
Robert Schulter
Phone: 630-600-6307

Zayo Bandwidth LLC
Jason Gilpin
Phone: 260-570-5677

Northwest Indiana Telephone Co. Inc.
Don Schoenbeck
Phone: 219-996-0216

Indiana Fiber Network LLC
Jim Royer
Phone: 317-777-7115
317-280-4636

MISCELLANEOUS AGENCIES

Merrillville Conservancy Dist.
Charles Stojakovich
Phone: 219-980-5220

City of Crown Point
Jay Olson
Phone: 219-662-3252
Kent Swinehart
Phone: 219-661-2287

INDOT ITS
Technology Deployment Division
Ed Cox
Phone: 317-899-8601

INDOT LaPorte District
(Signals Lighting)
Andy Costello
Phone: 219-325-7483

Indiana811
Know what's below. Call before you dig.

REVISIONS

SHEET NO.	DATE	REVISED

INDEX

SHEET NO.	SUBJECT
1	TITLE
2	INDEX
3	GENERAL PLAN

Note:

For Detour Route Details, see Maintenance Of Traffic Plans.

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: EWM DRAWN: EWM

CHECKED: MJK CHECKED: MJK

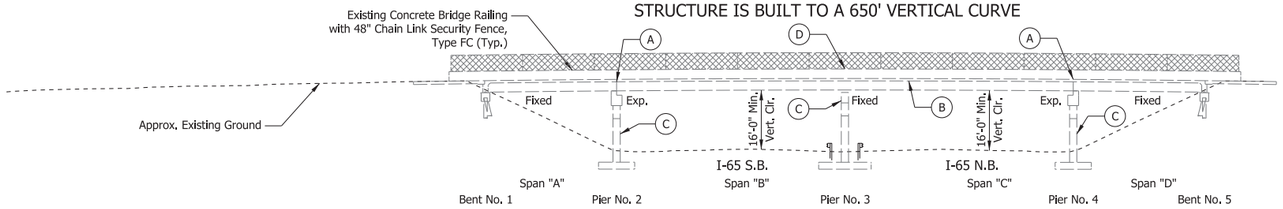
INDIANA
DEPARTMENT OF TRANSPORTATION

INDEX SHEET

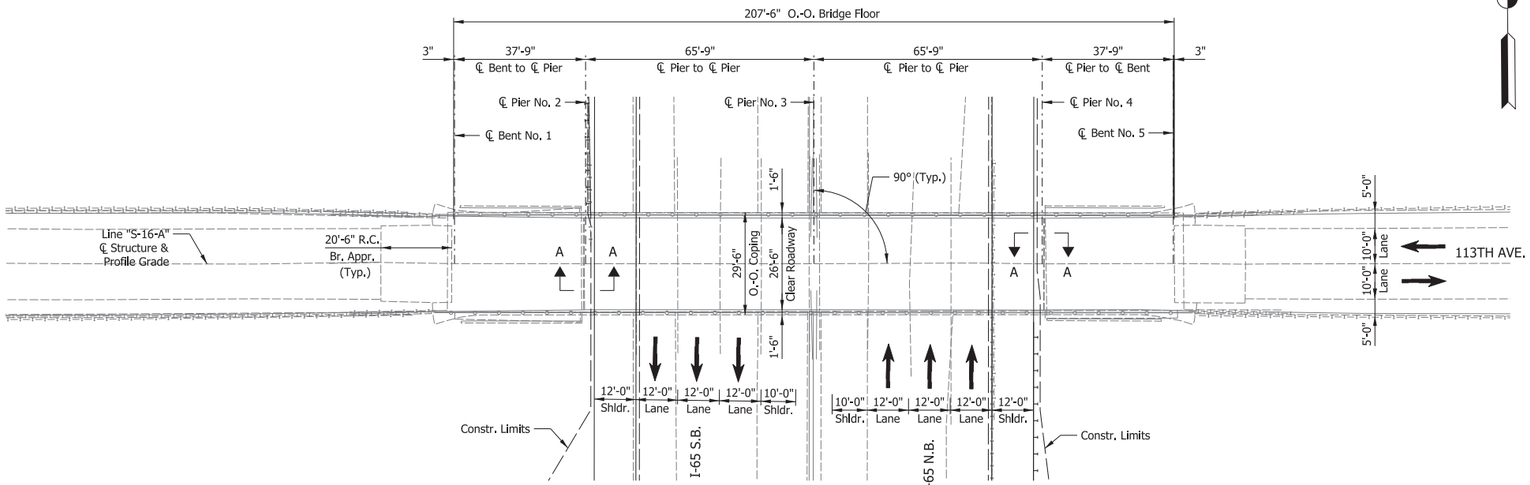
HORIZONTAL SCALE	BRIDGE FILE
NONE	I65-256-04899B
VERTICAL SCALE	DESIGNATION
NONE	1601116
SURVEY BOOK	SHEETS
ELECTRONIC	2 of 3
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B7_INDEX.01.dgn
22-JUL-2016

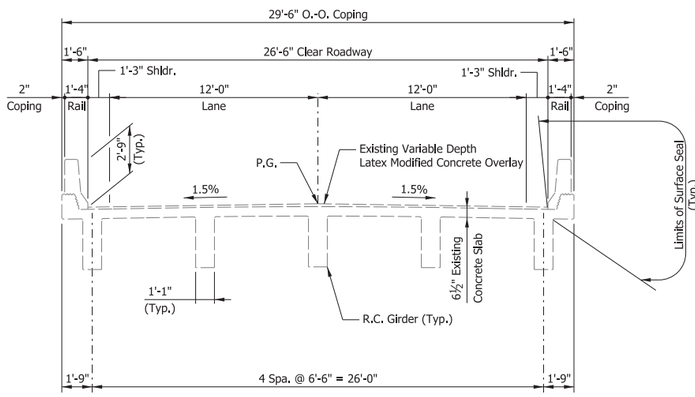
STRUCTURE IS BUILT TO A 650' VERTICAL CURVE



ELEVATION

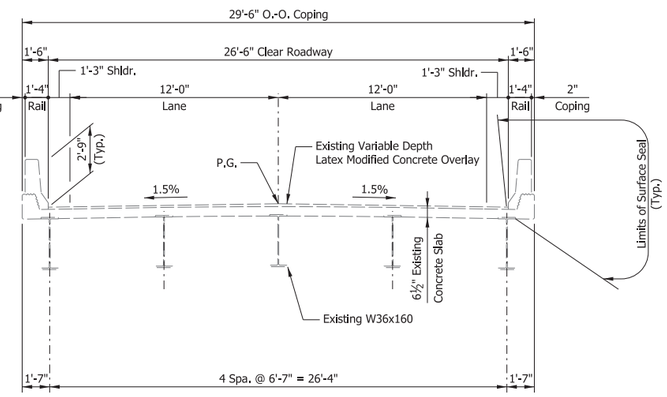


PLAN



EXISTING TYPICAL SECTION SPANS A & D

Scale: ¼" = 1'-0"



EXISTING TYPICAL SECTION SPANS B & C

Scale: ¼" = 1'-0"

GENERAL NOTES

Reinforcing steel covering shall be 2½" in Top and 1" min. in bottom of floor slabs, 3" in footing except bottom steel which shall be 4", and 2" in all other parts, unless noted.

All New Reinforcement Shall be Epoxy Coated.

Plans for the Existing Structure are on file in the Central Office, Indiana Dept. of Transportation as Bridge File No. I65-256-4899A, and are available upon request.

DESIGN DATA

Designed for HS-20 Loading, in accordance with AASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002, and its subsequent interims.

DEAD LOAD

Actual weight plus 35 psf. of future wearing surface and 15 psf for SIP Metal deck forms.

FLOOR SLAB

Designed with a 7½" structural depth, and a ½" integral wearing surface.

DESIGN STRESSES

CONCRETE

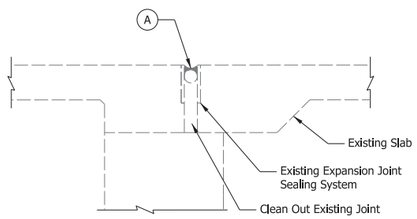
Class "A" Concrete	f'c = 3,500 p.s.i.
Class "B" Concrete	f'c = 3,000 p.s.i.
Class "C" Concrete	f'c = 4,000 p.s.i.

REINFORCING STEEL

Grade 60	f'y = 60,000 p.s.i.

LEGEND

- (A) Replace existing expansion joints with expansion joint sealing system.
- (B) Patch underside of deck (Est. Qty.= 130 Sft.)
- (C) Perform pier patching to areas of delamination and spalling. (Est. Qty.= 130 Sft.)
- (D) Surface seal existing bridge railings and copings.



SECTION A-A

Not To Scale

113TH AVENUE OVER I-65
R.C. GIRDER AND STEEL BEAM BRIDGE
4 SPANS: 35'-0", 65'-0", 65'-0", 35'-0"
SKEW: SQUARE
CLEAR ROADWAY: 26'-6"
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER _____ DATE

DESIGNED: EWM DRAWN: EWM

CHECKED: MJK CHECKED: MJK

INDIANA DEPARTMENT OF TRANSPORTATION

GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
1" = 20', U.N.	I65-256-04899B
VERTICAL SCALE	DESIGNATION
1" = 20', U.N.	1601116
SURVEY BOOK	SHEETS
ELECTRONIC	3 of 3
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B7_GENERAL PLAN.01.dgn
21-JUL-2016

BRIDGE NO. 8 AND 9

I-65

WALSH PARSONS Walsh & Kelly

R-37450
SECTION C

PROJECT	DESIGNATION
1172430	1600327 (N.B.) & 1600328 (S.B.)
CONTRACT	BRIDGE FILE
R-37450	I65-255-02320 JCNB & I65-255-02320 CSBL

STRUCTURE INFORMATION				
STRUCTURES	TYPE	SPAN AND SKEW	OVER	STATION
I-65-255-02320 JCNB I-65-255-02320 CSBL	Continuous Composite Steel Beam Bridge	5 Spans: 50'-6", 57'-6" 83'-0", 64'-6" & 51'-6" Skew: 25° Rt.	U.S. 231	1143+21.99 "A"

KIN DES. NUMBERS	DESCRIPTION	TYPE
1172430	I-65 ADDED TRAVEL LANES U.S. 231 TO U.S. 30	ROADWAY
1400349	I-65 ADDED TRAVEL LANES S.R. 2 TO U.S. 231	ROADWAY
1006741	PIPE LINER 2,64 MILES N OF S.R. 10	ROADWAY
1601115	93RD AVE. OVER I-65	BRIDGE
1600332	I-65 N.B. OVER BEAVER DAM	BRIDGE
1600331	I-65 S.B. OVER BEAVER DAM	BRIDGE
1600329	I-65 N.B. OVER 109TH AVE.	BRIDGE
1600330	I-65 S.B. OVER 109TH AVE.	BRIDGE
1601116	113TH AVE. OVER I-65	BRIDGE
1601117	137TH AVE. OVER I-65	BRIDGE
1382203	I-65 N.B. OVER WIRTZ DITCH	BRIDGE
1382204	I-65 S.B. OVER WIRTZ DITCH	BRIDGE
1298545	153RD AVE. OVER I-65	BRIDGE
1382207	I-65 N.B. OVER S.R. 2	BRIDGE
1382208	I-65 S.B. OVER S.R. 2	BRIDGE
0101469	I-65 N.B. OVER KANKAKEE RIVER	BRIDGE
0200140	I-65 S.B. OVER KANKAKEE RIVER	BRIDGE

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE REHABILITATION PLANS

FOR SPANS OVER 20 FEET

ROUTE: I-65 AT: RP 249+21

PROJECT NO. 1172430 P.E.

NO ADDITIONAL RIGHT-OF-WAY REQUIRED FOR THIS PROJECT

R/W

1172430 CONST.

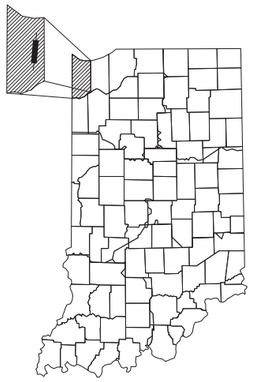
Bridge Deck Replacement and Widening on I-65 over U.S. 231 Located 5.37 Miles South of U.S. 30
in Section 15, T-34-N, R-8-W,
Center Township, Lake County, Indiana

Structures I65-255-02320 JCNB &
I65-255-02320 CSBL
Over U.S. 231
1143+21.99 "A"

SCALE: 1" = 4000'

TRAFFIC DATA		I-65 N.B.L.	I-65 S.B.L.
A.A.D.T.	(2015)	28,977 V.P.D.	21,860 V.P.D.
A.A.D.T.	(2035)	29,526 V.P.D.	22,274 V.P.D.
D.H.V	(2035)	2,362 V.P.H.	1,782 V.P.H.
DIRECTIONAL DISTRIBUTION		57 %	43 %
TRUCKS		34 % A.A.D.T.	34 % A.A.D.T.
		34 % D.H.V.	34 % D.H.V.

DESIGN DATA	
DESIGN SPEED	70 M.P.H.
PROJECT DESIGN CRITERIA	PARTIAL RECONSTRUCTION 4R (FREEWAY)
FUNCTIONAL CLASSIFICATION	INTERSTATE
RURAL/URBAN	RURAL
TERRAIN	LEVEL
ACCESS CONTROL	FULL



PROJECT LOCATION SHOWN BY
Lake County

LATITUDE: 41°23'36" N LONGITUDE: 87°19'26" W

BRIDGE LENGTH: 0.059 MI.
ROADWAY LENGTH: 0.008 MI.
TOTAL LENGTH: 0.067 MI.
MAX. GRADE: 3.00% %

MajorMoves 2020

INDIANA DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS DATED 2016
TO BE USED WITH THESE PLANS.

PARSONS
101 W. Ohio St., Suite 2121
Indianapolis, IN 46204
Bus (317) 616-1000
Fax (317) 616-1033

PLANS PREPARED BY: PARSONS 317-616-1000 PHONE NUMBER

CERTIFIED BY: _____ DATE

APPROVED FOR LETTING: _____ INDIANA DEPARTMENT OF TRANSPORTATION DATE

BRIDGE FILE	
I65-255-02320JCNB & 02320CSBL	
DESIGNATION	
1600327 & 1600328	
SURVEY BOOK	SHEETS
ELECTRONIC	1 of 20
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B8-B9_BRIDGE TITLE SHEET.01.dgn
20-JUL-2016

UTILITIES

ELECTRIC

NIPSCO Electric
MArk Lindsley
Phone: 219-647-4198

American Electric Power
Ngoc Alex KUrtz
Phone: 614-552-1332

GAS / PIPELINES

NIPSCO Gas
Neil Arndt
Phone: 219-647-4779

Buckeye Pipe Line Co., LP
Michael Norris
Phone: 219-313-5321

Enbridge Energy Company, Inc.
Michael Price
Phone: 219-922-7015

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Michael Seals
Phone: 317-885-2444

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AT&T Indiana (Dist)
Angelo LaMantia
Phone: 219-662-4418

AT&T Transmission (LD)
Carl Donahue
Phone: 630-552-9785
Dean Norwich
Phone: 574-344-0833

Comcast Cable
Robert Schulter
Phone: 630-600-6307

Zayo Bandwidth LLC
Jason Gilpin
Phone: 260-570-5677

Northwest Indiana Telephone Co. Inc.
Don Schoenbeck
Phone: 219-996-0216

Indiana Fiber Network LLC
Jim Royer
Phone: 317-777-7115
317-280-4636

MISCELLANEOUS AGENCIES

Merrillville Conservancy Dist.
Charles Stojakovich
Phone: 219-980-5220

City of Crown Point
Jay Olson
Phone: 219-662-3252
Kent Swinehart
Phone: 219-661-2287

INDOT ITS
Technology Deployment Division
Ed Cox
Phone: 317-899-8601

INDOT LaPorte District
(Signals Lighting)
Andy Costello
Phone: 219-325-7483

Indiana811
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INDEX

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1	TITLE
2	INDEX
3-4	MAINTENANCE OF TRAFFIC TYPICAL SECTIONS
5	REMOVAL DETAILS
6	LAYOUT
7-9	GENERAL PLAN
10-12	END BENT DETAILS
13	PIER DETAILS
14	FRAMING PLAN
15-17	SUPERSTRUCTURE DETAILS
18-20	R.C. BRIDGE APPROACH DETAILS

REVISIONS

SHEET NO.	DATE	REVISED

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: RTA DRAWN: EWM

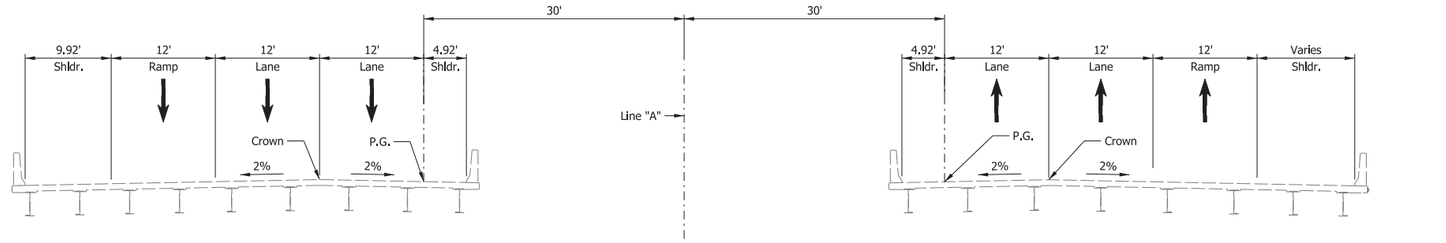
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INDIANA
DEPARTMENT OF TRANSPORTATION

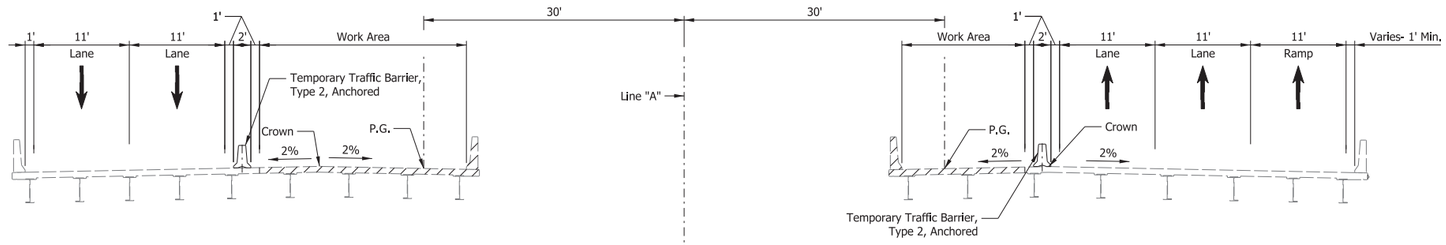
INDEX SHEET

HORIZONTAL SCALE	BRIDGE FILE
NONE	I65-255-02320JCNB & 02320CSBL
VERTICAL SCALE	DESIGNATION
NONE	1600327 & 1600328
SURVEY BOOK	SHEETS
ELECTRONIC	2 of 20
CONTRACT	PROJECT
R-37450	1172430

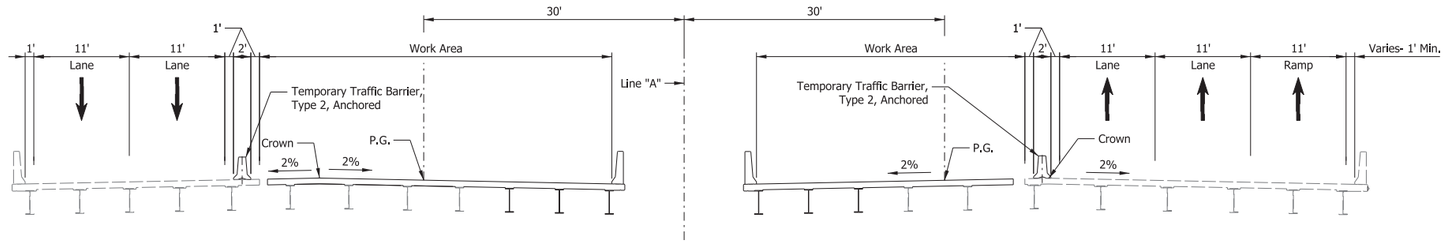
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22-JUL-2016



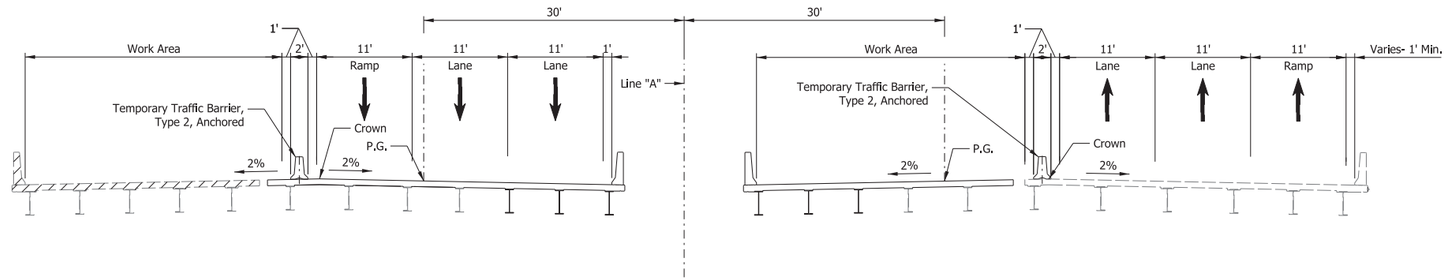
EXISTING TYPICAL SECTION



PHASE 1A



PHASE 1B



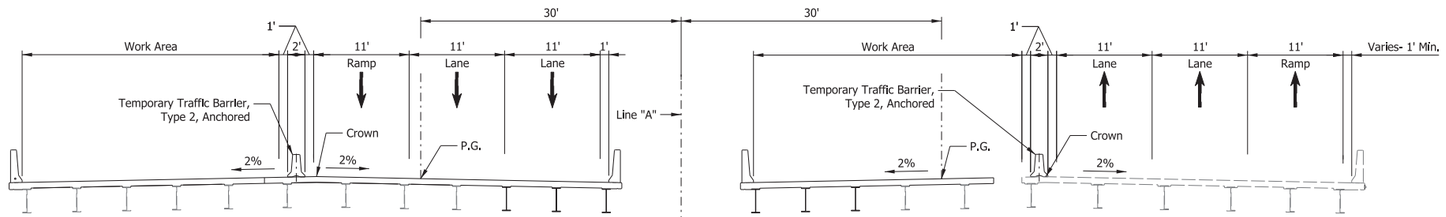
PHASE 2A

NOTE:

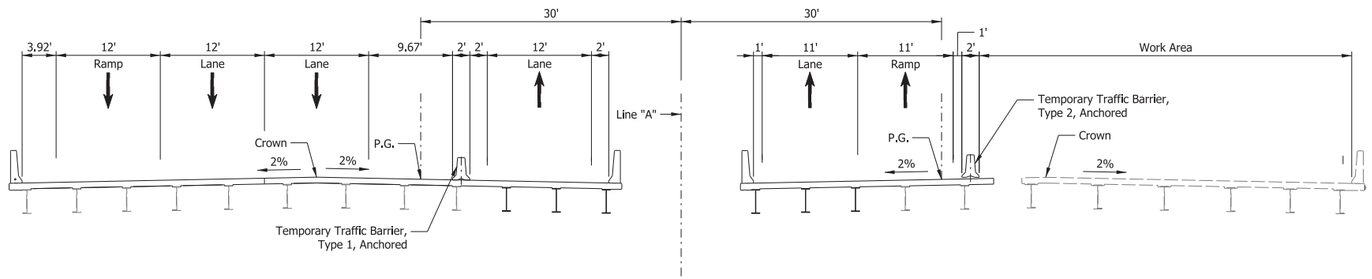
Hatched areas indicate limits of removal.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 1/8" = 1'-0"	BRIDGE FILE I65-255-02320JCNB & 02320CSBL
				VERTICAL SCALE 1/8" = 1'-0"	DESIGNATION 1600327 & 1600328
		DESIGNED: RTA DRAWN: ALF	MAINTENANCE OF TRAFFIC	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	3 of 20
				CONTRACT R-37450	PROJECT 1172430

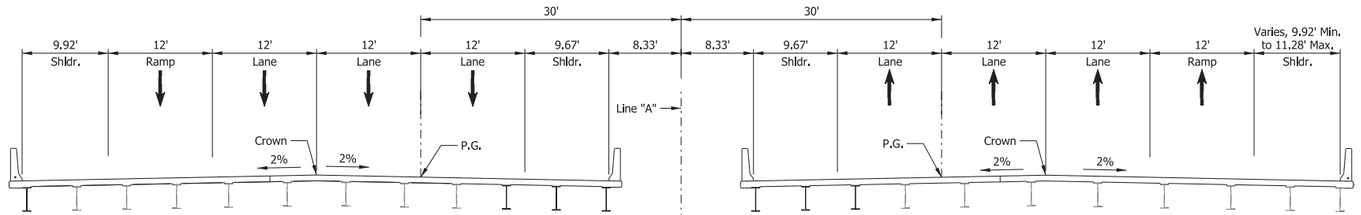
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20-JUL-2016



PHASE 2B



PHASE 3A



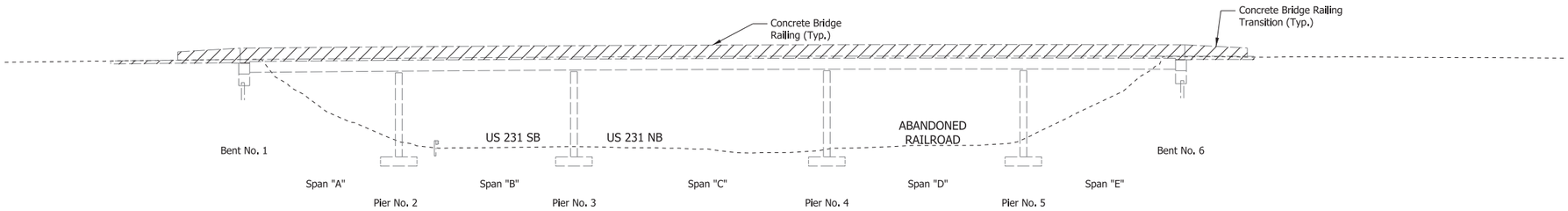
PROPOSED TYPICAL SECTION

NOTE:

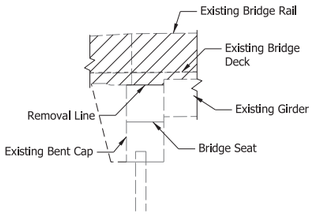
Hatched areas indicate limits of removal.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 1/8" = 1'-0"	BRIDGE FILE I65-255-02320JCNB & 02320CSBL
				VERTICAL SCALE 1/8" = 1'-0"	DESIGNATION 1600327 & 1600328
		DESIGNED: RTA / DRAWN: ALF	MAINTENANCE OF TRAFFIC	SURVEY BOOK	SHEETS
		CHECKED: MJK / CHECKED: MJK		ELECTRONIC	4 of 20
				CONTRACT R-37450	PROJECT 1172430

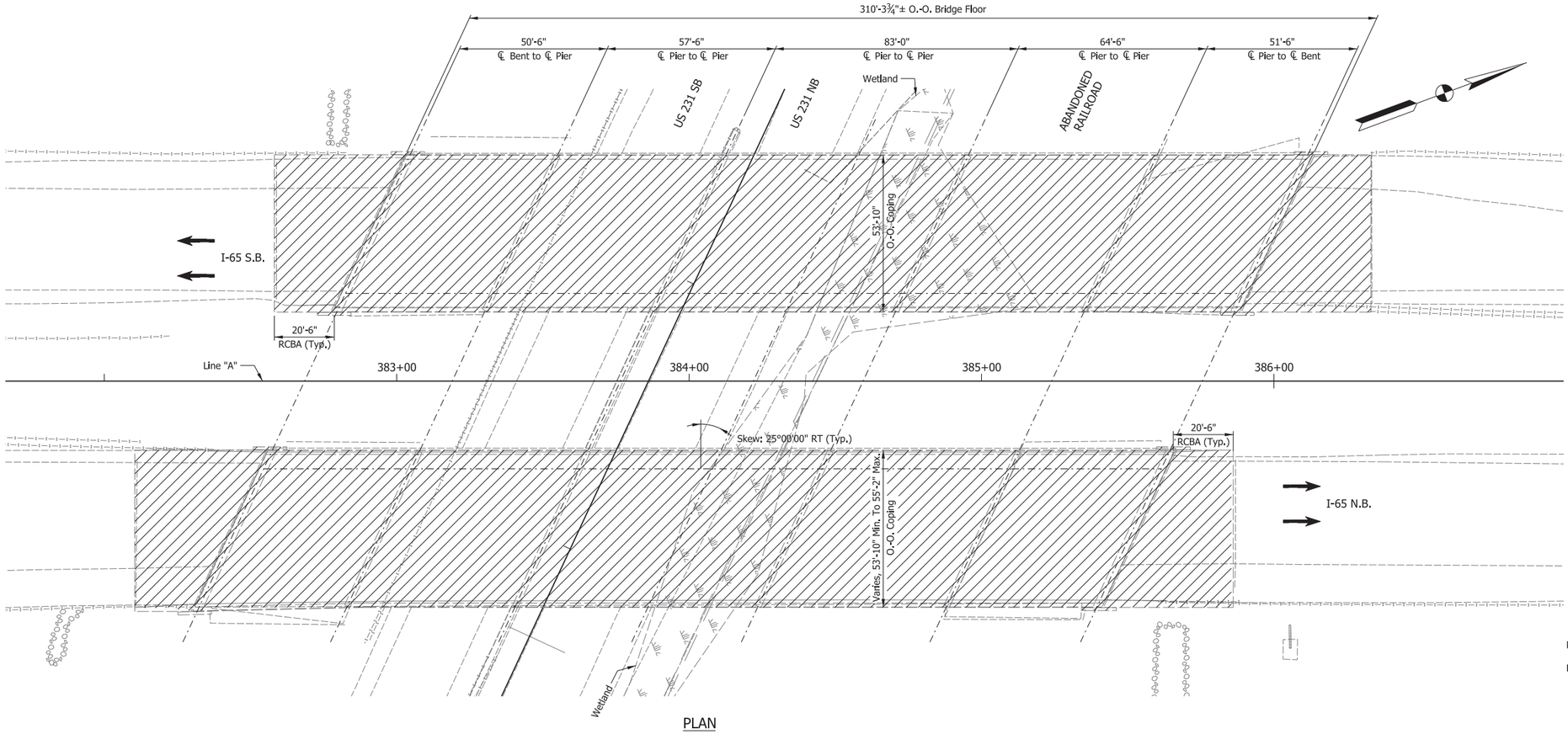
IP_PWP:dms13737\I65_NORTHWEST_B8-B9_MOT.02.dgn
22-JUL-2016



ELEVATION



TYPICAL SECTION
REMOVAL @ BENTS
Not To Scale



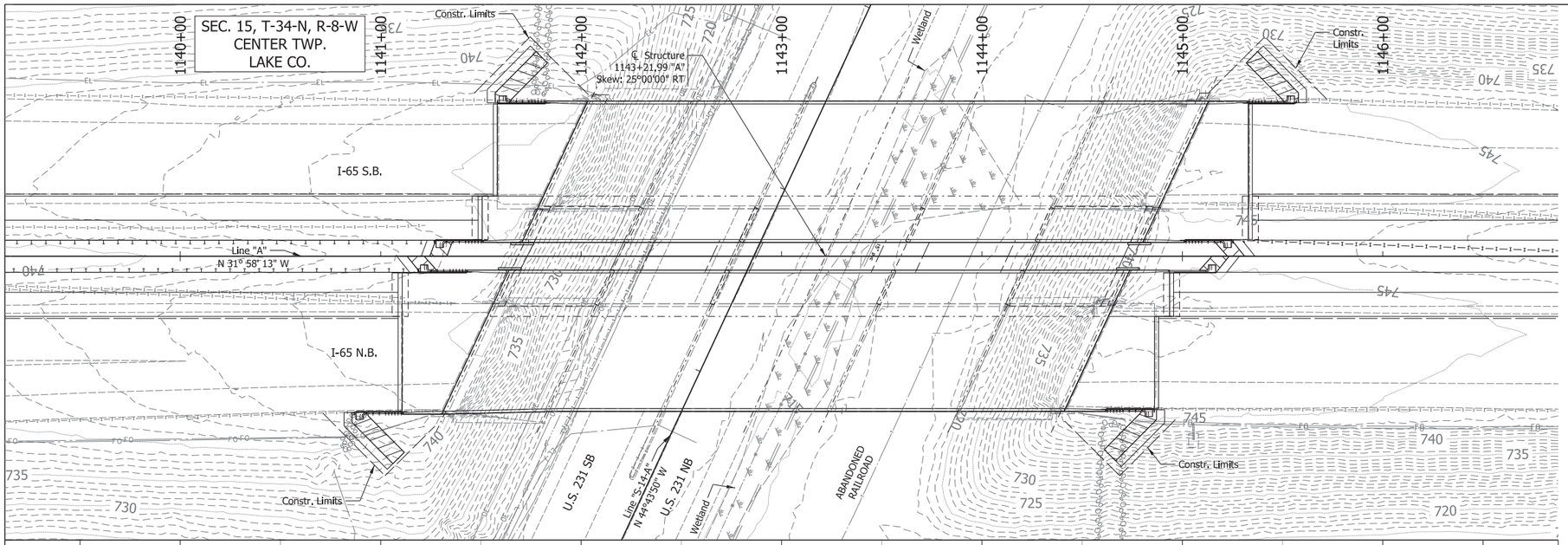
PLAN

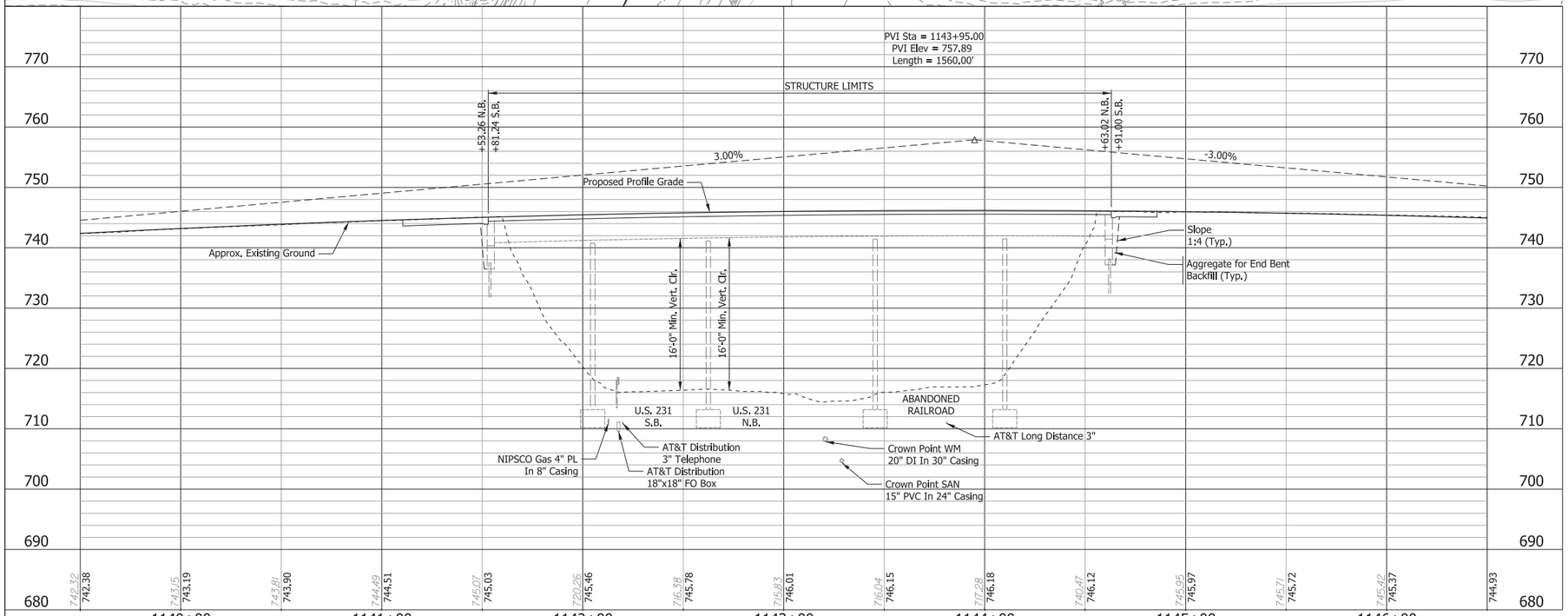
NOTES:

Hatched areas indicate limits of existing structure removal.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 1"=20'	BRIDGE FILE I65-255-02320JCNB & 02320CSBL
				VERTICAL SCALE 1"=20'	DESIGNATION 1600327 & 1600328
		DESIGNED: RTA DRAWN: ALF	REMOVAL DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	5 of 20
				CONTRACT R-37450	PROJECT 1172430

IP_PWP:dms13737\I65_NORTHWEST_B8-B9_REMOVAL DETAIL.01.dgn
21-JUL-2016





EXISTING STRUCTURE

The existing steel beam bridge was built in 1964 with 5- spans: 50'-6", 57'-6", 83'-0",64'-6" and 51'-6" and then widened in 1997 with a 50'-10" (S.B.) & variable 50'-10" min. to 52'-2" max. (N.B.) clear roadways with reinforced concrete decks. Existing structure to be rehabilitated and widened.

NOTES:

For R/W and Additional information see Roadway Plan & Profile sheets.

For Utility Contacts see Index Sheet No.2.

Hatched areas indicate limits of revetment riprap for riprap drainage turnouts. (Est. Riprap Qty. = TBD Tons) (Est. Geotextiles Qty. = TBD Sys.)

I-65 OVER U.S. 231
CONTINUOUS COMPOSITE STEEL BEAM BRIDGE
5 SPANS: 50'-6", 57'-6", 83'-0", 64'-6", 51'-6"
SKEW: 25° RT.
2 CLEAR ROADWAYS: 67'-7" S.B., VARIES N.B.
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: RTA DRAWN: ALF

CHECKED: MJK CHECKED: MJK

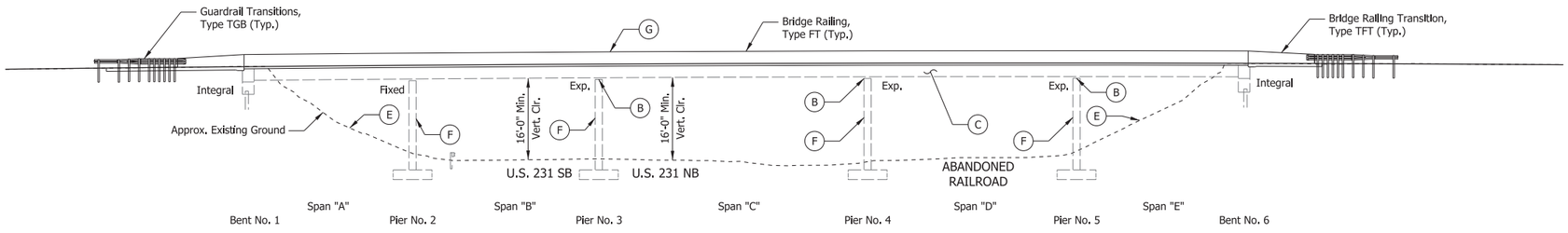
INDIANA
DEPARTMENT OF TRANSPORTATION

LAYOUT

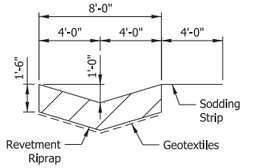
HORIZONTAL SCALE	BRIDGE FILE
1" = 20'	I65-255-02320JCNB & 02320CSBL
VERTICAL SCALE	DESIGNATION
1" = 20'	1600327 & 1600328
SURVEY BOOK	SHEETS
ELECTRONIC	6 of 20
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B8-B9_LAYOUT.01.dgn
20-JUL-2016

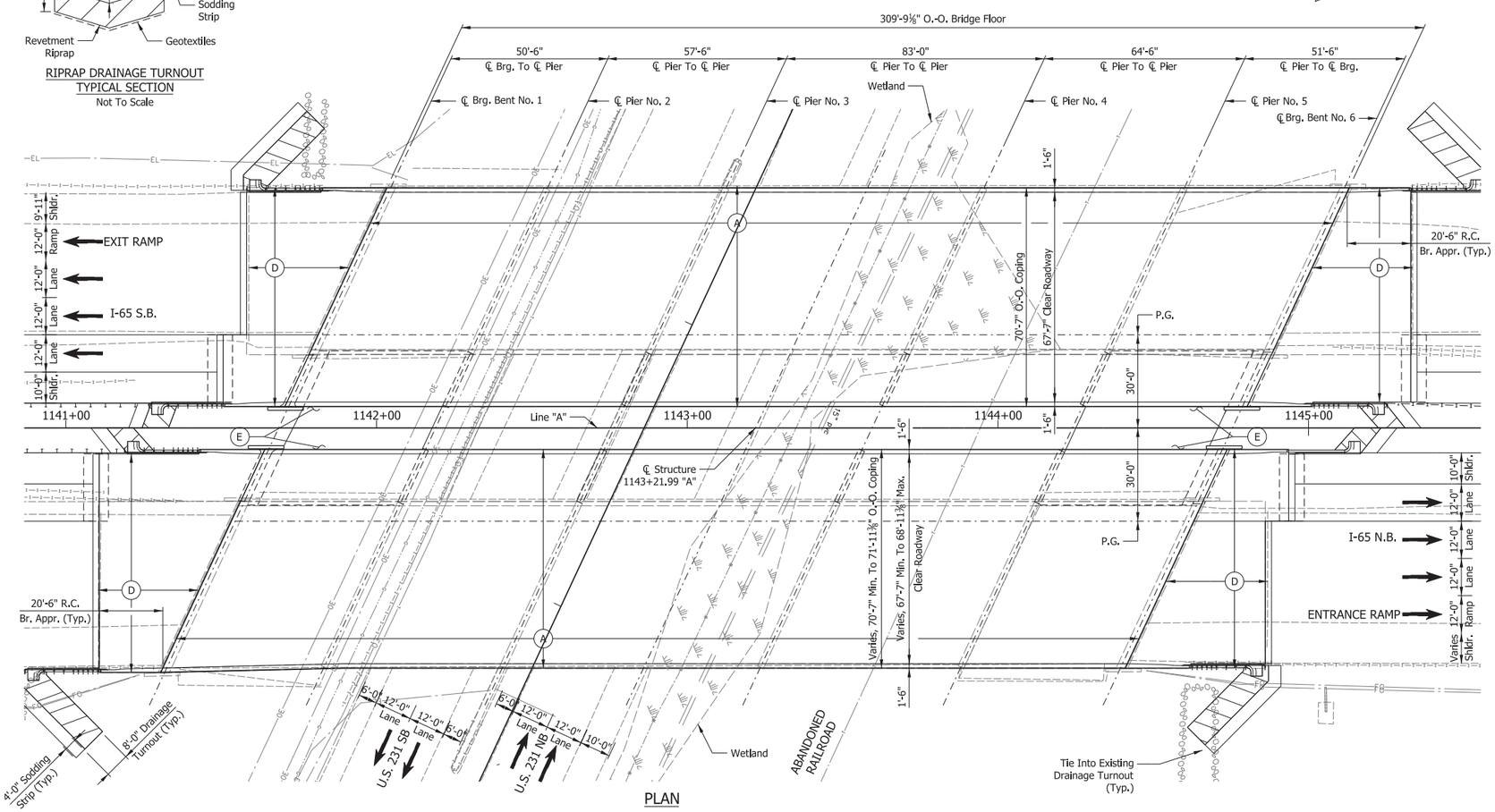
STRUCTURE IS BUILT TO A 1550' VERTICAL CURVE



ELEVATION



RIPRAP DRAINAGE TURNOUT TYPICAL SECTION
Not To Scale



PLAN

GENERAL NOTES

Reinforcing steel covering shall be 2½" in Top and 1" min. in bottom of floor slabs, 3" in footing except bottom steel which shall be 4", and 2" in all other parts, unless noted.

All New Reinforcement Shall be Epoxy Coated unless Otherwise Noted.

Plans for the Existing Structure are on file in the Central Office, Indiana Dept. of Transportation as Bridge File No. I65-255-2320 and I65-255-2320B and are available upon request.

DESIGN DATA

Designed for HS-20 Loading, in accordance with AASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002, and its subsequent interims.

DEAD LOAD

Actual weight plus 35 psf. of future wearing surface and 15 psf for SIP Metal deck forms.

FLOOR SLAB

Designed with a 7½" structural depth, and a ½" integral wearing surface.

DESIGN STRESSES

CONCRETE

Class "A" Concrete	f'c = 3,500 p.s.i.
Class "B" Concrete	f'c = 3,000 p.s.i.
Class "C" Concrete	f'c = 4,000 p.s.i.

REINFORCING STEEL

Grade 60	f'y = 60,000 p.s.i.

LEGEND

(A) Replace bridge deck and construct lengthened piers and end bents as well as full depth concrete slab, to accommodate new clear roadway width.

(B) Replace all existing steel bearing assemblies with elastomeric bearing pad assemblies.

(C) Tighten all bolts on bolted diaphragms between the original beams and the previous outside widening beams.

(D) Replace existing reinforced concrete approach slabs.

(E) Construct concrete slopewall in widened end bent area.

(F) Perform pier patching to areas of delamination and spalling. (Est. Qty.= 1010 Sft. Total, 550 Sft. NB & 460 Sft. SB Structure)

(G) Install ITS conduit in bridge railing.

I-65 OVER U.S. 231
CONTINUOUS COMPOSITE STEEL BEAM BRIDGE
5 SPANS: 50'-6", 57'-6", 83'-0", 64'-6", 51'-6"
SKEW: 25° RT.
2 CLEAR ROADWAYS: 67'-7" S.B., VARIES N.B.
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: RTA DRAWN: ALF

CHECKED: MJK CHECKED: MJK

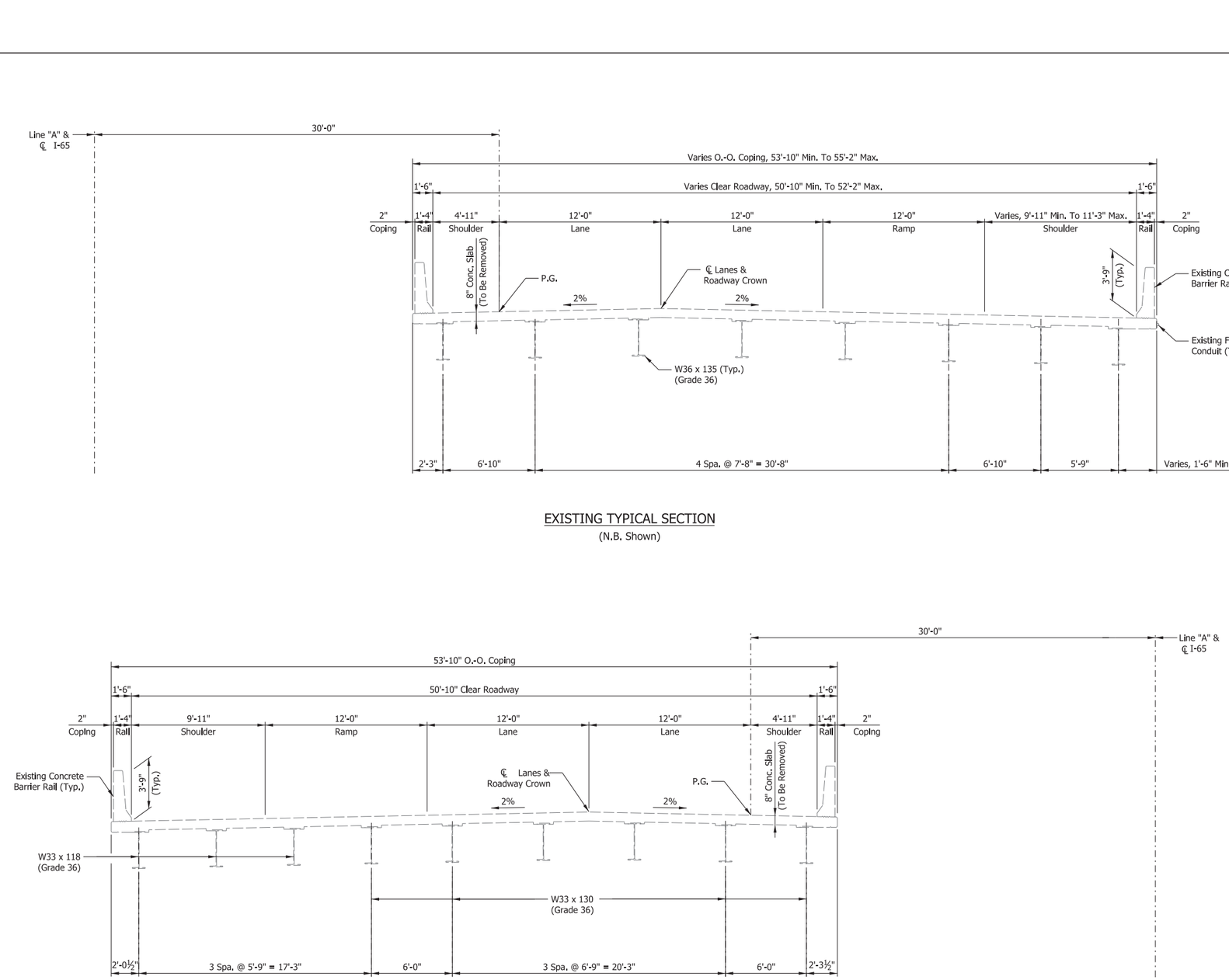
INDIANA DEPARTMENT OF TRANSPORTATION

GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
1" = 20'	I65-255-02320JCNB & 02320CSBL
VERTICAL SCALE	DESIGNATION
1" = 20'	1600327 & 1600328
SURVEY BOOK	SHEETS
ELECTRONIC	7 of 20
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B8-B9_GENERAL PLAN.01.dgn
20-JUL-2016

EXISTING TYPICAL SECTION
(N.B. Shown)



EXISTING TYPICAL SECTION
(S.B. Shown)

I-65 OVER U.S. 231
CONTINUOUS COMPOSITE STEEL BEAM BRIDGE
5 SPANS: 50'-6", 57'-6", 83'-0", 64'-6", 51'-6"
SKEW: 25° RT.
2 CLEAR ROADWAYS: 67'-7" S.B., VARIES N.B.
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER _____ DATE

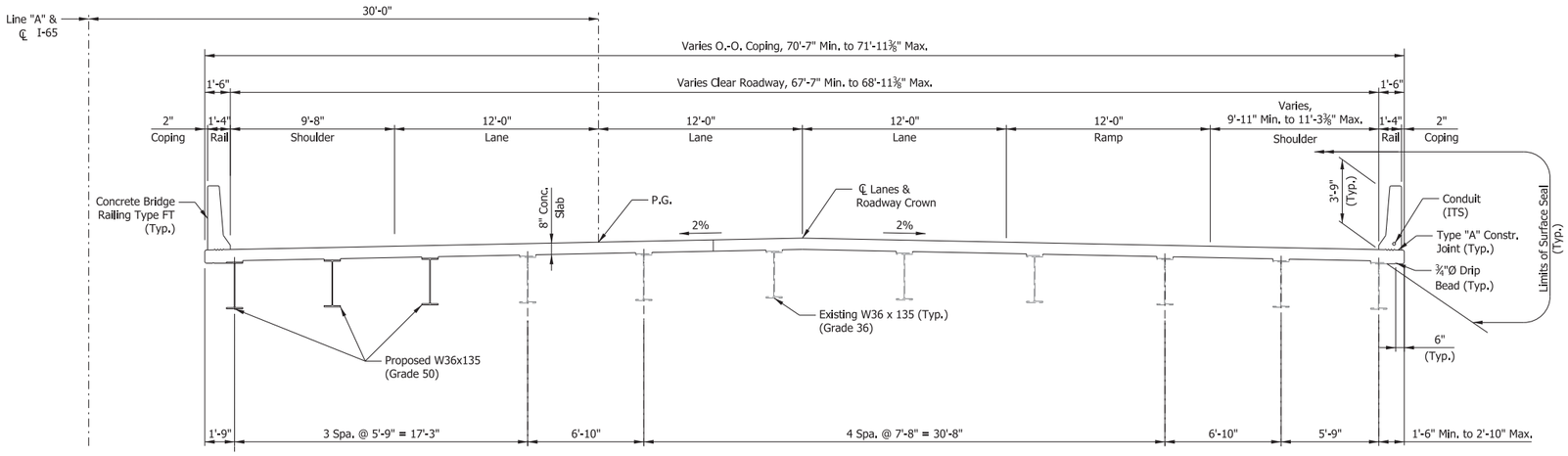
DESIGNED: RTA | DRAWN: EWM
CHECKED: MJK | CHECKED: MJK

INDIANA
DEPARTMENT OF TRANSPORTATION

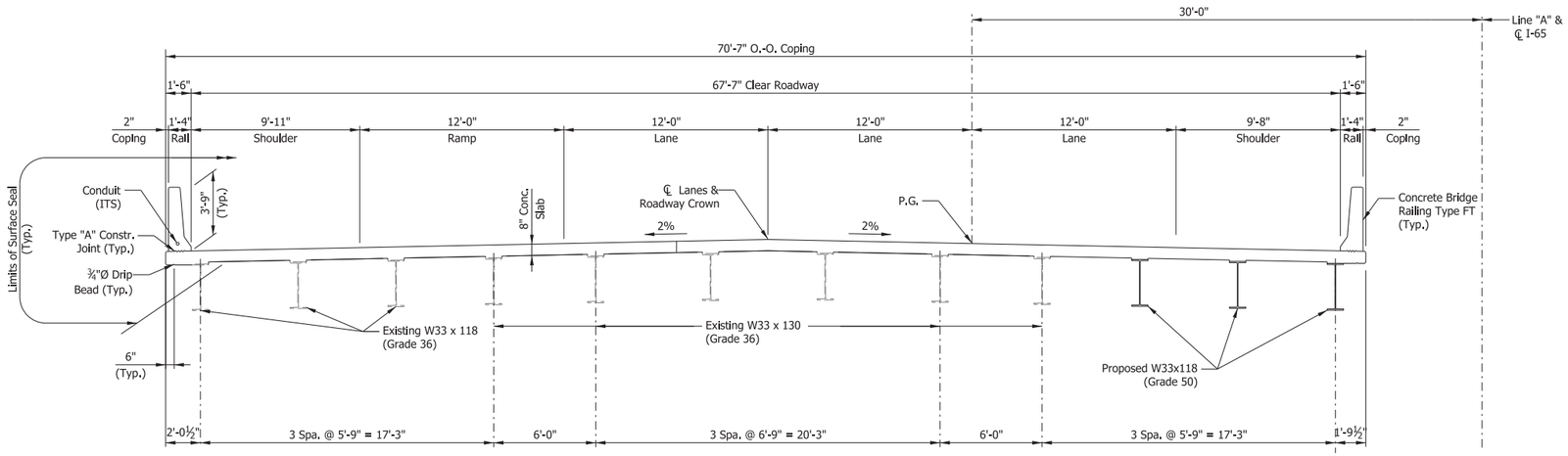
GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
1/4" = 1'-0"	I65-255-02320JCNB & 02320CSBL
VERTICAL SCALE	DESIGNATION
1/4" = 1'-0"	1600327 & 1600328
SURVEY BOOK	SHEETS
ELECTRONIC	8 of 20
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B8-B9_GENERAL PLAN.02.dgn
22-JUL-2016



PROPOSED TYPICAL SECTION
(N.B. Shown)



PROPOSED TYPICAL SECTION
(S.B. Shown)

I-65 OVER U.S. 231
CONTINUOUS COMPOSITE STEEL BEAM BRIDGE
5 SPANS: 50'-6", 57'-6", 83'-0", 64'-6", 51'-6"
SKEW: 25° RT.
2 CLEAR ROADWAYS: 67'-7" S.B., VARIES N.B.
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

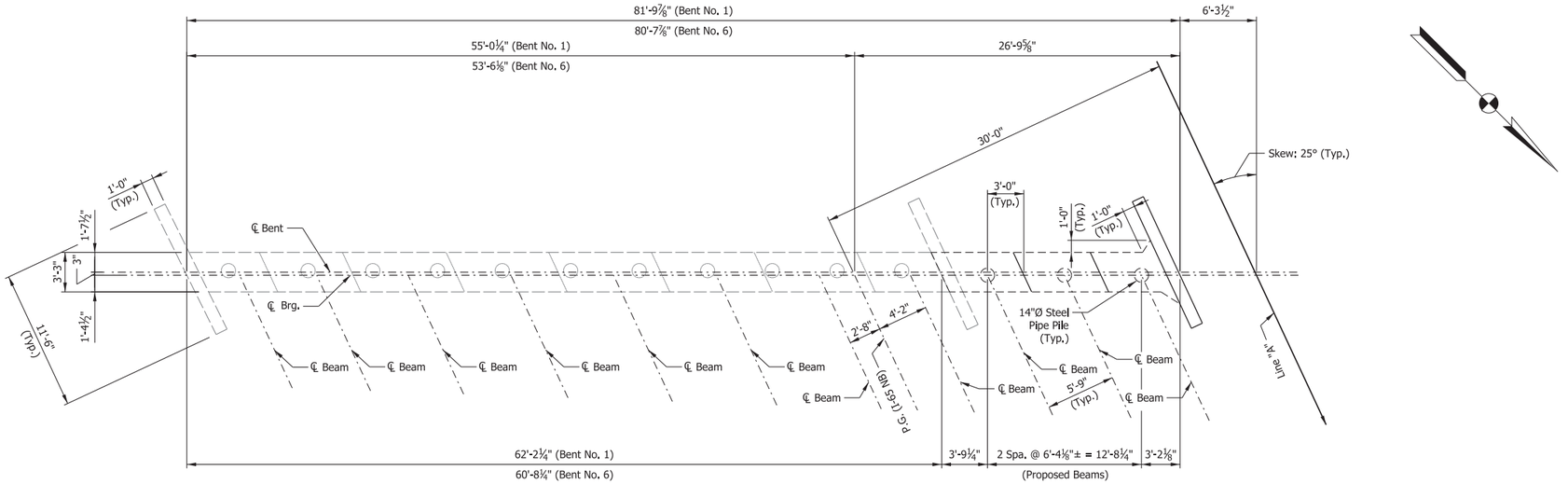
DESIGNED: RTA DRAWN: EWM
CHECKED: MJK CHECKED: MJK

INDIANA
DEPARTMENT OF TRANSPORTATION

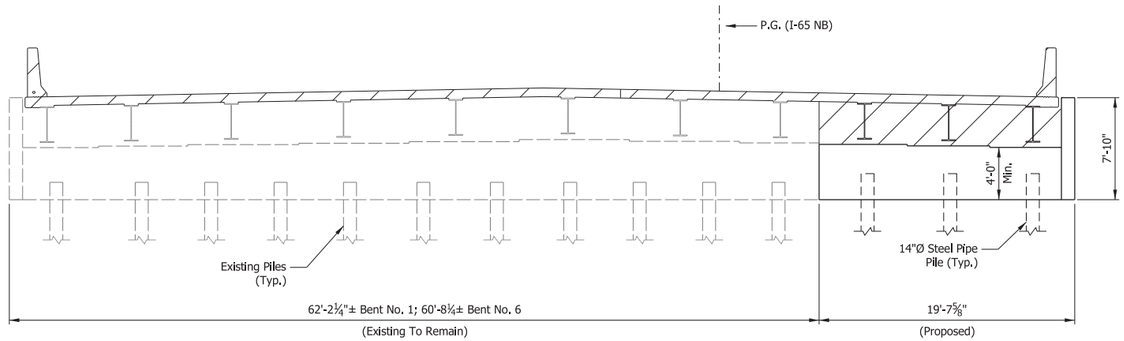
GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
1/4" = 1'-0"	I65-255-02320JCNB & 02320CSBL
VERTICAL SCALE	DESIGNATION
1/4" = 1'-0"	1600327 & 1600328
SURVEY BOOK	SHEETS
ELECTRONIC	9 of 20
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B8-B9_GENERAL PLAN.03.dgn
22-JUL-2016



PLAN @ BENT NO.1 N.B.
(Bent No. 6 Similar By Opposite Hand)



ELEVATION @ BENT NO.1 N.B.
(Bent No. 6 Similar By Opposite Hand)

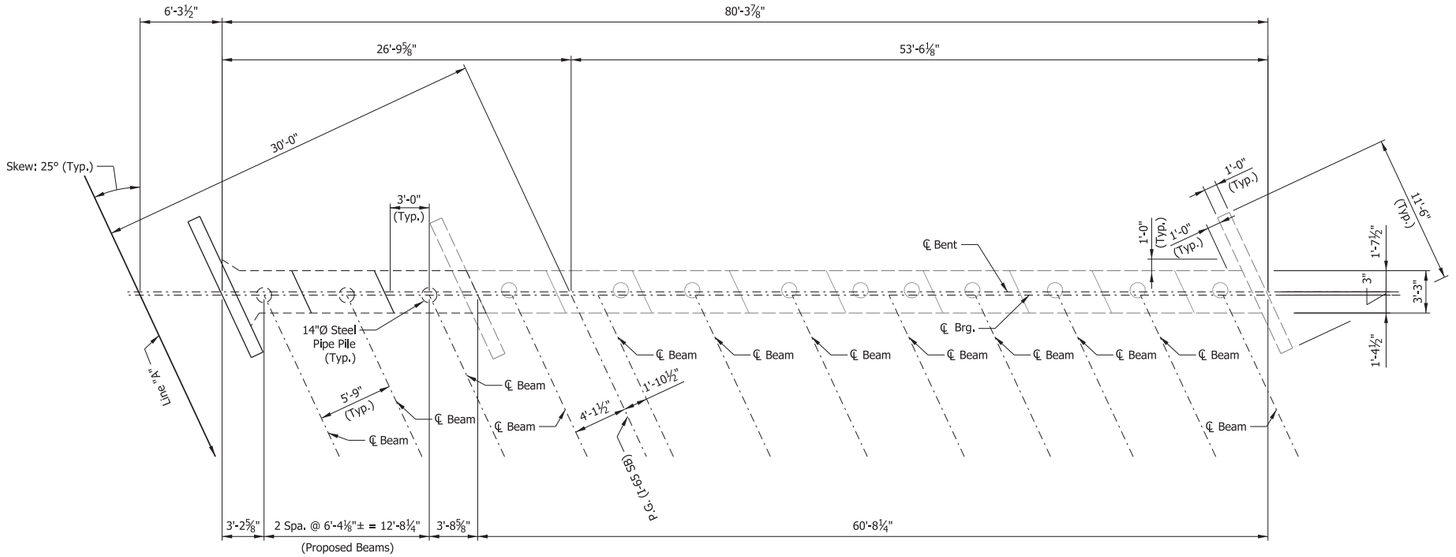
NOTES:

Dimensions shown along centerline of bearing.

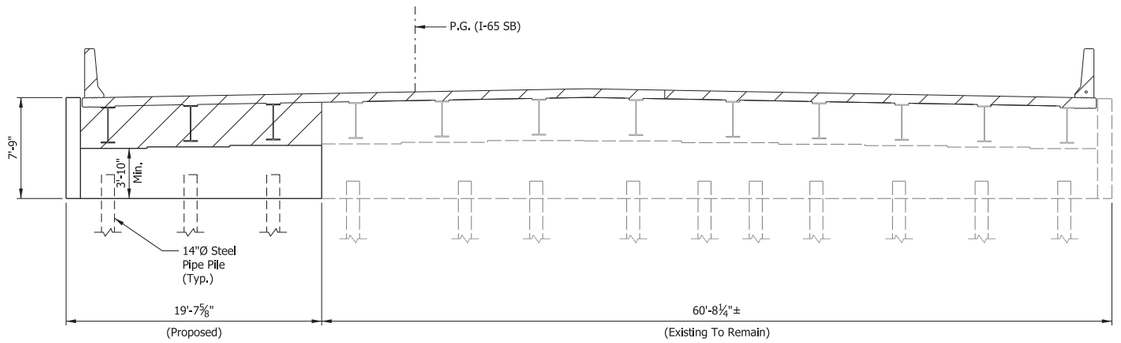
Hatched areas to be poured with superstructure.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 3/16" = 1'-0"	BRIDGE FILE: I65-255-02320JCNB & 02320CSBL
				VERTICAL SCALE: 3/16" = 1'-0"	DESIGNATION: 1600327 & 1600328
		DESIGNED: RTA DRAWN: ALF	END BENT DETAILS	SURVEY BOOK: ELECTRONIC	SHEETS: 10 of 20
		CHECKED: MJK CHECKED: MJK		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13737\I65_NORTHWEST_B8-B9_END BENT.01.dgn
20-JUL-2016



PLAN @ BENT NO.1 S.B.
(Bent No.6 Similar By Opposite Hand)



ELEVATION @ BENT NO.1 S.B.
(Bent No.6 Similar By Opposite Hand)

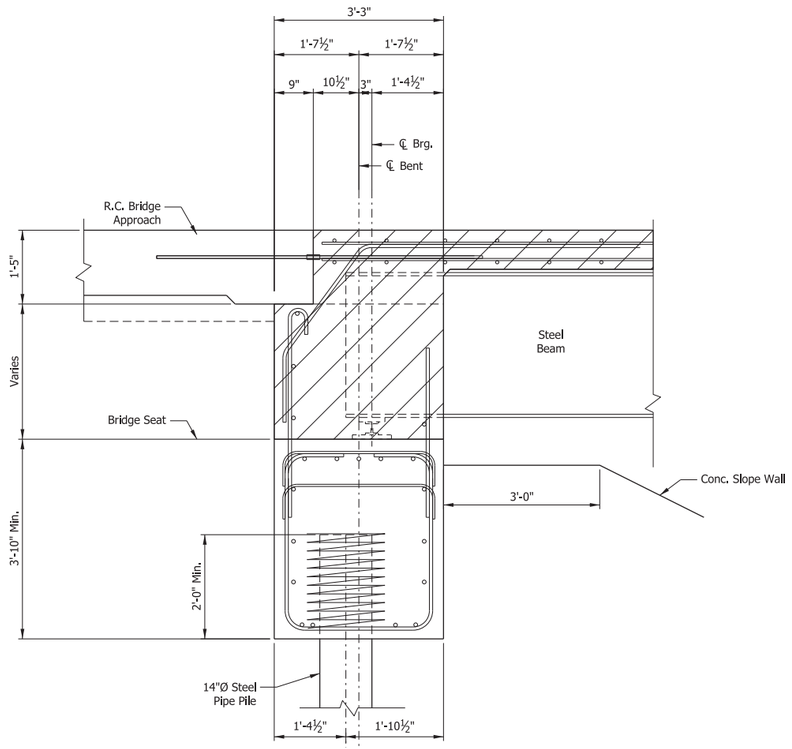
NOTES:

Dimensions shown along centerline of bearing.

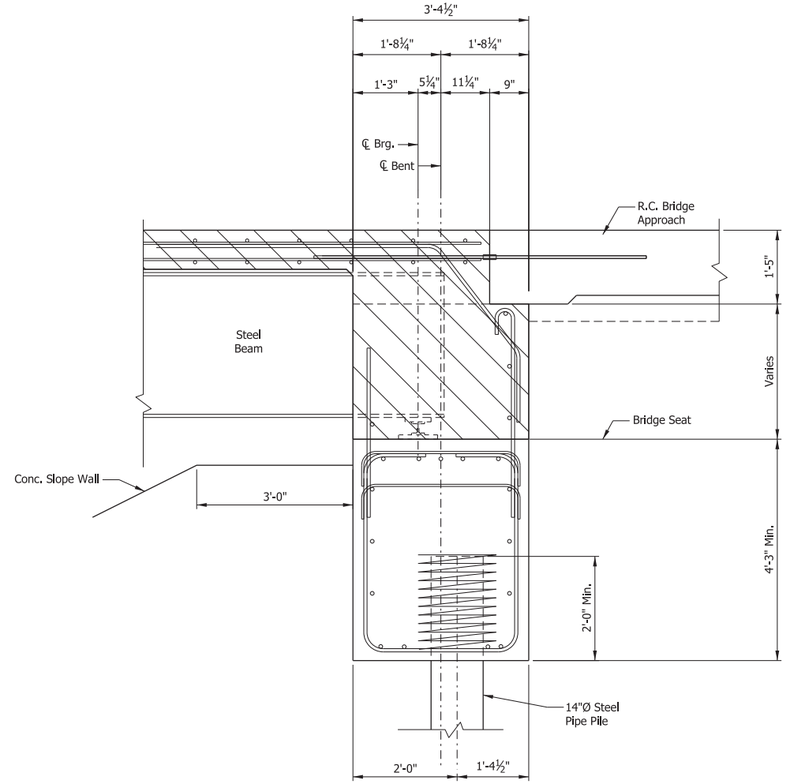
Hatched areas to be poured with superstructure.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 3/16" = 1'-0"	BRIDGE FILE: I65-255-02320JCNB & 02320CSBL
				VERTICAL SCALE: 3/16" = 1'-0"	DESIGNATION: 1600327 & 1600328
		DESIGNED: RTA DRAWN: ALF	END BENT DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC: 11 of 20	
				CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13737\I65_NORTHWEST_B8-B9_END BENT.02.dgn
20-JUL-2016



TYPICAL PROPOSED SECTION
@ BENT NO.1



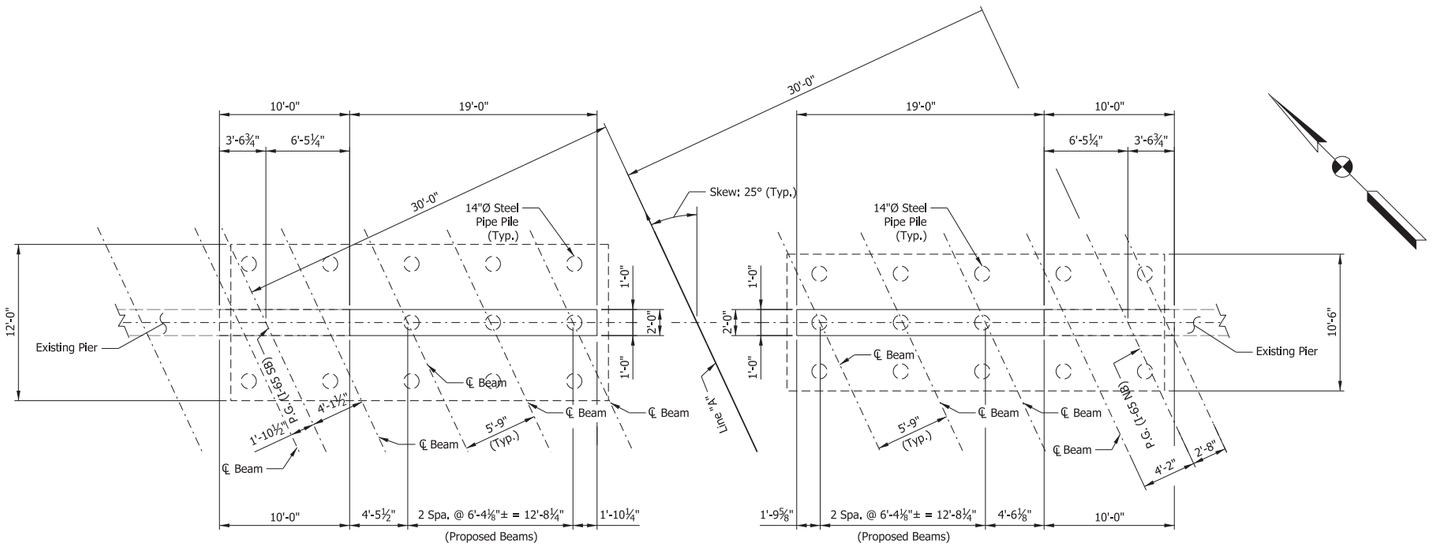
TYPICAL PROPOSED SECTION
@ BENT NO.6

NOTES:

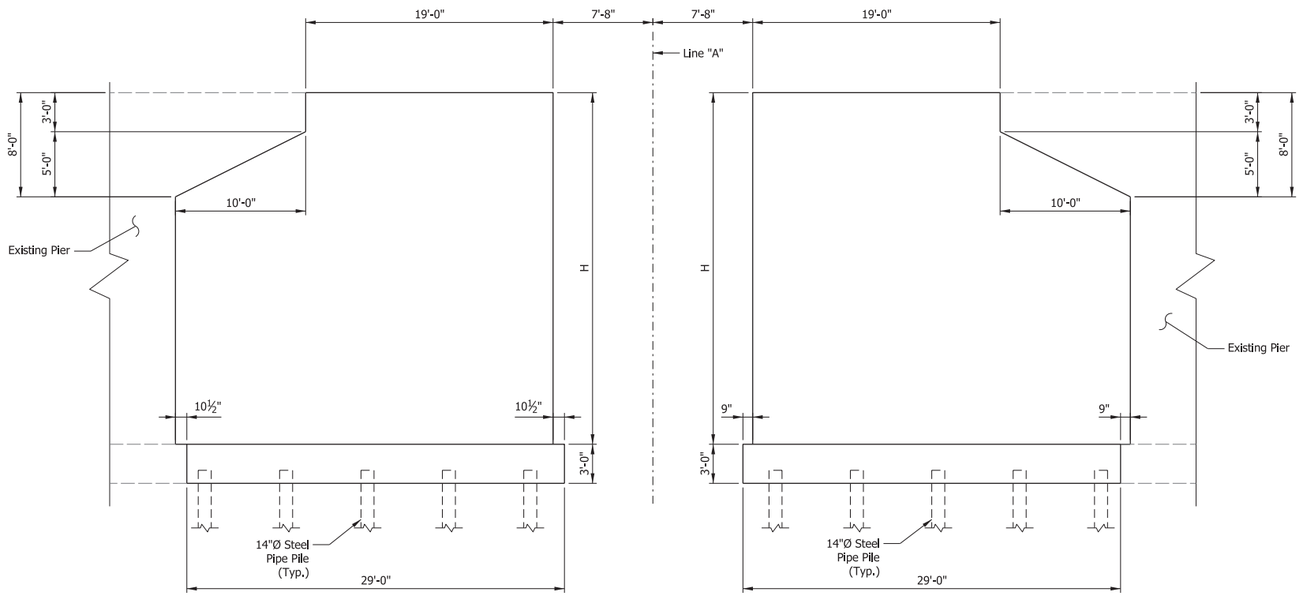
Hatched areas to be poured with superstructure.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 3/16" = 1'-0"	BRIDGE FILE: I65-255-02320JCNB & 02320CSBL
				VERTICAL SCALE: 3/16" = 1'-0"	DESIGNATION: 1600327 & 1600328
		DESIGNED: RTA / DRAWN: ALF	END BENT DETAILS	SURVEY BOOK: ELECTRONIC	SHEETS: 12 of 20
		CHECKED: MJK / CHECKED: MJK		CONTRACT: R-37450	PROJECT: 1172430

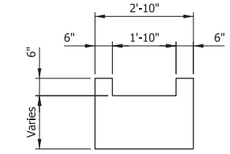
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20-JUL-2016



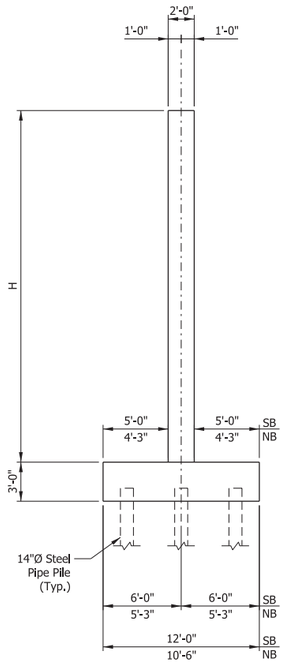
PLAN @ PIER NO.2
(Piers No. 3, 4, & 5 Same)



ELEVATION @ PIER NO.2
(Piers No. 3, 4, & 5 Same)



TYPICAL PROPOSED
PEDESTAL SECTION
(Piers No. 3, 4, & 5 Only)



TYPICAL PROPOSED SECTION @ PIER NO.2
(Piers No. 3, 4, & 5 Same)

LOCATION	H
Pier No.2 SB	28'-3"
Pier No.2 NB	27'-6"
Pier No.3,4 SB	27'-9"
Pier No.3,4 NB	27'-0"
Pier No.5 SB	27'-3"
Pier No.5 NB	26'-6"

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: RTA DRAWN: ALF

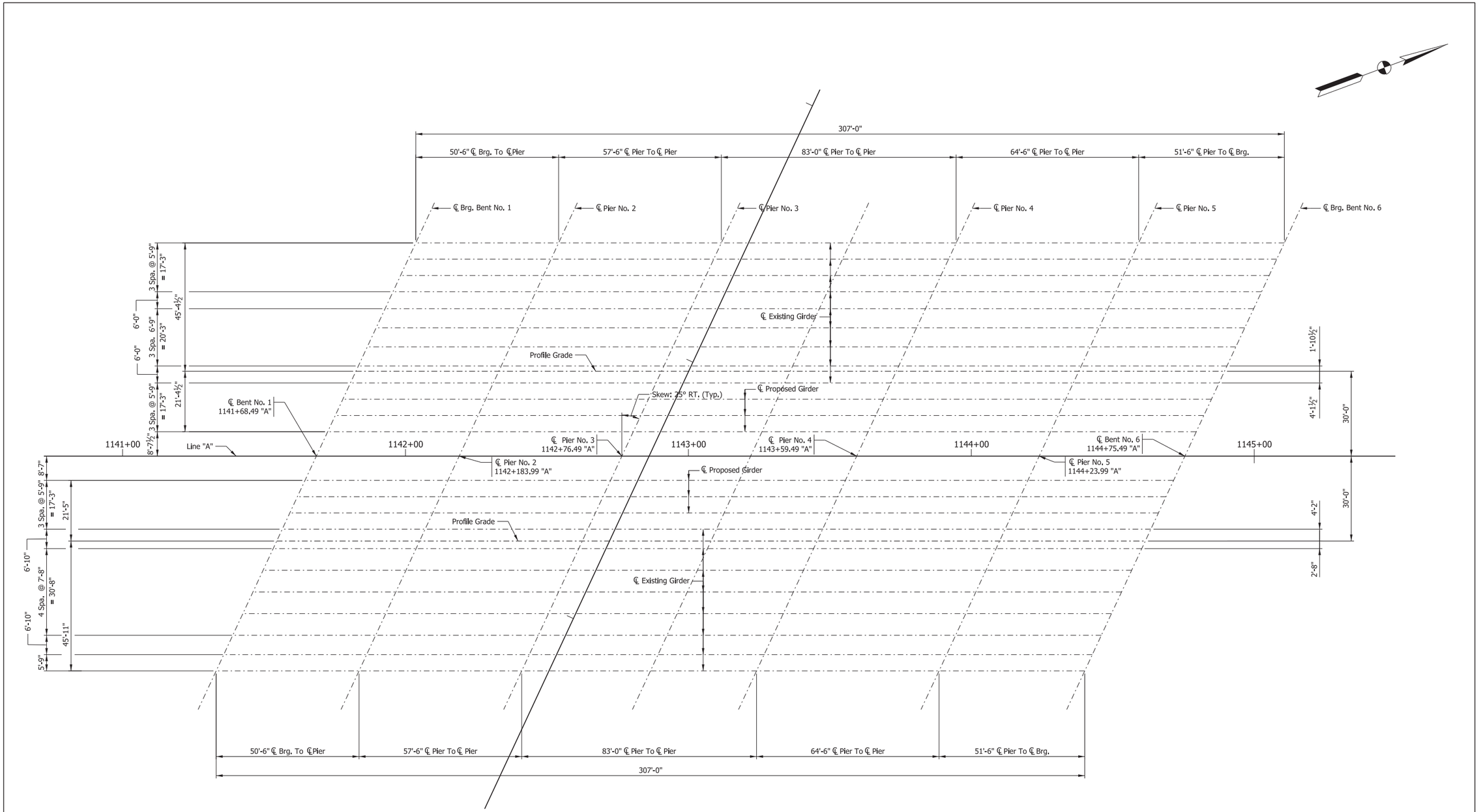
CHECKED: MJK CHECKED: MJK

INDIANA
DEPARTMENT OF TRANSPORTATION

PIER DETAILS

HORIZONTAL SCALE	BRIDGE FILE
3/16" = 1'-0"	I65-255-02320JCNB & 02320CSBL
VERTICAL SCALE	DESIGNATION
3/16" = 1'-0"	1600327 & 1600328
SURVEY BOOK	SHEETS
ELECTRONIC	13 of 20
CONTRACT	PROJECT
R-37450	1172430

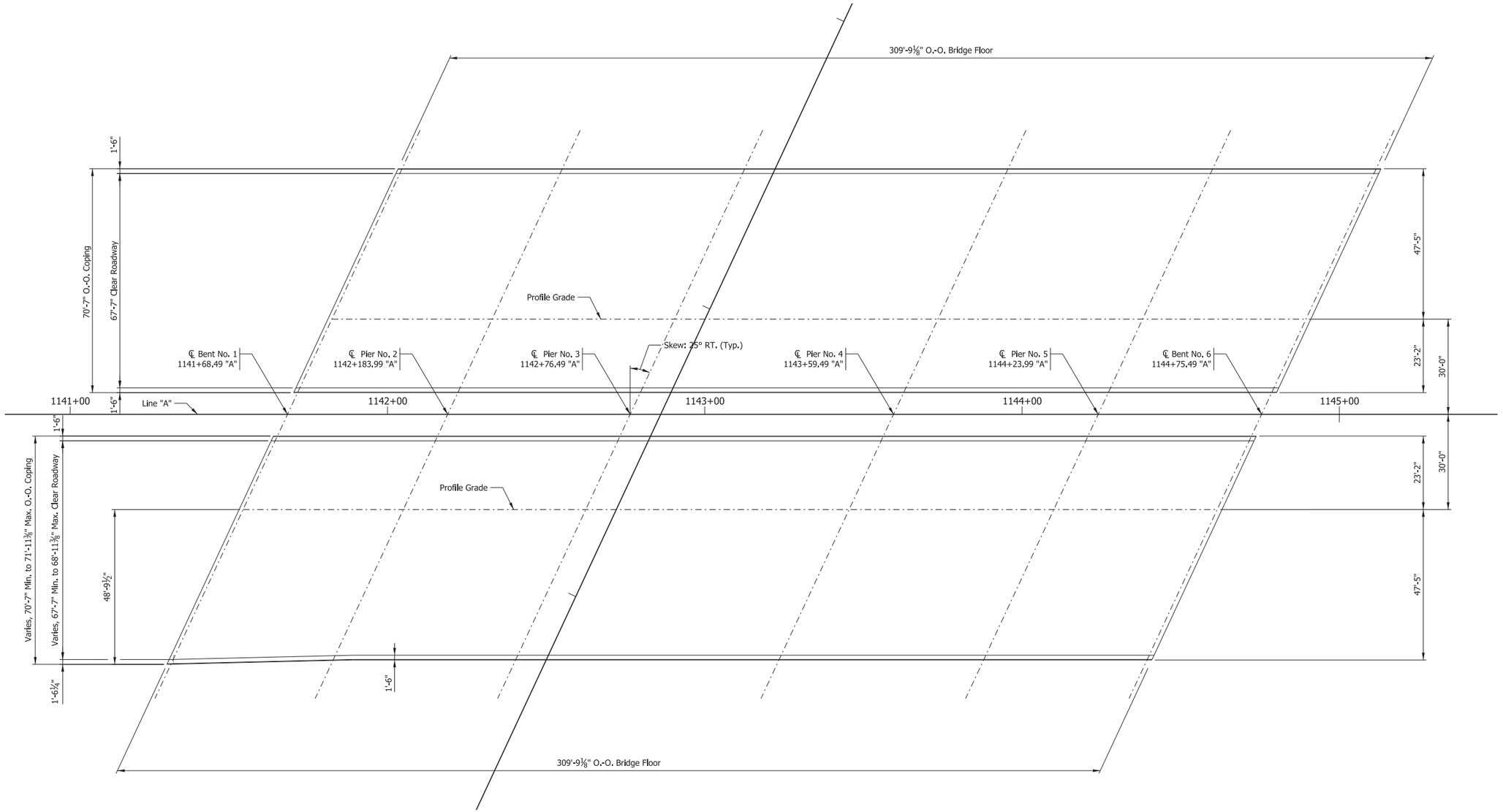
IP_PWP:dms13737\I65_NORTHWEST_B8-B9_PIER.01.dgn
20-JUL-2016



PLAN

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 1/16" = 1'-0"	BRIDGE FILE I65-255-02320JCNB & 02320CSBL
				VERTICAL SCALE 1/16" = 1'-0"	DESIGNATION 1600327 & 1600328
		DESIGNED: RTA DRAWN: EWM	FRAMING PLAN	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	14 of 20
				CONTRACT R-37450	PROJECT 1172430

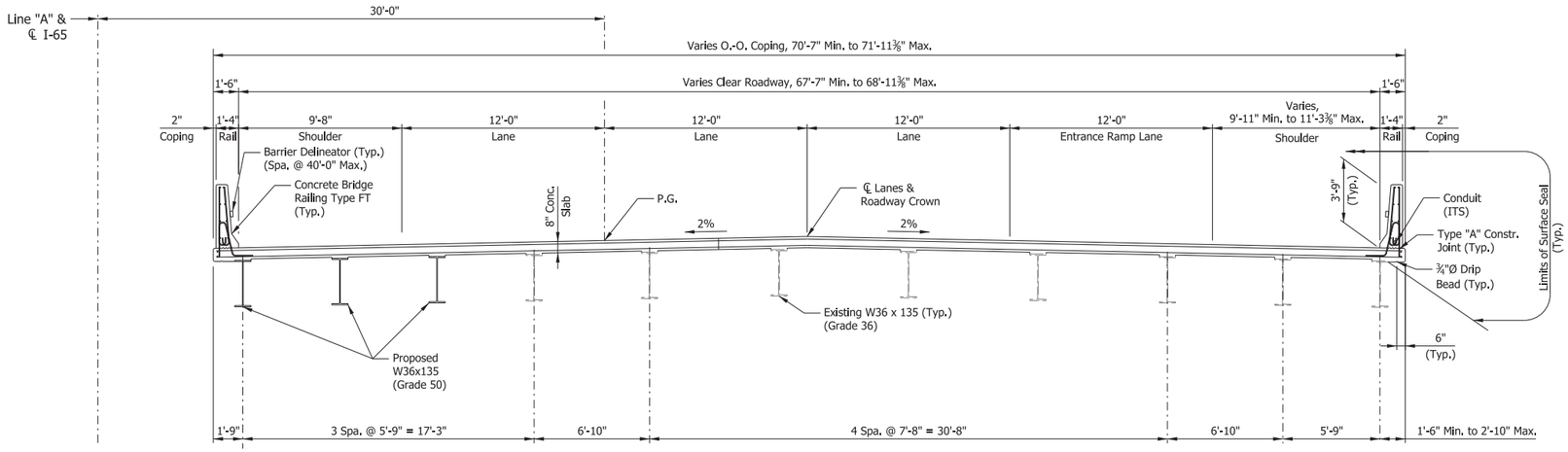
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20-JUL-2016



PLAN

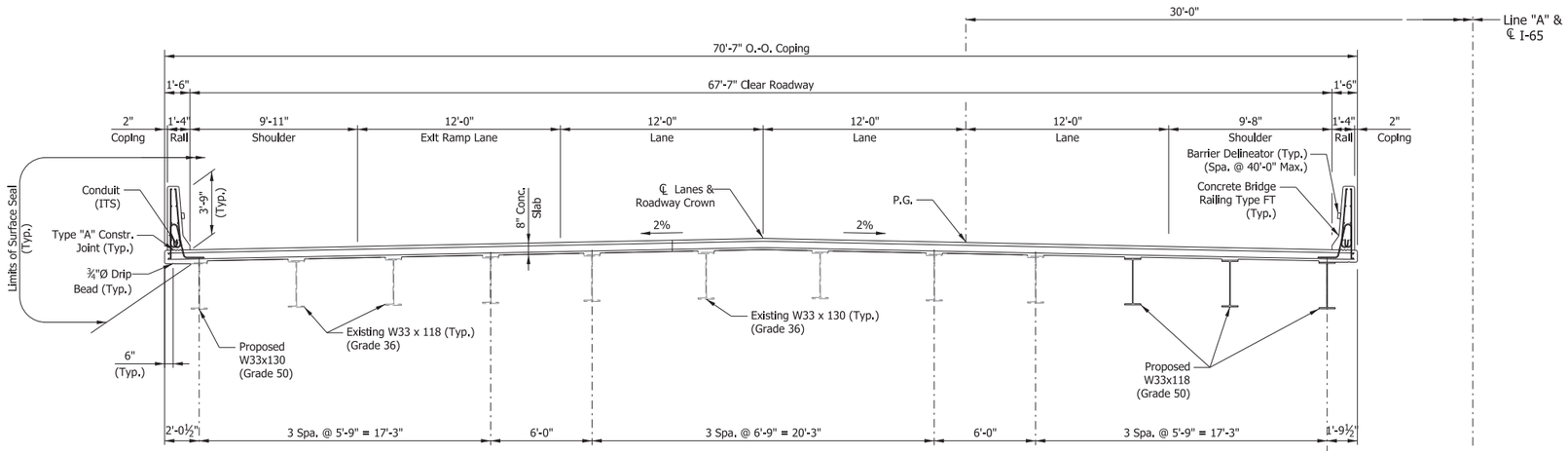
		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 1/16" = 1'-0"	BRIDGE FILE: I65-255-02320JCNB & 02320CSBL
				VERTICAL SCALE: 1/16" = 1'-0"	DESIGNATION: 1600327 & 1600328
		DESIGNED: RTA / DRAWN: ALF	SUPERSTRUCTURE DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK / CHECKED: MJK		ELECTRONIC: 15 of 20	
				CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13737\I65_NORTHWEST_B8-B9_SUPERSTRUCTURE.01.dgn
20-JUL-2016



PROPOSED TYPICAL SECTION

(N.B. Shown)

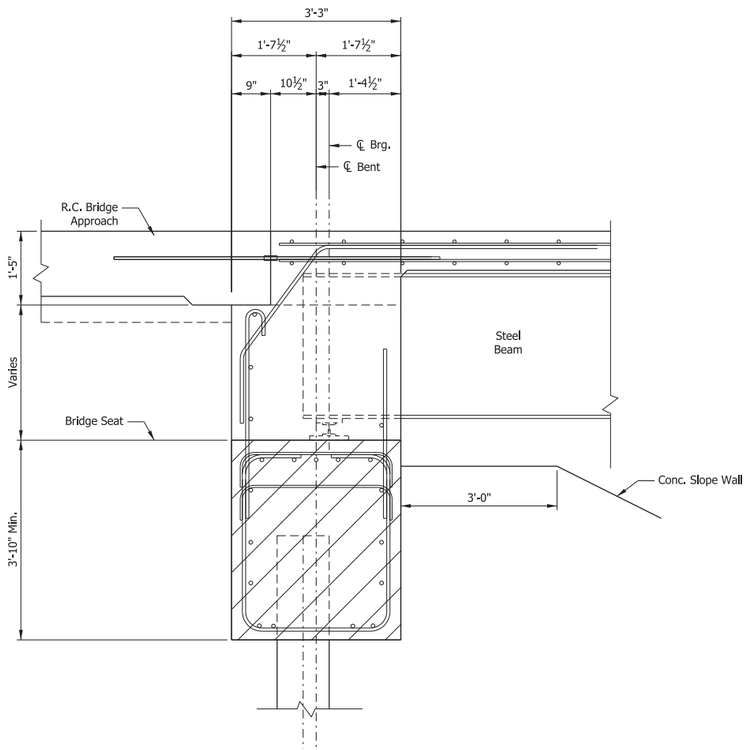


PROPOSED TYPICAL SECTION

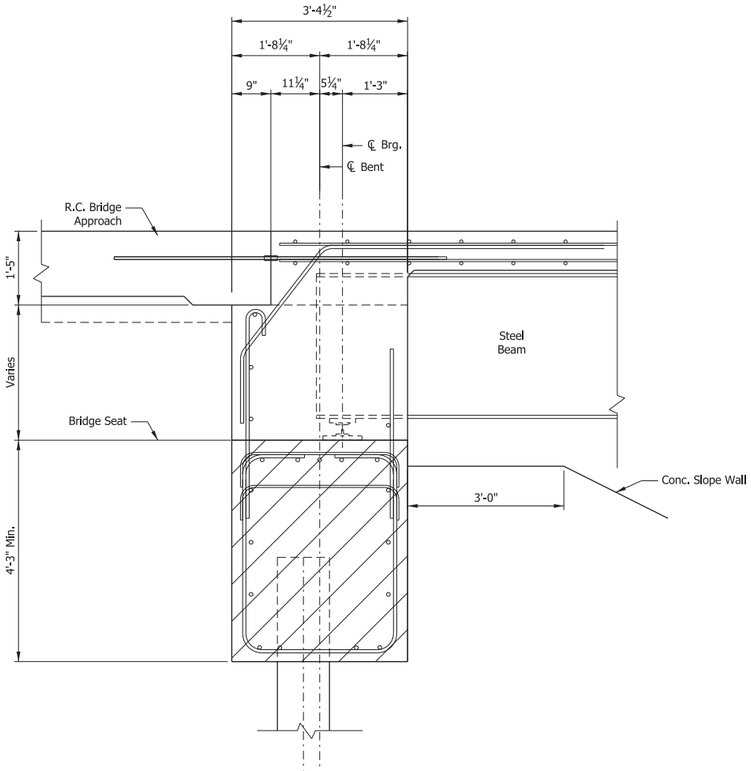
(S.B. Shown)

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 1/4" = 1'-0"	BRIDGE FILE I65-255-02320JCNB & 02320CSBL
				VERTICAL SCALE 1/4" = 1'-0"	DESIGNATION 1600327 & 1600328
		DESIGNED: RTA DRAWN: ALF	SUPERSTRUCTURE DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	16 of 20
				CONTRACT R-37450	PROJECT 1172430

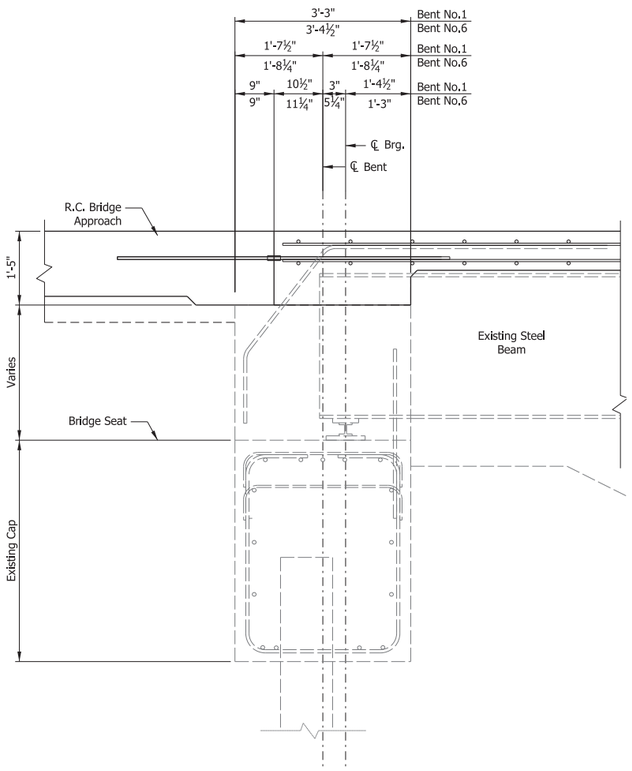
IP_PWP:dms13737\I65_NORTHWEST_B8-B9_SUPERSTRUCTURE.02.dgn
20-JUL-2016



TYPICAL PROPOSED SECTION
@ BENT NO.1



TYPICAL PROPOSED SECTION
@ BENT NO.6



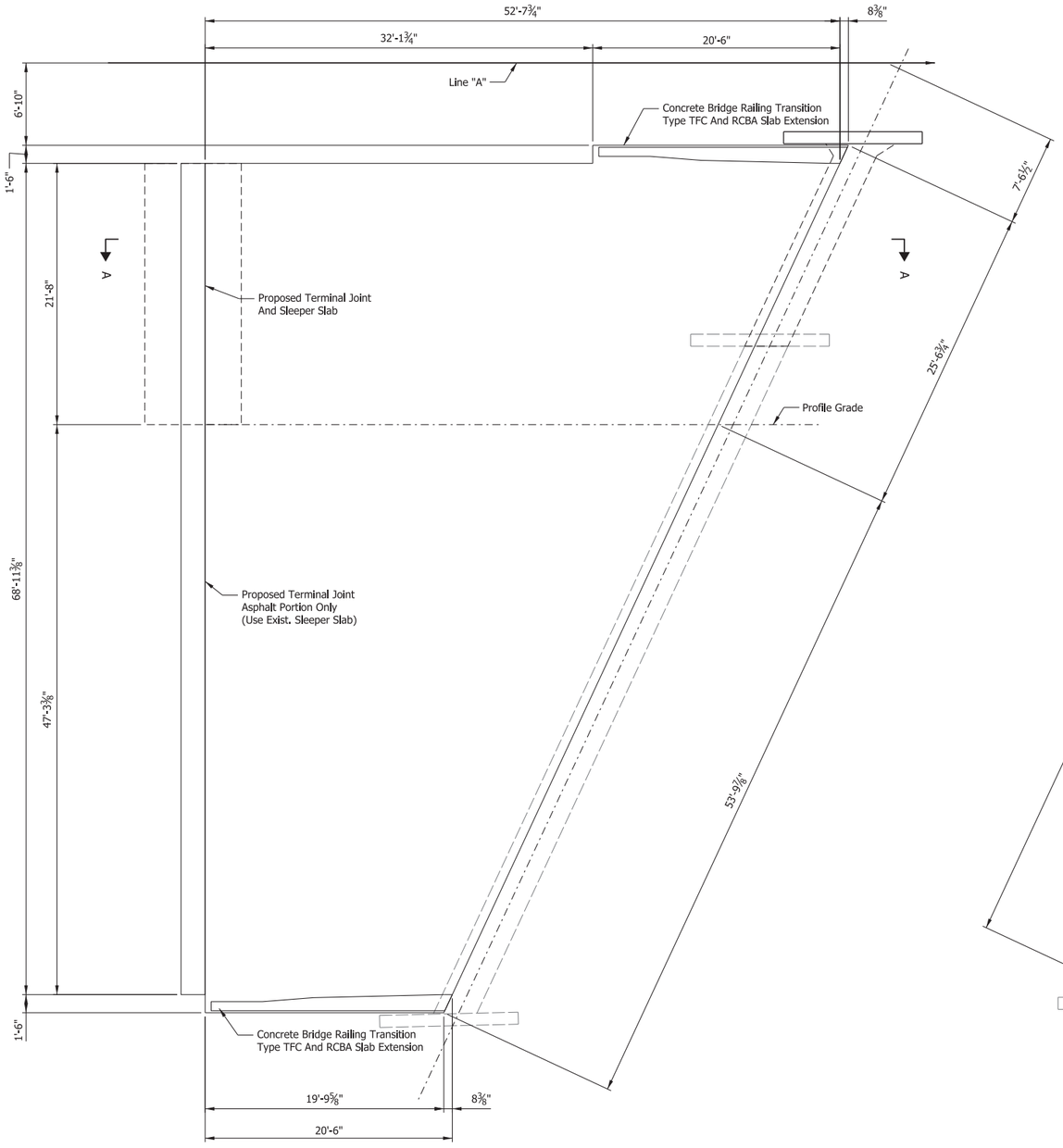
TYPICAL SECTION @
EXISTING BENT CAP LOCATIONS

NOTES:

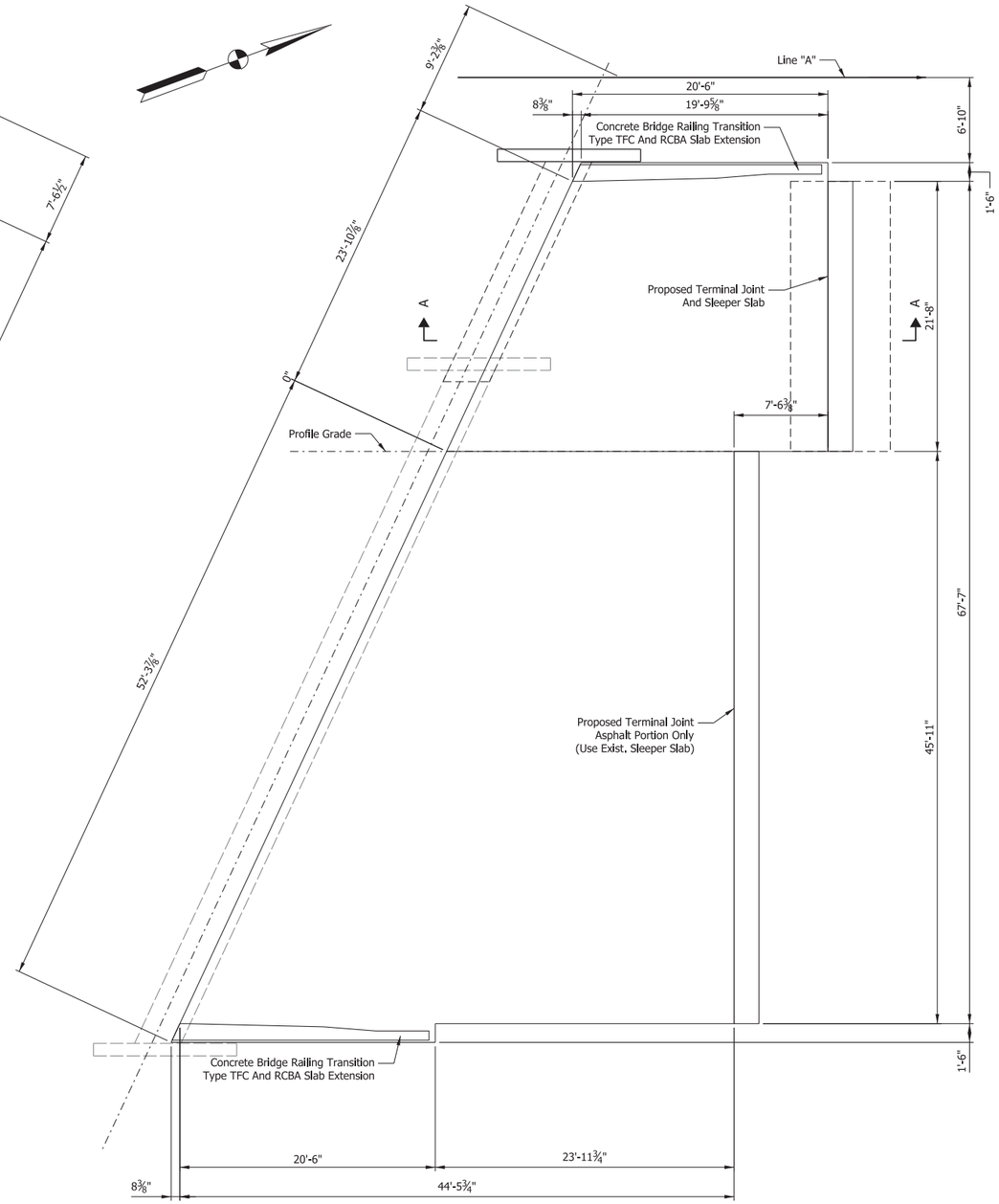
Hatched areas to be poured with substructure.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 3/4" = 1'-0"	BRIDGE FILE I-65-234-09807
				VERTICAL SCALE 3/4" = 1'-0"	DESIGNATION 0101469 & 0200140
		DESIGNED: RTA / DRAWN: ALF	SUPERSTRUCTURE DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK / CHECKED: MJK		ELECTRONIC	17 of 20
				CONTRACT R-37450	PROJECT 1172430

IP_PWP:dms13737\I65_NORTHWEST_B8-B9_SUPERSTRUCTURE.03.dgn
20-JUL-2016



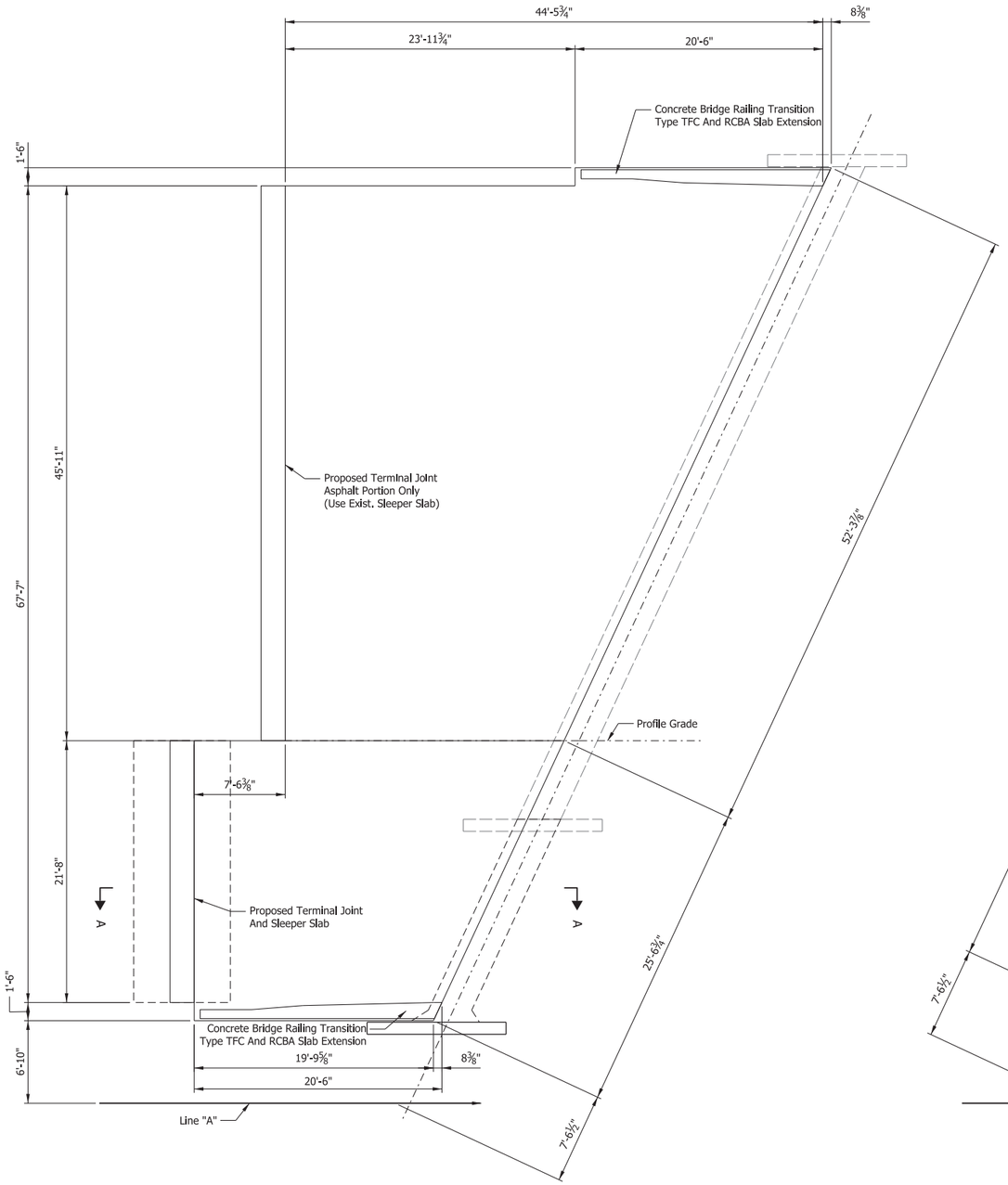
PLAN @ BENT NO.1 N.B.



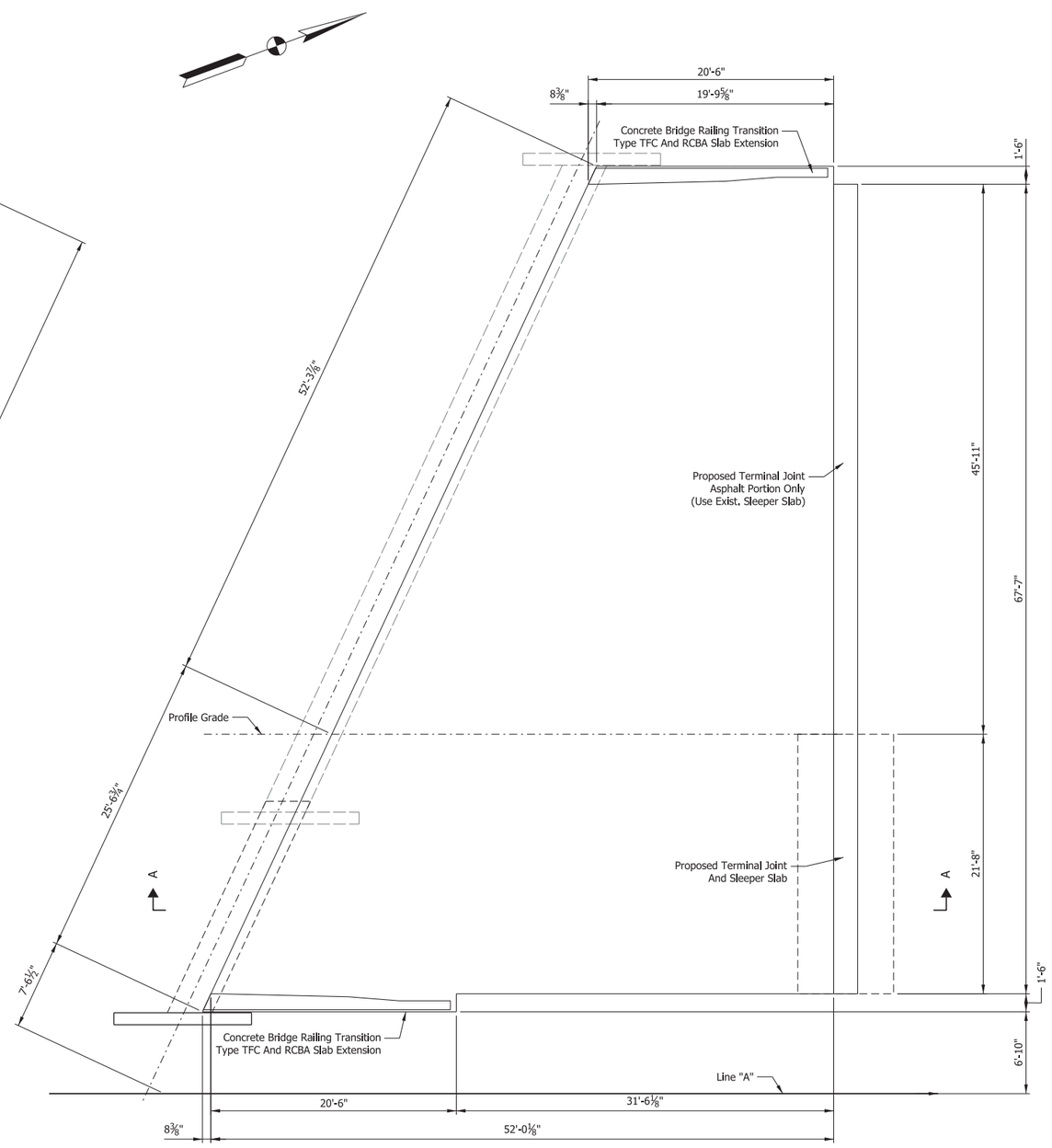
PLAN @ BENT NO.6 N.B.

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 3/16" = 1'-0"	BRIDGE FILE: I65-255-02320JCNB & 02320CSBL
		VERTICAL SCALE: 3/16" = 1'-0"	DESIGNATION: 1600327 & 1600328
DESIGNED: RTA DRAWN: ALF	R.C. BRIDGE APPROACH DETAILS	SURVEY BOOK	SHEETS
CHECKED: MJK CHECKED: MJK		ELECTRONIC	18 of 20
		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13737\I65_NORTHWEST_B8-B9_APPR SLAB.01.dgn
21-JUL-2016



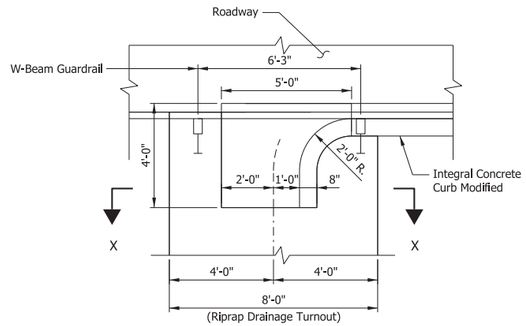
PLAN @ BENT NO.1 S.B.



PLAN @ BENT NO.6 S.B.

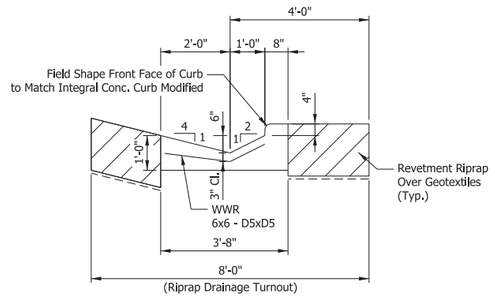
RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE		INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 3/16" = 1'-0" / BRIDGE FILE: I65-255-02320JCNB & 02320CSBL
			VERTICAL SCALE: 3/16" = 1'-0" / DESIGNATION: 1600327 & 1600328
DESIGNED: RTA	DRAWN: ALF	R.C. BRIDGE APPROACH DETAILS	SURVEY BOOK / SHEETS
CHECKED: MJK	CHECKED: MJK		ELECTRONIC: 19 of 20
			CONTRACT: R-37450 / PROJECT: 1172430

IP_PWP:dms13737\I65_NORTHWEST_B8-B9_APPR SLAB.02.dgn
20-JUL-2016



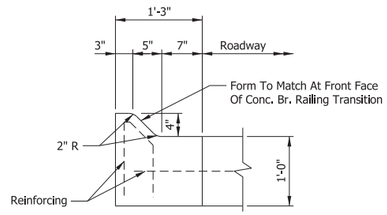
COMBINED CURB & GUTTER
TURNOUT, MODIFIED

Scale: ⅜" = 1'-0"



SECTION X-X

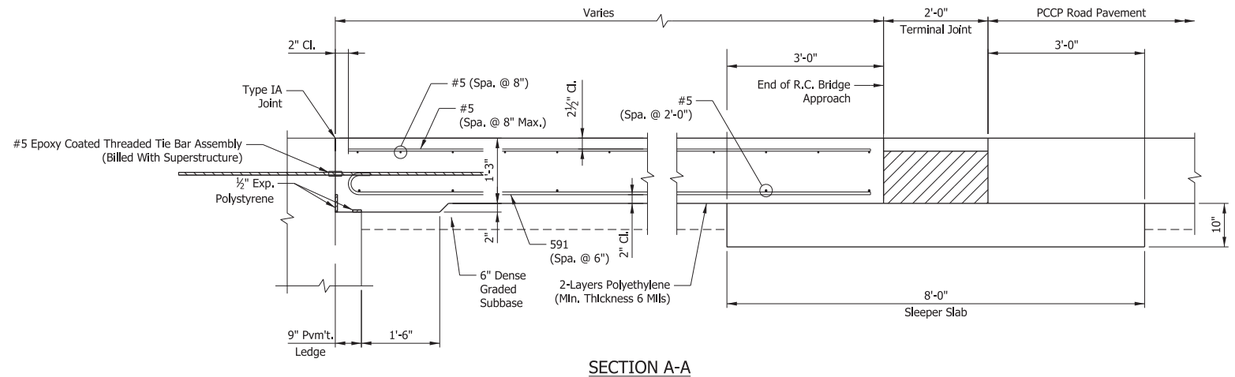
Scale: ½" = 1'-0"



NOTE:
For Reinforcing and Additional Details,
see Standard Drawing E605-CCIN-01.

TYPICAL SECTION
INTEGRAL CONCRETE CURB
MODIFIED, TYPE B

Scale: 1" = 1'-0"



SECTION A-A

Scale: ¾" = 1'-0"

NOTES:

For Reinforcing Bar Notes, see Standard Drawing E703-BRST-01.

All reinforcing steel to be epoxy coated.

For Section A-A and additional details, see Sheet No. 16 & 17

For Concrete Bridge Railing Transition Details, see Standard Drawings E706-CBRT-03 & -04.

Surface seal all exposed surfaces of the approaches.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: AS NOTED	BRIDGE FILE: I65-255-02320JCNB & 02320CSBL
				VERTICAL SCALE: AS NOTED	DESIGNATION: 1600327 & 1600328
		DESIGNED: RTA DRAWN: ALF	R.C. BRIDGE APPROACH DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	20 of 20
				CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13737\I65_NORTHWEST_B8-B9_APPR SLAB.03.dgn
20-JUL-2016

BRIDGE NO. 10

BRIDGE NO. 10

I-65

WALSH PARSONS Walsh & Kelly

R-37450
SECTION C

PROJECT	DESIGNATION
1172430	1601117
CONTRACT	BRIDGE FILE
R-37450	I65-254-04898B

STRUCTURE INFORMATION				
STRUCTURE	TYPE	SPAN AND SKEW	OVER	STATION
I65-256-04899B	Continuous Steel Beam & R.C. Girder	4 Spans: 36'-0", 2 @ 67'-9", 36'-0" Skew: 16°09'30" Lt.	I-65	50+00.00 "S-12-A"

KIN DES. NUMBERS	DESCRIPTION	TYPE
1172430	I-65 ADDED TRAVEL LANES U.S. 231 TO U.S. 30	ROADWAY
1400349	I-65 ADDED TRAVEL LANES S.R. 2 TO U.S. 231	ROADWAY
1006741	PIPE LINER 2.64 MILES N OF S.R. 10	ROADWAY
1601115	93RD AVE. OVER I-65	BRIDGE
1600332	I-65 N.B. OVER BEAVER DAM	BRIDGE
1600331	I-65 S.B. OVER BEAVER DAM	BRIDGE
1600329	I-65 N.B. OVER 109TH AVE.	BRIDGE
1600330	I-65 S.B. OVER 109TH AVE.	BRIDGE
1601116	113TH AVE. OVER I-65	BRIDGE
1600327	I-65 N.B. OVER U.S. 231	BRIDGE
1600328	I-65 S.B. OVER U.S. 231	BRIDGE
1382203	I-65 N.B. OVER WIRTZ DITCH	BRIDGE
1382204	I-65 S.B. OVER WIRTZ DITCH	BRIDGE
1298545	153RD AVE. OVER I-65	BRIDGE
1382207	I-65 N.B. OVER S.R. 2	BRIDGE
1382208	I-65 S.B. OVER S.R. 2	BRIDGE
0101469	I-65 N.B. OVER KANKAKEE RIVER	BRIDGE
0200140	I-65 S.B. OVER KANKAKEE RIVER	BRIDGE

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE REHABILITATION PLANS

FOR SPANS OVER 20 FEET

ROUTE: 137TH AVE. AT: RP 245+60

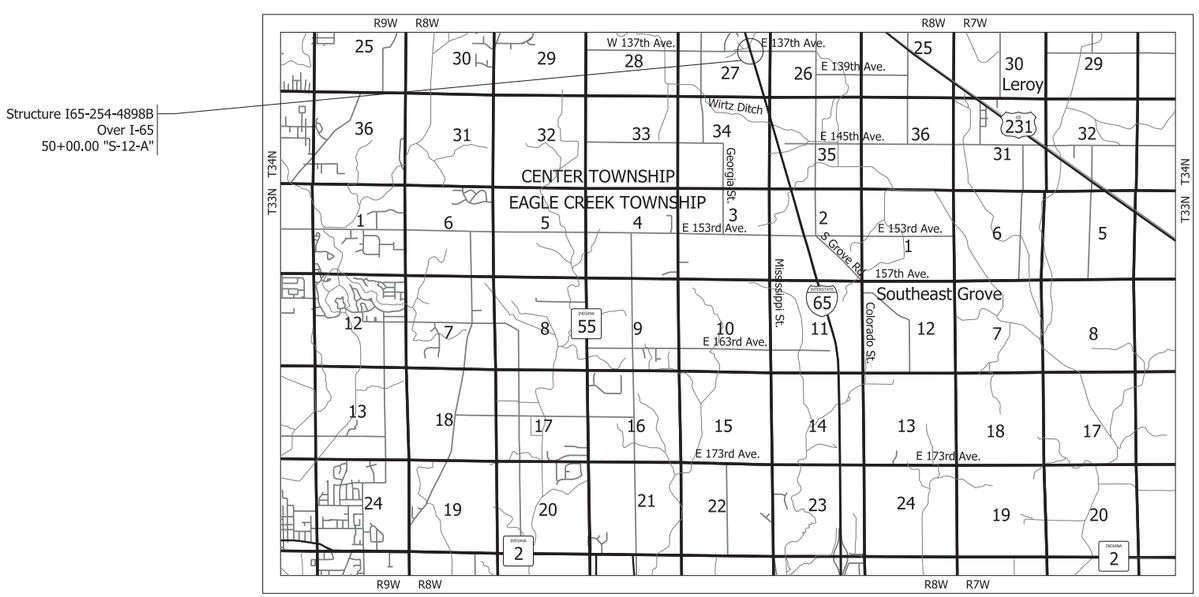
PROJECT NO. 1172430 P.E.

NO ADDITIONAL RIGHT-OF-WAY REQUIRED FOR THIS PROJECT

R/W

1172430 CONST.

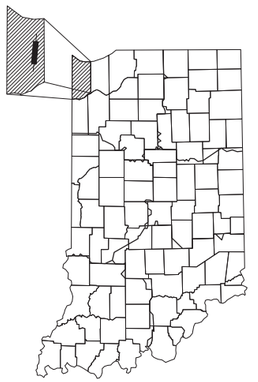
Bridge Deck Overlay on 137th Ave. over I-65 Located 1.73 Miles South of US 231
in Section 27, T-34-N, R-8-W,
Center Township, Lake County, Indiana



SCALE: 1" = 4000'

TRAFFIC DATA		I-65 N.B.L.	I-65 S.B.L.
A.A.D.T.	(2015)	25,990 V.P.D.	19,607 V.P.D.
A.A.D.T.	(2035)	31,464 V.P.D.	23,736 V.P.D.
D.H.V	(2035)	2,205 V.P.H.	1,663 V.P.H.
DIRECTIONAL DISTRIBUTION		57 %	43 %
TRUCKS		44 % A.A.D.T.	44 % A.A.D.T.
		44 % D.H.V.	44 % D.H.V.

DESIGN DATA	
DESIGN SPEED	70 M.P.H.
PROJECT DESIGN CRITERIA	PARTIAL RECONSTRUCTION 4R (FREEWAY)
FUNCTIONAL CLASSIFICATION	INTERSTATE
RURAL/URBAN	RURAL
TERRAIN	LEVEL
ACCESS CONTROL	FULL



PROJECT LOCATION SHOWN BY
Lake County

LATITUDE: 41°22'09" N LONGITUDE: 87°19'13" W

BRIDGE LENGTH:	0.041	MI.
ROADWAY LENGTH:	0.008	MI.
TOTAL LENGTH:	0.049	MI.
MAX. GRADE:	3.50	%

INDIANA DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS DATED 2016
TO BE USED WITH THESE PLANS.

MajorMoves 2020

PARSONS
101 W. Ohio St., Suite 2121
Indianapolis, IN 46204
Bus (317) 616-1000
Fax (317) 616-1033

PLANS PREPARED BY: PARSONS 317-616-1000 PHONE NUMBER

CERTIFIED BY: DATE

APPROVED FOR LETTING: INDIANA DEPARTMENT OF TRANSPORTATION DATE

BRIDGE FILE	
I65-254-04898B	
DESIGNATION	
1601117	
SURVEY BOOK	SHEETS
ELECTRONIC	1 of 5
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B10_BRIDGE TITLE SHEET.01.dgn
21-JUL-2016

UTILITIES

ELECTRIC

NIPSCO Electric
MArk Lindsley
Phone: 219-647-4198

American Electric Power
Ngoc Alex KUrtz
Phone: 614-552-1332

GAS / PIPELINES

NIPSCO Gas
Neil Arndt
Phone: 219-647-4779

Buckeye Pipe Line Co., LP
Michael Norris
Phone: 219-313-5321

Enbridge Energy Company, Inc.
Michael Price
Phone: 219-922-7015

WATER

IN American Water Company, Inc.
Michael Seals
Phone: 317-885-2444

TELECOMMUNICATIONS

AT&T Indiana (Dist)
Angelo LaMantia
Phone: 219-662-4418

AT&T Transmission (LD)
Carl Donahue
Phone: 630-552-9785
Dean Norwich
Phone: 574-344-0833

Comcast Cable
Robert Schulter
Phone: 630-600-6307

Zayo Bandwidth LLC
Jason Gilpin
Phone: 260-570-5677

Northwest Indiana Telephone Co. Inc.
Don Schoenbeck
Phone: 219-996-0216

Indiana Fiber Network LLC
Jim Royer
Phone: 317-777-7115
317-280-4636

MISCELLANEOUS AGENCIES

Merrillville Conservancy Dist.
Charles Stojakovich
Phone: 219-980-5220

City of Crown Point
Jay Olson
Phone: 219-662-3252
Kent Swinehart
Phone: 219-661-2287

INDOT ITS
Technology Deployment Division
Ed Cox
Phone: 317-899-8601

INDOT LaPorte District
(Signals Lighting)
Andy Costello
Phone: 219-325-7483

Indiana811
Know what's below. Call before you dig.

REVISIONS

SHEET NO.	DATE	REVISED

INDEX

SHEET NO.	SUBJECT
1	TITLE
2	INDEX
3-4	GENERAL PLAN
5	R.C. BRIDGE APPROACH DETAILS

Note:

For Detour Route Details, see Maintenance Of Traffic Plans.

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: EWM DRAWN: EWM

CHECKED: MJK CHECKED: MJK

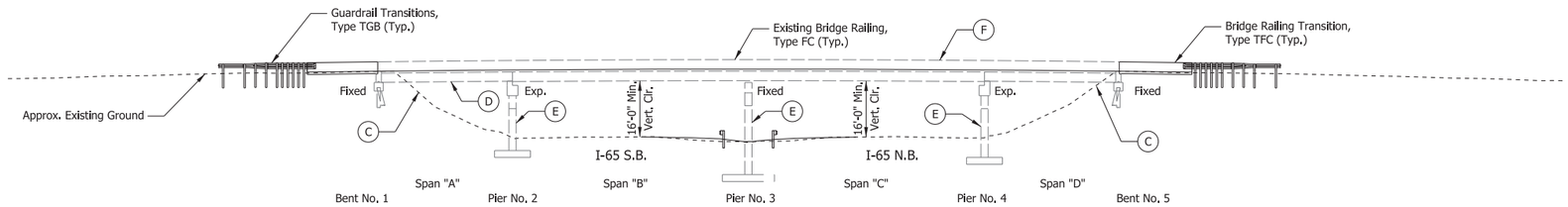
INDIANA
DEPARTMENT OF TRANSPORTATION

INDEX SHEET

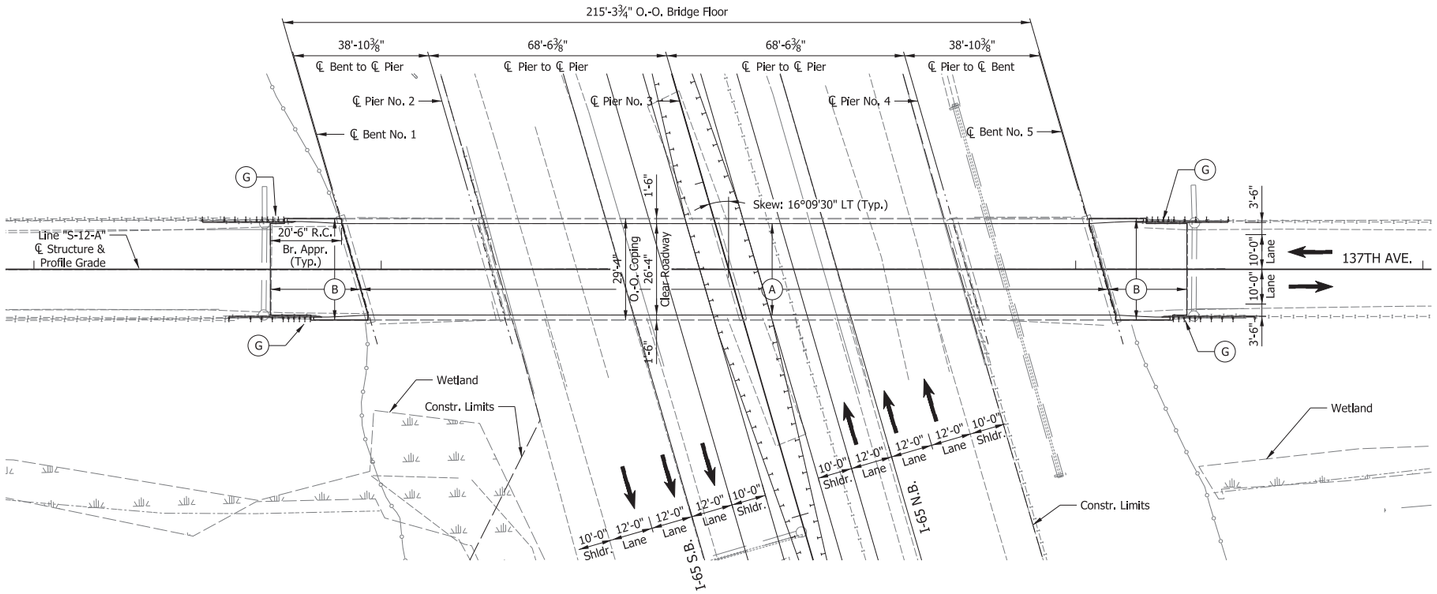
HORIZONTAL SCALE	BRIDGE FILE
NONE	I65-254-04898B
VERTICAL SCALE	DESIGNATION
NONE	1601117
SURVEY BOOK	SHEETS
ELECTRONIC	2 of 5
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B10_INDEX.01.dgn
22-JUL-2016

STRUCTURE IS BUILT TO A 600' VERTICAL CURVE



ELEVATION



PLAN

GENERAL NOTES

Reinforcing steel covering shall be 2½" in Top and 1" min. in bottom of floor slabs, 3" in footing except bottom steel which shall be 4", and 2" in all other parts, unless noted.

All New Reinforcement Shall be Epoxy Coated.

Plans for the Existing Structure are on file in the Central Office, Indiana Dept. of Transportation as Bridge File No. I65-254-4898A, and are available upon request.

DESIGN DATA

Designed for HS-20 Loading, in accordance with AASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002, and its subsequent interims.

DEAD LOAD

Actual weight plus 35 psf. of future wearing surface and 15 psf for SIP Metal deck forms.

FLOOR SLAB

Designed with a 7½" structural depth, and a ½" integral wearing surface.

DESIGN STRESSES

CONCRETE

Class "A" Concrete	f'c = 3,500 p.s.i.
Class "B" Concrete	f'c = 3,000 p.s.i.
Class "C" Concrete	f'c = 4,000 p.s.i.

REINFORCING STEEL

Grade 60	f'y = 60,000 p.s.i.

LEGEND

(A) Remove existing overlay and mill the existing bridge deck ½ inch depth, perform hydrodemolition to remove unsound concrete, and perform full depth patching as needed.

Place a variable depth (2 inch min.) latex-modified concrete overlay on entire bridge deck surface. Minimum cross-slope shall be 1.5 percent. Patch underside of deck (Est. Qty.= 130 Sft.)

(B) Replace existing reinforced concrete approach slabs and bridge railing transitions Type TFC. Replace the rubber strip-seal gasket in existing S-S expansion joints.

(C) Fill voids at the top of the east and west slopewalls

(D) Patch concrete beam spalls in Span A. (Est. Qty.= 10 Sft.)

(E) Perform pier patching to areas of delamination and spalling. (Est. Qty.= 130 Sft.)

(F) Surface seal existing bridge railings and copings.

(G) Install new TGB Transitions and tie into existing guardrail.

137TH AVENUE OVER I-65
R.C. GIRDER AND STEEL BEAM BRIDGE
4 SPANS: 36'-0", 67'-9", 67'-9", 36'-0"
SKEW: 16°09'30" LT.
CLEAR ROADWAY: 26'-4"
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: RAM DRAWN: EWM

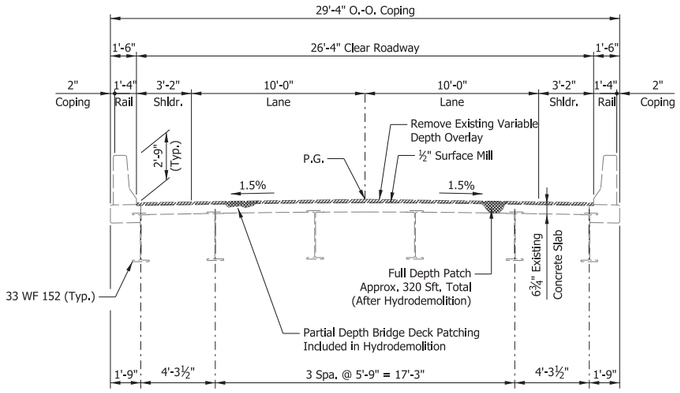
CHECKED: MJK CHECKED: MJK

INDIANA
DEPARTMENT OF TRANSPORTATION

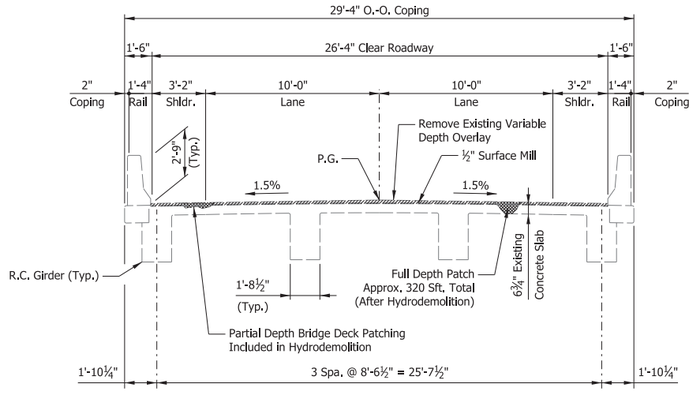
GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
1" = 20'	I65-254-04898B
VERTICAL SCALE	DESIGNATION
1" = 20'	1601117
SURVEY BOOK	SHEETS
ELECTRONIC	3 of 5
CONTRACT	PROJECT
R-37450	1172430

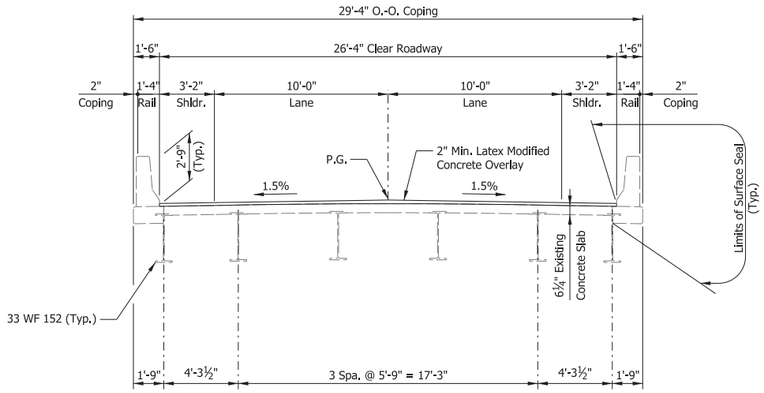
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21-JUL-2016



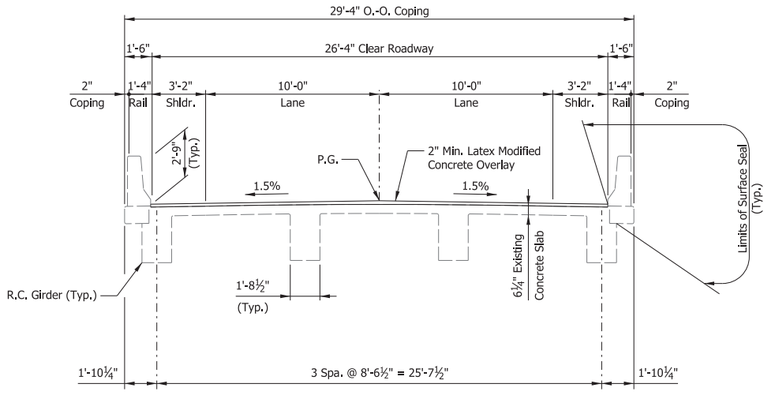
EXISTING TYPICAL SECTION SPANS B & C



EXISTING TYPICAL SECTION SPANS A & D



PROPOSED TYPICAL SECTION SPANS B & C



PROPOSED TYPICAL SECTION SPANS A & D

137TH AVENUE OVER I-65
R.C. GIRDER AND STEEL BEAM BRIDGE
4 SPANS: 36'-0", 67'-9", 67'-9", 36'-0"
SKEW: 16°09'30" LT.
CLEAR ROADWAY: 26'-4"
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER _____ DATE

DESIGNED: RAM | DRAWN: EWM

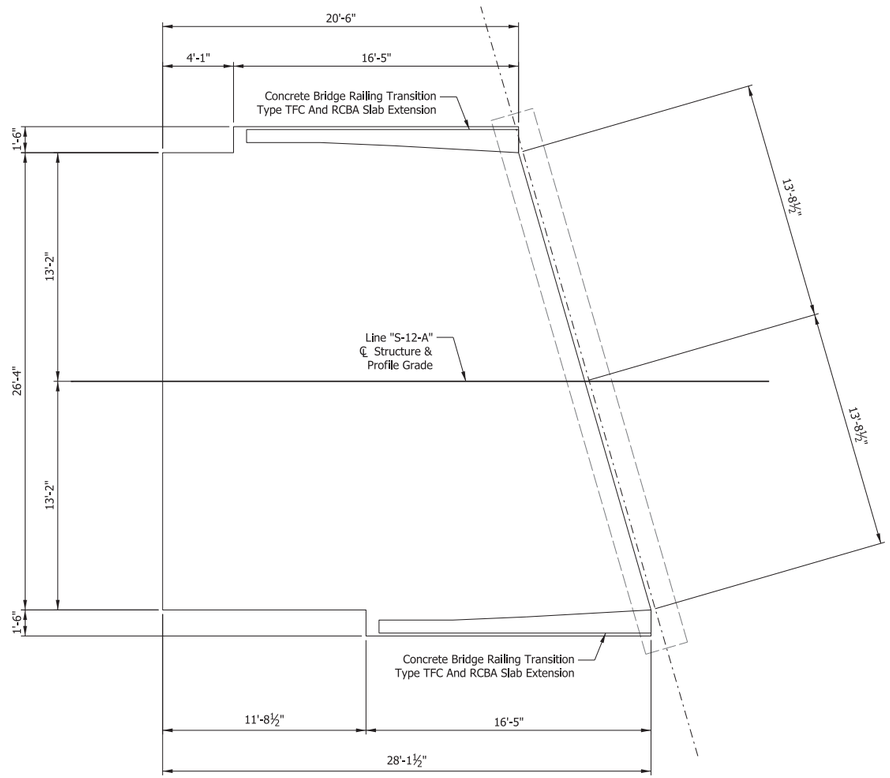
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INDIANA
DEPARTMENT OF TRANSPORTATION

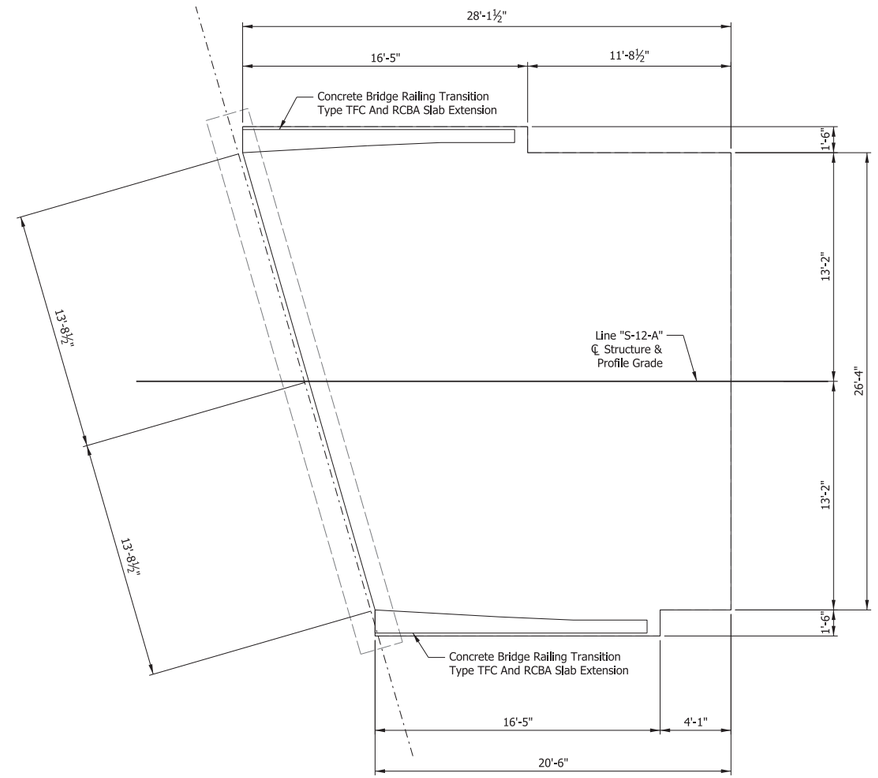
GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
1/4" = 1'-0"	I65-254-04898B
VERTICAL SCALE	DESIGNATION
1/4" = 1'-0"	1601117
SURVEY BOOK	SHEETS
ELECTRONIC	4 of 5
CONTRACT	PROJECT
R-37450	1172430

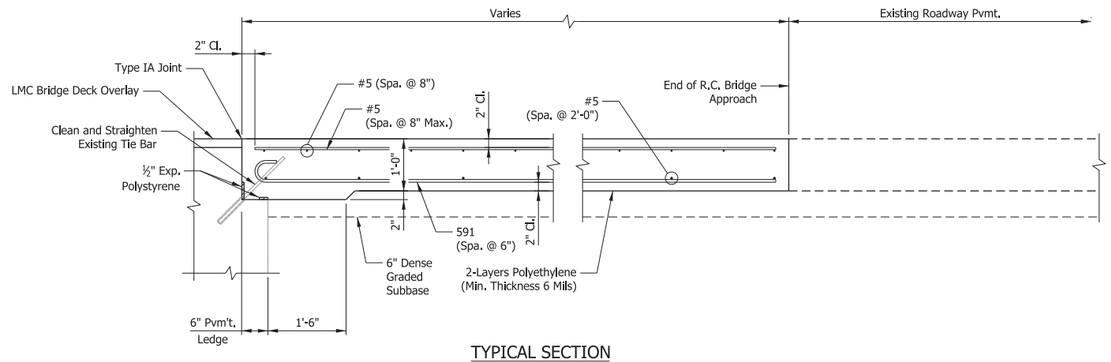
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21-JUL-2016



PLAN
BENT NO.1



PLAN
BENT NO.5



TYPICAL SECTION
Scale: ¾" = 1'-0"

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER _____ DATE

DESIGNED: RAM DRAWN: EWM
CHECKED: MJK CHECKED: MJK

INDIANA
DEPARTMENT OF TRANSPORTATION

R.C. BRIDGE APPROACH DETAILS

HORIZONTAL SCALE	BRIDGE FILE
1/4" = 1'-0"	I65-254-04898B
VERTICAL SCALE	DESIGNATION
1/4" = 1'-0"	1601117
SURVEY BOOK	SHEETS
ELECTRONIC	5 of 5
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B10_APPR SLAB.01.dgn
21-JUL-2016

BRIDGE NO. 11 AND 12

I-65

WALSH PARSONS Walsh & Kelly

R-37450
SECTION C

PROJECT	DESIGNATION
1172430	1382203 (N.B.) & 1382204 (S.B.)
CONTRACT	BRIDGE FILE
R-37450	I65-253-05119CNBL & I65-253-05119CSBL

STRUCTURE INFORMATION				
STRUCTURES	TYPE	SPAN AND SKEW	OVER	STATION
I65-253-05119CNBL I65-253-05119CSBL	Continuous Prestressed Concrete I-Beam Bridges	3 Spans: 36'-7", 37'-2" & 36'-7" Skew: 45° Rt.	Wirtz Ditch	1006+70.00 Line "A"

KIN DES. NUMBERS	DESCRIPTION	TYPE
1172430	I-65 ADDED TRAVEL LANES U.S. 231 TO U.S. 30	ROADWAY
1400349	I-65 ADDED TRAVEL LANES S.R. 2 TO U.S. 231	ROADWAY
1006741	PIPE LINER 2,64 MILES N OF S.R. 10	ROADWAY
1601115	93RD AVE. OVER I-65	BRIDGE
1600332	I-65 N.B. OVER BEAVER DAM	BRIDGE
1600331	I-65 S.B. OVER BEAVER DAM	BRIDGE
1600329	I-65 N.B. OVER 109TH AVE.	BRIDGE
1600330	I-65 S.B. OVER 109TH AVE.	BRIDGE
1601116	113TH AVE. OVER I-65	BRIDGE
1600327	I-65 N.B. OVER U.S. 231	BRIDGE
1600328	I-65 S.B. OVER U.S. 231	BRIDGE
1601117	137TH AVE. OVER I-65	BRIDGE
1298545	153RD AVE. OVER I-65	BRIDGE
1382207	I-65 N.B. OVER S.R. 2	BRIDGE
1382208	I-65 S.B. OVER S.R. 2	BRIDGE
0101469	I-65 N.B. OVER KANKAKEE RIVER	BRIDGE
0200140	I-65 S.B. OVER KANKAKEE RIVER	BRIDGE

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE REHABILITATION PLANS

FOR SPANS OVER 20 FEET

ROUTE: I-65 AT: RP 244+77

PROJECT NO. 1172430 P.E.

NO ADDITIONAL RIGHT-OF-WAY REQUIRED FOR THIS PROJECT

R/W

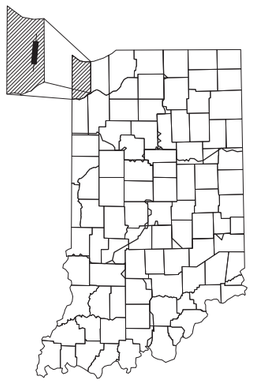
1172430 CONST.

Bridge Deck Widening on I-65 over Wirtz Ditch Located Approx. 4.8 Miles North of S.R. 2
in Sections 34 & 35, T-34-N, R-8-W,
Center Township, Lake County, Indiana

Structures I65-253-05119CNBL
& I65-253-05119CSBL
Wirtz Ditch
1006+70.00 Line "A"

TRAFFIC DATA		I-65 N.B.L.	I-65 S.B.L.
A.A.D.T.	(2015)	25,990 V.P.D.	19,607 V.P.D.
A.A.D.T.	(2035)	31,464 V.P.D.	23,736 V.P.D.
D.H.V	(2035)	2,205 V.P.H.	1,663 V.P.H.
DIRECTIONAL DISTRIBUTION		57 %	43 %
TRUCKS		44 % A.A.D.T.	44 % A.A.D.T.
		44 % D.H.V.	44 % D.H.V.

DESIGN DATA	
DESIGN SPEED	70 M.P.H.
PROJECT DESIGN CRITERIA	PARTIAL RECONSTRUCTION 4R (FREEWAY)
FUNCTIONAL CLASSIFICATION	INTERSTATE
RURAL/URBAN	RURAL
TERRAIN	LEVEL
ACCESS CONTROL	FULL



PROJECT LOCATION SHOWN BY
Lake County

SCALE: 1" = 4000'

LATITUDE: 41°21'27" N LONGITUDE: 87°18'57" W

BRIDGE LENGTH:	0.022	MI.
ROADWAY LENGTH:	0.008	MI.
TOTAL LENGTH:	0.030	MI.
MAX. GRADE:	0.100%	%

MajorMoves 2020

INDIANA DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS DATED 2016
TO BE USED WITH THESE PLANS.

PARSONS
101 W. Ohio St., Suite 2121
Indianapolis, IN 46204
Bus (317) 616-1000
Fax (317) 616-1033

PLANS PREPARED BY: PARSONS 317-616-1000 PHONE NUMBER

CERTIFIED BY: DATE

APPROVED FOR LETTING: INDIANA DEPARTMENT OF TRANSPORTATION DATE

BRIDGE FILE	
I65-253-05119CNBL & 05119CSBL	
DESIGNATION	
1382203 & 1382204	
SURVEY BOOK	SHEETS
ELECTRONIC	1 of 19
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B11-B12_BRIDGE TITLE SHEET.01.dgn
29-JUL-2016

UTILITIES

ELECTRIC

NIPSCO Electric
MArk Lindsley
Phone: 219-647-4198

American Electric Power
Ngoc Alex KUrtz
Phone: 614-552-1332

GAS / PIPELINES

NIPSCO Gas
Neil Arndt
Phone: 219-647-4779

Buckeye Pipe Line Co., LP
Michael Norris
Phone: 219-313-5321

Enbridge Energy Company, Inc.
Michael Price
Phone: 219-922-7015

WATER

IN American Water Company, Inc.
Michael Seals
Phone: 317-885-2444

TELECOMMUNICATIONS

AT&T Indiana (Dist)
Angelo LaMantia
Phone: 219-662-4418

AT&T Transmission (LD)
Carl Donahue
Phone: 630-552-9785
Dean Norwich
Phone: 574-344-0833

Comcast Cable
Robert Schulter
Phone: 630-600-6307

Zayo Bandwidth LLC
Jason Gilpin
Phone: 260-570-5677

Northwest Indiana Telephone Co. Inc.
Don Schoenbeck
Phone: 219-996-0216

Indiana Fiber Network LLC
Jim Royer
Phone: 317-777-7115
317-280-4636

MISCELLANEOUS AGENCIES

Merrillville Conservancy Dist.
Charles Stojakovich
Phone: 219-980-5220

City of Crown Point
Jay Olson
Phone: 219-662-3252
Kent Swinehart
Phone: 219-661-2287

INDOT ITS
Technology Deployment Division
Ed Cox
Phone: 317-899-8601

INDOT LaPorte District
(Signals Lighting)
Andy Costello
Phone: 219-325-7483

Indiana811
Know what's below. Call before you dig.

INDEX

SHEET NO.	SUBJECT
1	TITLE
2	INDEX
3	MAINTENANCE OF TRAFFIC DETAILS
4	REMOVAL DETAILS
5	LAYOUT
6-8	GENERAL PLAN
9-11	END BENT DETAILS
12	PIER DETAILS
13	FRAMING PLAN
14-16	SUPERSTRUCTURE DETAILS
17-19	R.C. BRIDGE APPROACH DETAILS

REVISIONS

SHEET NO.	DATE	REVISED

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: EWM DRAWN: EWM

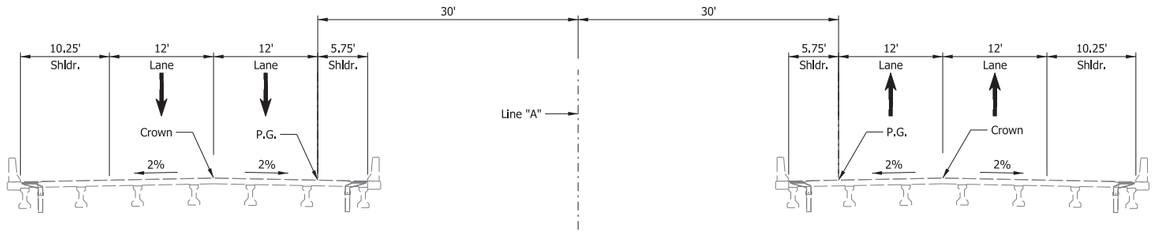
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INDIANA
DEPARTMENT OF TRANSPORTATION

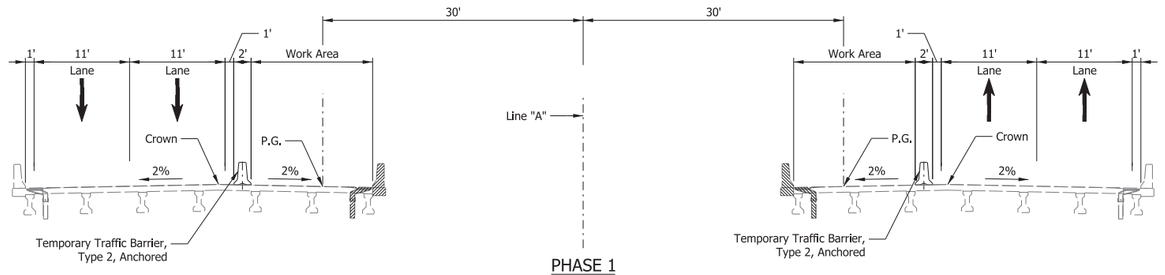
INDEX SHEET

HORIZONTAL SCALE	BRIDGE FILE
NO SCALE	I65-253-05119CNBL & 05119CSBL
VERTICAL SCALE	DESIGNATION
NO SCALE	1382203 & 1382204
SURVEY BOOK	SHEETS
ELECTRONIC	2 of 19
CONTRACT	PROJECT
R-37450	1172430

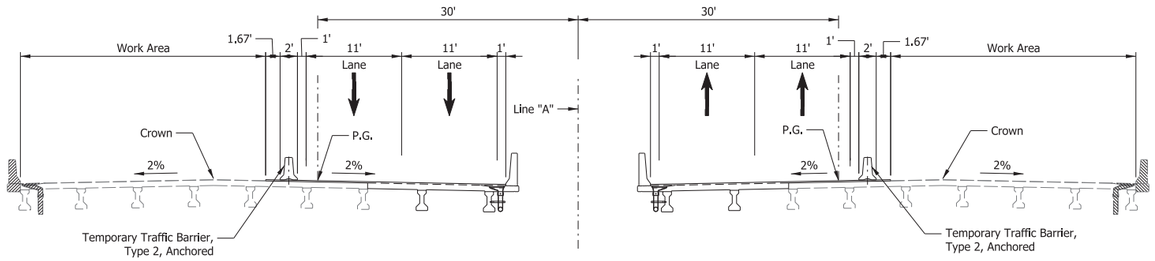
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29-JUL-2016



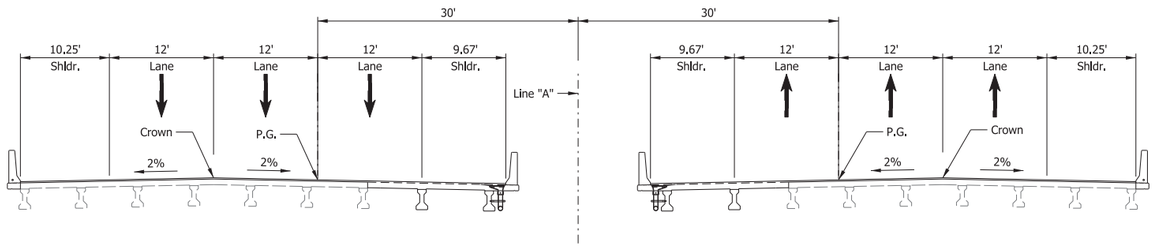
EXISTING TYPICAL SECTION



PHASE 1



PHASE 2



PROPOSED TYPICAL SECTION

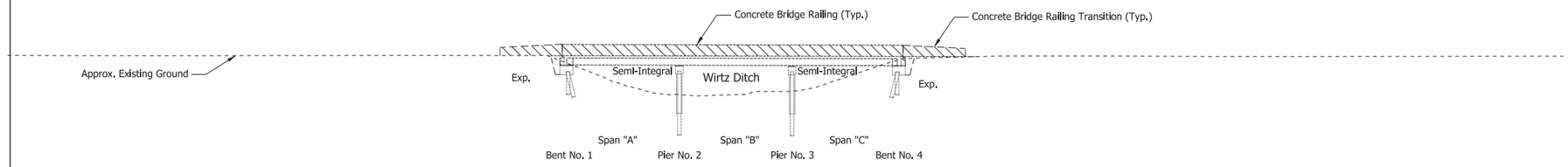
NOTE:

Hatched areas indicate limits of removal.

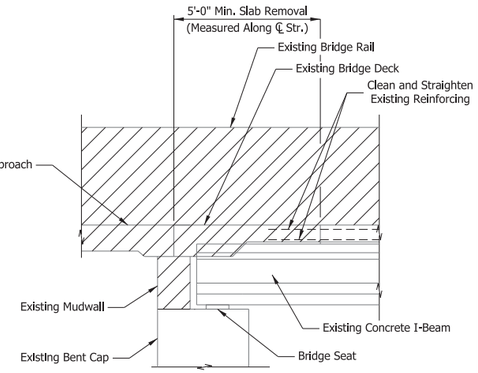
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				VERTICAL SCALE 1/8" = 1'-0"	DESIGNATION 1382203 & 1382204
		DESIGNED: RAM DRAWN: EWM	MAINTENANCE OF TRAFFIC	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	3 of 19
				CONTRACT R-37450	PROJECT 1172430

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29-JUL-2016

STRUCTURE TO BE BUILT TO A -0.10% GRADE

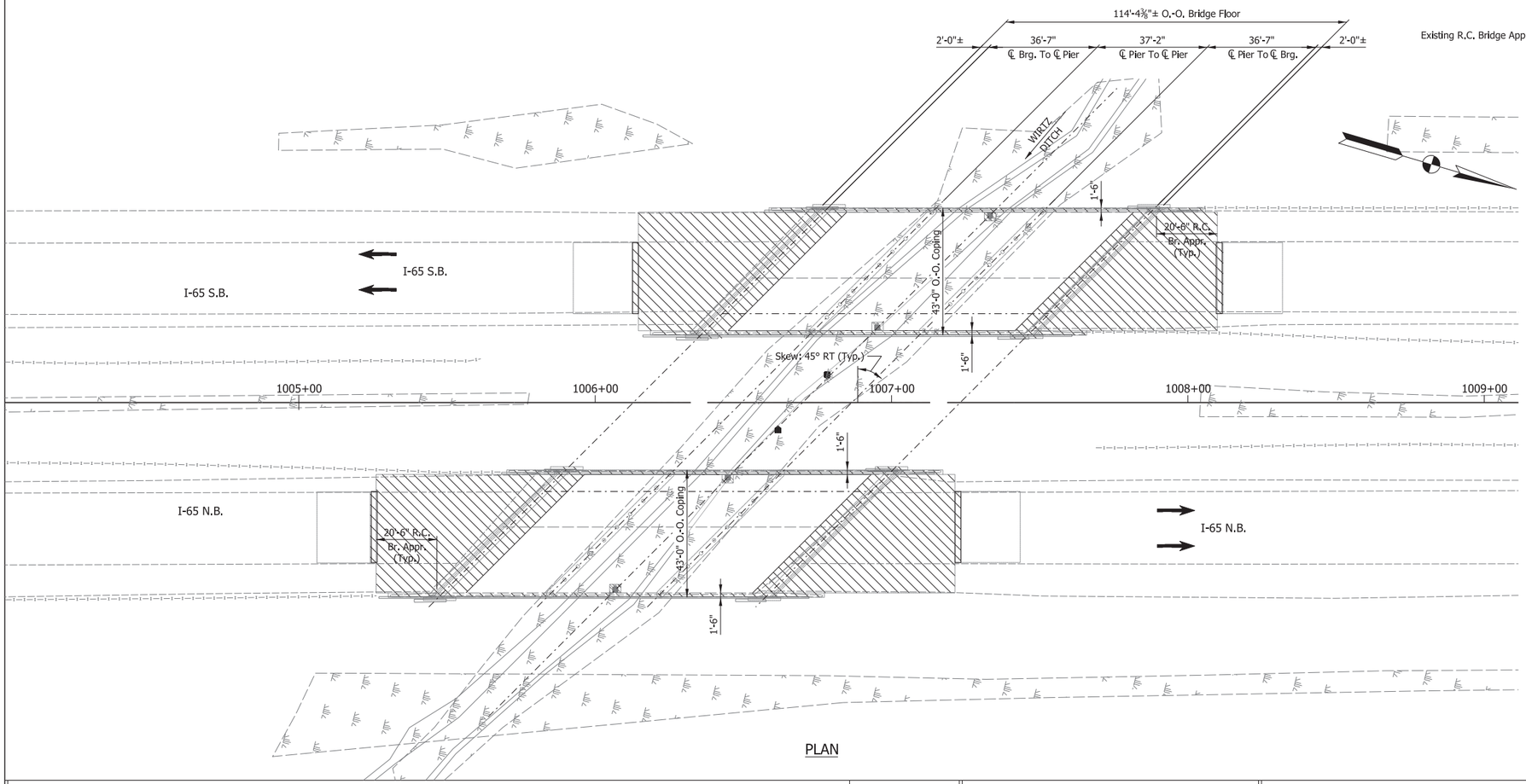


ELEVATION



TYPICAL SECTION
REMOVAL @ BENTS

Not To Scale



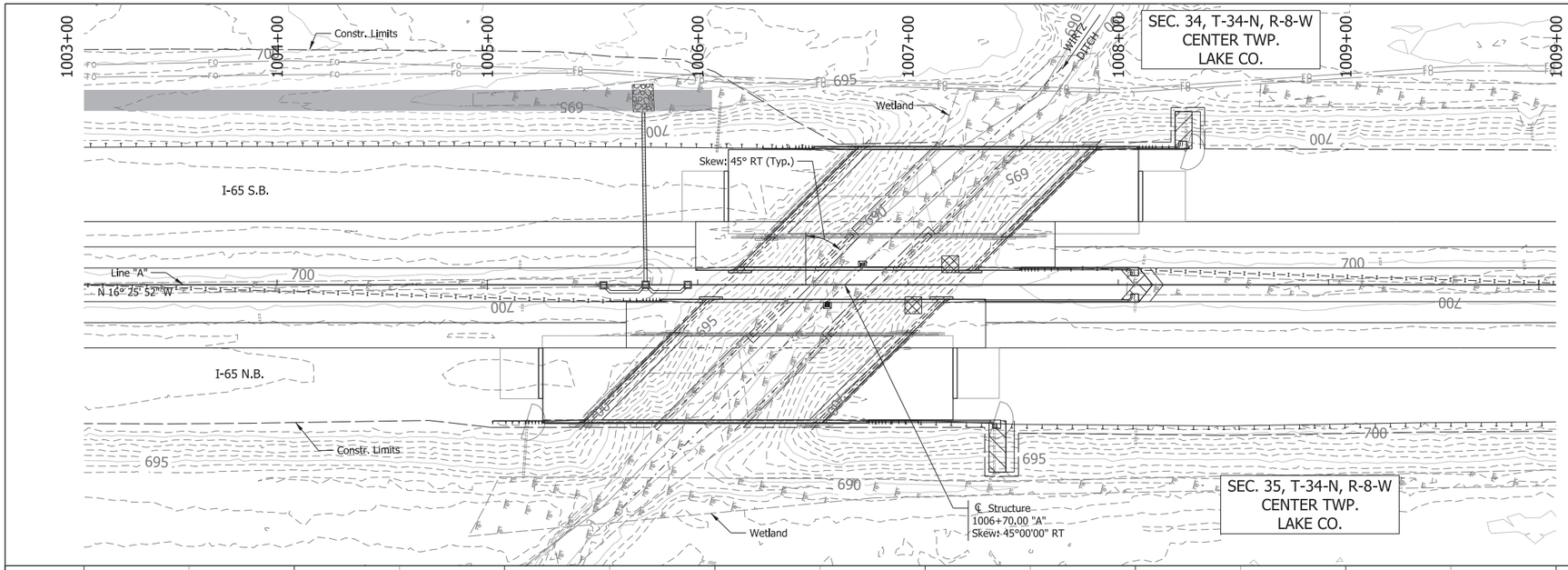
PLAN

NOTES:

Hatched areas indicate limits of existing structure removal.

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE		INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE	BRIDGE FILE
			1" = 20'-0"	I65-253-05119CNBL & 05119CSBL
			VERTICAL SCALE	DESIGNATION
			1" = 20'-0"	1382203 & 1382204
DESIGNED: RAM	DRAWN: EWM	REMOVAL DETAILS	SURVEY BOOK	SHEETS
			ELECTRONIC	4 of 19
CHECKED: MJK	CHECKED: MJK		CONTRACT	PROJECT
			R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B11-B12_REMOVAL PLAN.01.dgn
29-JUL-2016



SCOUR DATA

Q500	= 910 Cfs.
Q500 Elev.	= 693.62 Ft.
Contraction Scour	= 4.26 Ft.
Total Scour	= 8.53 Ft.
Q500 Scour Depth (Flowline Elev. 689.08)	= 680.55 Ft.

EXISTING STRUCTURE

The existing concrete I-beam bridge was built in 1962 with 3- spans: 36'-7", 2 @ 37'-2", and 36'-7" with a 40'-0" clear roadway reinforced concrete deck. Existing structure to be Widened.

NOTES:

For R/W and Additional Information see Roadway Plan & Profile sheets.

For Utility Contacts see Index Sheet No.2.

Cross-Hatched areas indicate limits of revetment riprap. (Est. Riprap Qty. = TBD Tons)

Hatched areas indicate limits of revetment riprap for riprap drainage turnouts, (Est. Riprap Qty. = TBD Tons) (Est. Geotextiles Qty. = TBD Sys.)

I-65 OVER WIRTZ DITCH
CONTINUOUS PRESTRESSED CONCRETE I-BEAM BRIDGE
3 SPANS: 36'-7", 37'-2", 36'-7"
SKEW: 45° RT.
2 CLEAR ROADWAYS: 55'-11" N.B., S.B.
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: RAM DRAWN: EWM

CHECKED: MJK CHECKED: MJK

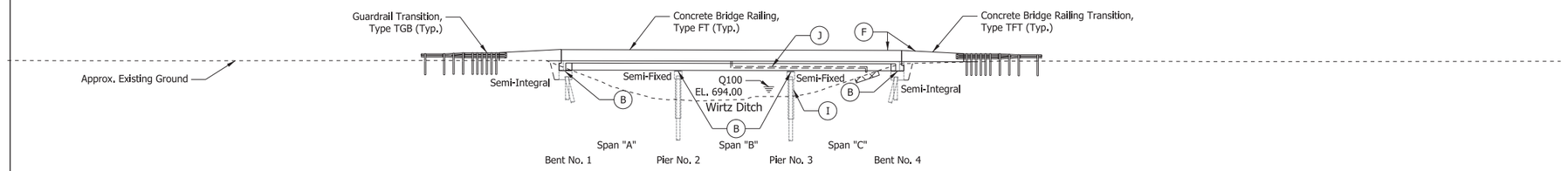
INDIANA
DEPARTMENT OF TRANSPORTATION

LAYOUT

HORIZONTAL SCALE	BRIDGE FILE
1" = 30'-0"	I65-253-05119CNBL & 05119CSBL
VERTICAL SCALE	DESIGNATION
1" = 10'-0"	1382203 & 1382204
SURVEY BOOK	SHEETS
ELECTRONIC	5 of 19
CONTRACT	PROJECT
R-37450	1172430

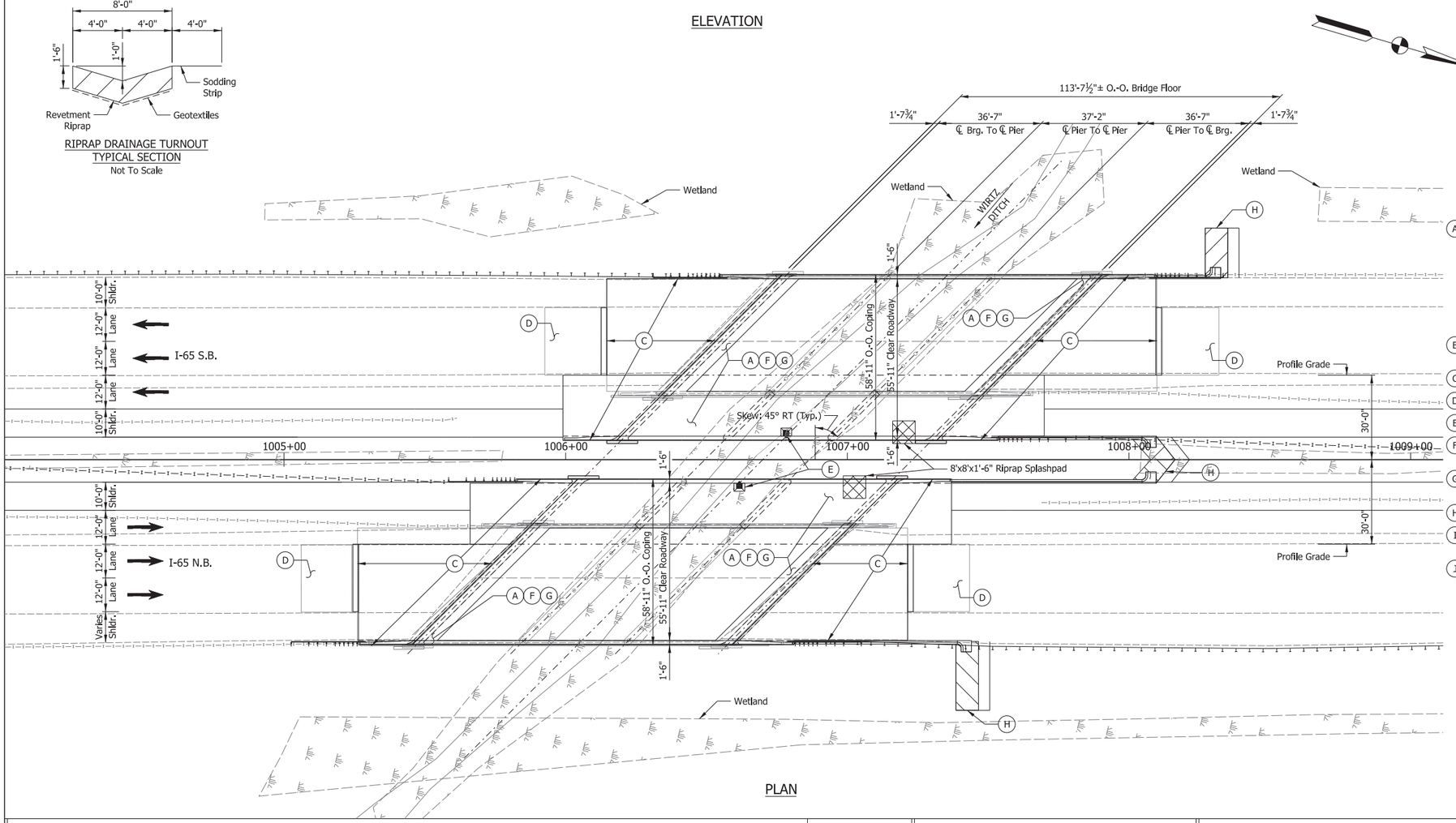
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29-JUL-2016

STRUCTURE TO BE BUILT TO A -0.10% GRADE



ELEVATION

RIPRAP DRAINAGE TURNOUT
TYPICAL SECTION
Not To Scale



PLAN

GENERAL NOTES

Reinforcing steel covering shall be 2½" in Top and 1" min. in bottom of floor slabs, 3" in footing except bottom steel which shall be 4", and 2" in all other parts, unless noted.

All New Reinforcement Shall be Epoxy Coated.

Plans for the Existing Structure are on file in the Central Office, Indiana Dept. of Transportation as Bridge File No. I65-253-05119, I65-253-05119A, and I65-2530-5119B and are available upon request.

DESIGN DATA

Designed for HS-20 Loading, in accordance with AASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002, and its subsequent interims.

DEAD LOAD

Actual weight plus 35 psf. of future wearing surface and 15 psf for SIP Metal deck forms.

FLOOR SLAB

Designed with a 7½" structural depth, and a ½" integral wearing surface.

DESIGN STRESSES

CONCRETE

Class "A" Concrete	f'c = 3,500 p.s.i.
Class "B" Concrete	f'c = 3,000 p.s.i.
Class "C" Concrete	f'c = 4,000 p.s.i.

REINFORCING STEEL

Grade 60	f'y = 60,000 p.s.i.

LEGEND

(A) Remove mudwalls down to the bridge seat and a minimum of 5'-0" of the bridge deck at the end bents. Construct lengthened piers and Semi-Integral end bents as well as full depth concrete bridge deck, to accommodate new clear roadway width. Mill ½" of the existing bridge deck and perform hydrodemolition. Perform full and partial depth bridge deck patching as needed. Remove a portion of the existing concrete bridge deck coping sufficient to connect the widened deck and to remove unsound concrete. Widen the concrete bridge deck, matching the milled existing bridge deck thickness. Place a variable depth (1¾" min.) latex-modified concrete overlay on existing and widened bridge deck surface. Extend spill slopes entirely accross median.

(B) Place elastomeric bearing pads at end bents and piers where beams are being added. Widen the end bents and piers in kind.

(C) Replace existing reinforced concrete approach slabs and transitions.

(D) Mill and resurface 30 feet of the approach roadway at each end.

(E) Remove existing inlets and patch concrete deck. Place new inlets in median shoulder.

(F) Surface seal new approach slabs, bridge railing, and new bridge deck concrete. Install ITS conduit in new bridge railing.

(G) Place sacrificial embedded galvanic anodes along all interfaces where cleaned and straightened steel reinforcing bars are cast in new concrete.

(H) Construct new riprap turnouts along with concrete curb and curb turnouts.

(I) Perform pier patching to areas of delamination and spalling. (Est. Qty. = 100 Sft. total, 50 Sft per structure).

(J) Install deck drainage system and carry water to 8'x8' riprap splashpad over geotextiles.

NOTES:

Cross-Hatched areas indicate limits of revetment riprap. (See Layout for Quantities).

Hatched areas indicate limits of revetment riprap for riprap drainage turnouts. (See Layout for Quantities).

I-65 OVER WIRTZ DITCH
CONTINUOUS PRESTRESSED CONCRETE I-BEAM BRIDGE
3 SPANS: 36'-7", 37'-2", 36'-7"
SKEW: 45° RT.
2 CLEAR ROADWAYS: 55'-11" N.B., S.B.
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER _____ DATE

DESIGNED: RAM DRAWN: EWM

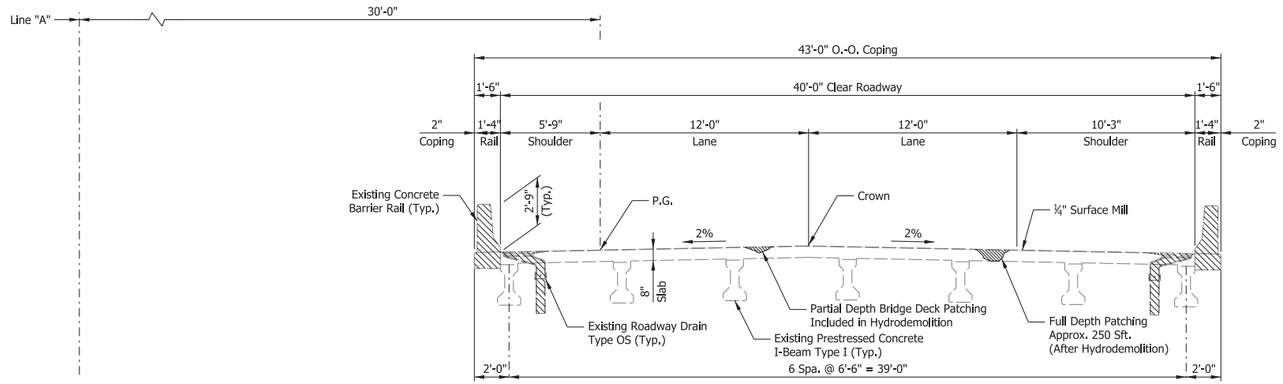
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INDIANA
DEPARTMENT OF TRANSPORTATION

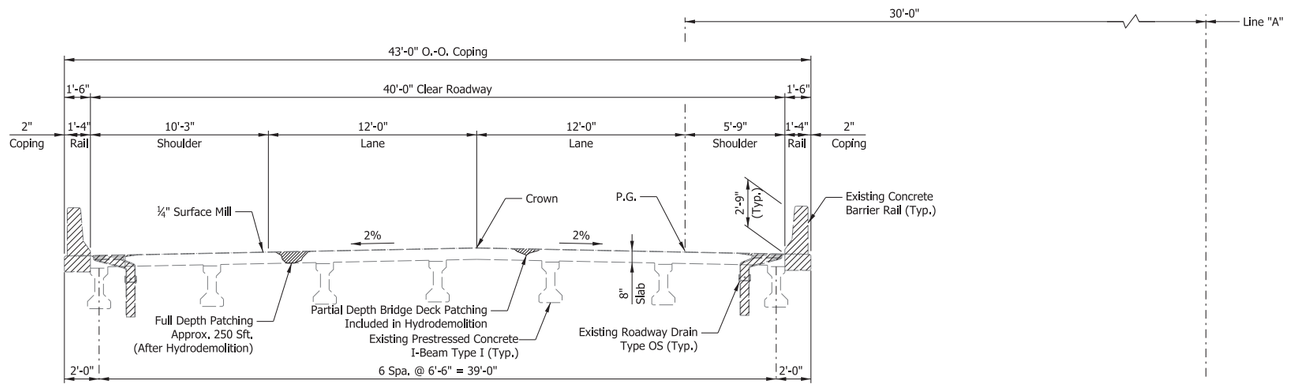
GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
1" = 20'-0"	I65-253-05119CNBL & 05119CSBL
VERTICAL SCALE	DESIGNATION
1" = 20'-0"	1382203 & 1382204
SURVEY BOOK	SHEETS
ELECTRONIC	6 of 19
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B11-B12_GENERAL PLAN.01.dgn
29-JUL-2016



EXISTING TYPICAL SECTION
(NB SHOWN)



EXISTING TYPICAL SECTION
(SB SHOWN)

Notes:

Hatching indicates limits of removal

I-65 OVER WIRTZ DITCH
CONTINUOUS PRESTRESSED CONCRETE I-BEAM BRIDGE
3 SPANS: 36'-7", 37'-2", 36'-7"
SKEW: 45° RT.
2 CLEAR ROADWAYS: 55'-11" N.B., S.B.
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER _____ DATE

DESIGNED: RAM | DRAWN: EWM

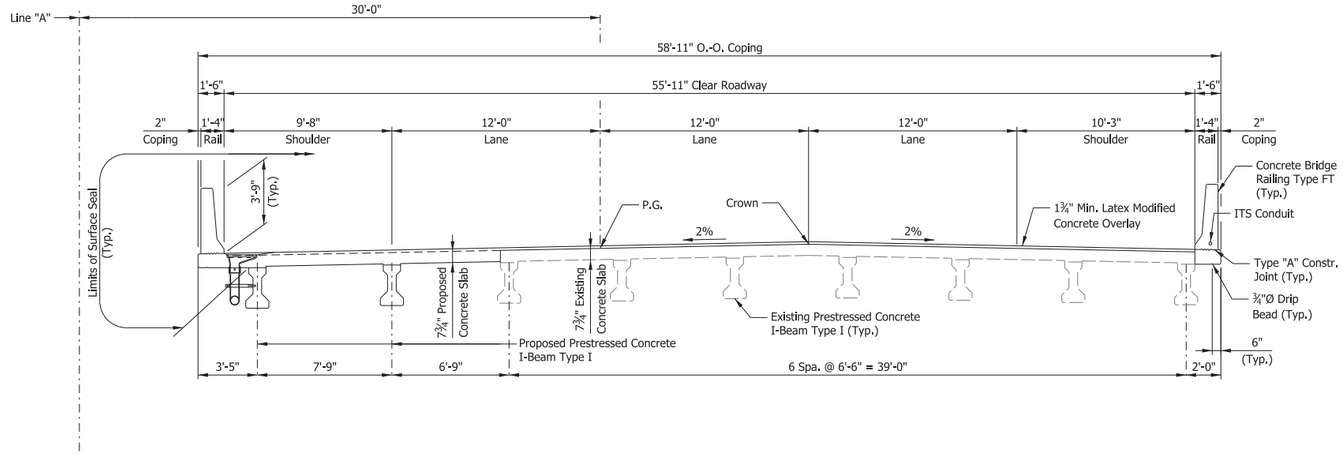
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INDIANA
DEPARTMENT OF TRANSPORTATION

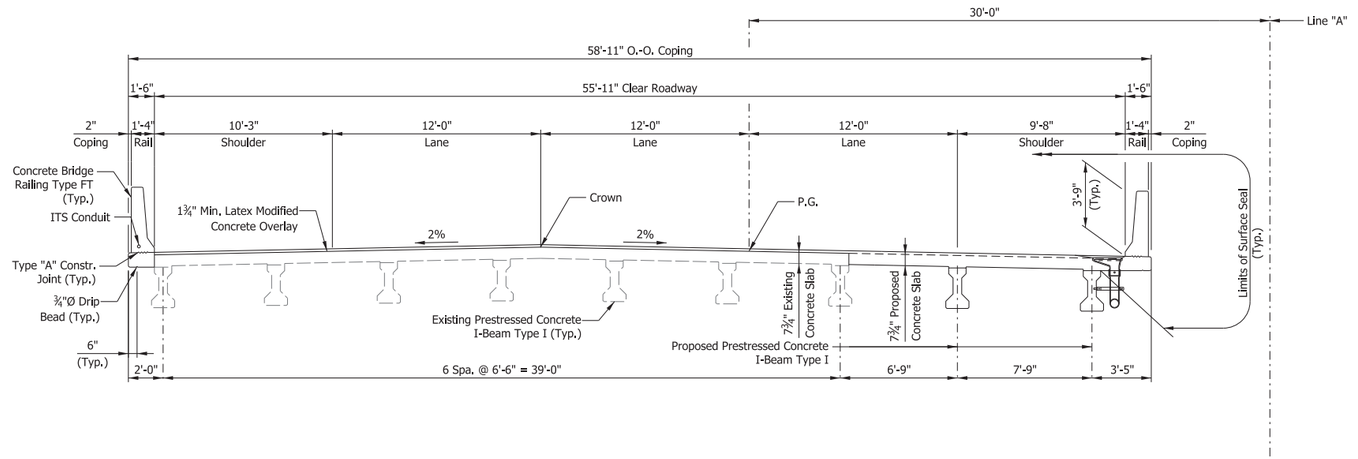
GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
1/4" = 1'-0"	I65-253-05119CNBL & 05119CSBL
VERTICAL SCALE	DESIGNATION
1/4" = 1'-0"	1382203 & 1382204
SURVEY BOOK	SHEETS
ELECTRONIC	7 of 19
CONTRACT	PROJECT
R-37450	1172430

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29-JUL-2016



PROPOSED NB TYPICAL SECTION

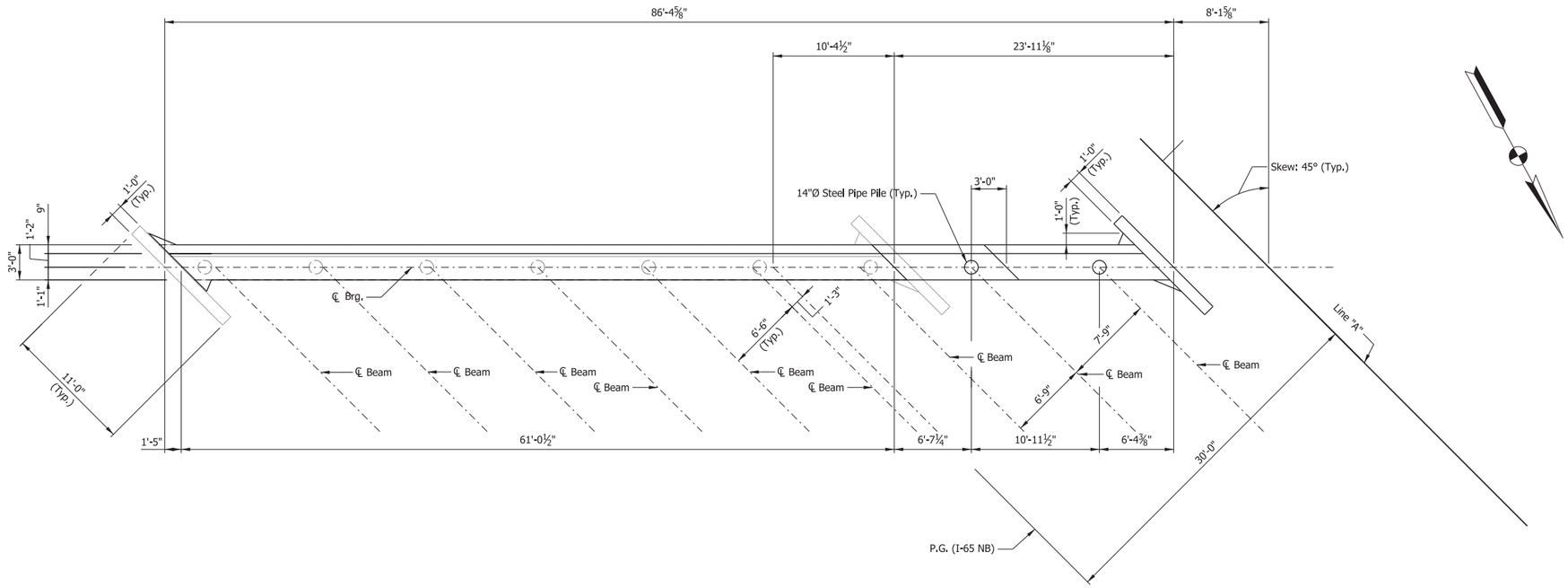


PROPOSED SB TYPICAL SECTION

I-65 OVER WIRTZ DITCH
CONTINUOUS PRESTRESSED CONCRETE I-BEAM BRIDGE
3 SPANS: 36'-7", 37'-2", 36'-7"
SKEW: 45° RT.
2 CLEAR ROADWAYS: 55'-11" N.B., S.B.
LAKE COUNTY

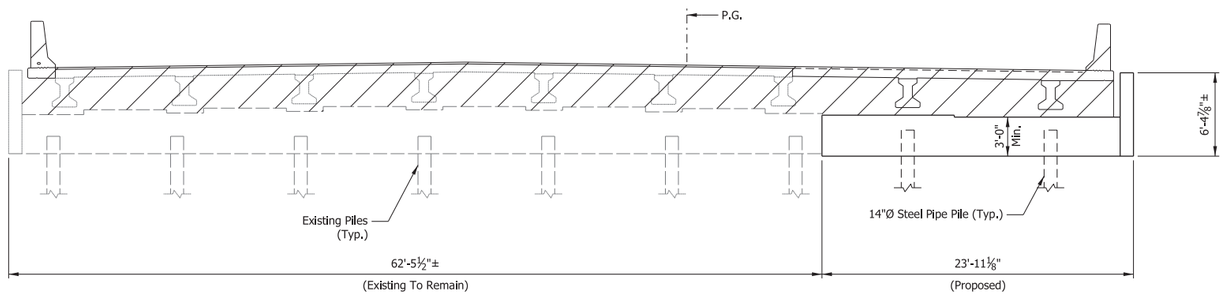
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		CHECKED: MJK CHECKED: MJK		ELECTRONIC	8 of 19
				CONTRACT R-37450	PROJECT 1172430

IP_PWP:dms13737\I65_NORTHWEST_B11-B12_GENERAL PLAN.03.dgn
01-AUG-2016



PLAN @ BENT NO.1 N.B.

(Bent No. 4 S.B. Same By 180° Rotation)



ELEVATION @ BENT NO.1 N.B.

(Bent No. 4 S.B. Same By 180° Rotation)

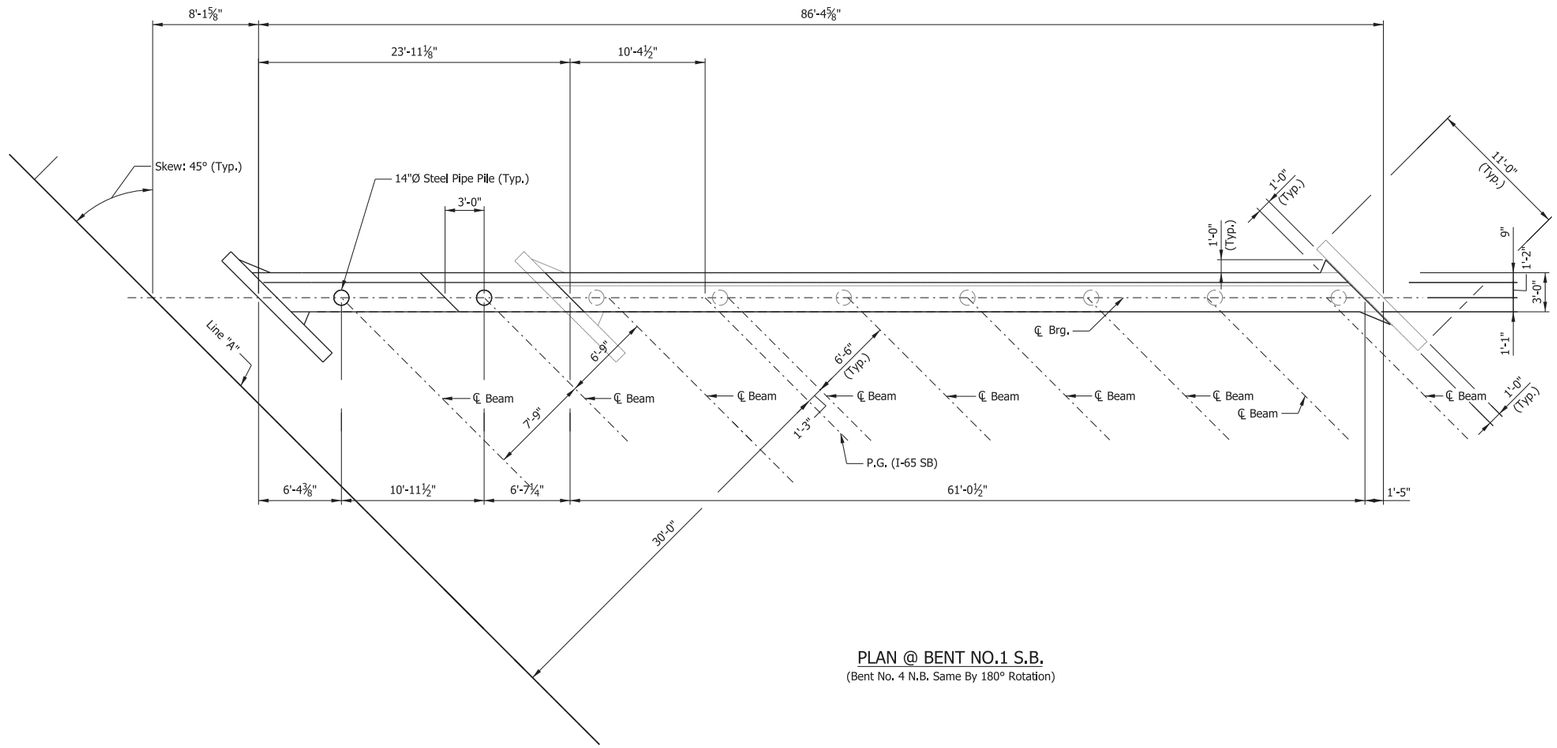
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Dimensions shown along centerline of bearing.

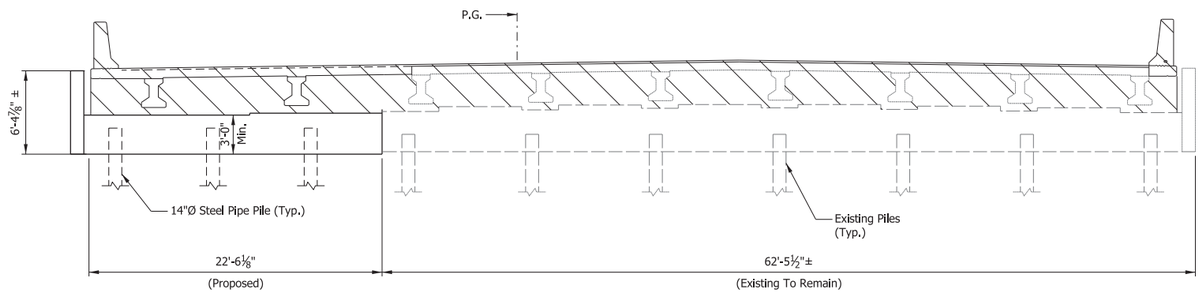
Hatched areas to be poured with superstructure.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 3/16" = 1'-0"	BRIDGE FILE I65-253-05119CNBL & 05119CSBL
				VERTICAL SCALE 3/16" = 1'-0"	DESIGNATION 1382203 & 1382204
		DESIGNED: SDW DRAWN: EWM	END BENT DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	9 of 19
				CONTRACT	PROJECT
				R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B11-B12_END BENT.01.dgn
29-JUL-2016



PLAN @ BENT NO.1 S.B.
(Bent No. 4 N.B. Same By 180° Rotation)



ELEVATION @ BENT NO.1 S.B.
(Bent No. 4 N.B. Same By 180° Rotation)

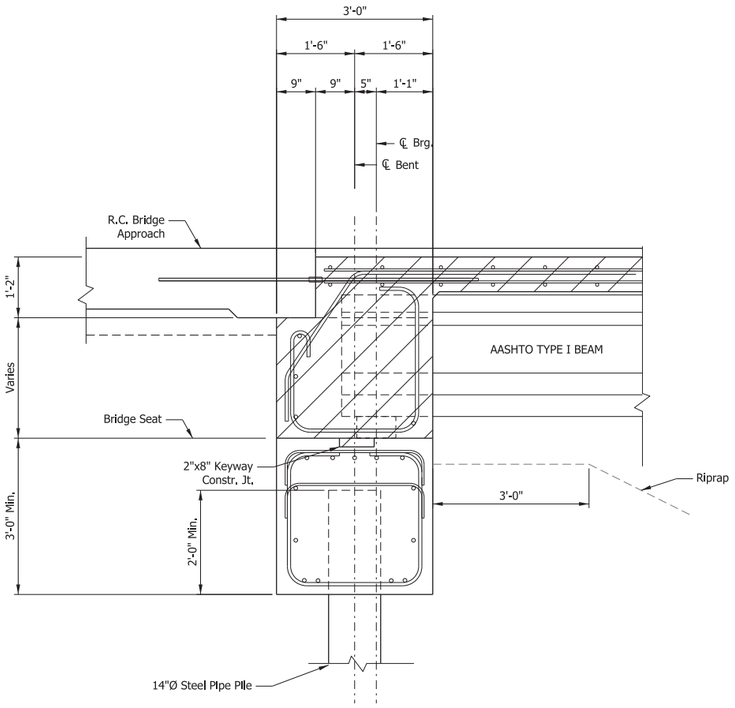
NOTES:

Dimensions shown along centerline of bearing.

Hatched areas to be poured with superstructure.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 3/16" = 1'-0"	BRIDGE FILE I65-253-05119CNBL & 05119CSBL
				VERTICAL SCALE 3/16" = 1'-0"	DESIGNATION 1382203 & 1382204
		DESIGNED: SDW DRAWN: EWM	END BENT DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	10 of 19
				CONTRACT R-37450	PROJECT 1172430

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29-JUL-2016



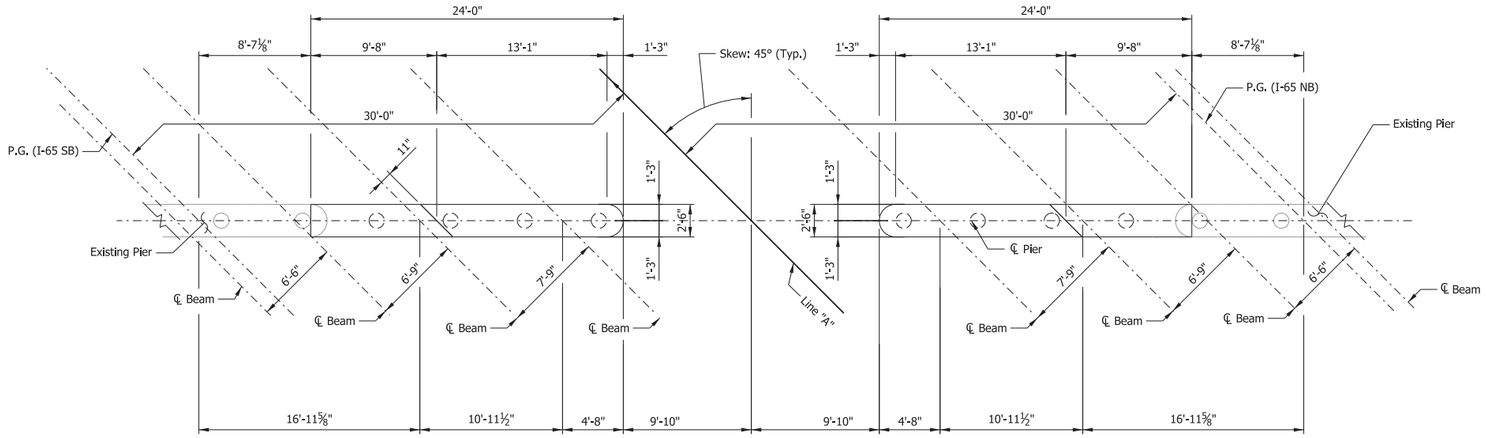
TYPICAL PROPOSED SECTION
@ BENT NO.1
(Bent No.4 Same)

NOTES:

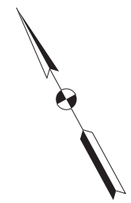
Hatched areas to be poured with superstructure.

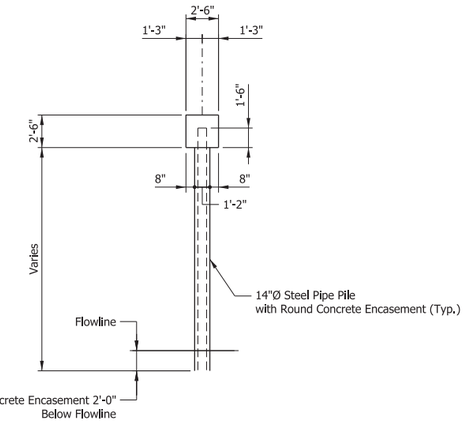
		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 3/4" = 1'-0"	BRIDGE FILE: I65-253-05119CNBL & 05119CSBL
				VERTICAL SCALE: 3/4" = 1'-0"	DESIGNATION: 1382203 & 1382204
		DESIGNED: SDW / DRAWN: EWM	END BENT DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK / CHECKED: MJK		ELECTRONIC	11 of 19
				CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13737\I65_NORTHWEST_B11-B12_END BENT.03.dgn
29-JUL-2016

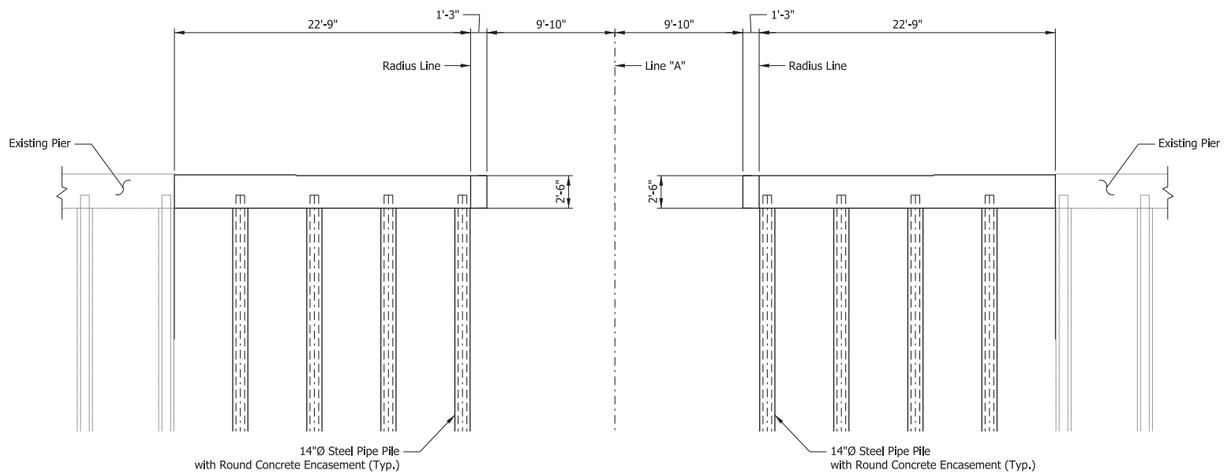


PLAN @ PIER NO.2
(Pier No. 3 Same)





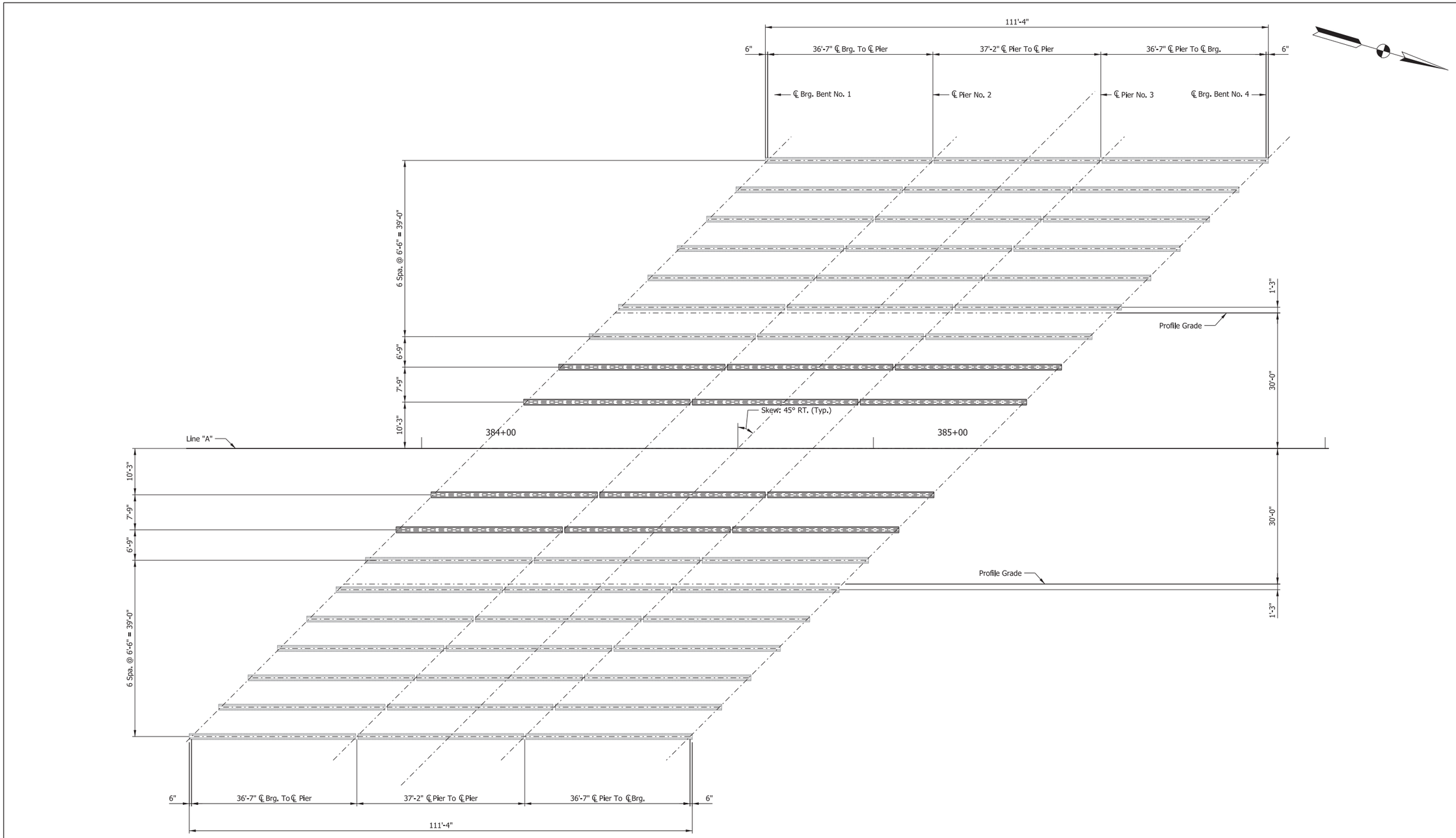
TYPICAL PROPOSED SECTION
(Pier No. 3 Same)



ELEVATION @ PIER NO.2
(Pier No. 3 Same)

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 3/16" = 1'-0"	BRIDGE FILE: I65-253-05119CNBL & 05119CSBL
		VERTICAL SCALE: 3/16" = 1'-0"	DESIGNATION: 1382203 & 1382204
DESIGNED: SDW DRAWN: EWM	PIER DETAILS	SURVEY BOOK	SHEETS
		ELECTRONIC	12 of 19
CHECKED: MJK CHECKED: MJK		CONTRACT: R-37450	PROJECT: 1172430

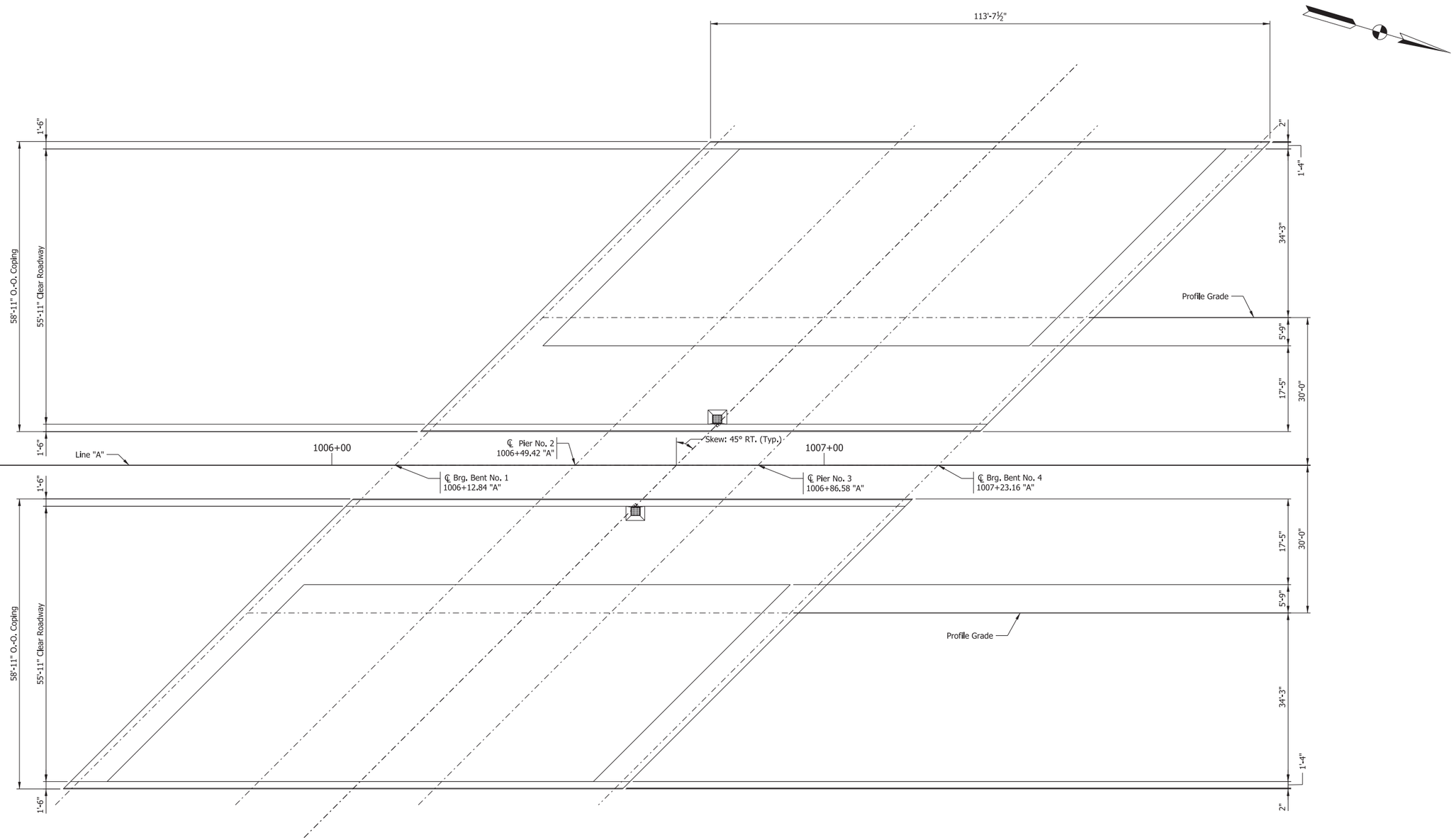
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29-JUL-2016



PLAN

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 1" = 10'-0"	BRIDGE FILE I65-253-05119CNBL & 05119CSBL
				VERTICAL SCALE 1" = 10'-0"	DESIGNATION 1382203 & 1382204
		DESIGNED: RAM DRAWN: EWM	FRAMING PLAN	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	13 of 19
				CONTRACT R-37450	PROJECT 1172430

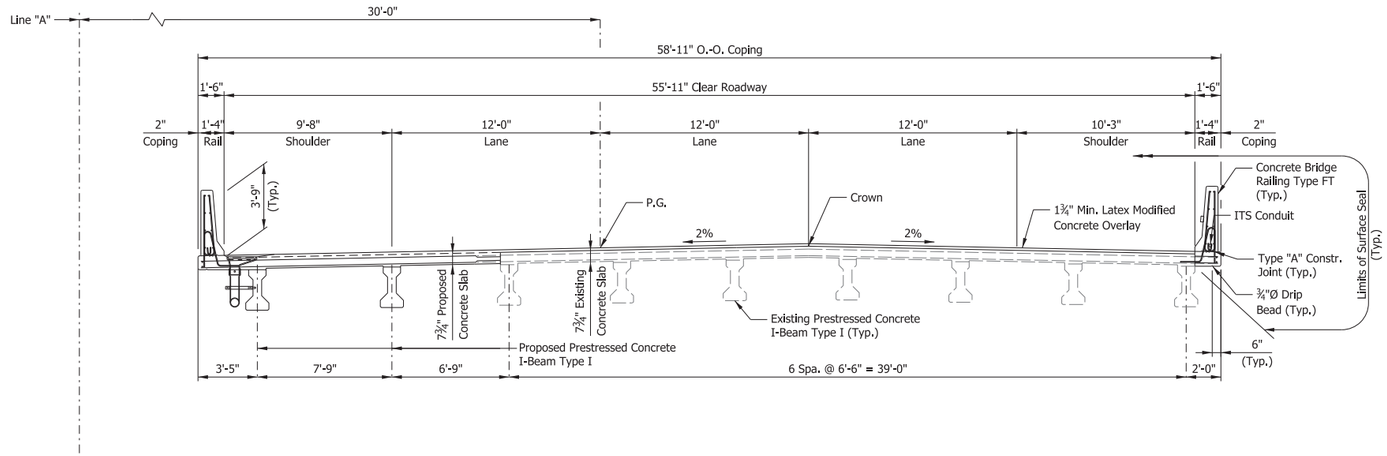
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29-JUL-2016



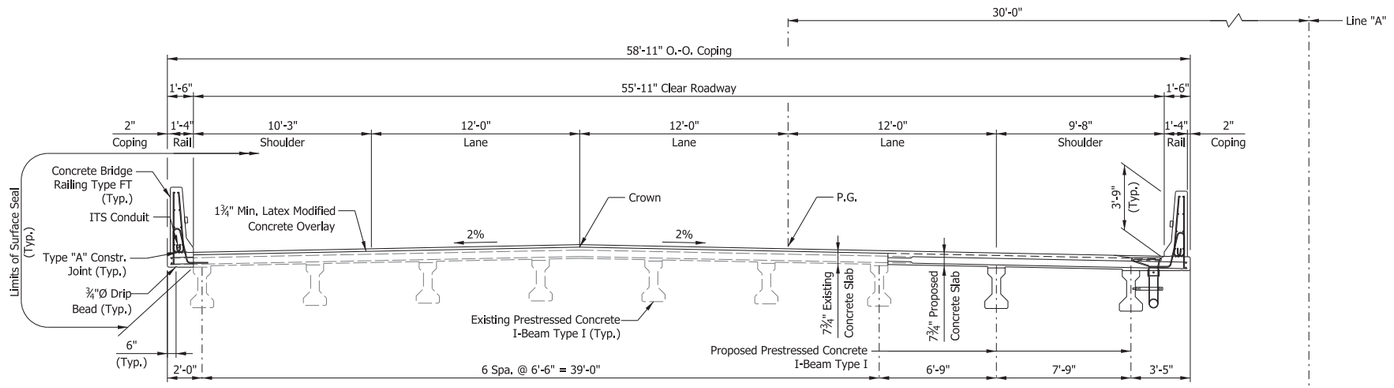
PLAN

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				VERTICAL SCALE 1/4" = 1'-0"	DESIGNATION 1382203 & 1382204
		DESIGNED: RAM DRAWN: EWM	SUPERSTRUCTURE DETAILS	SURVEY BOOK ELECTRONIC	SHEETS 14 of 19
		CHECKED: MJK CHECKED: MJK		CONTRACT R-37450	PROJECT 1172430

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29-JUL-2016



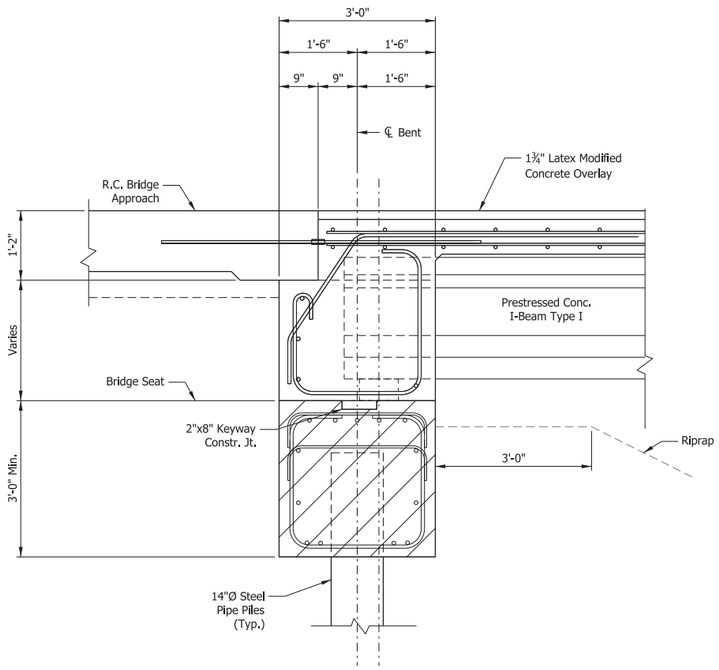
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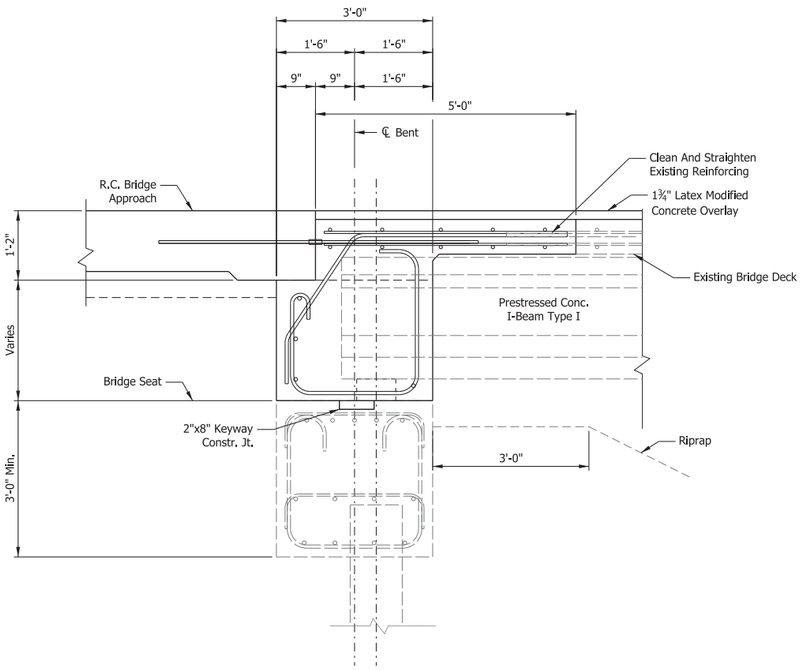
PROPOSED SB TYPICAL SECTION

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 1/4" = 1'-0"	BRIDGE FILE I65-253-05119CNBL & 05119CSBL
				VERTICAL SCALE 1/4" = 1'-0"	DESIGNATION 1382203 & 1382204
		DESIGNED: RAM DRAWN: EWM	SUPERSTRUCTURE DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	15 of 19
				CONTRACT R-37450	PROJECT 1172430

IP_PWP:dms13737\I65_NORTHWEST_B11-B12_SUPERSTRUCTURE.02.dgn
01-AUG-2016



TYPICAL PROPOSED SECTION
@ BENT NO.1
(Bent No.4 Same)



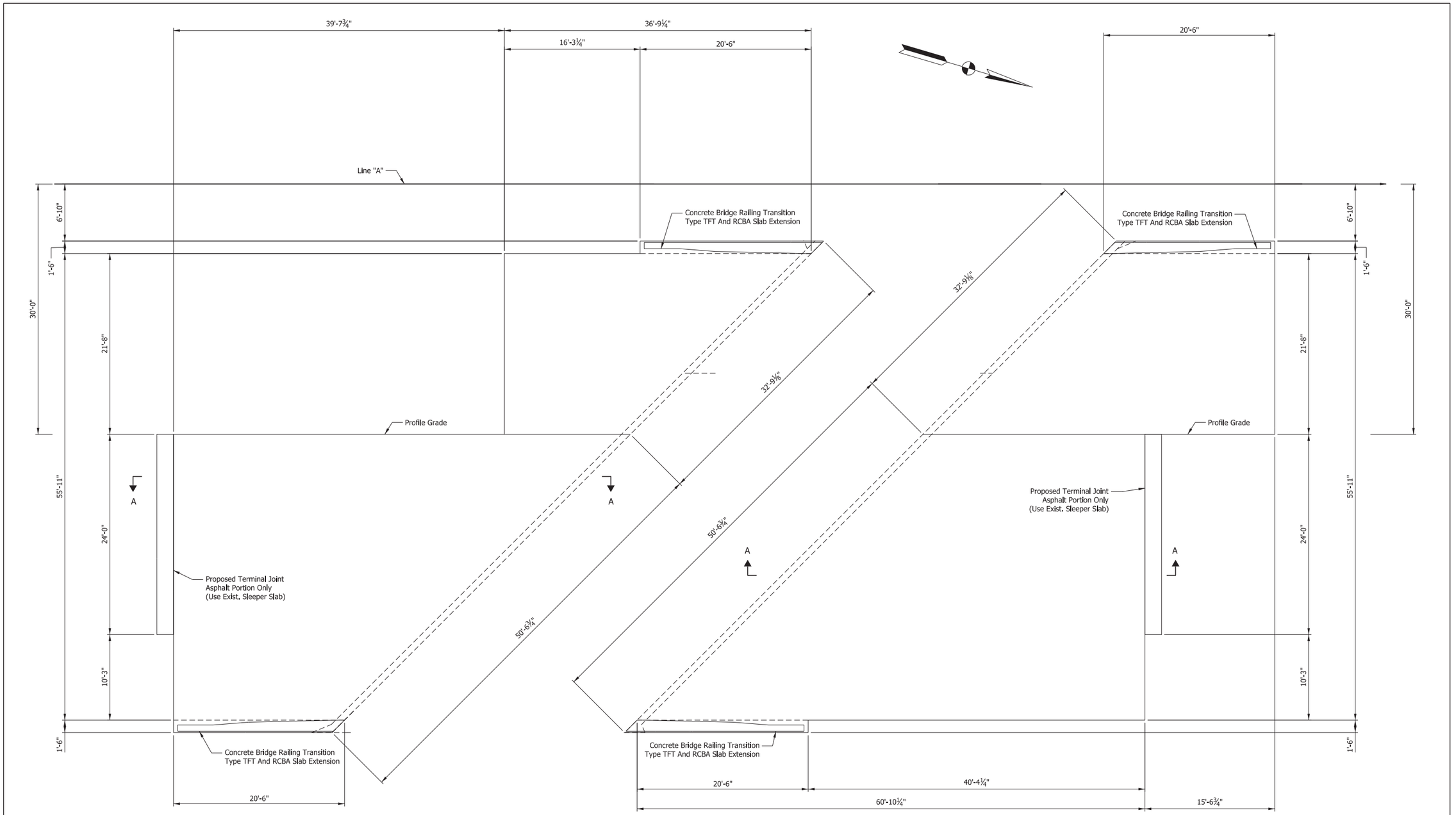
TYPICAL EXISTING BENT SECTION
@ BENT NO.1
(Bent No.4 Same)

NOTES:

Hatched areas to be poured with substructure.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 3/4" = 1'-0"	BRIDGE FILE: I65-253-05119CNBL & 05119CSBL
				VERTICAL SCALE: 3/4" = 1'-0"	DESIGNATION: 1382203 & 1382204
		DESIGNED: RAM DRAWN: EWM	SUPERSTRUCTURE DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	16 of 19
				CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13737\I65_NORTHWEST_B11-B12_SUPERSTRUCTURE.03.dgn
29-JUL-2016

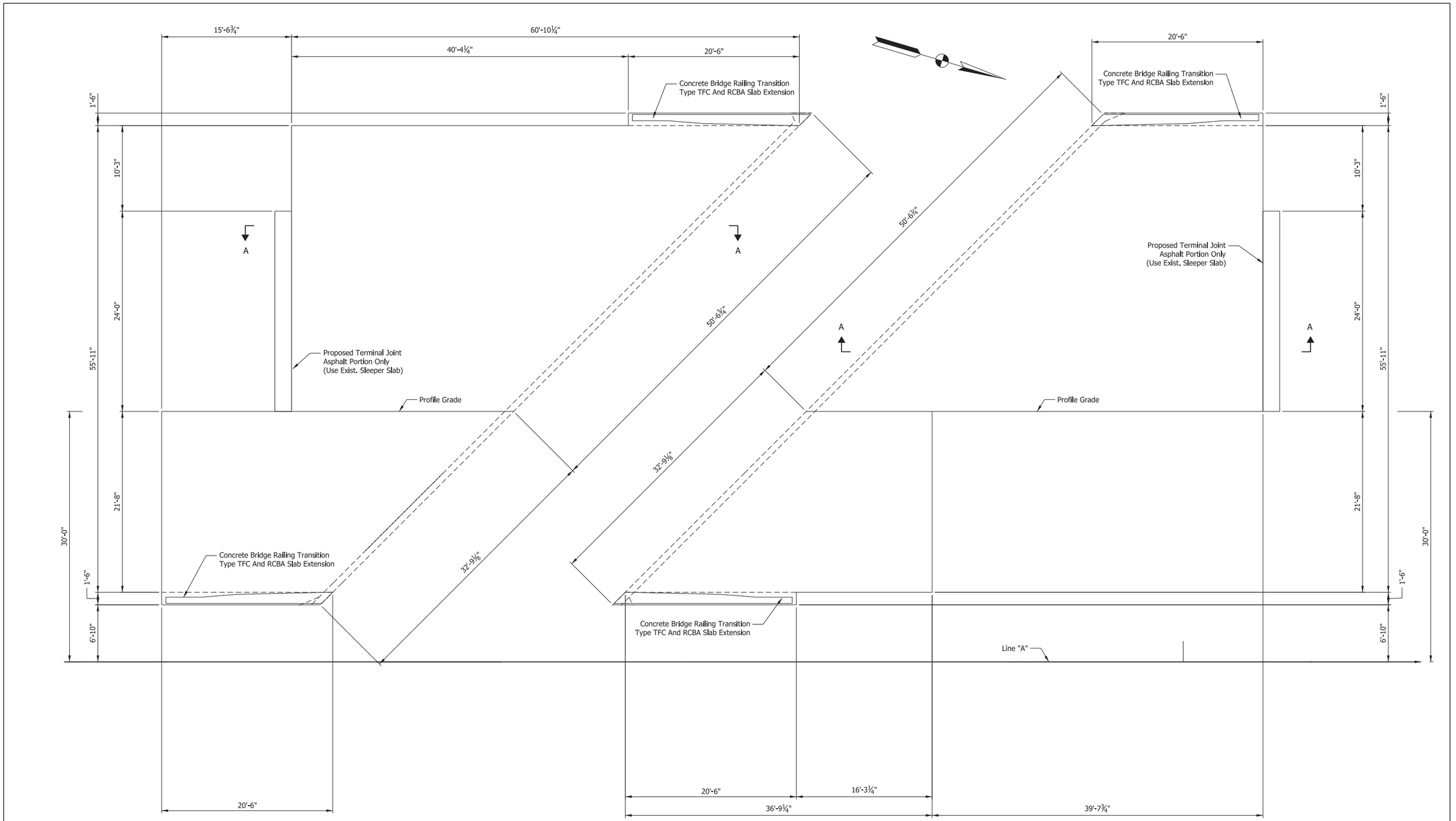


PLAN @ BENT NO.1 N.B.

PLAN @ BENT NO.4 N.B.

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE	BRIDGE FILE
		3/16" = 1'-0"	I65-253-05119CNBL & 05119CSBL
		VERTICAL SCALE	DESIGNATION
		3/16" = 1'-0"	1382203 & 1382204
DESIGNED: RAM DRAWN: EWM	R.C. BRIDGE APPROACH DETAILS	SURVEY BOOK	SHEETS
		ELECTRONIC	17 of 19
CHECKED: MJK CHECKED: MJK		CONTRACT	PROJECT
		R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B11-B12_APPR SLAB.01.dgn
29-JUL-2016

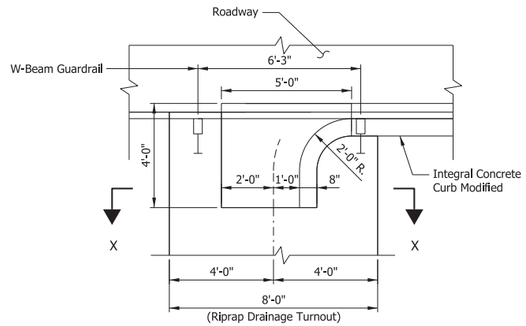


PLAN @ BENT NO.1 S.B.

PLAN @ BENT NO.4 S.B.

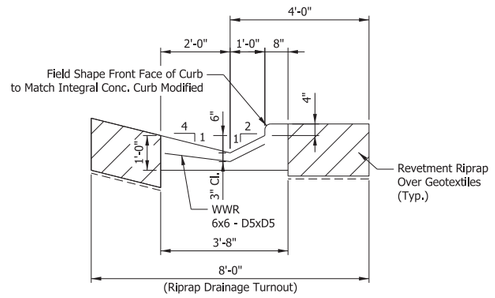
		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 3/16" = 1'-0"	BRIDGE FILE: I65-253-05119CNBL & 05119CSBL
				VERTICAL SCALE: 3/16" = 1'-0"	DESIGNATION: 1382203 & 1382204
		DESIGNED: RAM DRAWN: EWM	R.C. BRIDGE APPROACH DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	18 of 19
				CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13737\I65_NORTHWEST_B11-B12_APPR SLAB.02.dgn
29-JUL-2016



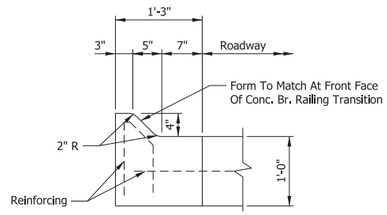
COMBINED CURB & GUTTER
TURNOUT, MODIFIED

Scale: ⅜" = 1'-0"



SECTION X-X

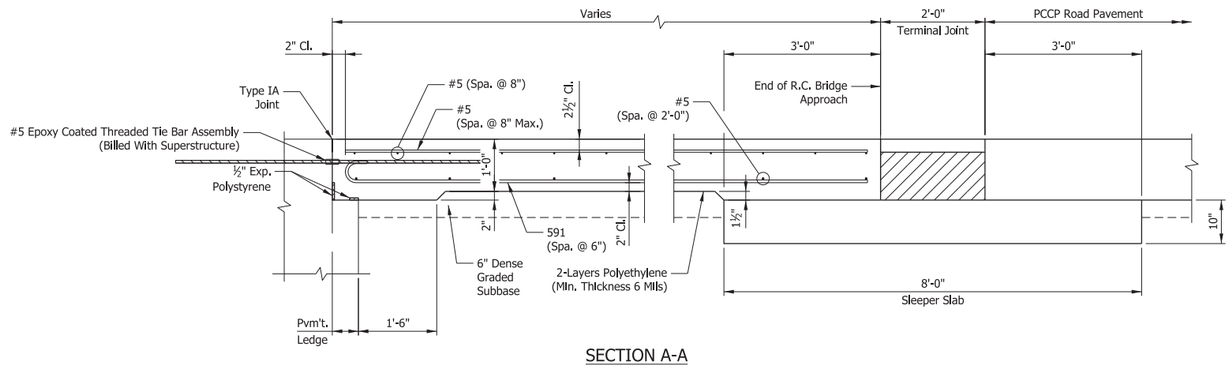
Scale: ½" = 1'-0"



NOTE:
For Reinforcing and Additional Details,
see Standard Drawing E605-CCIN-01.

TYPICAL SECTION
INTEGRAL CONCRETE CURB
MODIFIED, TYPE B

Scale: 1" = 1'-0"



SECTION A-A

Scale: ¾" = 1'-0"

NOTES:

For Reinforcing Bar Notes, see Standard Drawing E703-BRST-01.

All reinforcing steel to be epoxy coated.

For Concrete Bridge Railing Transition Details, see Standard Drawings E706-CBRT-03 & -04.

Surface seal all exposed surfaces of the approaches.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: AS NOTED	BRIDGE FILE: I65-253-05119CNBL & 05119CSBL
				VERTICAL SCALE: AS NOTED	DESIGNATION: 1382203 & 1382204
		DESIGNED: RAM DRAWN: EWM	R.C. BRIDGE APPROACH DETAILS	SURVEY BOOK: ELECTRONIC	SHEETS: 19 of 19
		CHECKED: MJK CHECKED: MJK		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13737\I65_NORTHWEST_B11-B12_APPR SLAB.03.dgn
29-JUL-2016

BRIDGE NO. 13

I-65

WALSH PARSONS Walsh & Kelly

R-37450
SECTION C

PROJECT	DESIGNATION
1172430	1298545
CONTRACT	BRIDGE FILE
R-37450	I65-252-04897B

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE REHABILITATION PLANS

FOR SPANS OVER 20 FEET

ROUTE: 153RD AVE. AT: RP 243+51

PROJECT NO. 1172430 P.E.

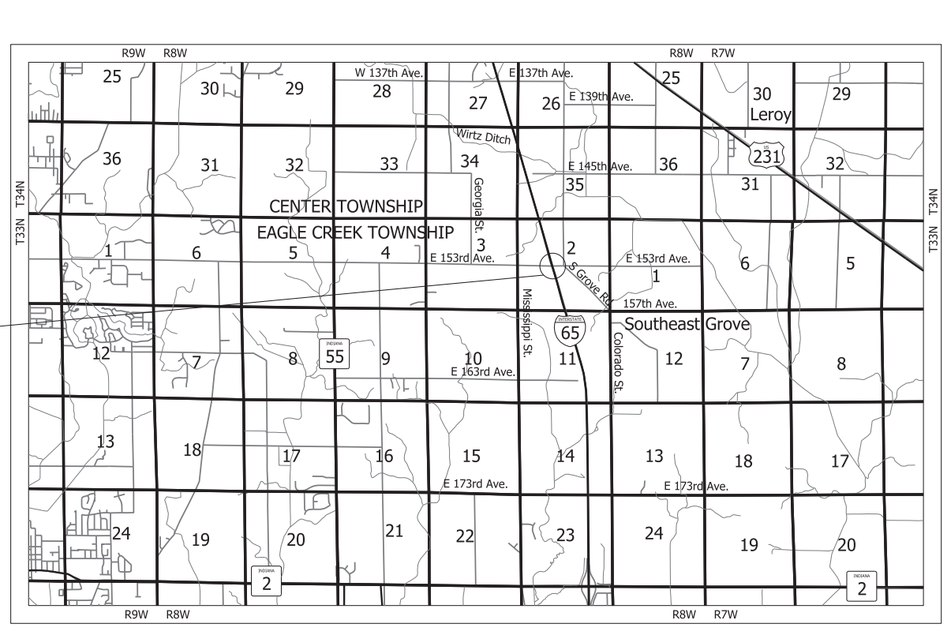
NO ADDITIONAL RIGHT-OF-WAY REQUIRED FOR THIS PROJECT — R/W

1172430 CONST.

Bridge Deck Overlay on 153rd Ave. over I-65 Located 3.58 Miles North of S.R. 2
in Section 2, T-33-N, R-8-W,
Eagle Creek Township, Lake County, Indiana

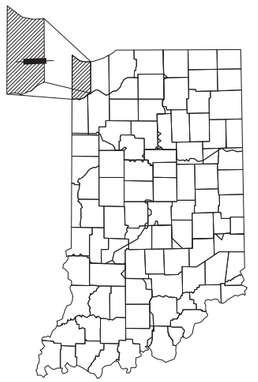
STRUCTURE INFORMATION				
STRUCTURE	TYPE	SPAN AND SKEW	OVER	STATION
I65-252-04897B	Continuous Steel Beam & R.C. Girder	4 Spans: 36'-0", 2 @ 68'-0", 36'-0" Skew: 16°58'30" Lt.	I-65	50+00.00 "S-10-A"

KIN DES. NUMBERS	DESCRIPTION	TYPE
1172430	I-65 ADDED TRAVEL LANES U.S. 231 TO U.S. 30	ROADWAY
1400349	I-65 ADDED TRAVEL LANES S.R. 2 TO U.S. 231	ROADWAY
1006741	PIPE LINER 2,64 MILES N OF S.R. 10	ROADWAY
1601115	93RD AVE. OVER I-65	BRIDGE
1600332	I-65 N.B. OVER BEAVER DAM	BRIDGE
1600331	I-65 S.B. OVER BEAVER DAM	BRIDGE
1600329	I-65 N.B. OVER 109TH AVE.	BRIDGE
1600330	I-65 S.B. OVER 109TH AVE.	BRIDGE
1601116	113TH AVE. OVER I-65	BRIDGE
1600327	I-65 N.B. OVER U.S. 231	BRIDGE
1600328	I-65 S.B. OVER U.S. 231	BRIDGE
1601117	137TH AVE. OVER I-65	BRIDGE
1382203	I-65 N.B. OVER WIRTZ DITCH	BRIDGE
1382204	I-65 S.B. OVER WIRTZ DITCH	BRIDGE
1382207	I-65 N.B. OVER S.R. 2	BRIDGE
1382208	I-65 S.B. OVER S.R. 2	BRIDGE
0101469	I-65 N.B. OVER KANKAKEE RIVER	BRIDGE
0200140	I-65 S.B. OVER KANKAKEE RIVER	BRIDGE



TRAFFIC DATA		I-65 N.B.L.	I-65 S.B.L.
A.A.D.T.	(2015)	25,990 V.P.D.	19,607 V.P.D.
A.A.D.T.	(2035)	31,464 V.P.D.	23,736 V.P.D.
D.H.V	(2035)	2,205 V.P.H.	1,663 V.P.H.
DIRECTIONAL DISTRIBUTION		57 %	43 %
TRUCKS		44 % A.A.D.T.	44 % A.A.D.T.
		44 % D.H.V.	44 % D.H.V.

DESIGN DATA	
DESIGN SPEED	70 M.P.H.
PROJECT DESIGN CRITERIA	PARTIAL RECONSTRUCTION 4R (FREEWAY)
FUNCTIONAL CLASSIFICATION	INTERSTATE
RURAL/URBAN	RURAL
TERRAIN	LEVEL
ACCESS CONTROL	FULL



PROJECT LOCATION SHOWN BY
Lake County

SCALE: 1" = 4000'

LATITUDE: 41°20'24" N LONGITUDE: 87°18'32" W

BRIDGE LENGTH:	0.041	MI.
ROADWAY LENGTH:	0.008	MI.
TOTAL LENGTH:	0.049	MI.
MAX. GRADE:	5.00	%

MajorMoves 2020

INDIANA DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS DATED 2016
TO BE USED WITH THESE PLANS.

PARSONS
101 W. Ohio St., Suite 2121
Indianapolis, IN 46204
Bus (317) 616-1000
Fax (317) 616-1033

PLANS PREPARED BY: PARSONS 317-616-1000 PHONE NUMBER

CERTIFIED BY: _____ DATE

APPROVED FOR LETTING: _____ INDIANA DEPARTMENT OF TRANSPORTATION DATE

BRIDGE FILE	
I65-252-4897B	
DESIGNATION	
1298545	
SURVEY BOOK	SHEETS
ELECTRONIC	1 of 4
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B13_BRIDGE TITLE SHEET.01.dgn
20-JUL-2016

UTILITIES

ELECTRIC

NIPSCO Electric
MArk Lindsley
Phone: 219-647-4198

American Electric Power
Ngoc Alex KUrtz
Phone: 614-552-1332

GAS / PIPELINES

NIPSCO Gas
Neil Arndt
Phone: 219-647-4779

Buckeye Pipe Line Co., LP
Michael Norris
Phone: 219-313-5321

Enbridge Energy Company, Inc.
Michael Price
Phone: 219-922-7015

WATER

IN American Water Company, Inc.
Michael Seals
Phone: 317-885-2444

TELECOMMUNICATIONS

AT&T Indiana (Dist)
Angelo LaMantia
Phone: 219-662-4418

AT&T Transmission (LD)
Carl Donahue
Phone: 630-552-9785
Dean Norwich
Phone: 574-344-0833

Comcast Cable
Robert Schulter
Phone: 630-600-6307

Zayo Bandwidth LLC
Jason Gilpin
Phone: 260-570-5677

Northwest Indiana Telephone Co. Inc.
Don Schoenbeck
Phone: 219-996-0216

Indiana Fiber Network LLC
Jim Royer
Phone: 317-777-7115
317-280-4636

MISCELLANEOUS AGENCIES

Merrillville Conservancy Dist.
Charles Stojakovich
Phone: 219-980-5220

City of Crown Point
Jay Olson
Phone: 219-662-3252
Kent Swinehart
Phone: 219-661-2287

INDOT ITS
Technology Deployment Division
Ed Cox
Phone: 317-899-8601

INDOT LaPorte District
(Signals Lighting)
Andy Costello
Phone: 219-325-7483

Indiana811
Know what's below. Call before you dig.

INDEX

SHEET NO.	SUBJECT
1	TITLE
2	INDEX
3-4	GENERAL PLAN

REVISIONS

SHEET NO.	DATE	REVISED

NOTE:
For Detour Route Details, See Maintenance Of Traffic Plans.

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: EWM DRAWN: EWM

CHECKED: MJK CHECKED: MJK

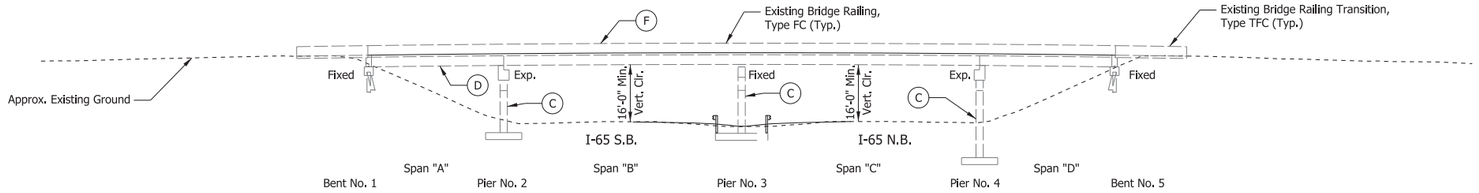
INDIANA
DEPARTMENT OF TRANSPORTATION

INDEX SHEET

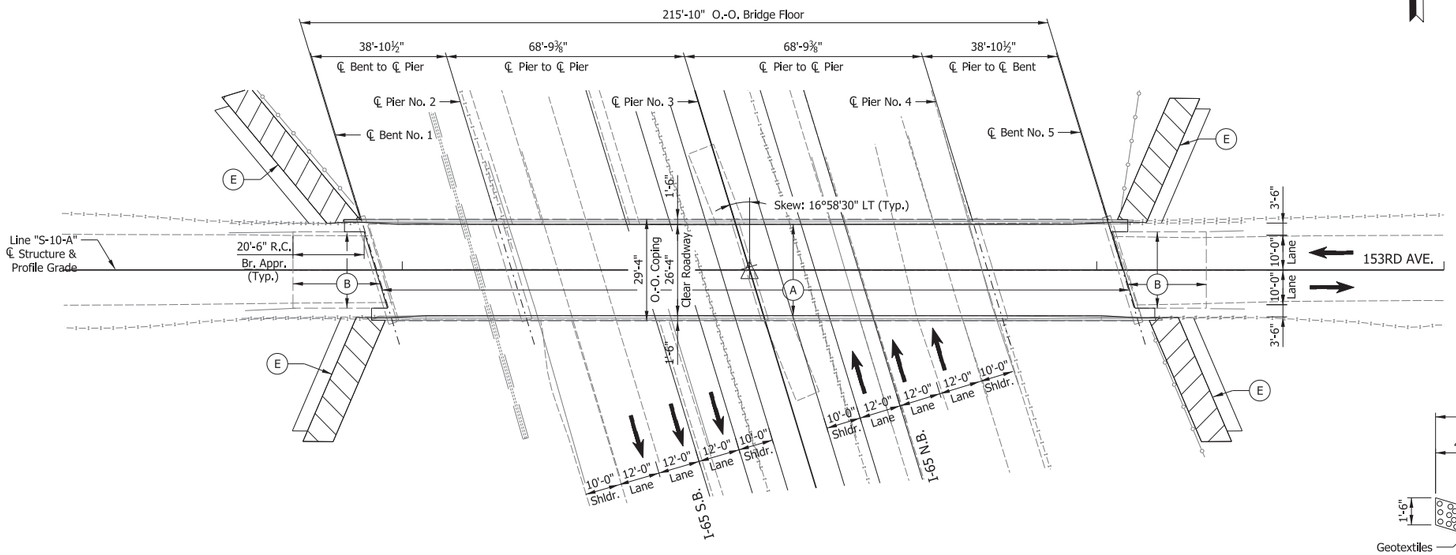
HORIZONTAL SCALE	BRIDGE FILE
NONE	I65-252-4897B
VERTICAL SCALE	DESIGNATION
NONE	1298545
SURVEY BOOK	SHEETS
ELECTRONIC	2 of 4
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B13_INDEX.01.dgn
22-JUL-2016

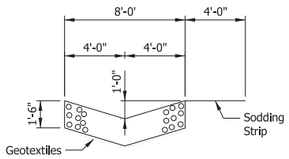
STRUCTURE IS BUILT TO A 800' VERTICAL CURVE



ELEVATION



PLAN



RIPRAP TURNOUT
TYPICAL SECTION
Not To Scale

GENERAL NOTES

Reinforcing steel covering shall be 2½" in Top and 1" min. in bottom of floor slabs, 3" in footing except bottom steel which shall be 4", and 2" in all other parts, unless noted.

All New Reinforcement Shall be Epoxy Coated.

Plans for the Existing Structure are on file in the Central Office, Indiana Dept. of Transportation as Bridge File No. I65-252-4897A, and are available upon request.

DESIGN DATA

Designed for HS-20 Loading, in accordance with AASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002, and its subsequent interims.

DEAD LOAD

Actual weight plus 35 psf. of future wearing surface and 15 psf for SIP Metal deck forms.

FLOOR SLAB

Designed with a 7½" structural depth, and a ½" integral wearing surface.

DESIGN STRESSES

CONCRETE

Class "A" Concrete	f'c = 3,500 p.s.i.
Class "B" Concrete	f'c = 3,000 p.s.i.
Class "C" Concrete	f'c = 4,000 p.s.i.

REINFORCING STEEL

Grade 60	f'y = 60,000 p.s.i.

LEGEND

(A) Remove existing concrete overlay, mill the existing bridge deck ½ inch depth and perform hydrodemolition to remove unsound concrete. Perform full depth patching as needed.

Place a variable depth (2¼ inch minimum to match existing profile) latex-modified concrete overlay on entire deck surface. Minimum cross slope shall be 1.5 percent. Replace expansion joints with precompressed foam joints. Patch underside of deck (Est. Qty.= 130 Sft.)

(B) Place surface seal on existing reinforced concrete approach slabs.

(C) Perform pier patching (Est. Qty.= 120 Sft.) and wrap the I-65 outside shoulder piers with a fiber wrap concrete encasement system. The fiber wrap shall extend vertically from 6 inch below ground to the bottom of the hammerhead pier cap and shall encase the traffic face and both edges of the pier.

(D) Patch concrete beam spalls in Span A. (Est. Qty.= 10 Sft.)

(E) Construct riprap turnouts.

(F) Surface seal existing bridge railings and copings.

153RD AVENUE OVER I-65
R.C. GIRDER AND STEEL BEAM BRIDGE
4 SPANS: 36'-0", 68'-0", 68'-0", 36'-0"
SKEW: 16°58'30" LT.
CLEAR ROADWAY: 26'-4"
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER _____ DATE

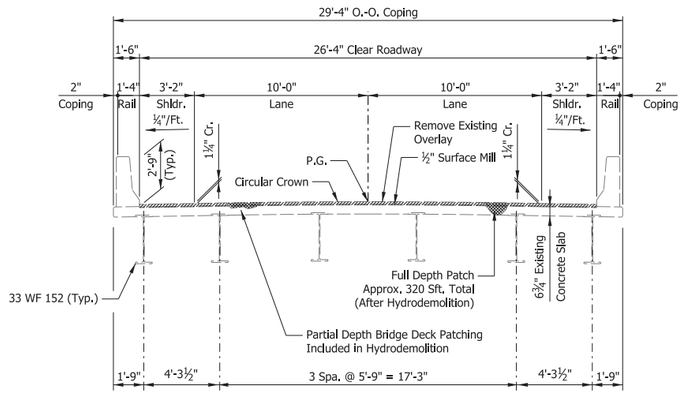
DESIGNED: RAM DRAWN: EWM
CHECKED: MJK CHECKED: MJK

INDIANA
DEPARTMENT OF TRANSPORTATION

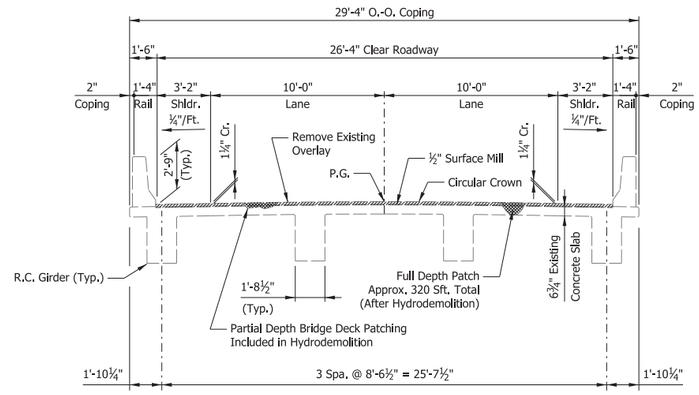
GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
1" = 20'	I65-252-4897B
VERTICAL SCALE	DESIGNATION
1" = 20'	1298545
SURVEY BOOK	SHEETS
ELECTRONIC	3 of 4
CONTRACT	PROJECT
R-37450	1172430

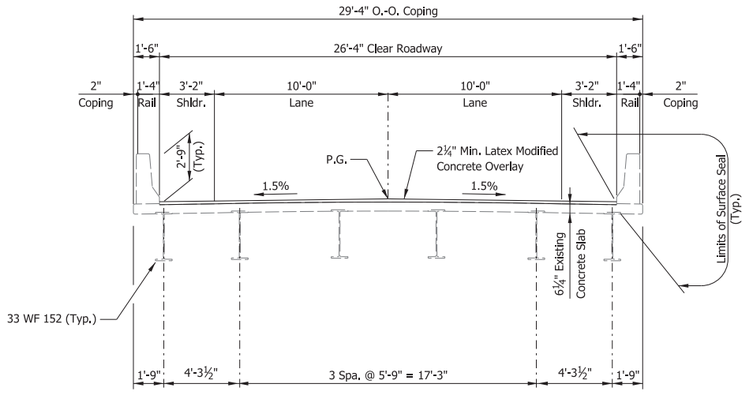
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20-JUL-2016



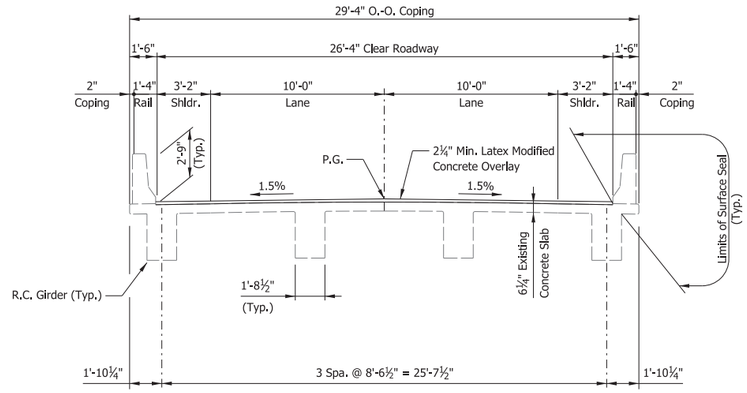
EXISTING TYPICAL SECTION SPANS B & C



EXISTING TYPICAL SECTION SPANS A & D



PROPOSED TYPICAL SECTION SPANS B & C



PROPOSED TYPICAL SECTION SPANS A & D

153RD AVENUE OVER I-65
R.C. GIRDER AND STEEL BEAM BRIDGE
4 SPANS: 36'-0", 68'-0", 68'-0", 36'-0"
SKEW: 16°58'30" LT.
CLEAR ROADWAY: 26'-4"
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: RAM DRAWN: EWM

CHECKED: MJK CHECKED: MJK

INDIANA
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN

HORIZONTAL SCALE	BRIDGE FILE
1/4" = 1'-0"	I65-252-4897B
VERTICAL SCALE	DESIGNATION
1/4" = 1'-0"	1298545
SURVEY BOOK	SHEETS
ELECTRONIC	4 of 4
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B13_GENERAL PLAN.02.dgn
20-JUL-2016

BRIDGE NO. 14 AND 15

I-65

WALSH PARSONS Walsh & Kelly

R-37450
SECTION C

PROJECT	DESIGNATION
1172430	1382207 (N.B.) & 1382208 (S.B.)
CONTRACT	BRIDGE FILE
R-37450	I65-249-04896CNBL & I65-249-04896CSBL

STRUCTURE INFORMATION				
STRUCTURES	TYPE	SPAN AND SKEW	OVER	STATION
I65-249-04896CNBL I65-249-04896CSBL	Continuous Composite Steel Beam Bridges	4 Spans: 33'-6", 2 @ 44'-3" & 33'-6" Skew: Square	S.R. 2	752+48.58 "A"

KIN DES. NUMBERS	DESCRIPTION	TYPE
1172430	I-65 ADDED TRAVEL LANES U.S. 231 TO U.S. 30	ROADWAY
1400349	I-65 ADDED TRAVEL LANES S.R. 2 TO U.S. 231	ROADWAY
1006741	PIPE LINER 2.64 MILES N OF S.R. 10	ROADWAY
1601115	93RD AVE. OVER I-65	BRIDGE
1600332	I-65 N.B. OVER BEAVER DAM	BRIDGE
1600331	I-65 S.B. OVER BEAVER DAM	BRIDGE
1600329	I-65 N.B. OVER 109TH AVE.	BRIDGE
1600330	I-65 S.B. OVER 109TH AVE.	BRIDGE
1601116	113TH AVE. OVER I-65	BRIDGE
1600327	I-65 N.B. OVER U.S. 231	BRIDGE
1600328	I-65 S.B. OVER U.S. 231	BRIDGE
1601117	137TH AVE. OVER I-65	BRIDGE
1382203	I-65 N.B. OVER WIRTZ DITCH	BRIDGE
1382204	I-65 S.B. OVER WIRTZ DITCH	BRIDGE
1298545	153RD AVE. OVER I-65	BRIDGE
0101469	I-65 N.B. OVER KANKAKEE RIVER	BRIDGE
0200140	I-65 S.B. OVER KANKAKEE RIVER	BRIDGE

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE REHABILITATION PLANS

FOR SPANS OVER 20 FEET

ROUTE: I-65 AT: RP 239+94

PROJECT NO. 1172430 P.E.

NO ADDITIONAL RIGHT-OF-WAY REQUIRED FOR THIS PROJECT

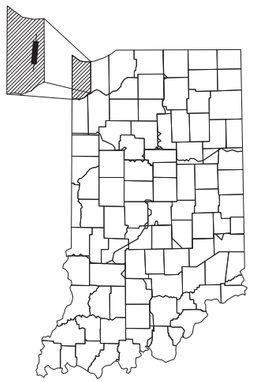
R/W

1172430 CONST.

Bridge Widening on I-65 over S.R. 2 Located Approx. 7.4 Miles South of U.S. 231
in Sections 23 & 26, T-33-N, R-8-W,
Eagle Creek Township, Lake County, Indiana

TRAFFIC DATA		I-65 N.B.L.	I-65 S.B.L.
A.A.D.T.	(2015)	25,990 V.P.D.	19,607 V.P.D.
A.A.D.T.	(2035)	31,464 V.P.D.	23,736 V.P.D.
D.H.V	(2035)	2,205 V.P.H.	1,663 V.P.H.
DIRECTIONAL DISTRIBUTION		57 %	43 %
TRUCKS		44 % A.A.D.T.	44 % A.A.D.T.
		44 % D.H.V.	44 % D.H.V.

DESIGN DATA	
DESIGN SPEED	70 M.P.H.
PROJECT DESIGN CRITERIA	PARTIAL RECONSTRUCTION 4R (FREEWAY)
FUNCTIONAL CLASSIFICATION	INTERSTATE
RURAL/URBAN	RURAL
TERRAIN	LEVEL
ACCESS CONTROL	FULL



PROJECT LOCATION SHOWN BY
Lake County

SCALE: 1" = 4000'

LATITUDE: 41°17'22" N LONGITUDE: 87°18'04" W

BRIDGE LENGTH:	0.029	MI.
ROADWAY LENGTH:	0.008	MI.
TOTAL LENGTH:	0.037	MI.
MAX. GRADE:	0.9%	%

MajorMoves 2020

INDIANA DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS DATED 2016
TO BE USED WITH THESE PLANS.

PARSONS
101 W. Ohio St., Suite 2121
Indianapolis, IN 46204
Bus (317) 616-1000
Fax (317) 616-1033

PLANS PREPARED BY: PARSONS 317-616-1000 PHONE NUMBER

CERTIFIED BY: _____ DATE

APPROVED FOR LETTING: _____ INDIANA DEPARTMENT OF TRANSPORTATION DATE

BRIDGE FILE	
I65-249-04896CNBL & 04896CSBL	
DESIGNATION	
1382207 & 1382208	
SURVEY BOOK	SHEETS
ELECTRONIC	1 of 17
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B14-B15_BRIDGE TITLE SHEET.01.dgn
21-JUL-2016

UTILITIES

ELECTRIC

NIPSCO Electric
MArk Lindsley
Phone: 219-647-4198

American Electric Power
Ngoc Alex KUrtz
Phone: 614-552-1332

GAS / PIPELINES

NIPSCO Gas
Neil Arndt
Phone: 219-647-4779

Buckeye Pipe Line Co., LP
Michael Norris
Phone: 219-313-5321

Enbridge Energy Company, Inc.
Michael Price
Phone: 219-922-7015

WATER

IN American Water Company, Inc.
Michael Seals
Phone: 317-885-2444

TELECOMMUNICATIONS

AT&T Indiana (Dist)
Angelo LaMantia
Phone: 219-662-4418

AT&T Transmission (LD)
Carl Donahue
Phone: 630-552-9785
Dean Norwich
Phone: 574-344-0833

Comcast Cable
Robert Schulter
Phone: 630-600-6307

Zayo Bandwidth LLC
Jason Gilpin
Phone: 260-570-5677

Northwest Indiana Telephone Co. Inc.
Don Schoenbeck
Phone: 219-996-0216

Indiana Fiber Network LLC
Jim Royer
Phone: 317-777-7115
317-280-4636

MISCELLANEOUS AGENCIES

Merrillville Conservancy Dist.
Charles Stojakovich
Phone: 219-980-5220

City of Crown Point
Jay Olson
Phone: 219-662-3252
Kent Swinehart
Phone: 219-661-2287

INDOT ITS
Technology Deployment Division
Ed Cox
Phone: 317-899-8601

INDOT LaPorte District
(Signals Lighting)
Andy Costello
Phone: 219-325-7483

Indiana811 Know what's below. Call before you dig.

INDEX

SHEET NO.	SUBJECT
1	TITLE
2	INDEX
3	MAINTENANCE OF TRAFFIC
4	REMOVAL DETAILS
5	LAYOUT
6-8	GENERAL PLAN
9-10	END BENT DETAILS
11	PIER DETAILS
12	FRAMING PLAN
13-15	SUPERSTRUCTURE DETAILS
16-17	R.C. BRIDGE APPROACH DETAILS

REVISIONS

SHEET NO.	DATE	REVISED

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: EWM DRAWN: EWM

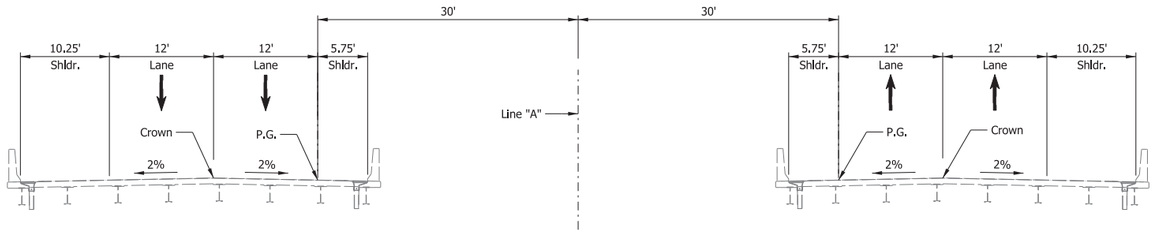
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INDIANA
DEPARTMENT OF TRANSPORTATION

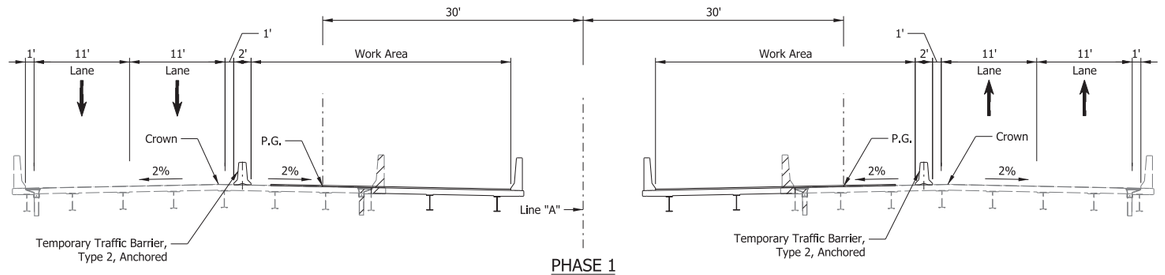
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HORIZONTAL SCALE	BRIDGE FILE
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VERTICAL SCALE	DESIGNATION
NO SCALE	1382207 & 1382208
SURVEY BOOK	SHEETS
ELECTRONIC	2 of 17
CONTRACT	PROJECT
R-37450	1172265

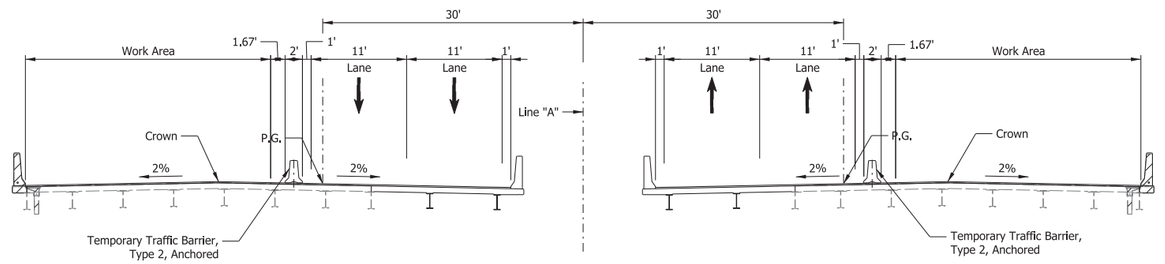
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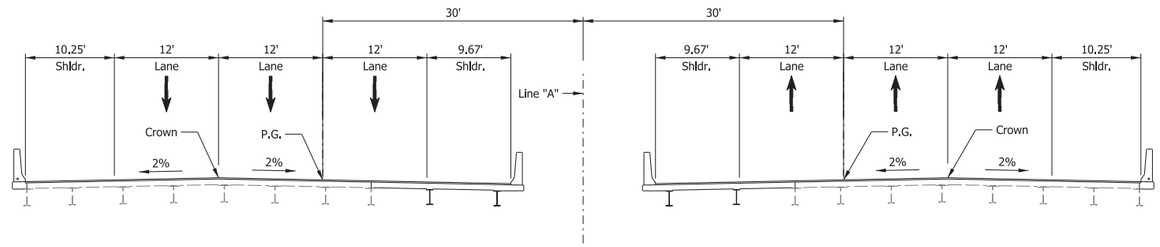
EXISTING TYPICAL SECTION



PHASE 1



PHASE 2



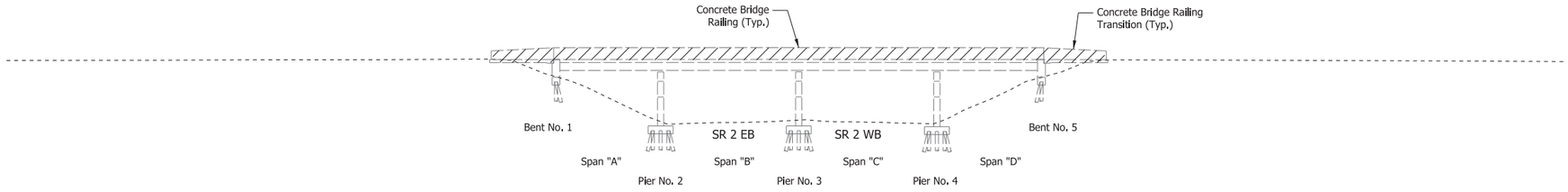
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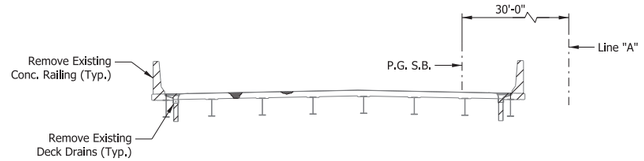
Hatched areas indicate limits of removal.

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				VERTICAL SCALE: 1/8" = 1'-0" / DESIGNATION: 1382207 & 1382208
		DESIGNED: SDW / DRAWN: ALF	MAINTENANCE OF TRAFFIC	SURVEY BOOK / SHEETS
		CHECKED: MJK / CHECKED: MJK		ELECTRONIC: 3 of 17
				CONTRACT: R-37450 / PROJECT: 1172430

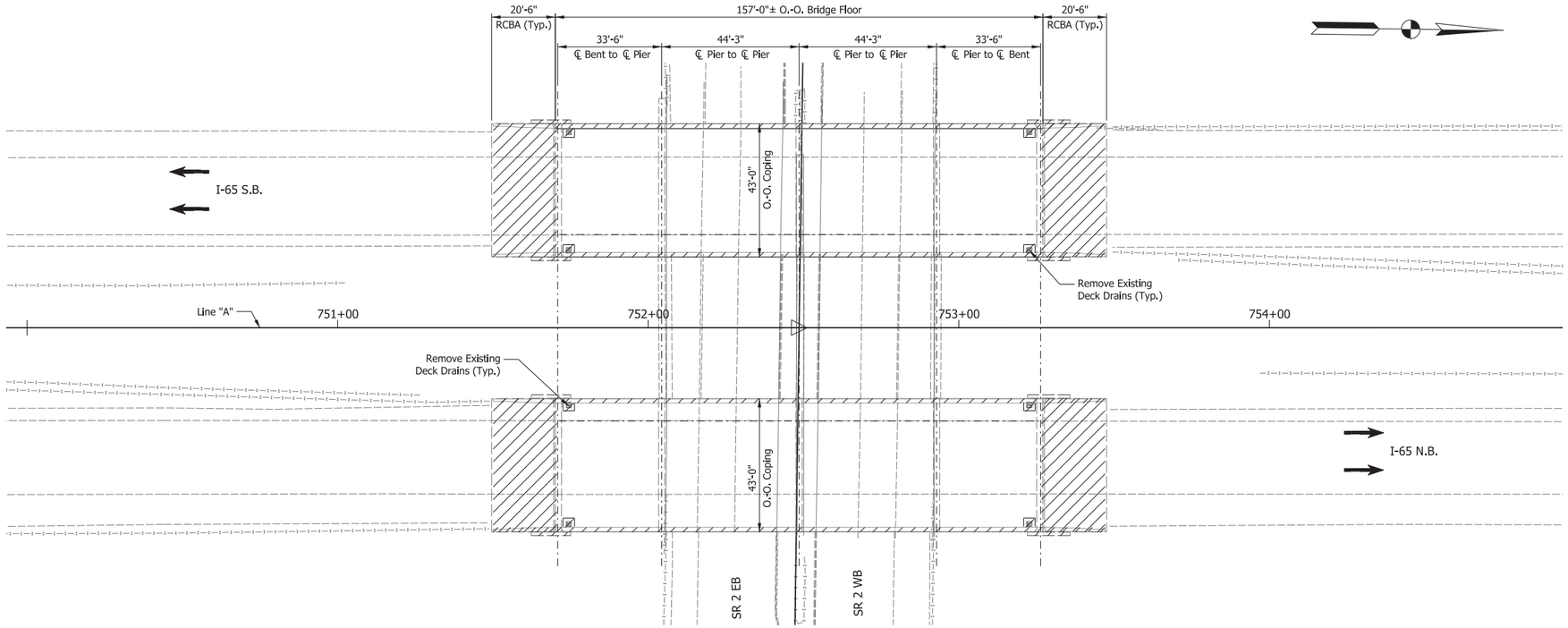
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21-JUL-2016



ELEVATION



TYPICAL SECTION
(S.B. Shown, N.B. Similar)
Not To Scale



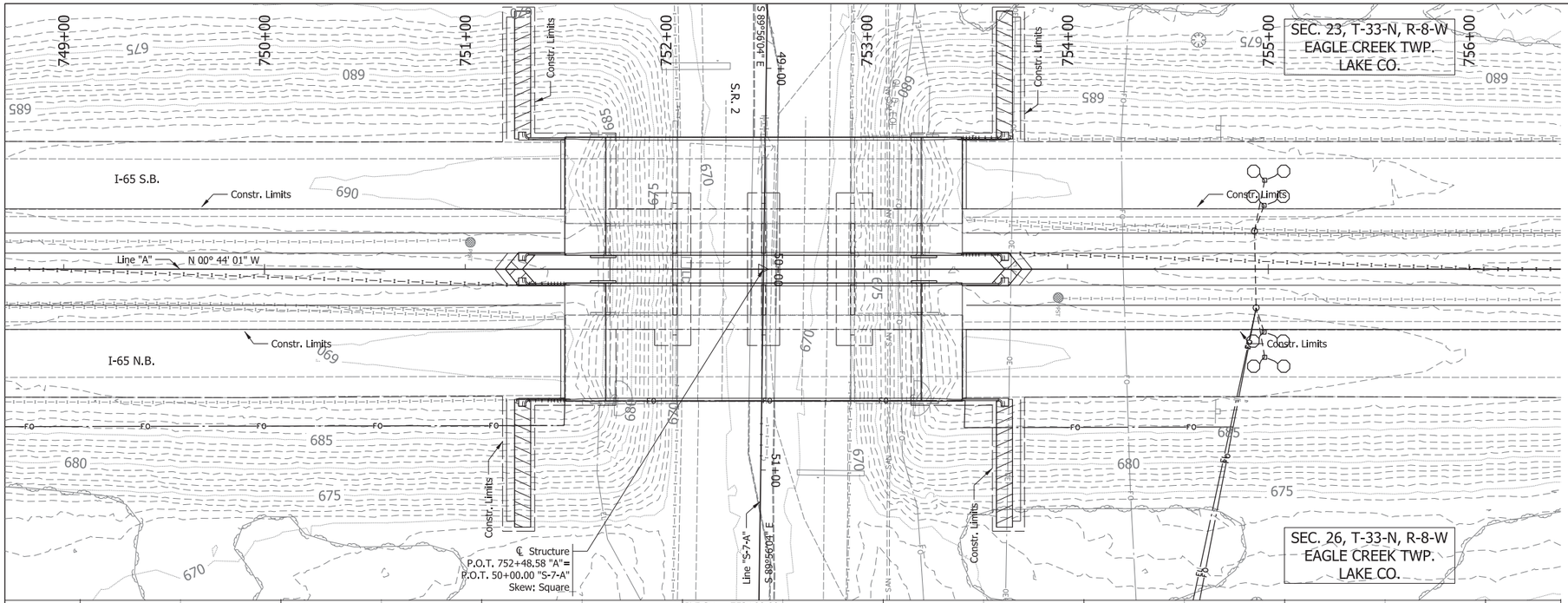
PLAN

NOTES:

Hatched areas indicate limits of existing structure removal.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 1" = 20'	BRIDGE FILE I65-249-04896CNBL & 04896CSBL
				VERTICAL SCALE 1" = 20'	DESIGNATION 1382207 & 1382208
		DESIGNED: SDW DRAWN: ALF	REMOVAL DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	4 of 17
				CONTRACT	PROJECT
				R-37450	1172430

IP_PWP:dms13737\I65_NORTHWEST_B14-B15_REMOVAL DETAIL.01.dgn
21-JUL-2016



EXISTING STRUCTURE

The existing steel beam bridge was built in 1962 with 4- spans: 33'-0", 2 @ 44'-3", and 33'-0" with a 40'-0" clear roadway and reinforced concrete deck. Existing structure to be Widened.

NOTES:

For R/W and Additional information see Roadway Plan & Profile sheets.

For Utility Contacts see Index Sheet No.2.

Hatched areas indicate limits of revetment riprap for riprap drainage turnouts. (Est. Riprap Qty. = TBD Tons) (Est. Geotextiles Qty. = TBD Sys.)

I-65 OVER S.R. 2
CONTINUOUS STEEL BEAM BRIDGES
4 SPANS: 33'-6", 2 @ 44'-3", 33'-6"
SKEW: SQUARE
2 CLEAR ROADWAYS: 55'-11" N.B., S.B.
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: SDW DRAWN: ALF

CHECKED: MJK CHECKED: MJK

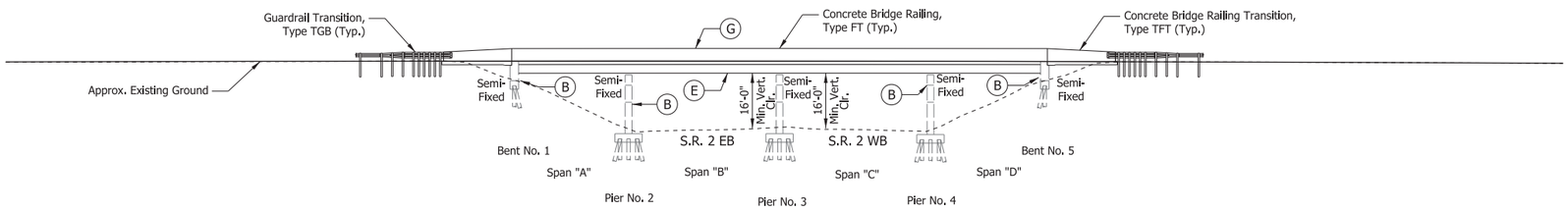
INDIANA
DEPARTMENT OF TRANSPORTATION

LAYOUT

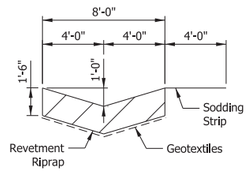
HORIZONTAL SCALE	BRIDGE FILE
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VERTICAL SCALE	DESIGNATION
1" = 10'-0"	1382207 & 1382208
SURVEY BOOK	SHEETS
ELECTRONIC	5 of 17
CONTRACT	PROJECT
R-37450	1172265

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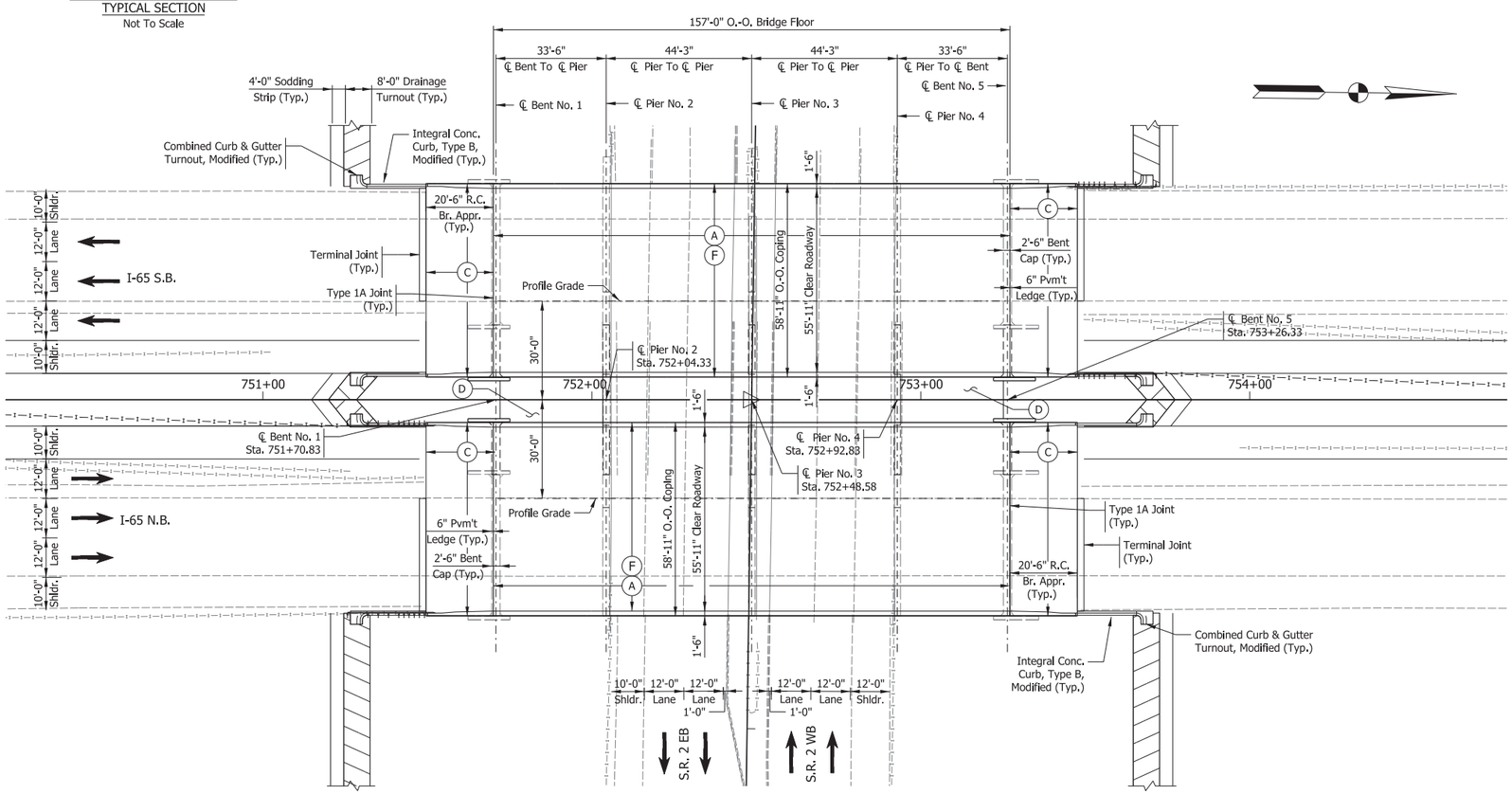
STRUCTURE BUILT TO AN 1500' VERTICAL CURVE



ELEVATION



RIPRAP DRAINAGE TURNOUT
TYPICAL SECTION
Not To Scale



PLAN

GENERAL NOTES

Reinforcing steel covering shall be 2½" in Top and 1" min. in bottom of floor slabs, 3" in footing except bottom steel which shall be 4", and 2" in all other parts, unless noted.

All New Reinforcement Shall be Epoxy Coated. Unless Otherwise Noted.

Plans for the Existing Structure are on file in the Central Office, Indiana Dept. of Transportation as Bridge File No. I65-249-4896B and are available upon request.

DESIGN DATA

Designed for HS-20 Loading, in accordance with AASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002, and its subsequent interims.

DEAD LOAD

Actual weight plus 35 psf. of future wearing surface and 15 psf for SIP Metal deck forms.

FLOOR SLAB

Designed with a 7½" structural depth, and a ½" integral wearing surface.

DESIGN STRESSES

CONCRETE

Class "A" Concrete	f'c = 3,500 p.s.i.
Class "B" Concrete	f'c = 3,000 p.s.i.
Class "C" Concrete	f'c = 4,000 p.s.i.

REINFORCING STEEL

Grade 60	f'y = 60,000 p.s.i.

LEGEND

(A) Mill ¼" of the existing bridge deck and perform hydrodemolition. Perform full and partial depth bridge deck patching as needed. Remove a portion of the existing concrete bridge deck coping sufficient to connect the widened deck and to remove unsound concrete. Widen the concrete bridge deck, matching the milled existing bridge deck thickness. Place a variable depth (1¾" min.) latex-modified concrete overlay on existing and widened bridge deck surface.

(B) Widen the end bents and piers in kind. Perform pier patching to areas of delamination and spalling. (Est. Qty.= 120 Sft. Total, 60 Sft. per Structure)

(C) Replace existing reinforced concrete approach slabs and transitions.

(D) Construct concrete slopewall in widened end bent area.

(E) New structural steel shall be painted to match the color of existing structural steel.

(F) Place sacrificial embedded galvanic anodes along all interfaces where cleaned and straightened steel reinforcing bars are cast in new concrete.

(G) Install ITS conduit in bridge railing.

NOTES:

Hatched areas indicate limits of revetment riprap for riprap drainage turnouts. (See Layout for Quantities).

I-65 OVER S.R. 2
CONTINUOUS STEEL BEAM BRIDGES
4 SPANS: 33'-6", 2 @ 44'-3", 33'-6"
SKEW: SQUARE
2 CLEAR ROADWAYS: 55'-11" N.B., S.B.
LAKE COUNTY

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: SDW DRAWN: ALF

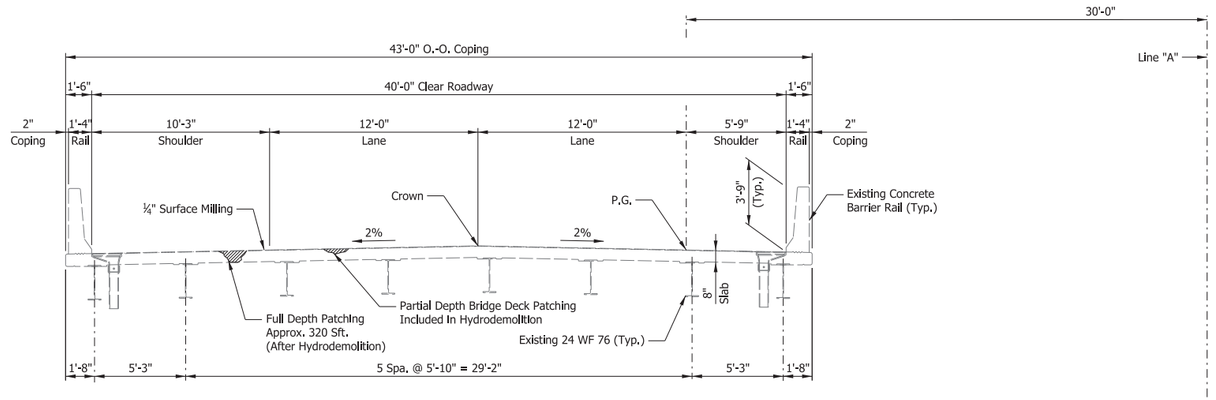
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INDIANA
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN

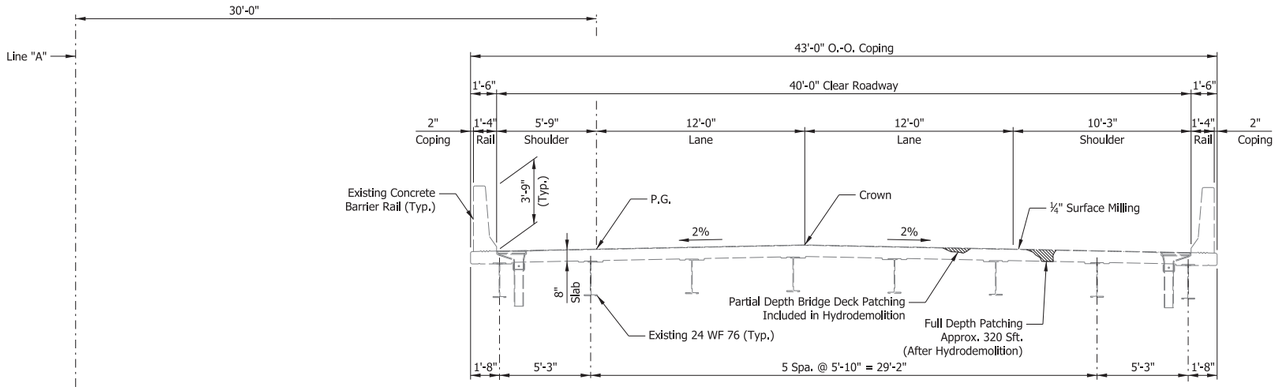
HORIZONTAL SCALE	BRIDGE FILE
1" = 20'-0"	I65-249-04896CNBL & 04896CSBL
VERTICAL SCALE	DESIGNATION
1" = 20'-0"	1382207 & 1382208
SURVEY BOOK	SHEETS
ELECTRONIC	6 of 17
CONTRACT	PROJECT
R-37450	1172265

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22-JUL-2016



EXISTING TYPICAL SECTION

(S.B. Shown)



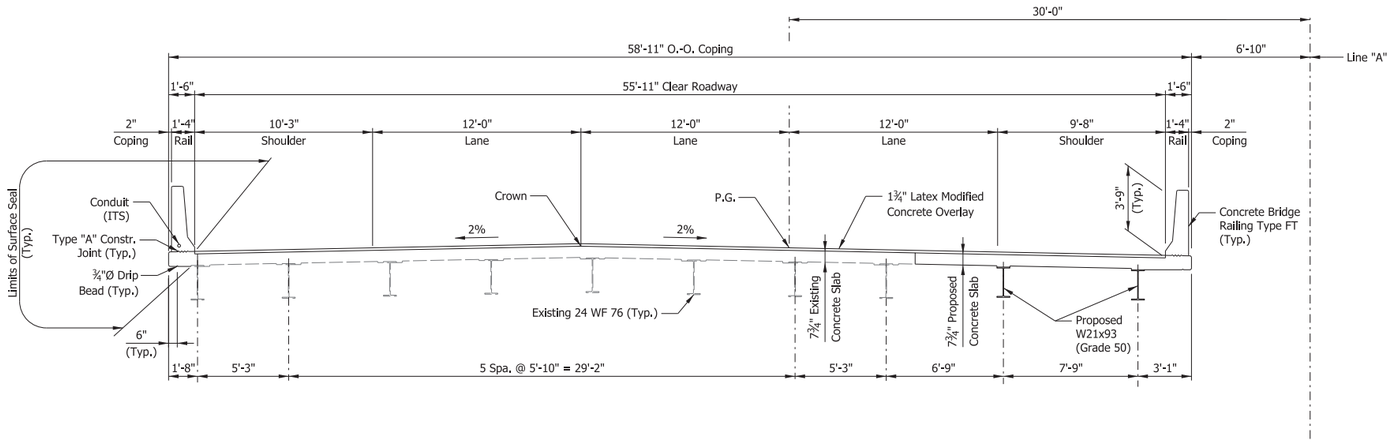
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(N.B. Shown)

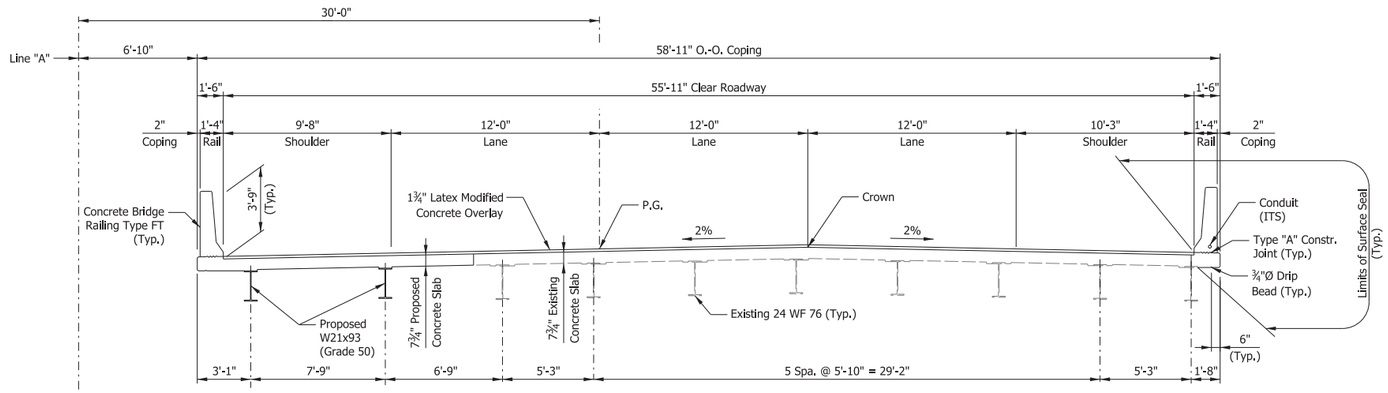
I-65 OVER S.R. 2
CONTINUOUS STEEL BEAM BRIDGES
4 SPANS: 33'-6", 2 @ 44'-3", 33'-6"
SKEW: SQUARE
2 CLEAR ROADWAYS: 55'-11" N.B., S.B.
LAKE COUNTY

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 1/4" = 1'-0"	BRIDGE FILE I65-249-04896CNBL & 04896CSBL
				VERTICAL SCALE 1/4" = 1'-0"	DESIGNATION 1382207 & 1382208
		DESIGNED: SDW DRAWN: ALF	GENERAL PLAN	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	7 of 17
				CONTRACT R-37450	PROJECT 1172265

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21-JUL-2016



PROPOSED TYPICAL SECTION
(S.B. Shown)

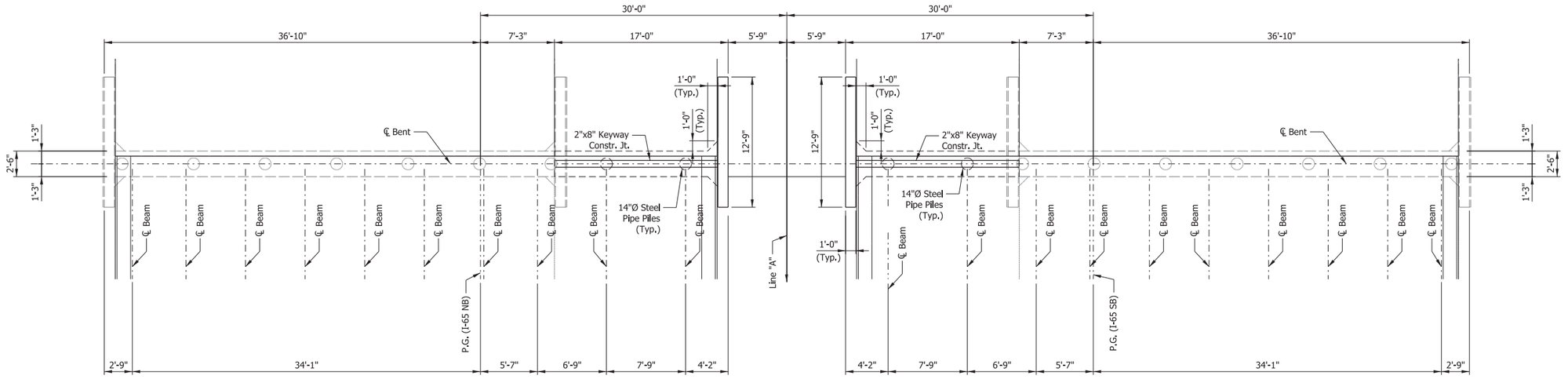


PROPOSED TYPICAL SECTION
(N.B. Shown)

I-65 OVER S.R. 2
CONTINUOUS STEEL BEAM BRIDGES
4 SPANS: 33'-6", 2 @ 44'-3", 33'-6"
SKEW: SQUARE
2 CLEAR ROADWAYS: 55'-11" N.B., S.B.
LAKE COUNTY

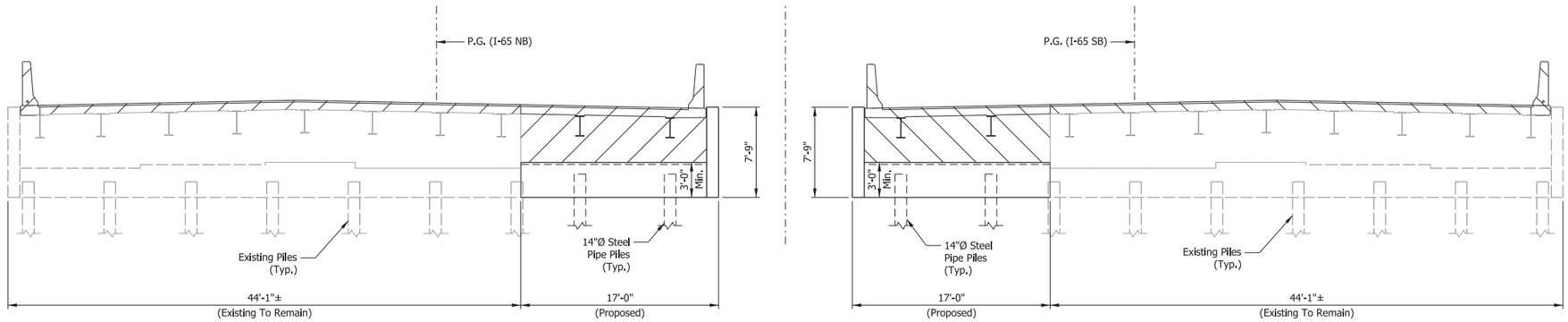
		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 1/4" = 1'-0"	BRIDGE FILE: I65-249-04896CNBL & 04896CSBL
				VERTICAL SCALE: 1/4" = 1'-0"	DESIGNATION: 1382207 & 1382208
		DESIGNED: SDW DRAWN: ALF	GENERAL PLAN	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC: 8 of 17	
				CONTRACT: R-37450	PROJECT: 1172265

IP_PWP:dms13737\I65_NORTHWEST_B14-B15_GENERAL PLAN.03.dgn
21-JUL-2016



PLAN @ BENT NO.1

(Bent No. 5 Same By Opposite Hand)



ELEVATION @ BENT NO.1

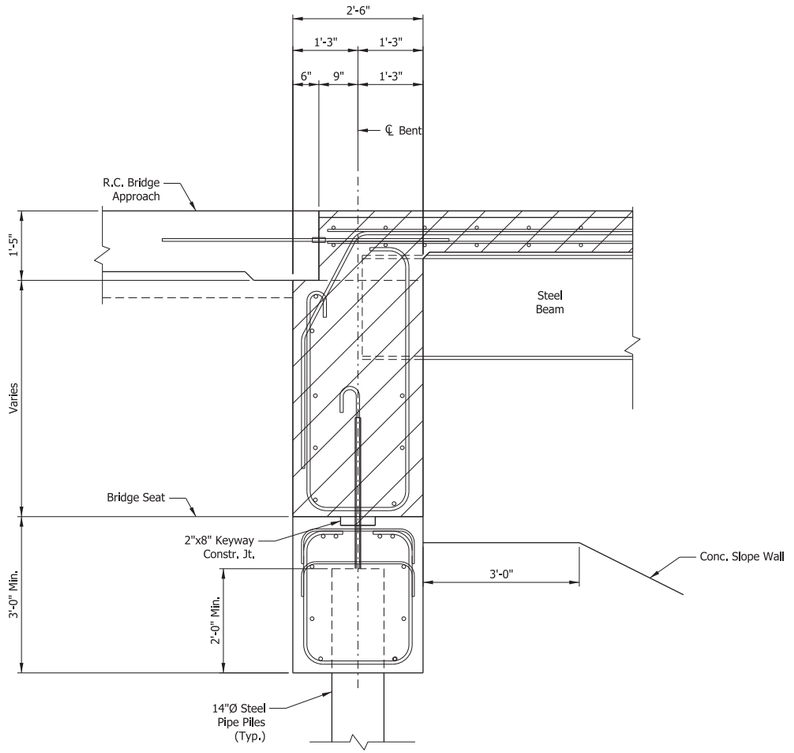
(Bent No. 5 Same By Opposite Hand)

NOTES:

Hatched areas to be poured with superstructure.

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE	3/16" = 1'-0"	BRIDGE FILE	I65-249-04896CNBL & 04896CSBL
		VERTICAL SCALE	3/16" = 1'-0"	DESIGNATION	1382207 & 1382208
DESIGNED: SDW DRAWN: ALF	END BENT DETAILS	SURVEY BOOK		SHEETS	
		ELECTRONIC		9 of 17	
CHECKED: MJK CHECKED: MJK		CONTRACT	R-37450	PROJECT	1172430

IP_PWP:dms13737\I65_NORTHWEST_B14-B15_END BENT.01.dgn
21-JUL-2016



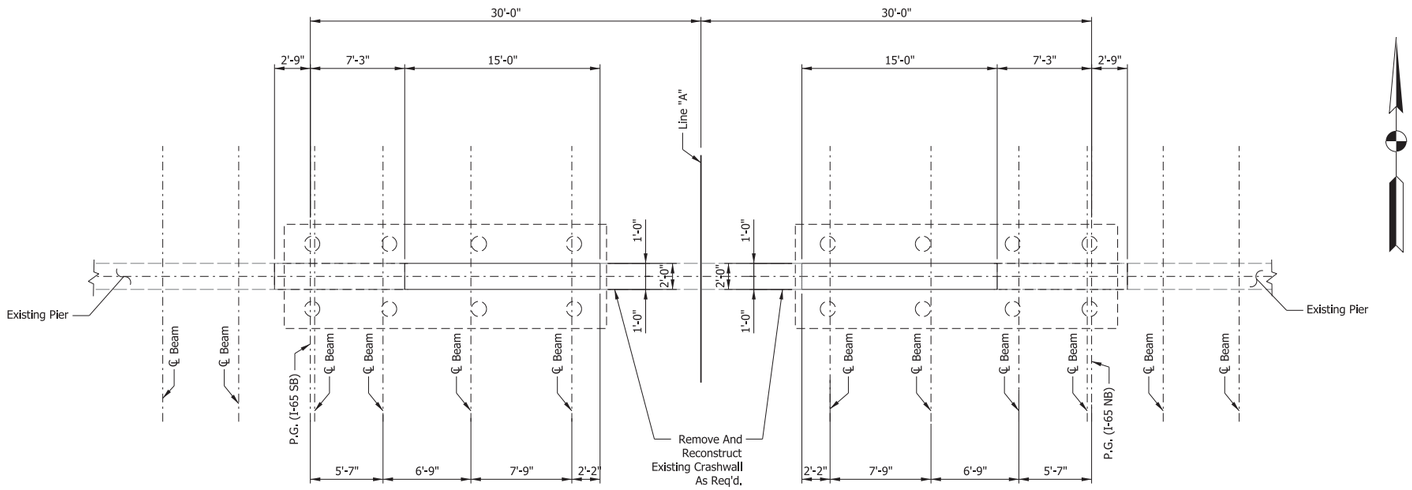
TYPICAL PROPOSED SECTION
@ BENT NO.1
(Bent No.5 Same)

NOTES:

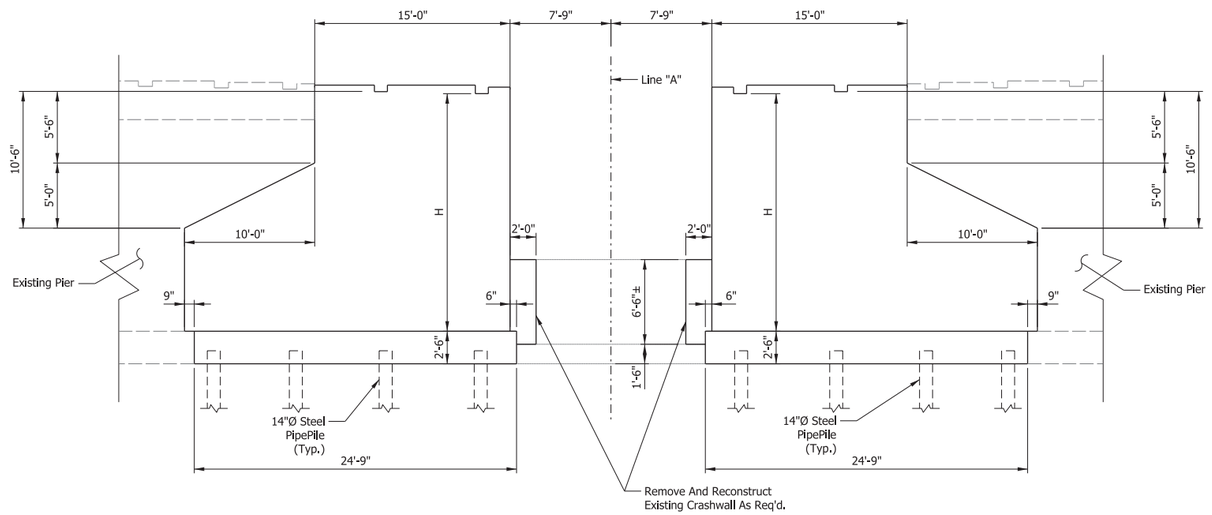
Hatched areas to be poured with superstructure.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 3/4" = 1'-0"	BRIDGE FILE: I65-249-04896CNBL & 04896CSBL
				VERTICAL SCALE: 3/4" = 1'-0"	DESIGNATION: 1382207 & 1382208
		DESIGNED: SDW / DRAWN: ALF	END BENT DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK / CHECKED: MJK		ELECTRONIC	10 of 17
				CONTRACT: R-37450	PROJECT: 1172430

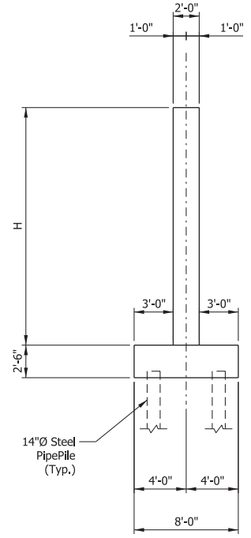
IP_PWP:dms13737\I65_NORTHWEST_B14-B15_END BENT.02.dgn
21-JUL-2016



PLAN @ PIER NO.2
(Piers No. 3 & 4 Same)



ELEVATION @ PIER NO.2
(Piers No. 3 & 4 Same)



TYPICAL PROPOSED SECTION
(Piers No. 3 & 4 Same)

LOCATION	H
Piers No.2,4	18'-3"
Pier No.3	19'-1"

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER _____ DATE

DESIGNED: SDW DRAWN: ALF

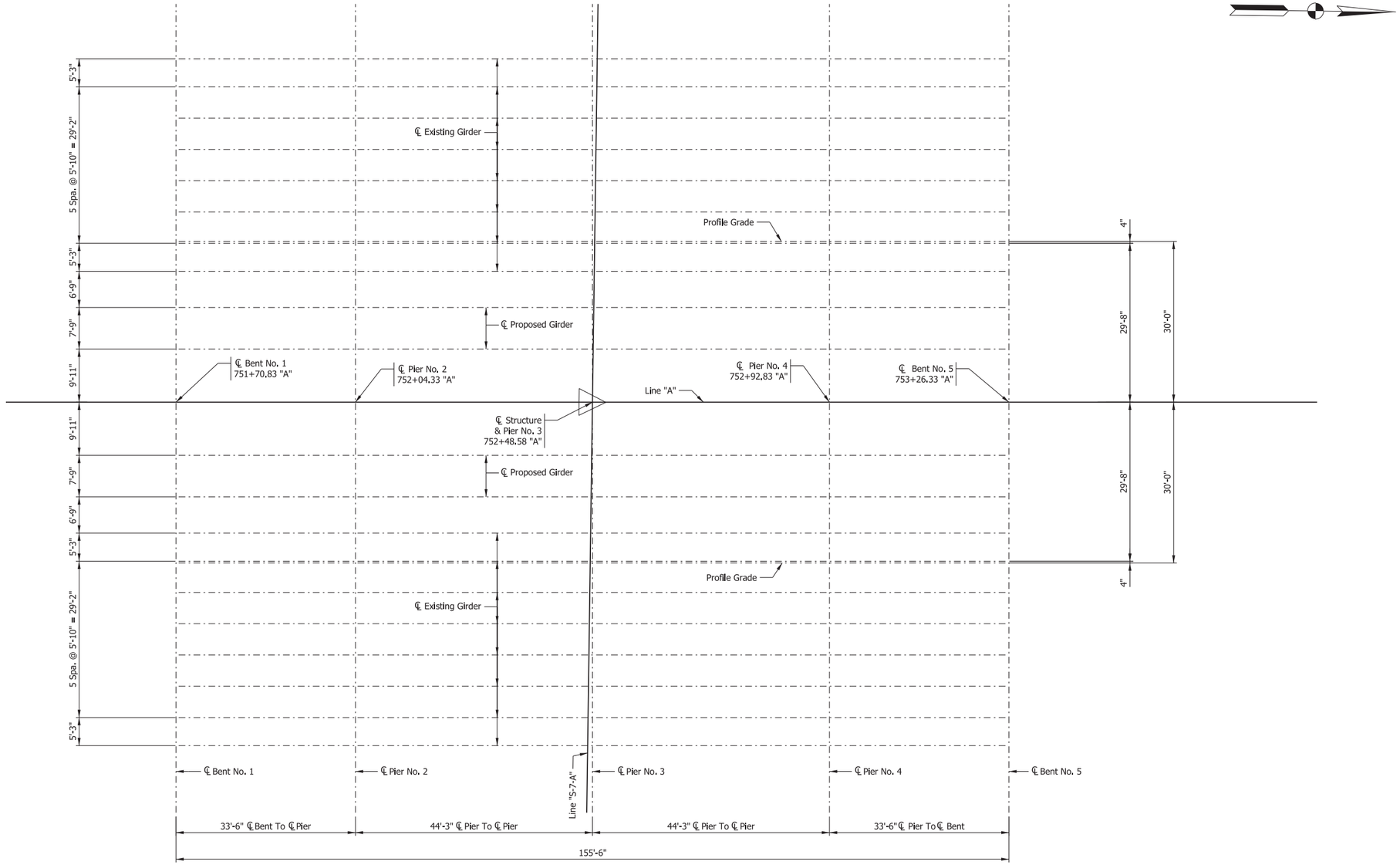
CHECKED: MJK CHECKED: MJK

INDIANA
DEPARTMENT OF TRANSPORTATION

PIER DETAILS

HORIZONTAL SCALE	3/16" = 1'-0"
VERTICAL SCALE	3/16" = 1'-0"
BRIDGE FILE	I65-249-04896CNBL & 04896CSBL
DESIGNATION	1382207 & 1382208
SURVEY BOOK	
SHEETS	
ELECTRONIC	11 of 17
CONTRACT	R-37450
PROJECT	1172430

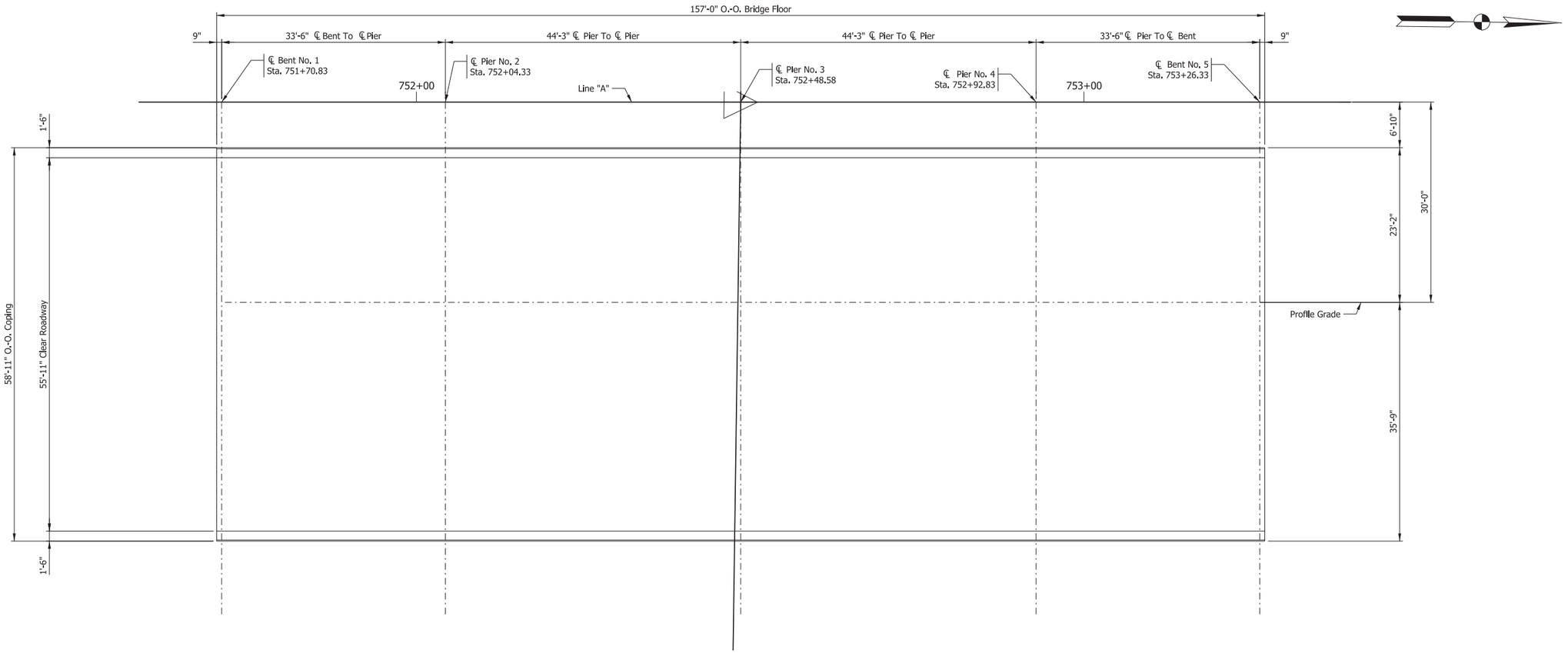
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21-JUL-2016



PLAN

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 1" = 10'	BRIDGE FILE: I65-249-04896CNBL & 04896CSBL
				VERTICAL SCALE: 1" = 10'	DESIGNATION: 1382207 & 1382208
		DESIGNED: SDW / DRAWN: ALF	FRAMING PLAN	SURVEY BOOK / ELECTRONIC	SHEETS: 12 of 17
		CHECKED: MJK / CHECKED: MJK		CONTRACT: R-37450	PROJECT: 1172430

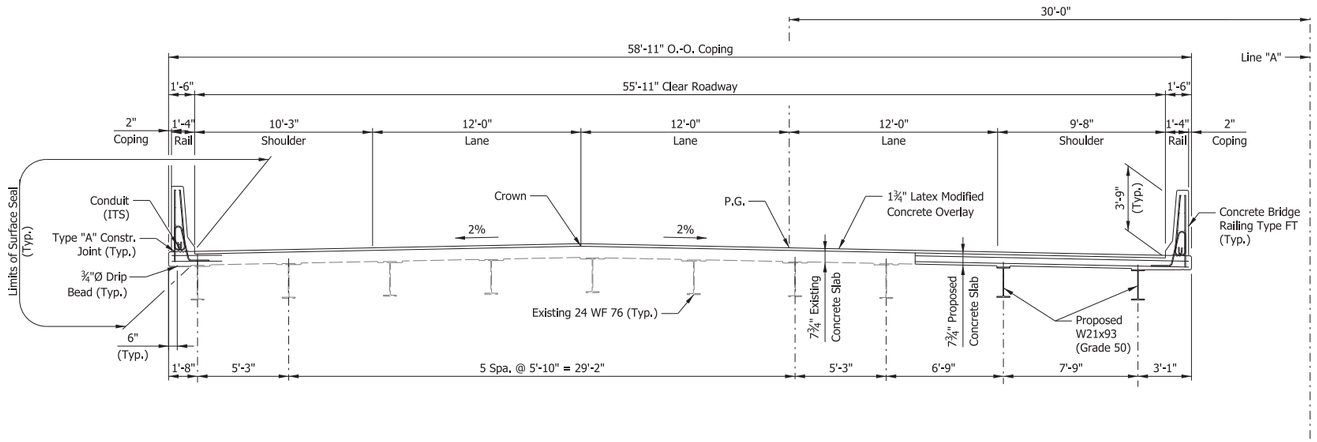
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21-JUL-2016



PLAN
(NB Shown, SB Same)

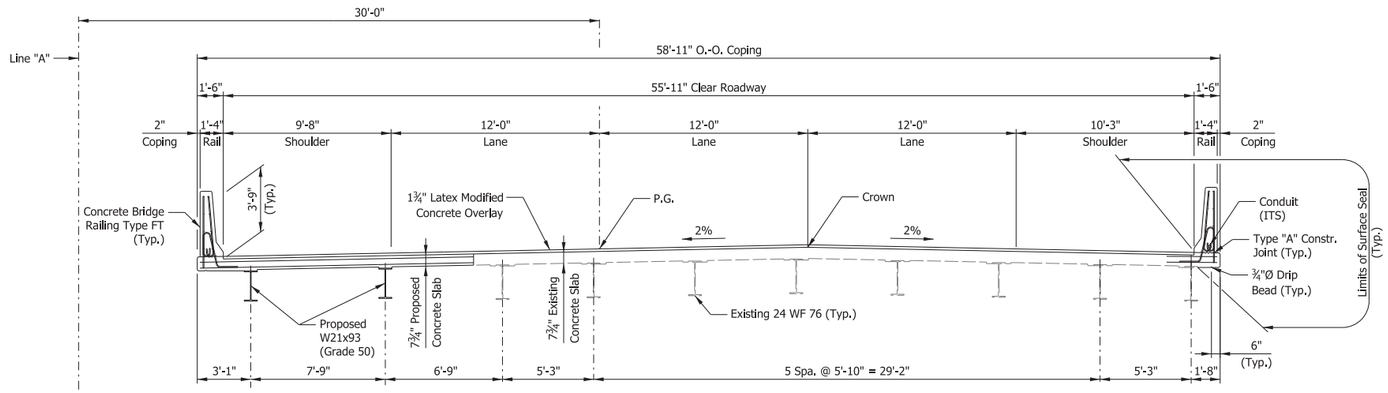
		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 1/8" = 1'-0"	BRIDGE FILE: I65-249-04896CNBL & 04896CSBL
				VERTICAL SCALE: 1/8" = 1'-0"	DESIGNATION: 1382207 & 1382208
		DESIGNED: SDW / DRAWN: ALF	SUPERSTRUCTURE DETAILS	SURVEY BOOK	SHEETS: 13 of 17
		CHECKED: MJK / CHECKED: MJK		ELECTRONIC	
				CONTRACT: R-37450	PROJECT: 1172265

IP_PWP:dms13737\I65_NORTHWEST_B14-B15_SUPERSTRUCTURE.01.dgn
21-JUL-2016



PROPOSED TYPICAL SECTION

(S.B. Shown)

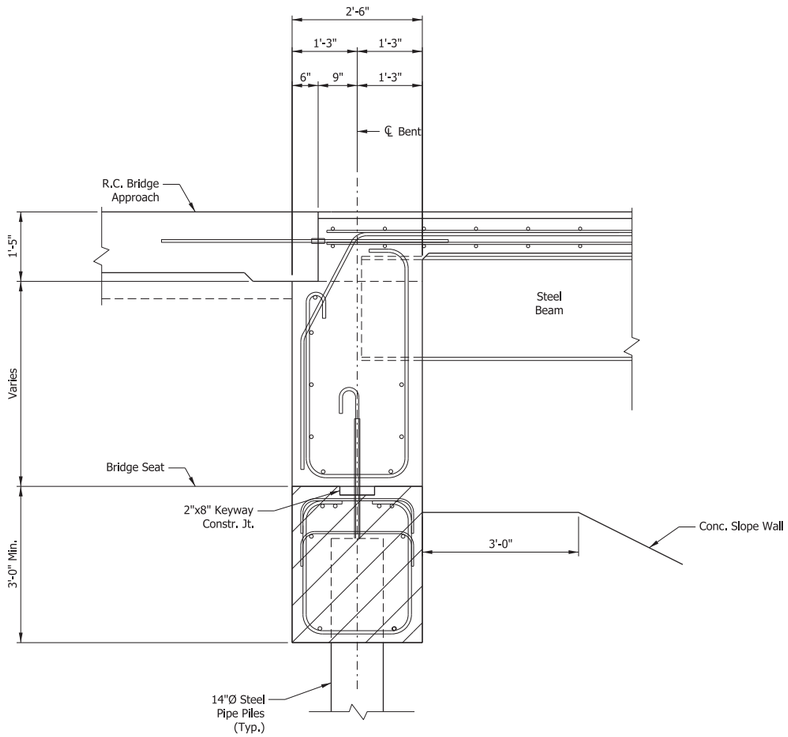


PROPOSED TYPICAL SECTION

(N.B. Shown)

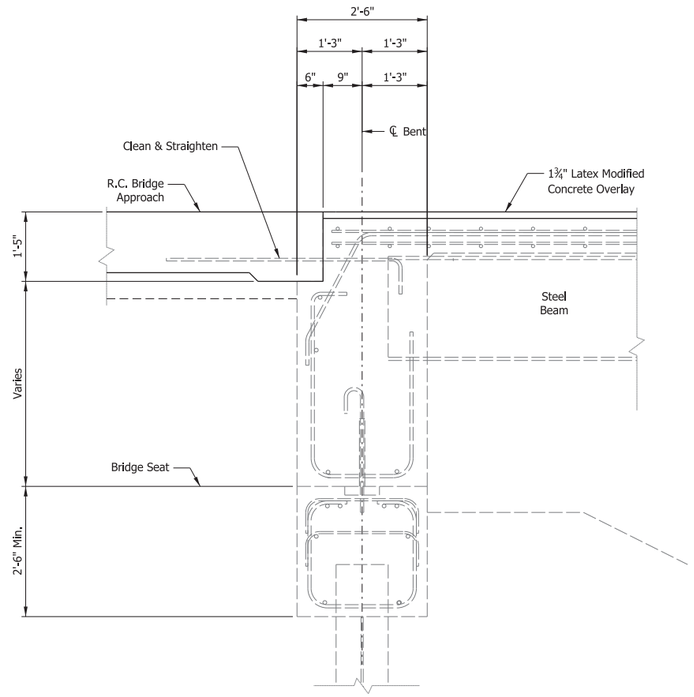
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				VERTICAL SCALE: 1/4" = 1'-0"	DESIGNATION: 1382207 & 1382208
		DESIGNED: SDW DRAWN: ALF	SUPERSTRUCTURE DETAILS	SURVEY BOOK: ELECTRONIC	SHEETS: 14 of 17
		CHECKED: MJK CHECKED: MJK		CONTRACT: R-37450	PROJECT: 1172265

IP_PWP:dms13737\I65_NORTHWEST_B14-B15_SUPERSTRUCTURE.02.dgn
21-JUL-2016



TYPICAL PROPOSED SECTION
@ BENT NO.1

(Bent No.5 Same)



TYPICAL EXISTING SECTION
@ BENT NO.1

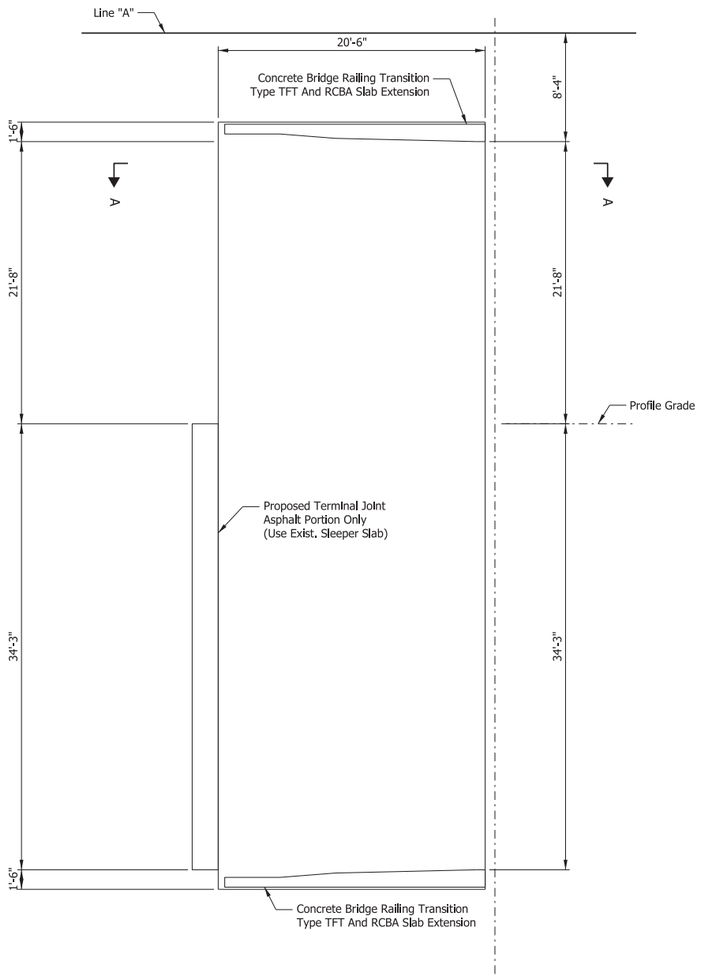
(Bent No.5 Same)

NOTES:

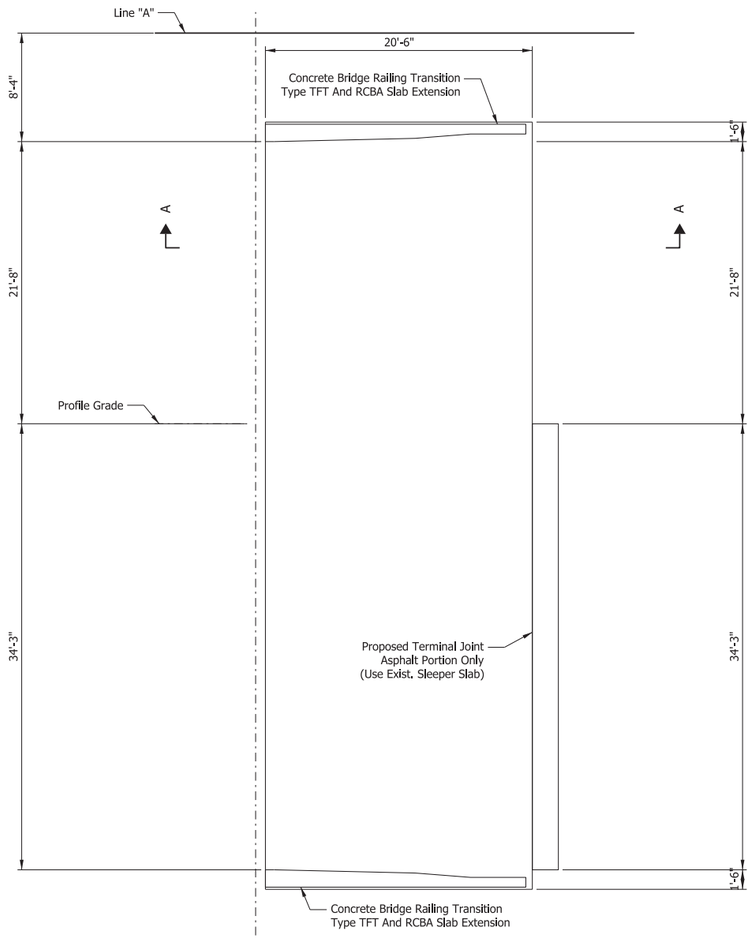
Hatched areas to be poured with substructure.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: 3/4" = 1'-0"	BRIDGE FILE: I65-249-04896CNBL & 04896CSBL
				VERTICAL SCALE: 3/4" = 1'-0"	DESIGNATION: 1382207 & 1382208
		DESIGNED: SDW / DRAWN: ALF	SUPERSTRUCTURE DETAILS	SURVEY BOOK: ELECTRONIC	SHEETS: 15 of 17
		CHECKED: MJK / CHECKED: MJK		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13737\I65_NORTHWEST_B14-B15_SUPERSTRUCTURE.03.dgn
21-JUL-2016



PLAN @ BENT NO.1 N.B.
(S.B. Same By Opposite Hand)



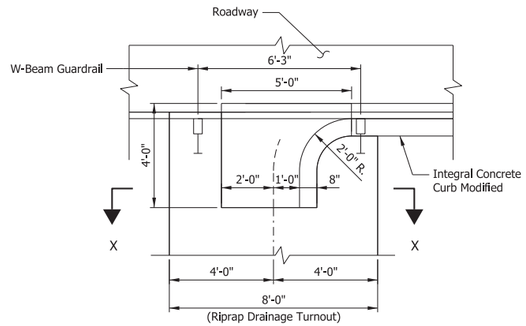
PLAN @ BENT NO.2 N.B.
(S.B. Same By Opposite Hand)

NOTE:

For Section A-A see sheet no. 17.

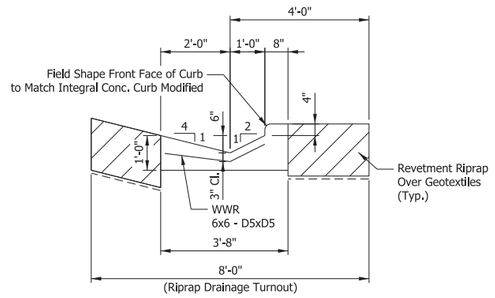
		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE 3/16" = 1'-0"	BRIDGE FILE I65-249-04896CNBL & 04896CSBL
				VERTICAL SCALE 3/16" = 1'-0"	DESIGNATION 1382207 & 1382208
		DESIGNED: SDW / DRAWN: ALF	R.C. BRIDGE APPROACH DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK / CHECKED: MJK		ELECTRONIC	16 of 17
				CONTRACT R-37450	PROJECT 1172265

IP_PWP:dms13737\I65_NORTHWEST_B14-B15_APPR SLAB.01.dgn
22-JUL-2016



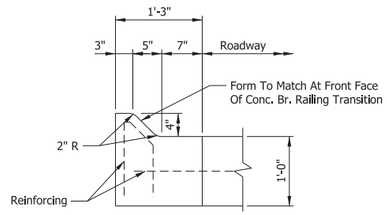
COMBINED CURB & GUTTER
TURNOUT, MODIFIED

Scale: ⅜" = 1'-0"



SECTION X-X

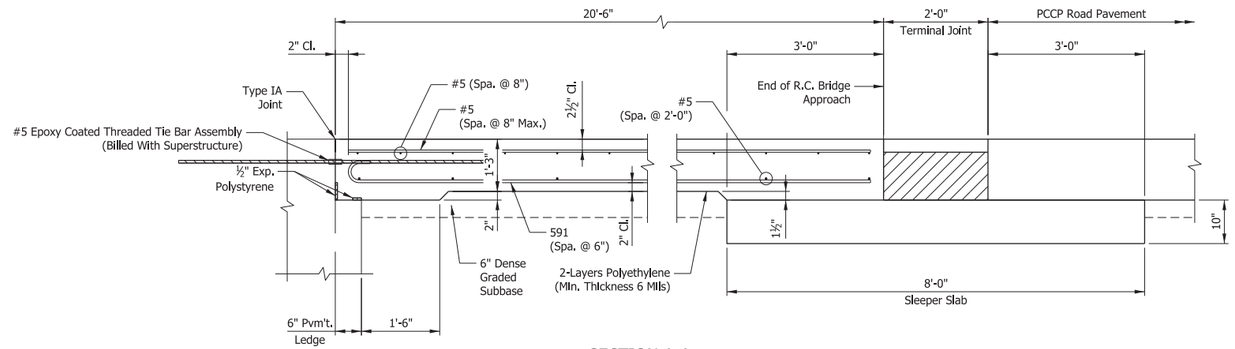
Scale: ½" = 1'-0"



NOTE:
For Reinforcing and Additional Details,
see Standard Drawing E605-CCIN-01.

TYPICAL SECTION
INTEGRAL CONCRETE CURB
MODIFIED, TYPE B

Scale: 1" = 1'-0"



SECTION A-A

Scale: ¾" = 1'-0"

NOTES:

For Reinforcing Bar Notes, see Standard Drawing E703-BRST-01.

All reinforcing steel to be epoxy coated.

For Concrete Bridge Railing Transition Details, see Standard Drawings E706-CBRT-03 & -04.

Surface seal all exposed surfaces of the approaches.

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	HORIZONTAL SCALE: AS NOTED	BRIDGE FILE: I65-249-04896CNBL & 04896CSBL
				VERTICAL SCALE: AS NOTED	DESIGNATION: 1382207 & 1382208
		DESIGNED: SDW DRAWN: ALF	R.C. BRIDGE APPROACH DETAILS	SURVEY BOOK	SHEETS
		CHECKED: MJK CHECKED: MJK		ELECTRONIC	17 of 17
				CONTRACT: R-37450	PROJECT: 1172265

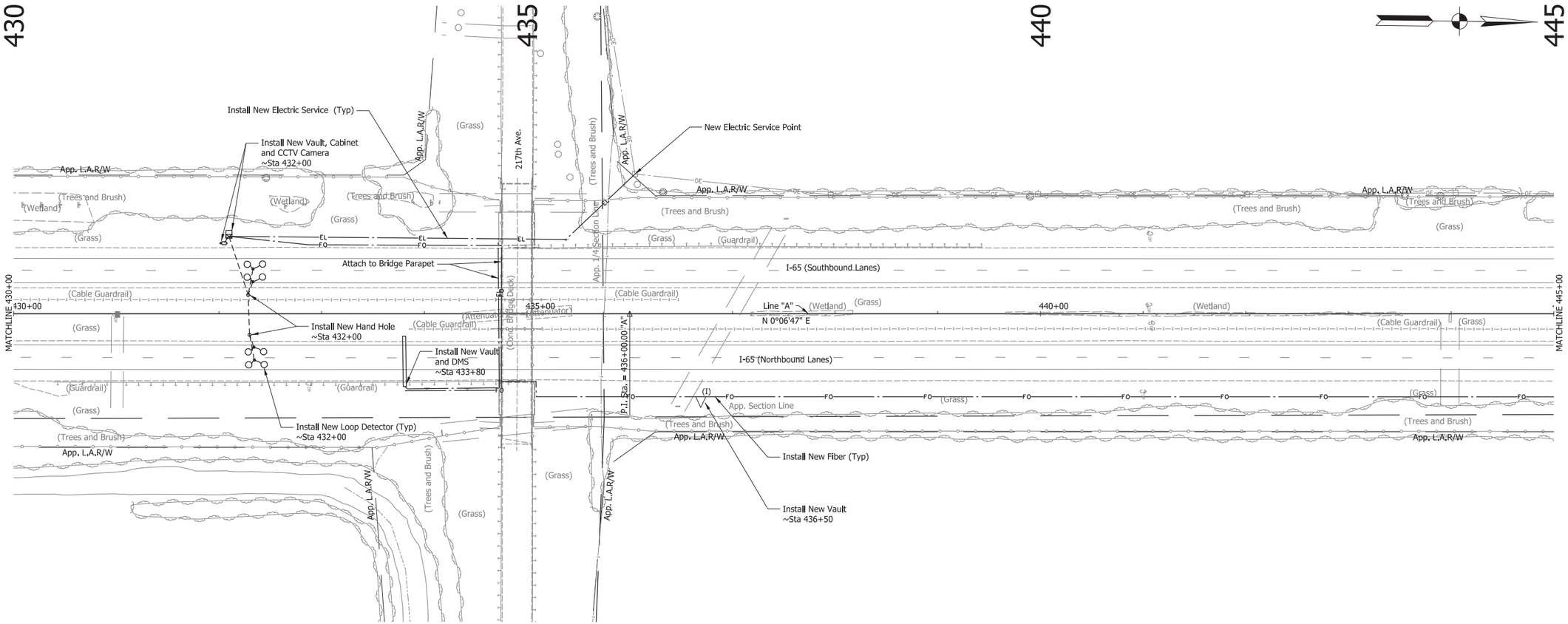
IP_PWP:dms13737\I65_NORTHWEST_B14-B15_APPR SLAB.02.dgn
21-JUL-2016

INTELLIGENT TRANSPORTATION SYSTEM



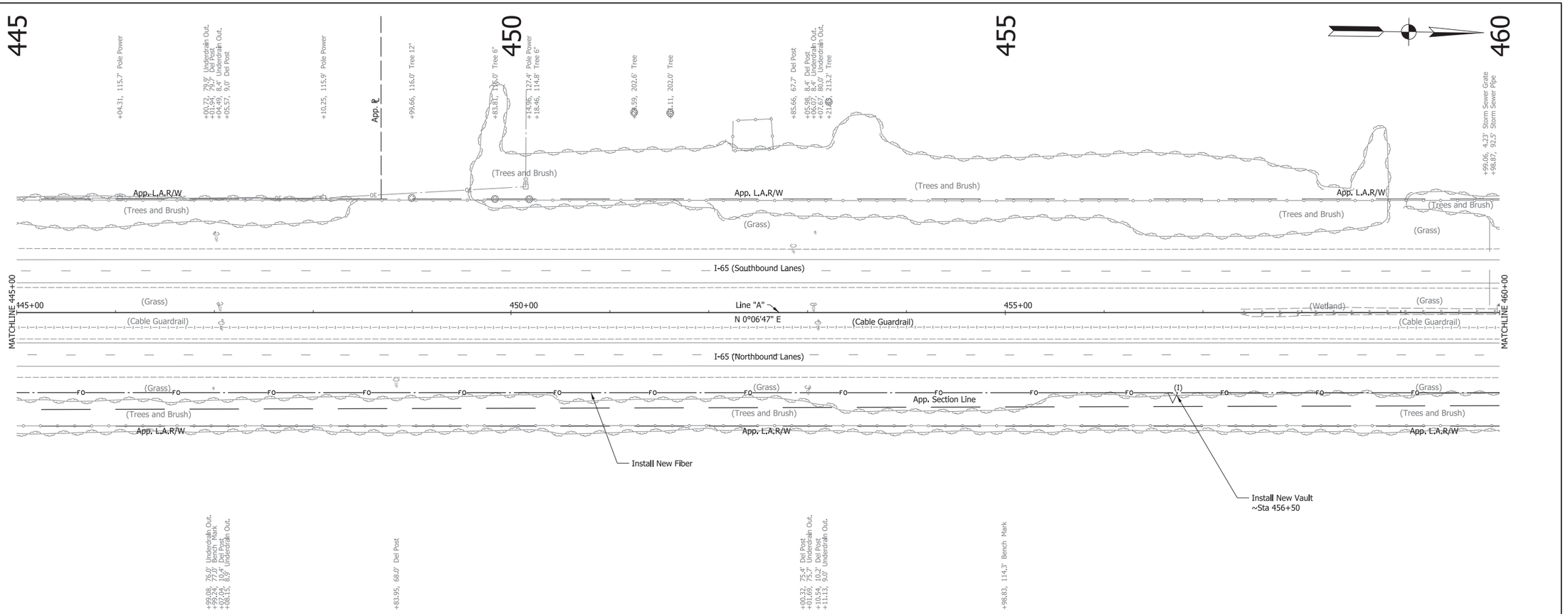
WALSH PARSONS Walsh & Kelly

INTELLIGENT TRANSPORTATION SYSTEM



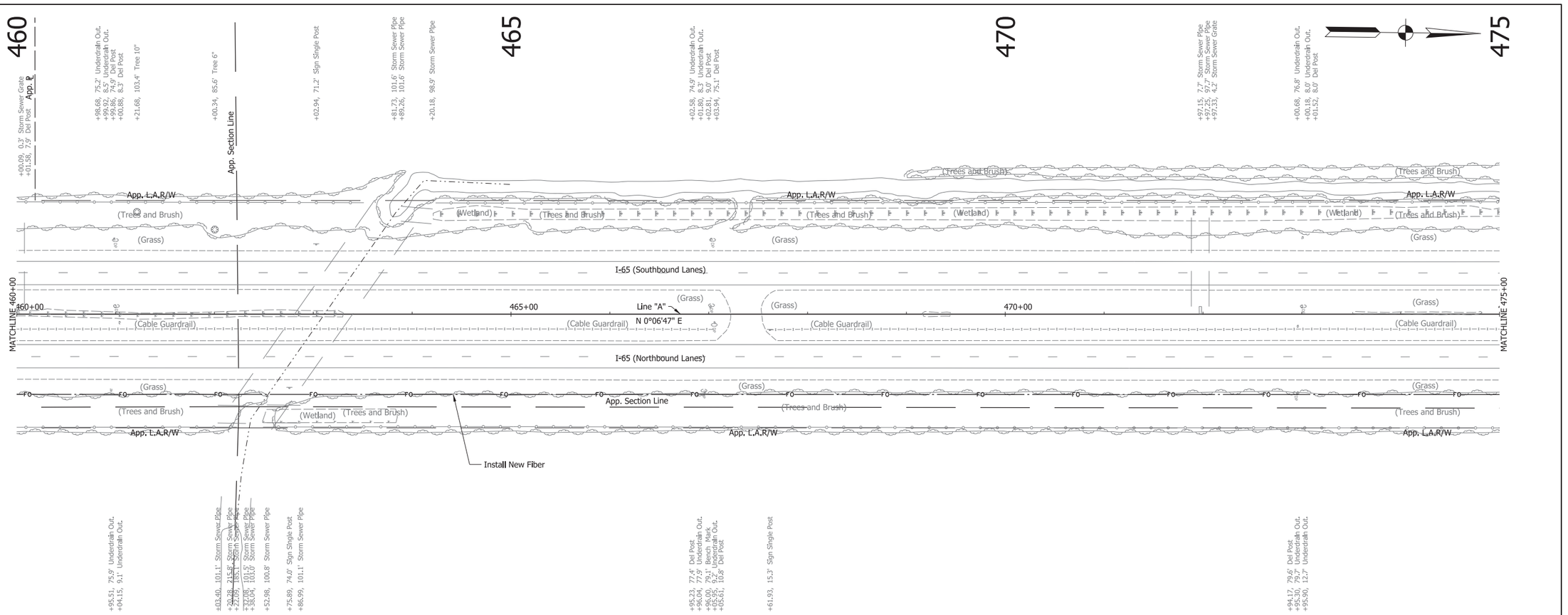
		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE 1" = 50'	BRIDGE FILE N/A
				VERTICAL SCALE	DESIGNATION 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. 430+00 TO STA. 445+00	SURVEY BOOK N/A	SHEET 1 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT R-37450	PROJECT 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_01.dgn



		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. 445+00 TO STA. 460+00	SURVEY BOOK: N/A	SHEET: 2 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_02.dgn



RECOMMENDED FOR APPROVAL

DESIGN ENGINEER DATE

DESIGNED: MB DRAWN: MW

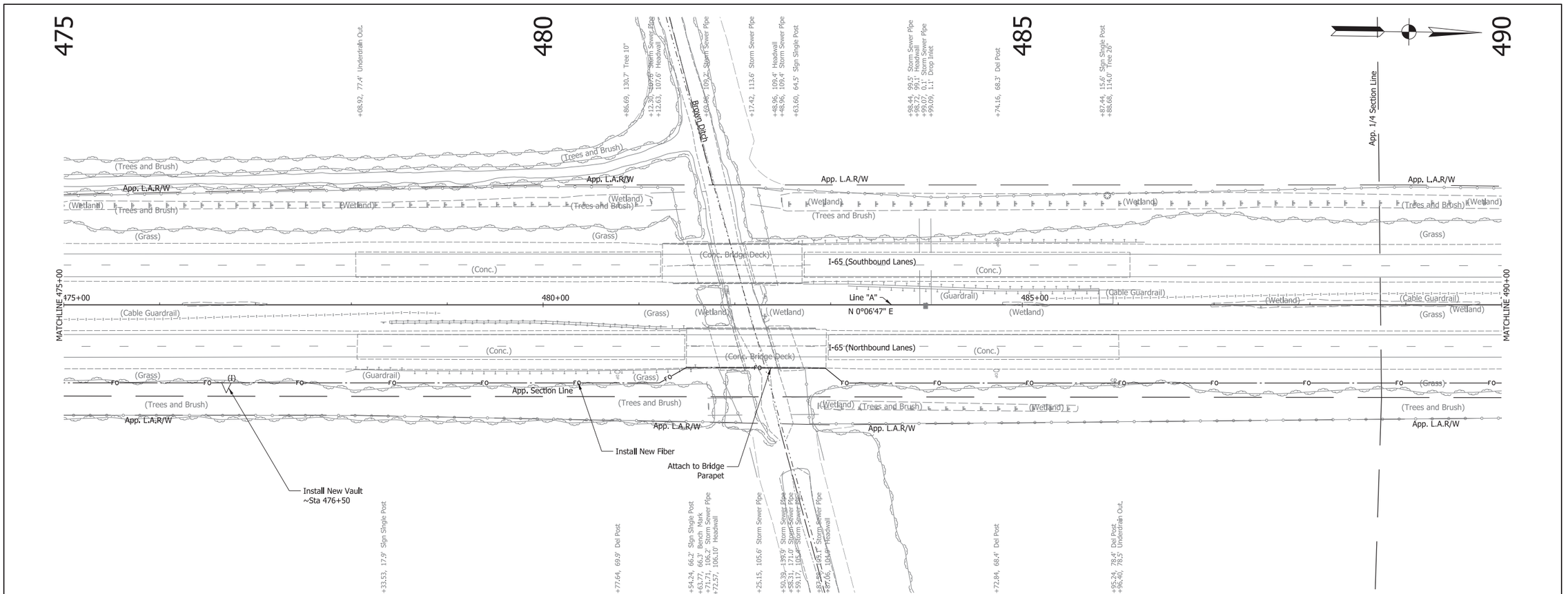
CHECKED: EJT CHECKED: JAM

INDIANA
DEPARTMENT OF TRANSPORTATION

ITS PLAN SHEET
I-65 - LINE "A"
STA. 460+00 TO STA. 475+00

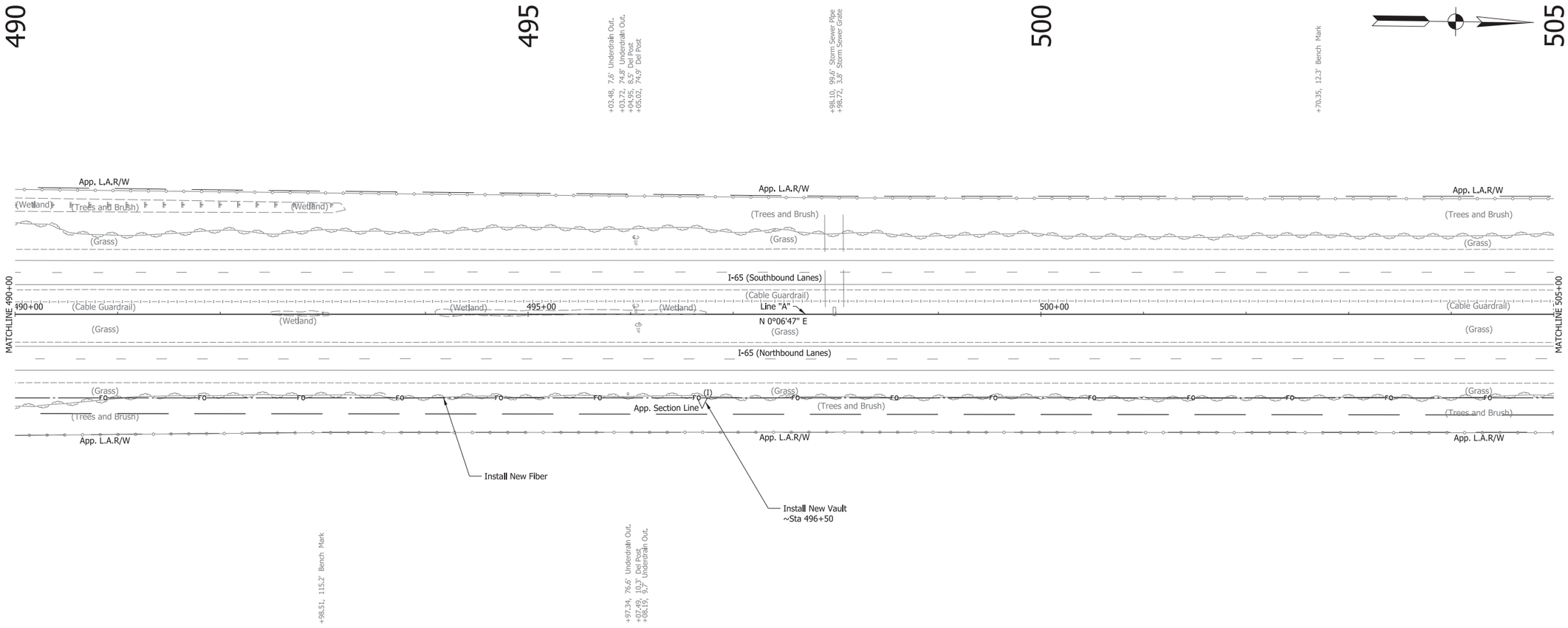
SCALE	BRIDGE FILE
1" = 50'	N/A
VERTICAL SCALE	DESIGNATION
	1172430
SURVEY BOOK	SHEET
N/A	3 of 63
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_03.dgn



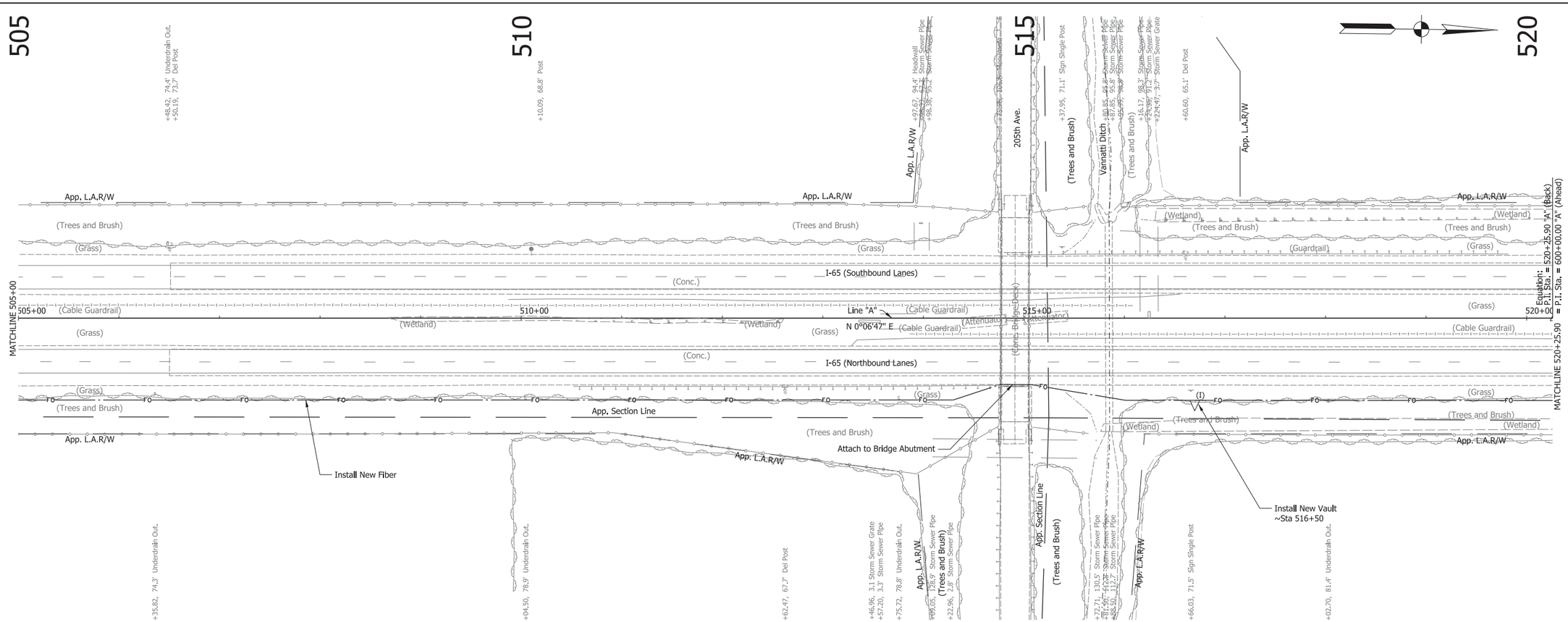
		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. 475+00 TO STA. 490+00	SURVEY BOOK: N/A	SHEET: 4 of 63
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IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_04.dgn



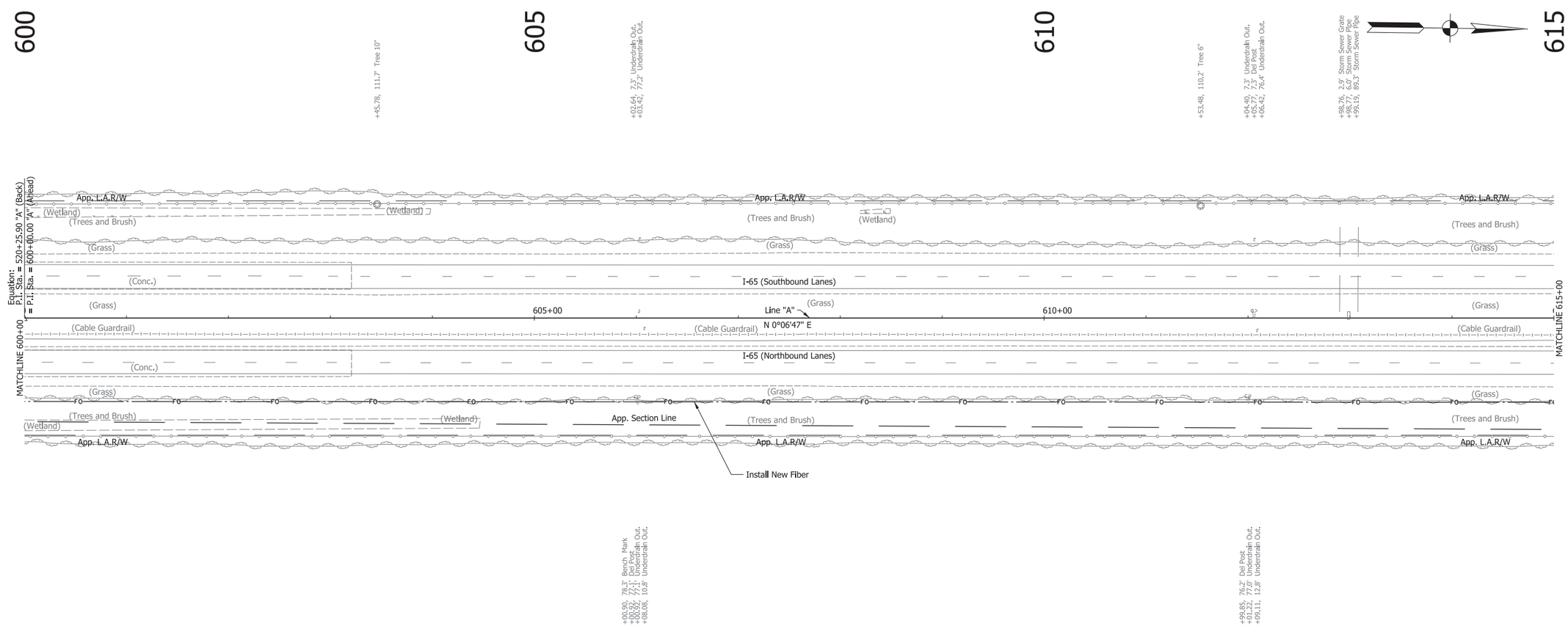
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				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB / DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. 490+00 TO STA. 505+00	SURVEY BOOK: N/A	SHEET: 5 of 63
		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_05.dgn



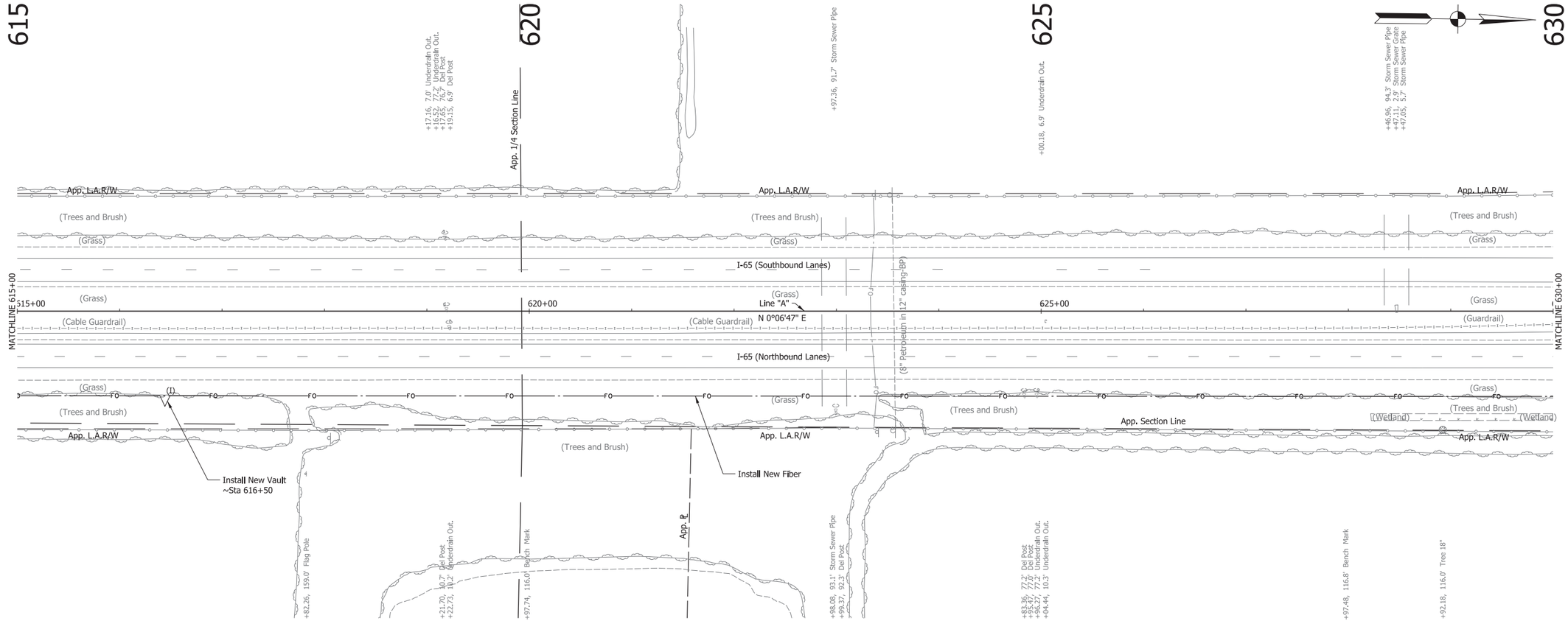
		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. 505+00 TO STA. 520+25.90	SURVEY BOOK: N/A	SHEET: 6 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_06.dgn



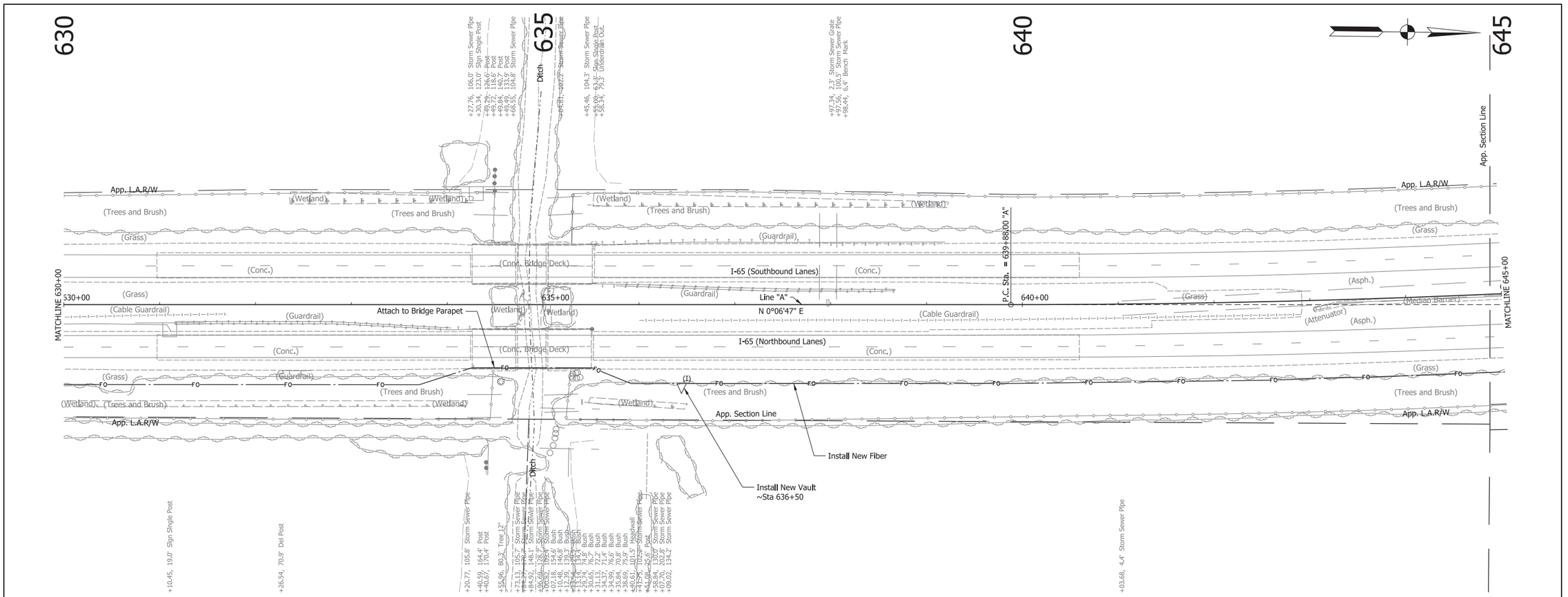
		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB / DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. 600+00 TO STA. 615+00	SURVEY BOOK: N/A	SHEET: 7 of 63
		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_07.dgn



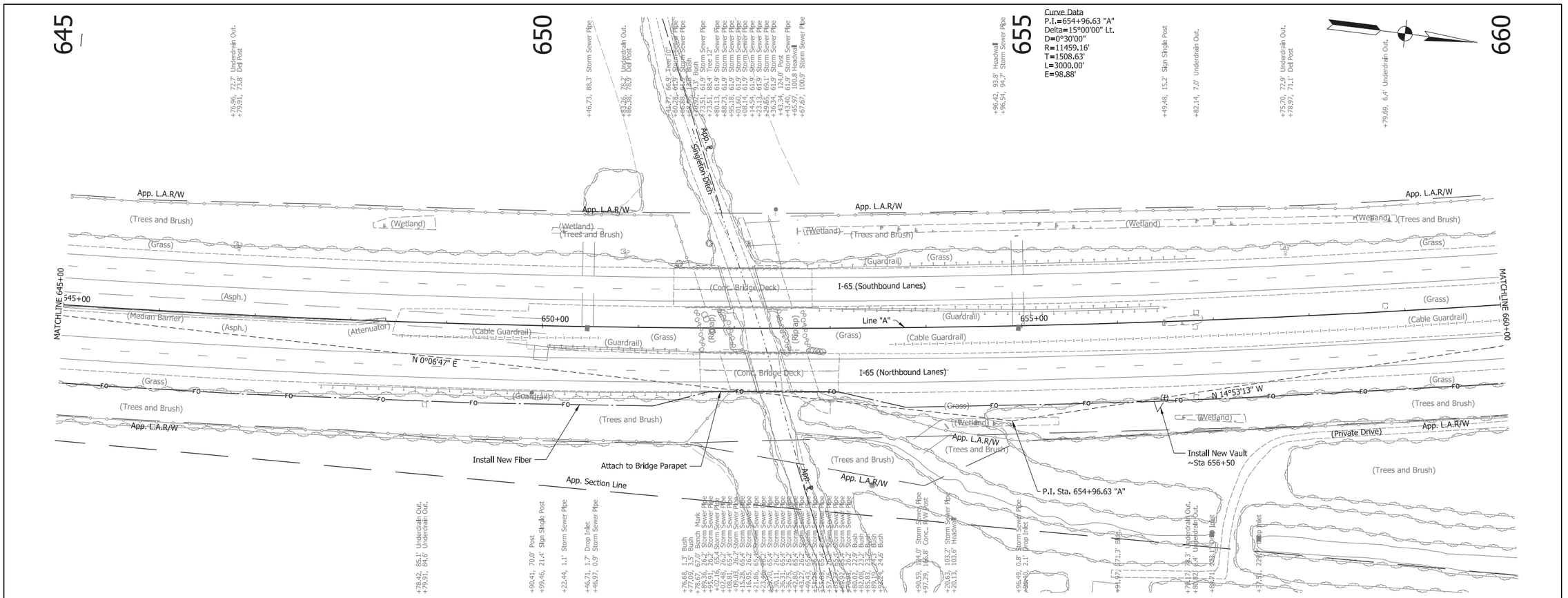
		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. 615+00 TO STA. 630+00	SURVEY BOOK: N/A	SHEET: 8 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_08.dgn



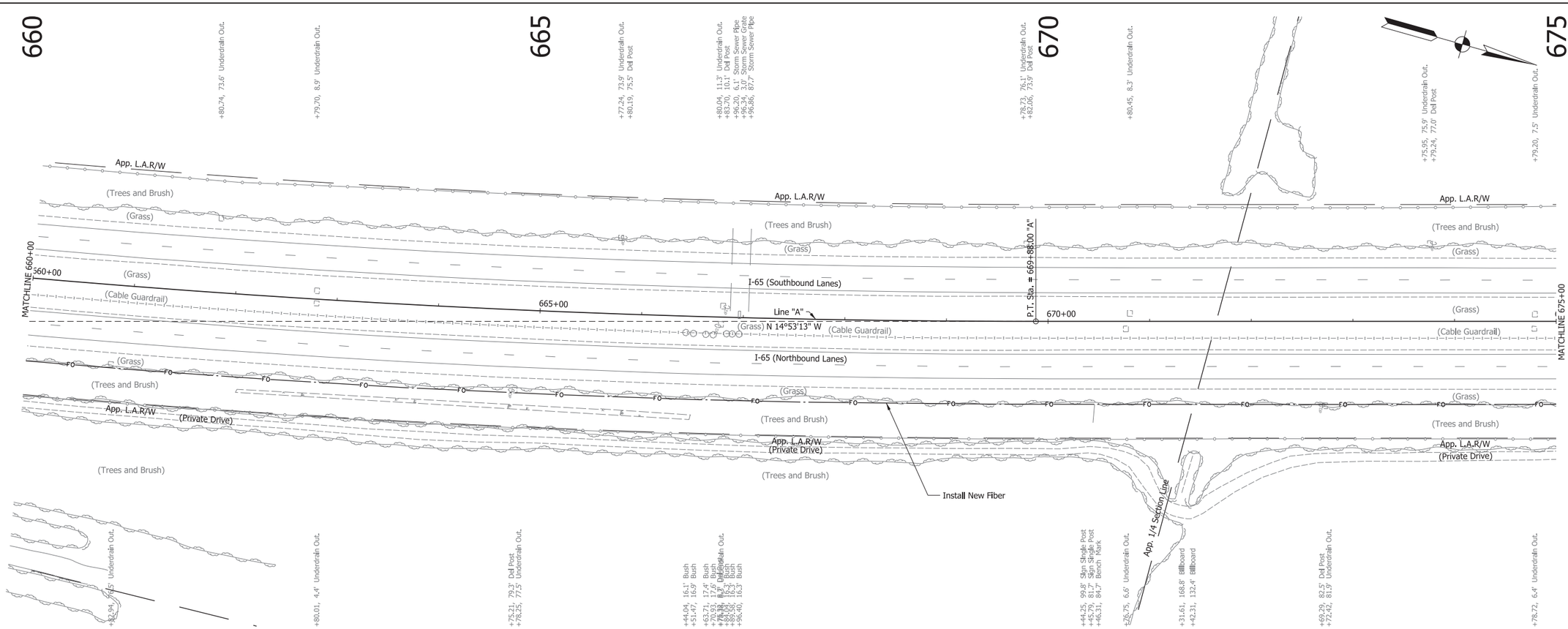
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				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. 630+00 TO STA. 645+00	SURVEY BOOK: N/A	SHEET: 9 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_09.dgn



		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE 1" = 50'	BRIDGE FILE N/A
				VERTICAL SCALE	DESIGNATION 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. 645+00 TO STA. 660+00	SURVEY BOOK N/A	SHEET 10 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT R-37450	PROJECT 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_10.dgn



		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. 660+00 TO STA. 675+00	SURVEY BOOK: N/A	SHEET: 11 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_11.dgn

675

+37.68, 8.1' Underdrain Out.
+47.70, 76.8' Underdrain Out.
+47.77, 75.9' Storm Sewer Pipe
+45.88, 3.0' Storm Sewer Grate
+46.21, 84.2' Storm Sewer Pipe
+49.62, 78.2' Del Post
+52.06, 7.6' Underdrain Out.
+54.72, 116.5' Tree 6"
+56.45, 6.7' Del Post

+80.48, 8.8' Underdrain Out.

680

+01.87, 64.8' Post

+75.31, 117.1' Tree 8"
+77.86, 76.9' Underdrain Out.
+81.28, 77.9' Del Post

+43.56, 70.8' Underdrain Out.
+43.81, 11.4' Underdrain Out.

+79.18, 7.9' Underdrain Out.

685

+71.47, 117.2' Tree 8"

+80.63, 78.1' Underdrain Out.
+83.57, 77.9' Del Post

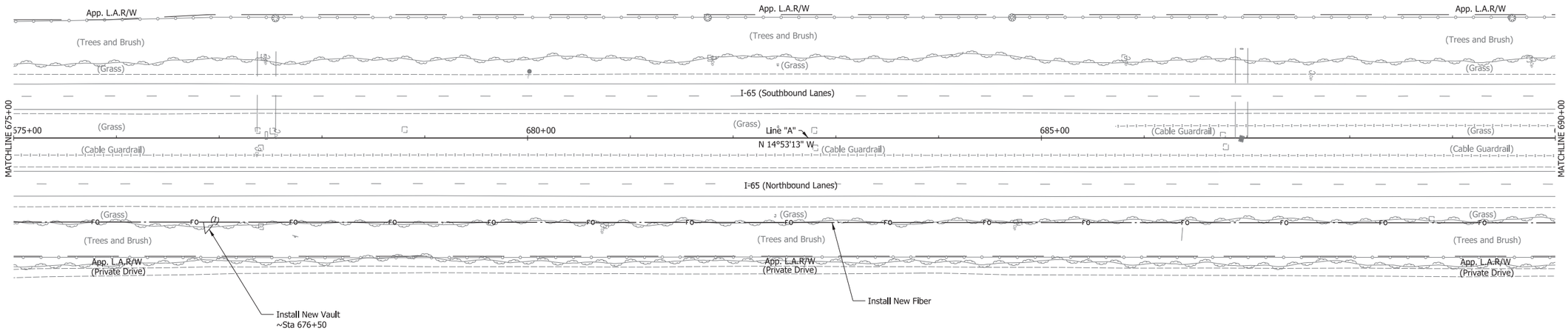
+76.67, 3.6' Underdrain Out.

+94.77, 87.5' Storm Sewer Pipe
+94.79, 86.7' Headwall

+63.51, 63.7' Del Post

690

+57.89, 116.6' Tree 8"
+75.04, 76.1' Underdrain Out.
+78.30, 76.2' Del Post



+37.83, 10.7' Del Post
+41.19, 10.3' Underdrain Out.
+41.24, 84.9' Underdrain Out.

+74.04, 95.3' Sign Single Post

+73.84, 85.5' Del Post
+76.50, 83.7' Underdrain Out.
+78.73, 82.5' Bench Mark

+40.93, 74.9' Underdrain Out.

+79.86, 9.8' Underdrain Out.

+75.28, 82.0' Del Post
+78.49, 80.8' Underdrain Out.

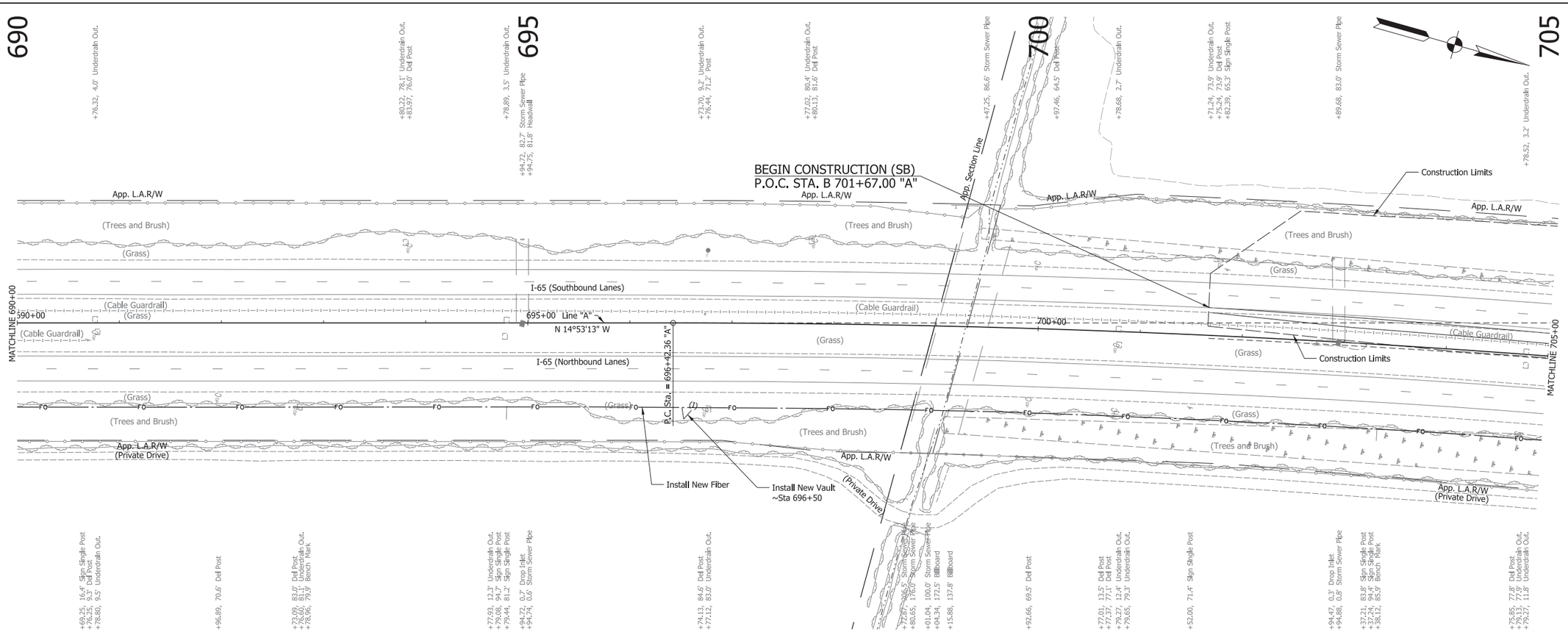
+37.39, 87.0' Sign Single Post
+36.31, 99.9' Sign Single Post

+79.53, 8.3' Underdrain Out.
+94.64, 0.7' Storm Sewer Pipe
+94.65, 0.7' Drop Inlet

+79.76, 78.0' Underdrain Out.

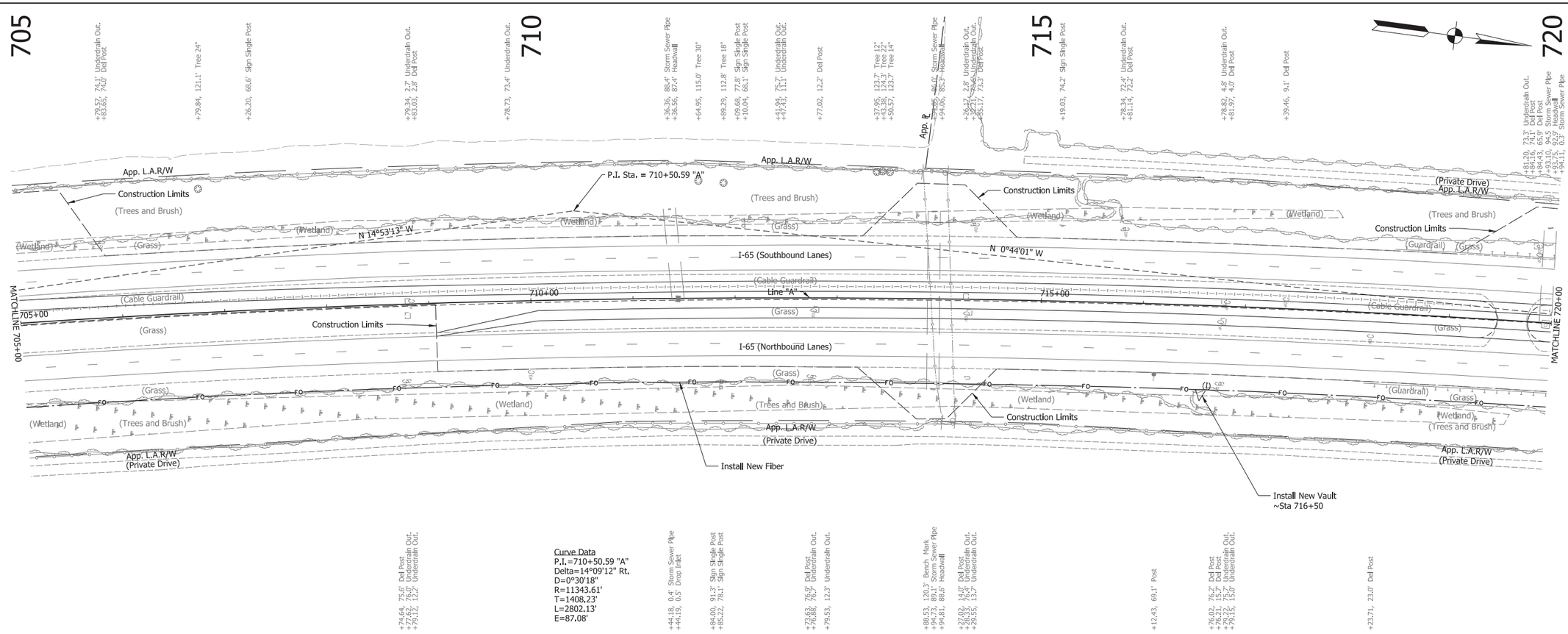
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		VERTICAL SCALE:	DESIGNATION: 1172430
DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. 675+00 TO STA. 690+00	SURVEY BOOK: N/A	SHEET: 12 of 63
CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_12.dgn



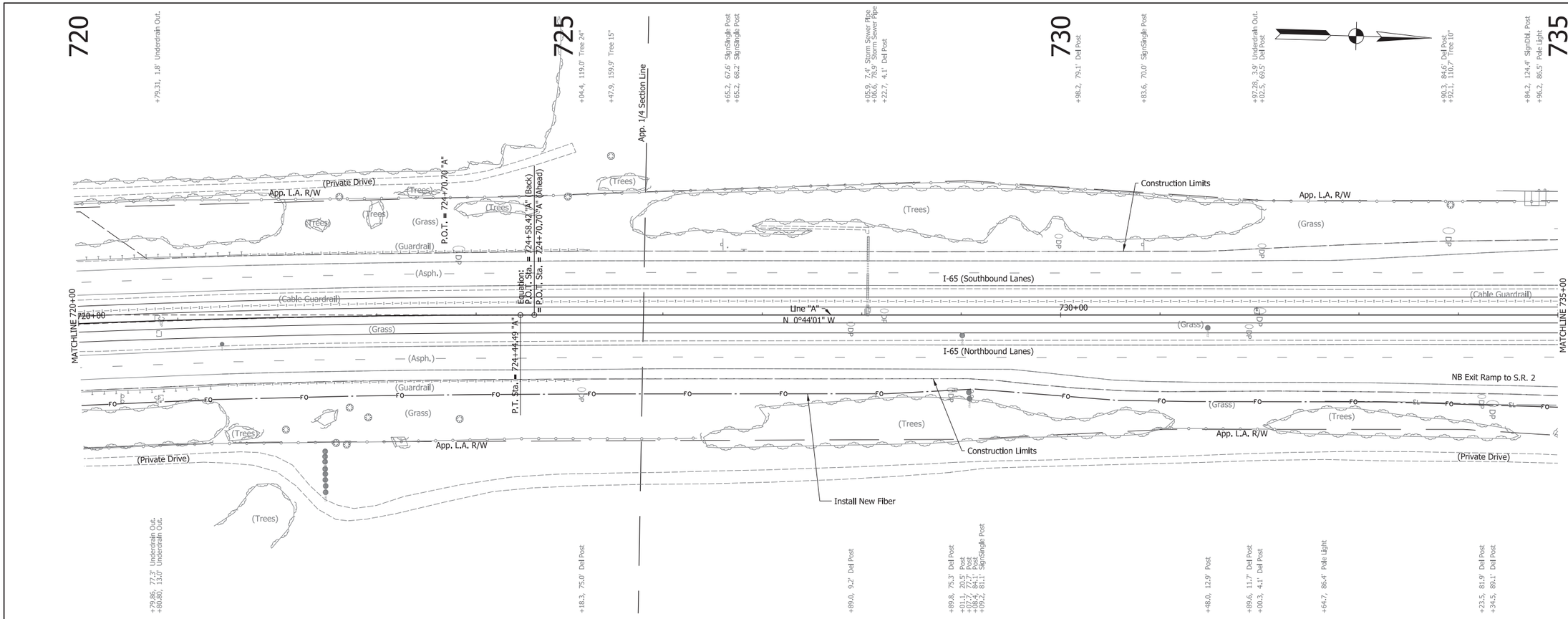
		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB / DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. 690+00 TO STA. 705+00	SURVEY BOOK: N/A	SHEET: 13 of 63
		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_13.dgn



		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB / DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. 705+00 TO STA. 720+00	SURVEY BOOK: N/A	SHEET: 14 of 63
		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_14.dgn



		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB / DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. 720+00 TO STA. 735+00	SURVEY BOOK: N/A	SHEET: 15 of 63
		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_15.dgn

735

740

745

750

(Field)

(Trees)

(Trees)

(Trees)

(Grass)

App. L.A. R/W

Construction Limits

App. L.A. R/W

(Trees)

(Grass)

(Trees)

SB Entrance Ramp from S.R. 2

(Asph.)

Construction Limits

(Asph.)

(Asph.)

I-65 (Southbound Lanes)

MATCHLINE 735+00

(Cable Guardrail)

735+00

(Wetland)

740+00

Line "A"

(Grass)

(Wetland)

N 0°44'01" W

745+00

(Wetland)

(Cable Guardrail)

MATCHLINE 750+00

(Grass)

A-W62

(Guardrail)

I-65 (Northbound Lanes)

(Asph.)

(Asph.)

(Asph.)

(Guardrail)

(1)

(Trees)

(Grass)

Construction Limits

App. L.A. R/W

(Wetland)

(Trees)

Install New Fiber (Typ)

(Conc.)

(Grass)

Str. No. 100
+05 Line "A"
Pipe Type 1, Circular, 36"
Length = 174'
2 SMES

Construction Limits

(Trees)

(Trees)

B-W01
No Impact

NB Exit Ramp to S.R. 2

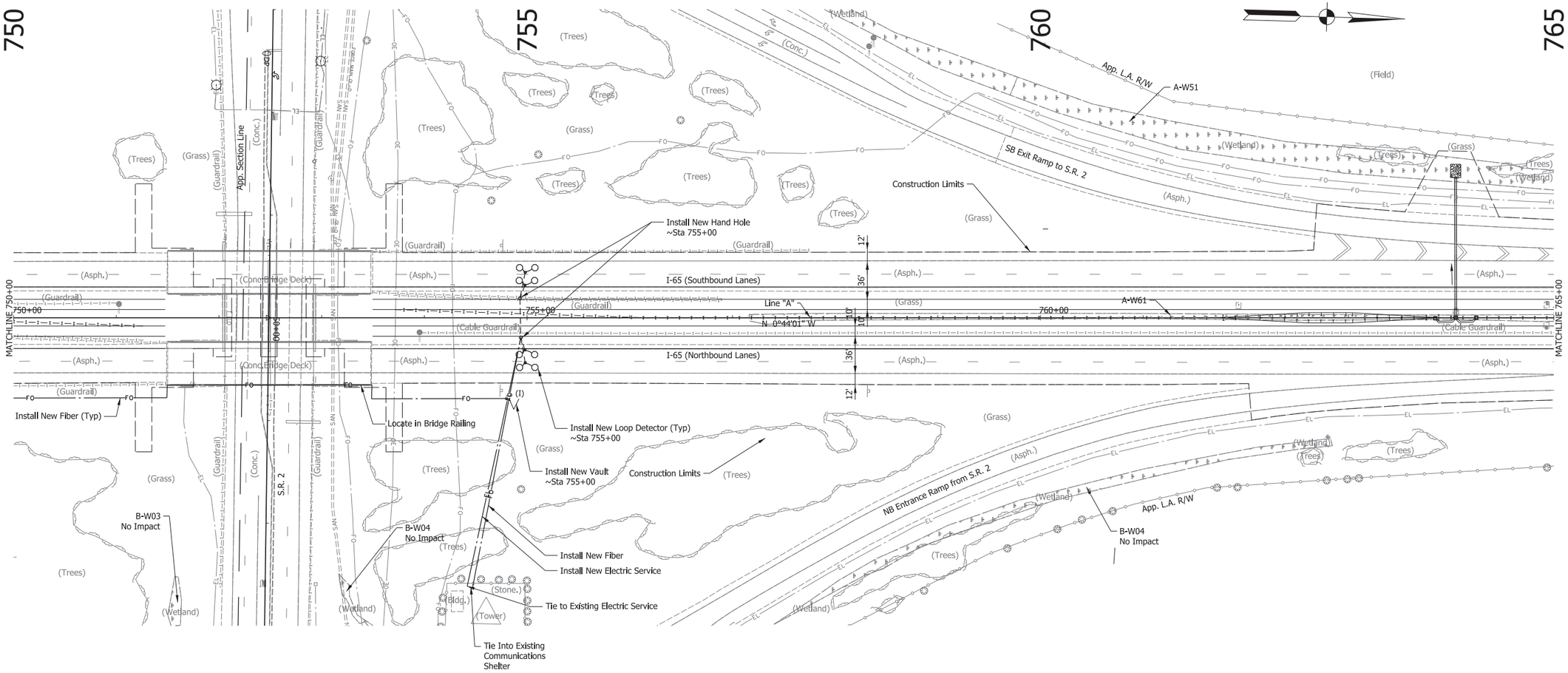
(Asph.)

App. L.A. R/W

Install New Vault
~Sta 736+50

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE		INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50' / VERTICAL SCALE: — / BRIDGE FILE: N/A / DESIGNATION: 1172430
		DESIGNED: MB	DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. C 735+00 TO STA. C 750+00	SURVEY BOOK: N/A / SHEET: 16 of 63
		CHECKED: EJT	CHECKED: JAM		CONTRACT: R-37450 / PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_16.dgn



RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER _____ DATE

INDIANA
DEPARTMENT OF TRANSPORTATION

ITS PLAN SHEET
I-65 - LINE "A"
STA. C 750+00 TO STA. C 765+00

DESIGNED: MB	DRAWN: MW
CHECKED: EJT	CHECKED: JAM

SCALE	BRIDGE FILE
1" = 50'	N/A
VERTICAL SCALE	DESIGNATION
	1172430
SURVEY BOOK	SHEET
N/A	17 of 63
CONTRACT	PROJECT
R-37450	1172430

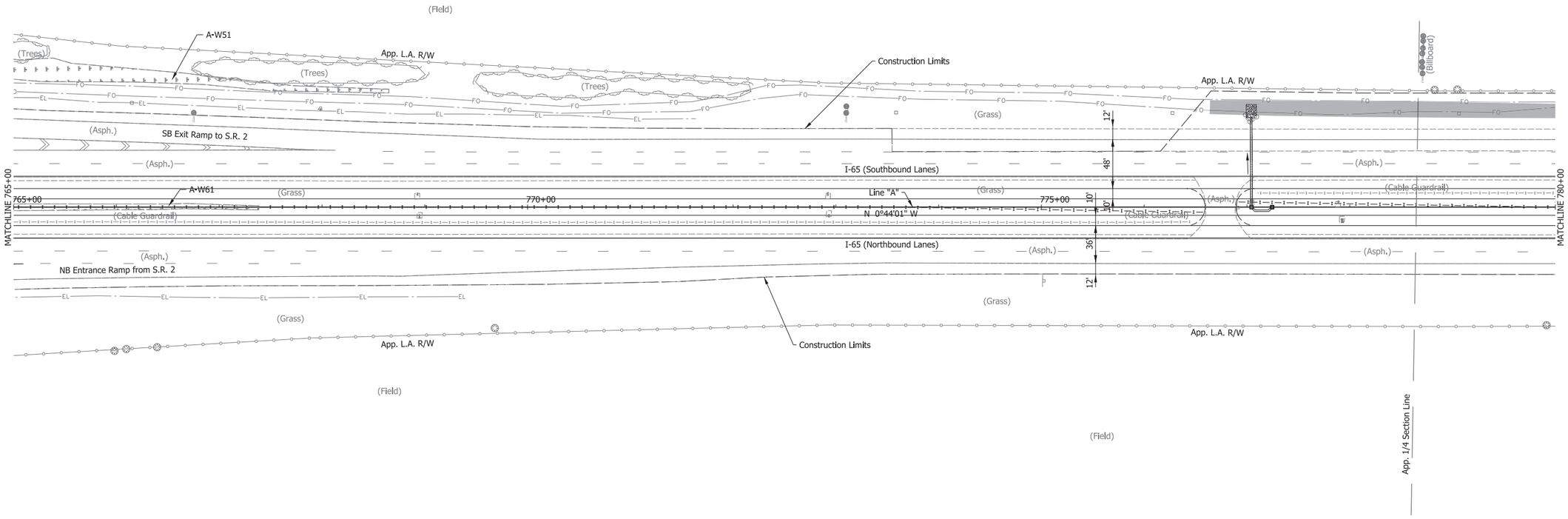
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765

770

775

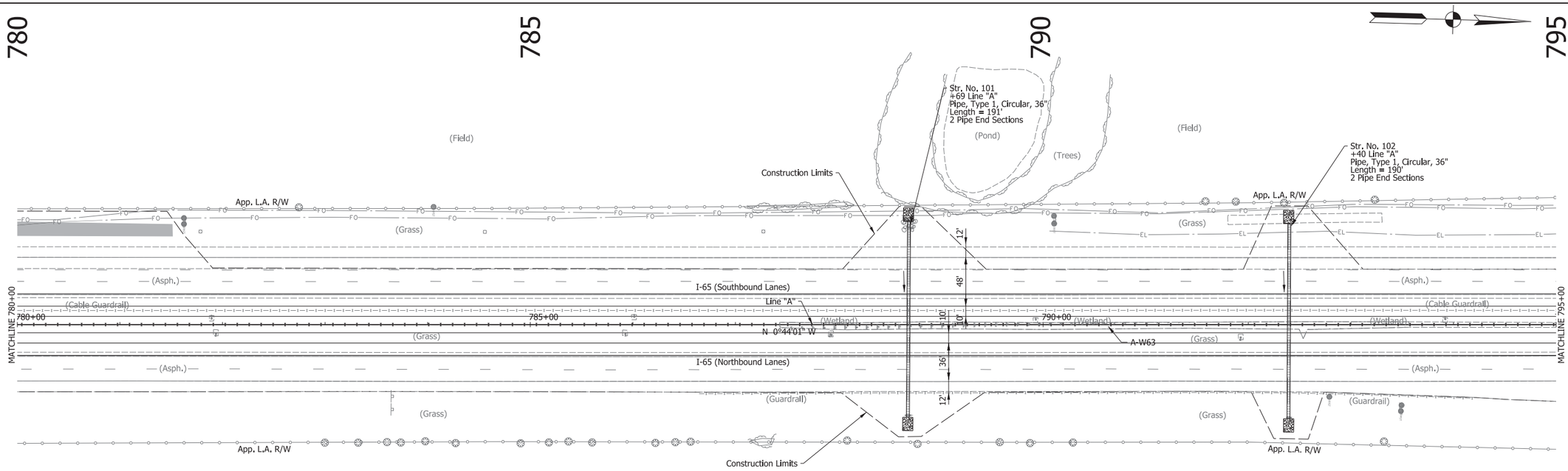
780



No ITS Work On This Sheet

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE 1" = 50'	BRIDGE FILE N/A
				VERTICAL SCALE	DESIGNATION 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. C 765+00 TO STA. C 780+00	SURVEY BOOK N/A	SHEET 18 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT R-37450	PROJECT 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_18.dgn



No ITS Work On This Sheet

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB / DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. C 780+00 TO STA. C 795+00	SURVEY BOOK: N/A	SHEET: 19 of 63
		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_19.dgn

795

800

805

810

Construction Limits

App. L.A. R/W

App. L.A. R/W

(Field)

(Grass)

App. Section Line

(Conc.)

SB Weigh Station

(Bldg.)

SB Weigh Station

(Conc.)

12'

48'

(Asph.)

(Asph.)

(Cable Guardrail)

I-65 (Southbound Lanes)

Line "A"

N 0°44'01" W

MATCHLINE 795+00

795+00

800+00

805+00

MATCHLINE 810+00

(Cable Guardrail)

A-W64

(Grass)

A-W65

I-65 (Northbound Lanes)

36'

12'

(Asph.)

(Asph.)

(Grass)

(Grass)

(Bldg.)

App. L.A. R/W

Construction Limits

NB Weigh Station

(Asph.)

(Asph.)

B-W06
No Impact

App. L.A. R/W

App. Section Line

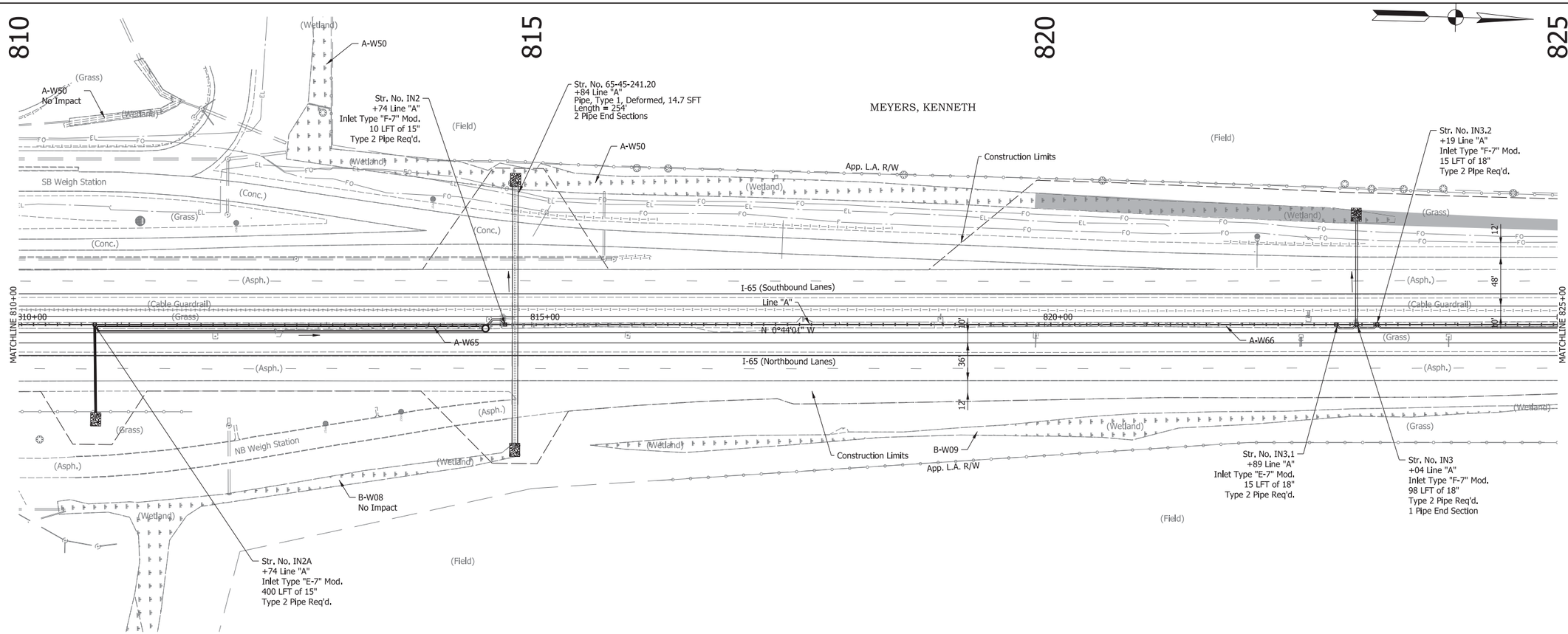
B-W07
No Impact

(Field)

No ITS Work On This Sheet

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				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB / DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. C 795+00 TO STA. C 810+00	SURVEY BOOK: N/A	SHEET: 20 of 63
		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_20.dgn



No ITS Work On This Sheet

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: MB DRAWN: MW

CHECKED: EJT CHECKED: JAM

INDIANA
DEPARTMENT OF TRANSPORTATION

ITS PLAN SHEET
I-65 - LINE "A"
STA. C 810+00 TO STA. C 825+00

SCALE	BRIDGE FILE
1" = 50'	N/A
VERTICAL SCALE	DESIGNATION
	1172430
SURVEY BOOK	SHEET
N/A	21 of 63
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_21.dgn

825

830

835

840

Str. No. IN3A.1
+50 Line "A"
Manhole
346 LFT of 15"
Type 2 Pipe Req'd.

MEYERS, KENNETH

(Field)

App. 1/4 Section Line

Construction Limits

Str. No. 65-45-241.70 (Liner)
+92 Line "A"
Pipe, Type 1, Deformed, 15.9 SFT
Length = 180'
2 Pipe End Sections

Str. No. 65-45-241.70
+82 Line "A"
Pipe, Type 1, Circular, 42"
Length = 180'
2 Pipe End Sections

A-W49

App. L.A. R/W

(Grass)

(Conc.)

(Asph.)

(Cable Guardrail)

12'

48'

I-65 (Southbound Lanes)

MATCHLINE 825+00

325+00

830+00

Line "A"

N 0°44'01" W

835+00

MATCHLINE 840+00

I-65 (Northbound Lanes)

36'

12'

(Wetland)

B-W10

B-W11

Str. No. IN3A
+00 Line "A"
Inlet Type "E-7" Mod.
350 LFT of 15"
Type 2 Pipe Req'd.

Construction Limits

Str. No. IN4
+00 Line "A"
Inlet Type "F-7" Mod.
9 LFT of 15"
Type 2 Pipe Req'd.

U-Turn Median Opening
Sta. C 839+66.00 "A"
W = 36', R = 18'

BULT, ROBERT
& BULT, LORI

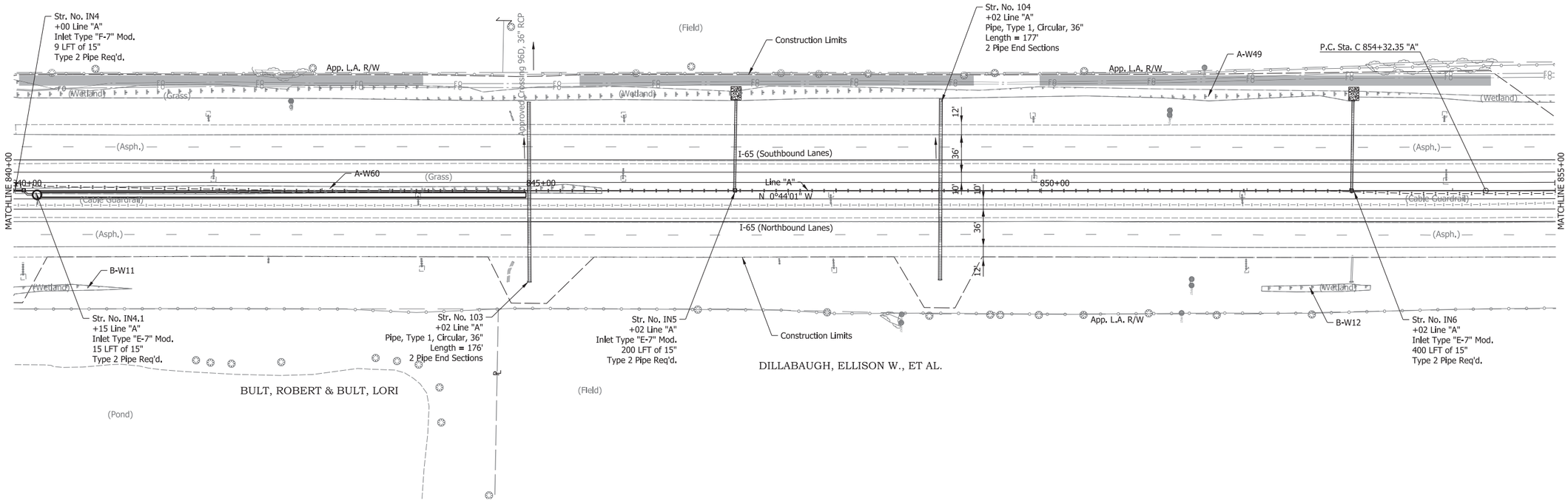
(Pond)

No ITS Work On This Sheet

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE		INDIANA DEPARTMENT OF TRANSPORTATION	SCALE	1" = 50'	BRIDGE FILE N/A
			VERTICAL SCALE		DESIGNATION 1172430
DESIGNED: MB	DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. C 825+00 TO STA. C 840+00	SURVEY BOOK	N/A	SHEET 22 of 63
CHECKED: EJT	CHECKED: JAM		CONTRACT	R-37450	PROJECT 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_22.dgn

840 845 850 855



No ITS Work On This Sheet

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. C 840+00 TO STA. C 855+00	SURVEY BOOK: N/A	SHEET: 23 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_23.dgn

855

860

865

870

JEVERT, GLENN ET UX.

AUSTGEN, DAVID M.
TRUSTEE

Str. No. 105
+26 Line "A"
Pipe, Type 1, Circular, 36"
Length = 174'
2 Pipe End Sections

Construction Limits

Install New Hand Hole
~Sta 862+00

App. L.A. R/W

A-W48

A-W49

App. Section Line

(Wetland)

(Field)

(Grass)

(Asph.)

(Guardrail)

(Cable Guardrail)

MATCHLINE 855+00

355+00

860+00

865+00

MATCHLINE 870+00

I-65 (Southbound Lanes)

Line "A"

I-65 (Northbound Lanes)

N 0°44'01" W

12'

36'

Install New Loop Detector (Typ)
~Sta 862+00

Str. No. IN7
+01 Line "A"
Inlet Type "E-7" Mod.
81 LFT of 15"
Type 2 Pipe Req'd.
1 SMES Req'd.

AEP 200' Easement

Construction Limits

Str. No. IN8
+02 Line "A"
Inlet Type "E-7" Mod.
24 LFT of 15"
Type 2 Pipe Req'd.

Install New Vault, Cabinet
and CCTV Camera
~Sta 862+00

B-W13

Str. No. 106
+00 Line "A"
Pipe, Type 1, Circular, 36"
Length = 183'
2 Pipe End Sections

No ITS Work On This Sheet

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: MB DRAWN: MW

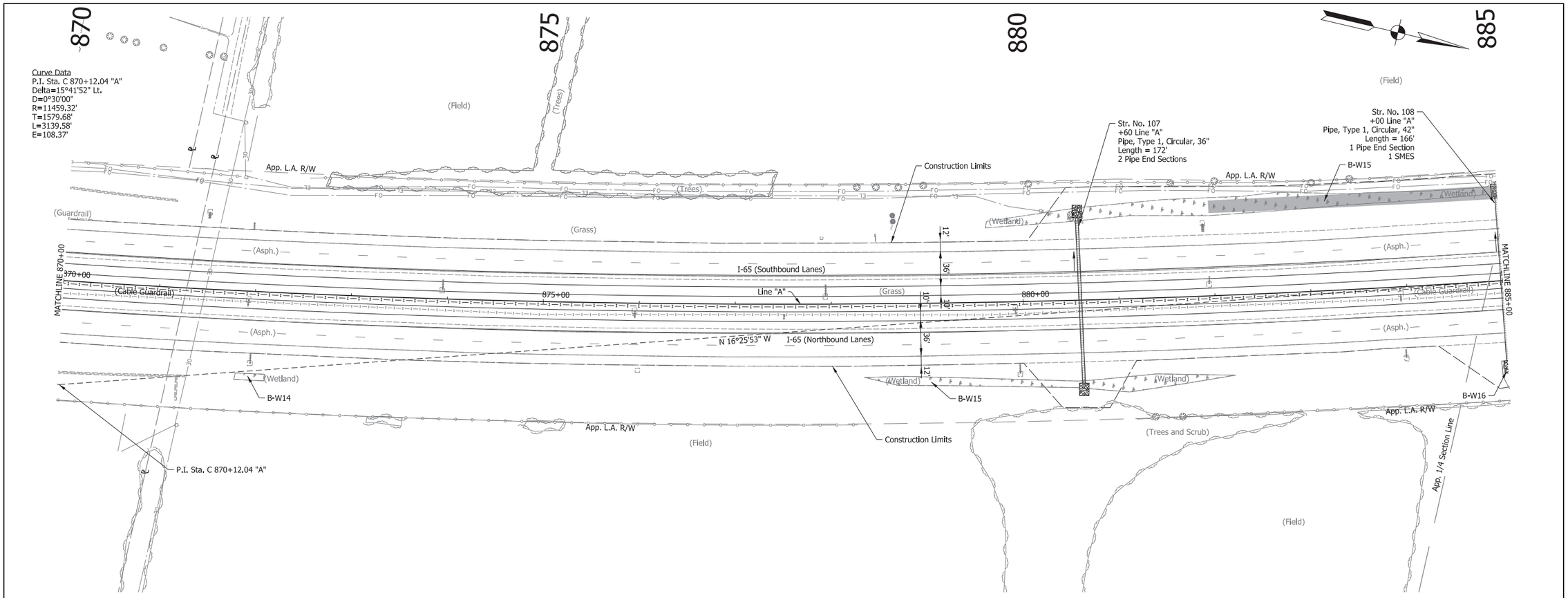
CHECKED: EJT CHECKED: JAM

INDIANA
DEPARTMENT OF TRANSPORTATION

ITS PLAN SHEET
I-65 - LINE "A"
STA. C 855+00 TO STA. C 870+00

SCALE	BRIDGE FILE
1" = 50'	N/A
VERTICAL SCALE	DESIGNATION
	1172430
SURVEY BOOK	SHEET
N/A	24 of 63
CONTRACT	PROJECT
R-37450	1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_24.dgn



No ITS Work On This Sheet

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE	DESIGNATION: 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. C 870+00 TO STA. C 885+00	SURVEY BOOK: N/A	SHEET: 25 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_25.dgn

885

890

895

900

HEIN, EDWARD J., ET AL.

App. 1/4 Section Line

B-W15

Equation
P.T. Sta. C 885+71.93 "A" (Back) =
P.T. Sta. D 885+69.00 "A" (Ahead)

App. L.A. R/W

(Wetland)

Construction Limits

Str. No. 109
+15 Line "A"
Pipe, Type 1, Circular, 36"
Length = 202'
2 Pipe End Sections

B-W17

Str. No. IN9.1
+80 Line "A"
Inlet Type "F-7" Mod.
266 LFT of 18"
Type 2 Pipe Req'd.

Str. No. IN9
+95 Line "A"
Inlet Type "F-7" Mod.
15 LFT of 18"
Type 2 Pipe Req'd.

(Field)

(Grass)

(Guardrail)

12'

36'

(Asph.)

(Cable Guardrail)

I-65 (Southbound Lanes)

MATCHLINE 885+00

885+00

890+00

Line "A"
N 16°25'53" W

A-W67

895+00

MATCHLINE 900+00

I-65 (Northbound Lanes)

Approx. RR Crossing 974+1.48' Rt.

(Trees)

B-W16

Str. No. IN9A
+00 Line "A"
Inlet Type "E-7" Mod.
103 LFT of 15"
Type 2 Pipe Req'd.

App. L.A. R/W

Construction Limits

B-W17

Str. No. IN9.2
+10 Line "A"
Inlet Type "E-7" Mod.
15 LFT of 18"
Type 2 Pipe Req'd.

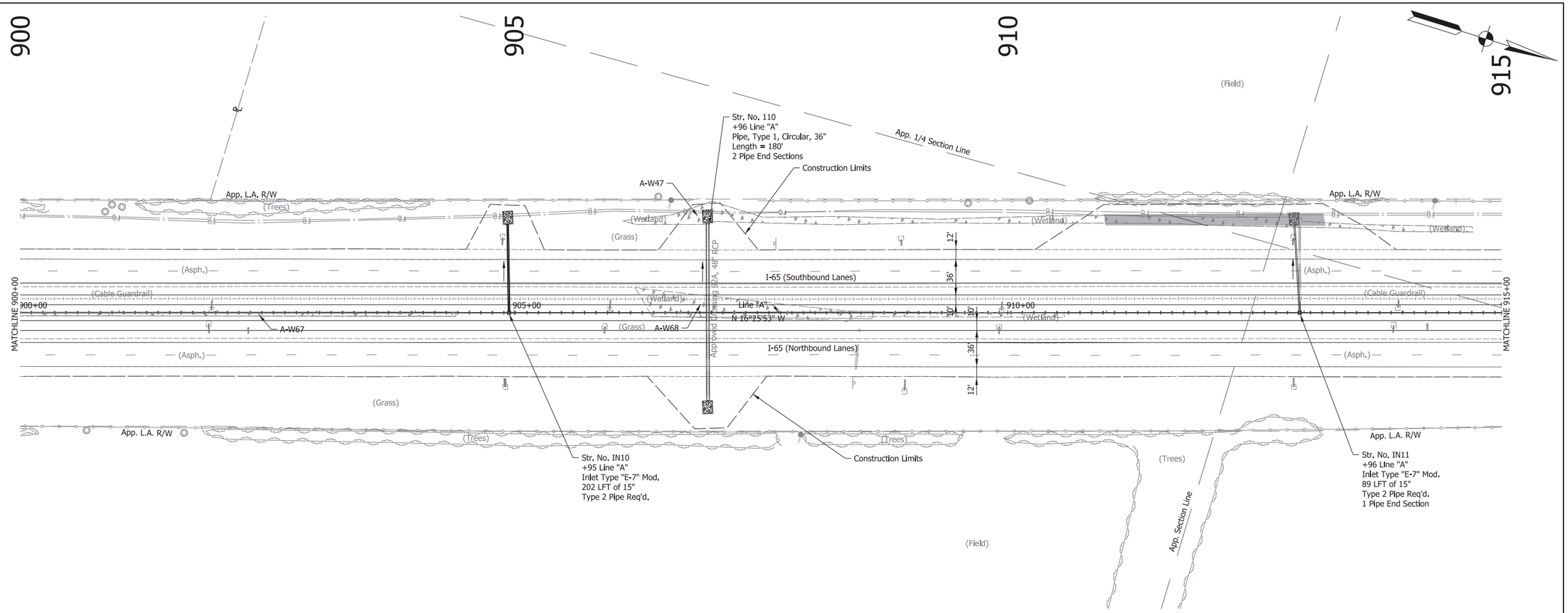
HEIN, EDWARD J., ET AL.

(Field)

No ITS Work On This Sheet

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE	DESIGNATION: 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. C 885+00 TO STA. D 900+00	SURVEY BOOK: N/A	SHEET: 26 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_26.dgn



No ITS Work On This Sheet

	RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
			VERTICAL SCALE:	DESIGNATION: 1172430
	DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. D 900+00 TO STA. D 915+00	SURVEY BOOK: N/A	SHEET: 27 of 63
	CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

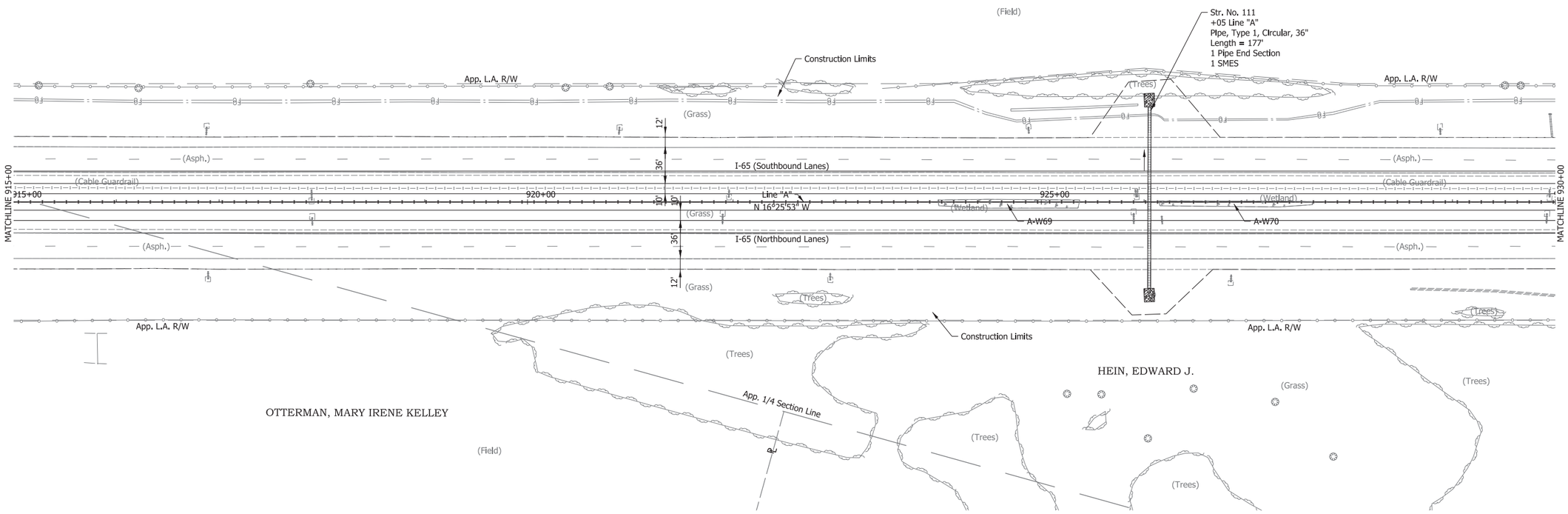
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915

920

925

930



No ITS Work On This Sheet

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE		INDIANA DEPARTMENT OF TRANSPORTATION	SCALE	BRIDGE FILE	
			1" = 50'	N/A	
			VERTICAL SCALE	DESIGNATION	
				1172430	
DESIGNED: MB	DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. D 915+00 TO STA. D 930+00	SURVEY BOOK	SHEET	
			N/A	28 of 63	
CHECKED: EJT	CHECKED: JAM		CONTRACT	PROJECT	
			R-37450	1172430	

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_28.dgn

930

935

940

945

(Field)

(Field)

App. R/W

153rd Ave.

(Guardrail)

(Asph.)

(Guardrail)

App. R/W

Construction Limits

App. L.A. R/W

(Trees)

A-W46

App. L.A. R/W

Construction Limits

(Grass)

12'

36'

I-65 (Southbound Lanes)

(Guardrail)

(Asph.)

(Asph.)

(Cable Guardrail)

MATCHLINE 930+00

930+00

(Wetland)

935+00

Line "A"

N 16°25'53" W

940+00

(Conc.)

(Cable Guardrail)

(Cable Guardrail)

MATCHLINE 945+00

A-W71

10'

10'

(Grass)

(Cable Guardrail)

(Asph.)

36'

I-65 (Northbound Lanes)

(Asph.)

(Guardrail)

12'

(Guardrail)

(Trees)

(Trees)

(Trees)

(Trees)

(Trees)

(Trees)

App. L.A. R/W

(Trees)

Construction Limits

(Trees)

Str. No. IN12
+05 Line "A"
Inlet Type "E-7" Mod.
75 LFT of 15"
Type 2 Pipe Req'd.
1 SMES Req'd.

Construction Limits

App. L.A. R/W

(Grass)

Str. No. 112
+95 Line "A"
Pipe, Type 1, Circular, 36"
Length = 176'
2 Pipe End Sections

HEIN, EDWARD J.

App. R/W

(Guardrail)

(Asph.)

(Guardrail)

(Trees)

App. I-74 Section Line

App. R/W

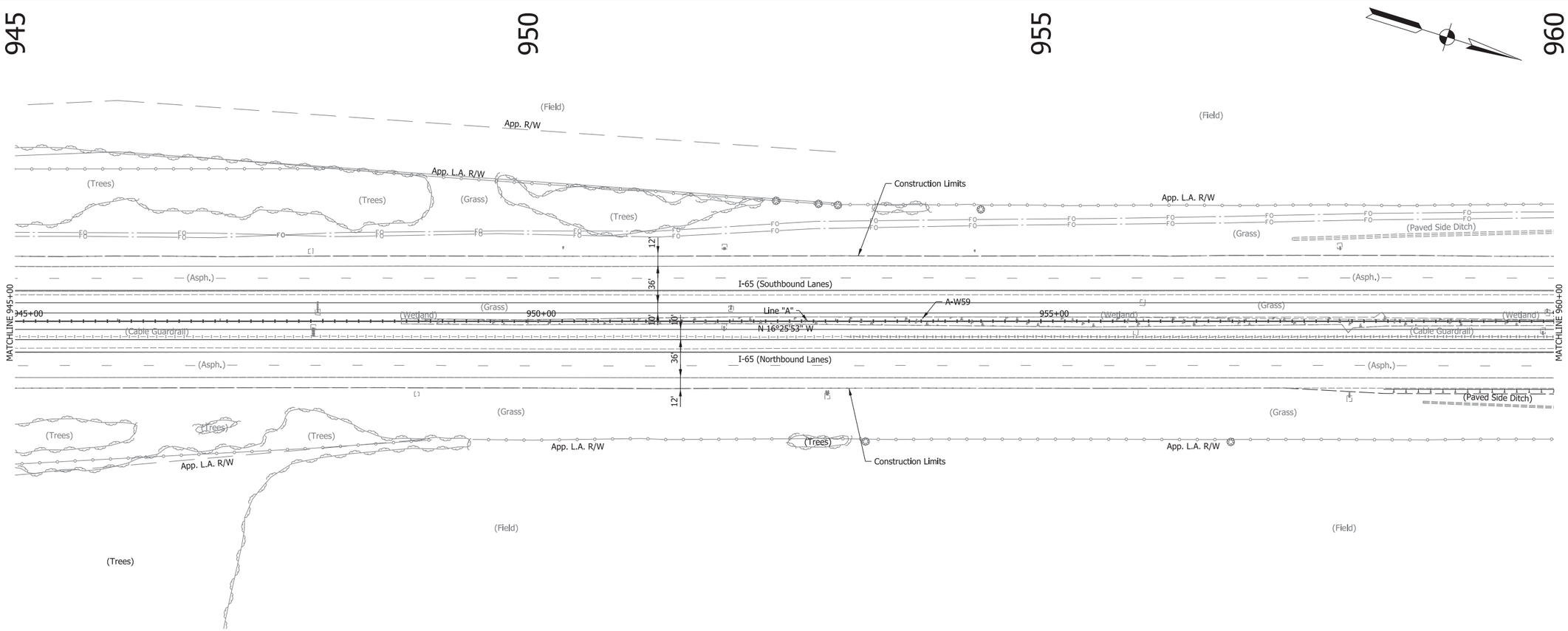
(Trees)

(Trees)

No ITS Work On This Sheet

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB / DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. D 930+00 TO STA. D 945+00	SURVEY BOOK: N/A	SHEET: 29 of 63
		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

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No ITS Work On This Sheet

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE		INDIANA DEPARTMENT OF TRANSPORTATION	SCALE	1" = 50'	BRIDGE FILE N/A
			VERTICAL SCALE		DESIGNATION 1172430
DESIGNED: MB	DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. D 945+00 TO STA. D 960+00	SURVEY BOOK	N/A	SHEET 30 of 63
CHECKED: EJT	CHECKED: JAM		CONTRACT	R-37450	PROJECT 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_30.dgn

960

965

970

975

Str. No. 65-45-244.10
+00 Line "A"
Pipe, Type 1, Circular, 48"
Length = 200'
2 Pipe End Sections

Str. No. IN13
+94 Line "A"
Inlet Type "E-7" Mod.
206 LFT of 15"
Type 2 Pipe Req'd.

Str. No. 65-45-244.20
+75 Line "A"
Pipe, Type 1, Circular, 36"
Length = 180'
1 Pipe End Section
1 SMES

Str. No. IN14.1
+80 Line "A"
Inlet Type "F-7" Mod.
205 LFT of 18"
Type 2 Pipe Req'd.

U-Turn Median Opening
Sta. D 972+27.00 "A"
W = 36', R = 18'

Str. No. IN14
+95 Line "A"
Inlet Type "E-7" Mod.
15 LFT of 18"
Type 2 Pipe Req'd.

Stream B-S01
Branch of Stony
Run

Construction Limits

App. Section Line

App. L.A. R/W

B-W18

B-W19

B-W20

B-W02

A-W59

A-W58

A-W72

Line "A"
N 16°25'53" W

I-65 (Southbound Lanes)

I-65 (Northbound Lanes)

MATCHLINE 960+00

MATCHLINE 975+00

960+00

965+00

970+00

(Field)

(Grass)

(Guardrail)

(Wetland)

(Asph.)

(Cable Guardrail)

(Paved Side Ditch)

(Trees)

(Rprap)

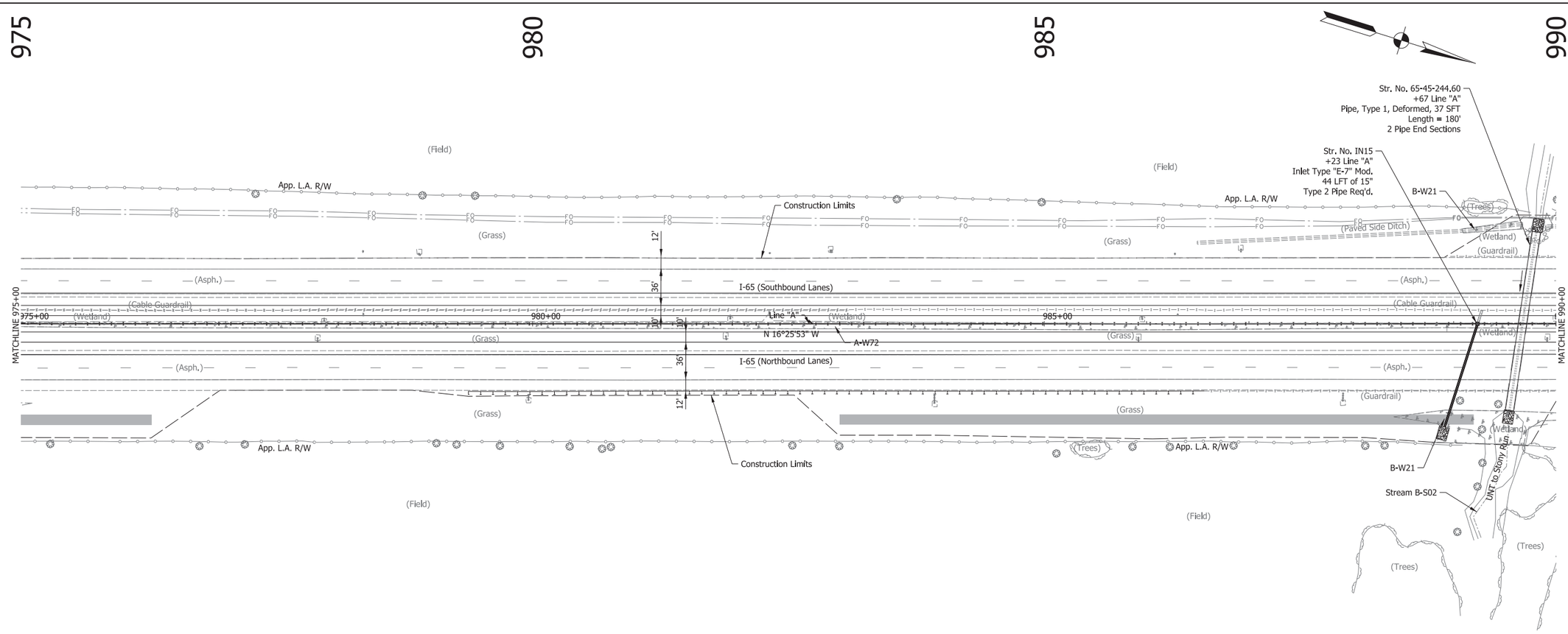
36'

12'

No ITS Work On This Sheet

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE		INDIANA DEPARTMENT OF TRANSPORTATION	SCALE	BRIDGE FILE	
			1" = 50'	N/A	
			VERTICAL SCALE	DESIGNATION	
				1172430	
DESIGNED: MB	DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. D 960+00 TO STA. D 975+00	SURVEY BOOK	SHEET	
CHECKED: EJT	CHECKED: JAM		N/A	31 of 63	
			CONTRACT	PROJECT	
			R-37450	1172430	

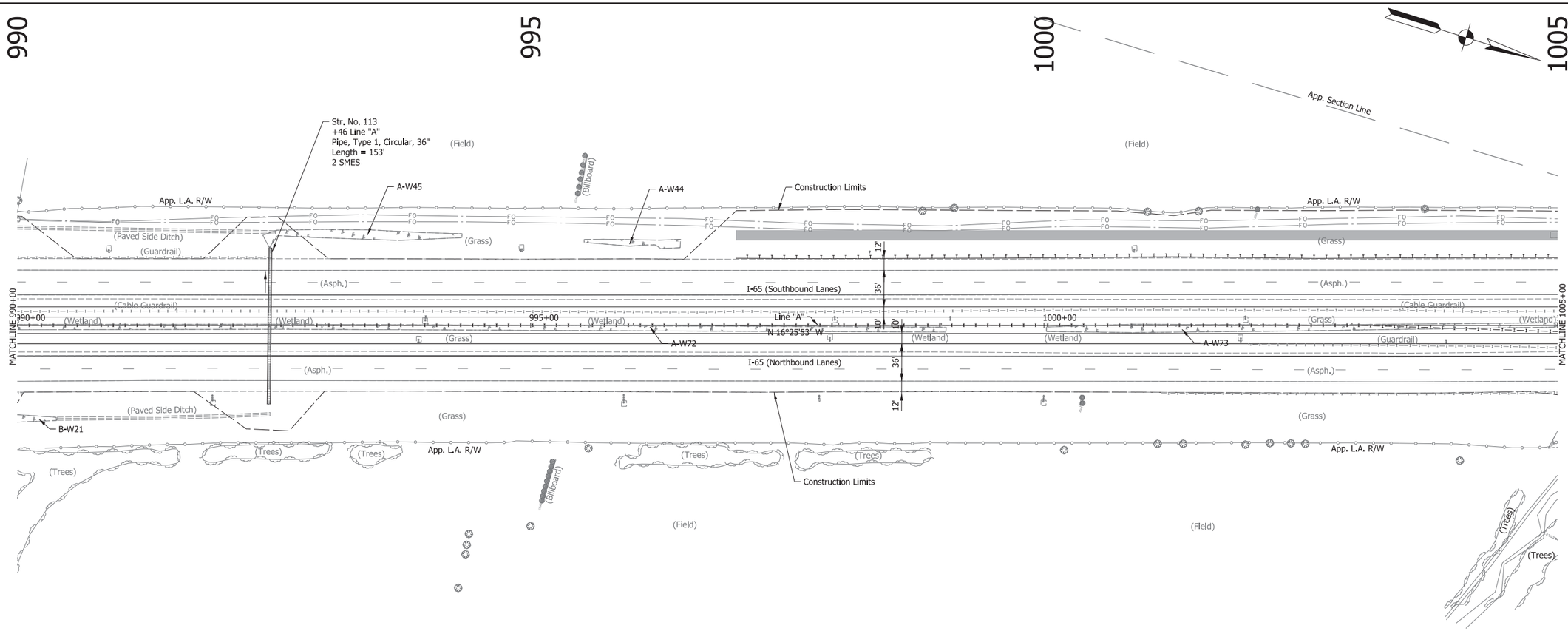
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				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. D 975+00 TO STA. D 990+00	SURVEY BOOK: N/A	SHEET: 32 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

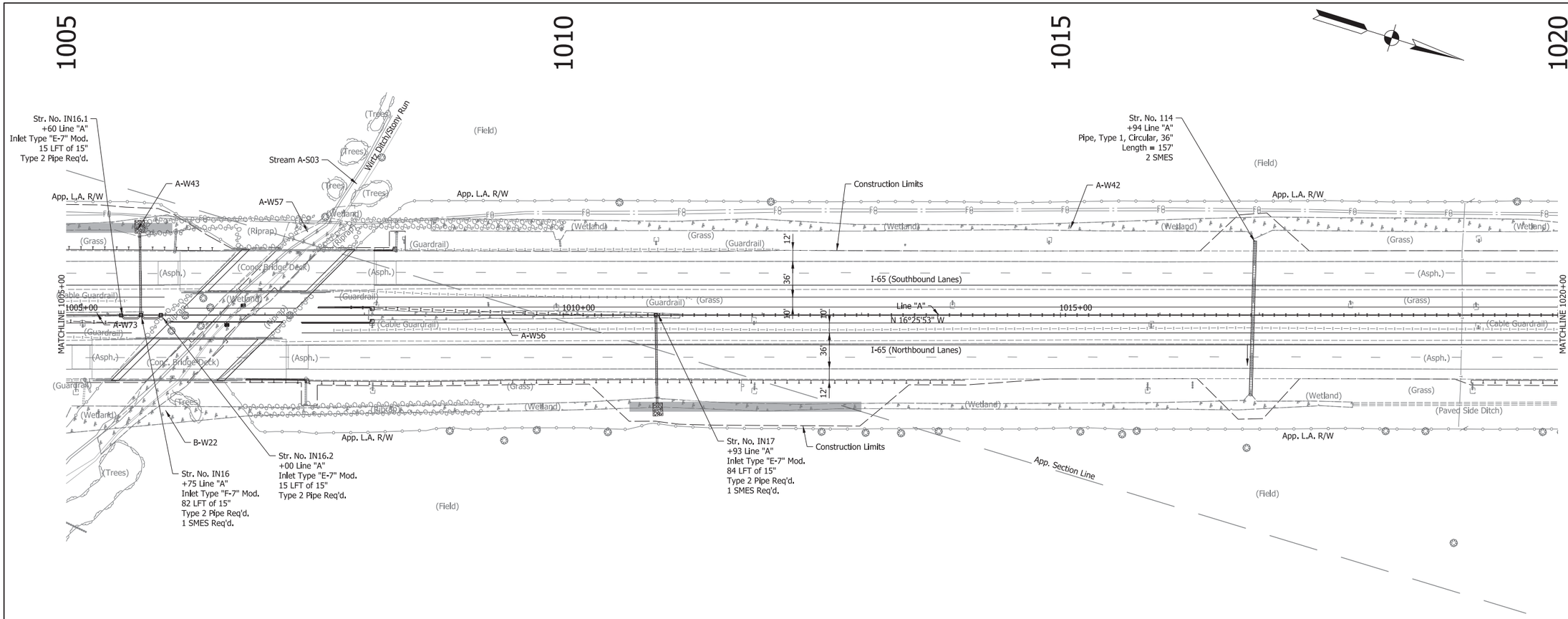
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No ITS Work On This Sheet

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE	1" = 50'	BRIDGE FILE	N/A
		VERTICAL SCALE		DESIGNATION	1172430
DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. D 990+00 TO STA. D 1005+00	SURVEY BOOK	N/A	SHEET	33 of 63
CHECKED: EJT CHECKED: JAM		CONTRACT	R-37450	PROJECT	1172430

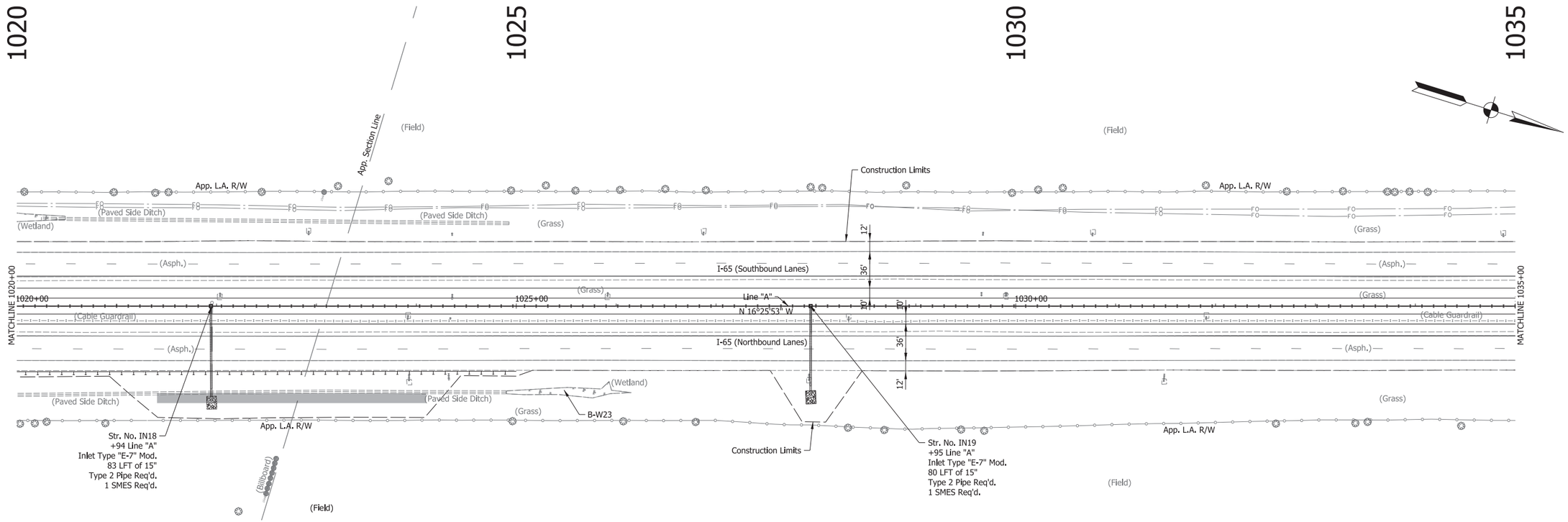
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				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB / DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. D 1005+00 TO STA. D 1020+00	SURVEY BOOK: N/A	SHEET: 34 of 63
		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

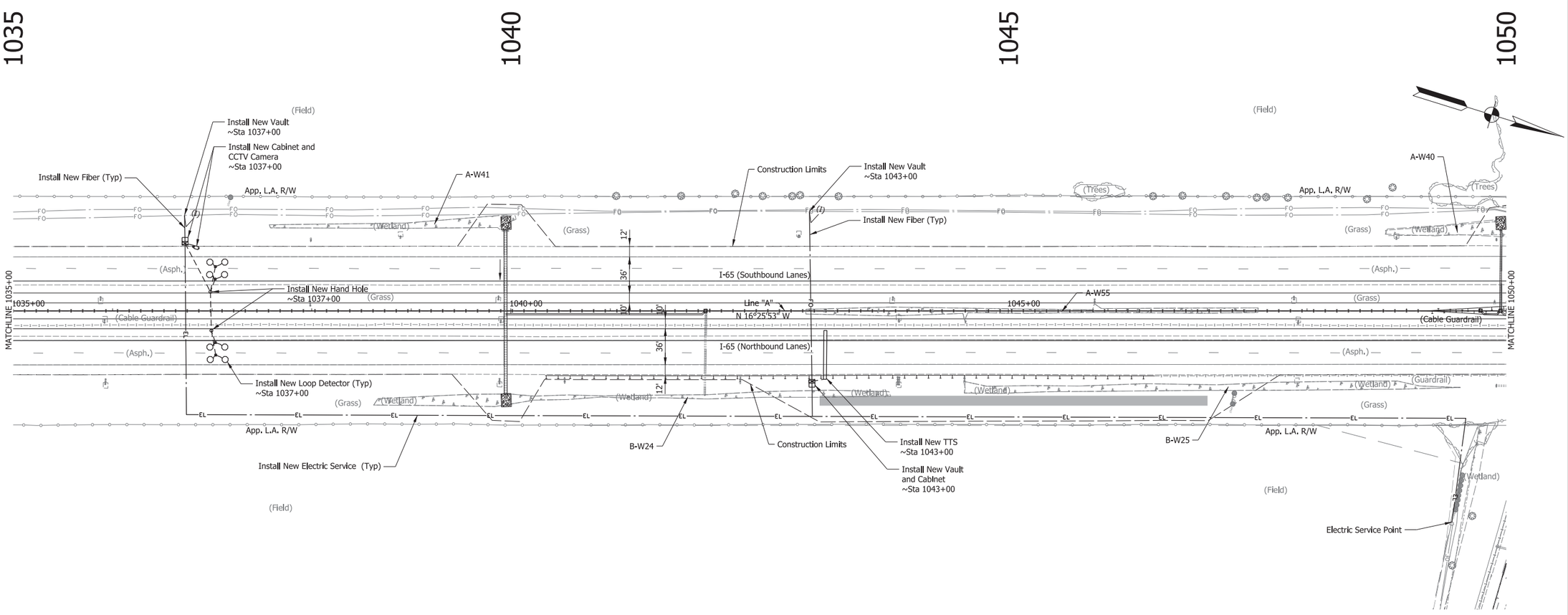
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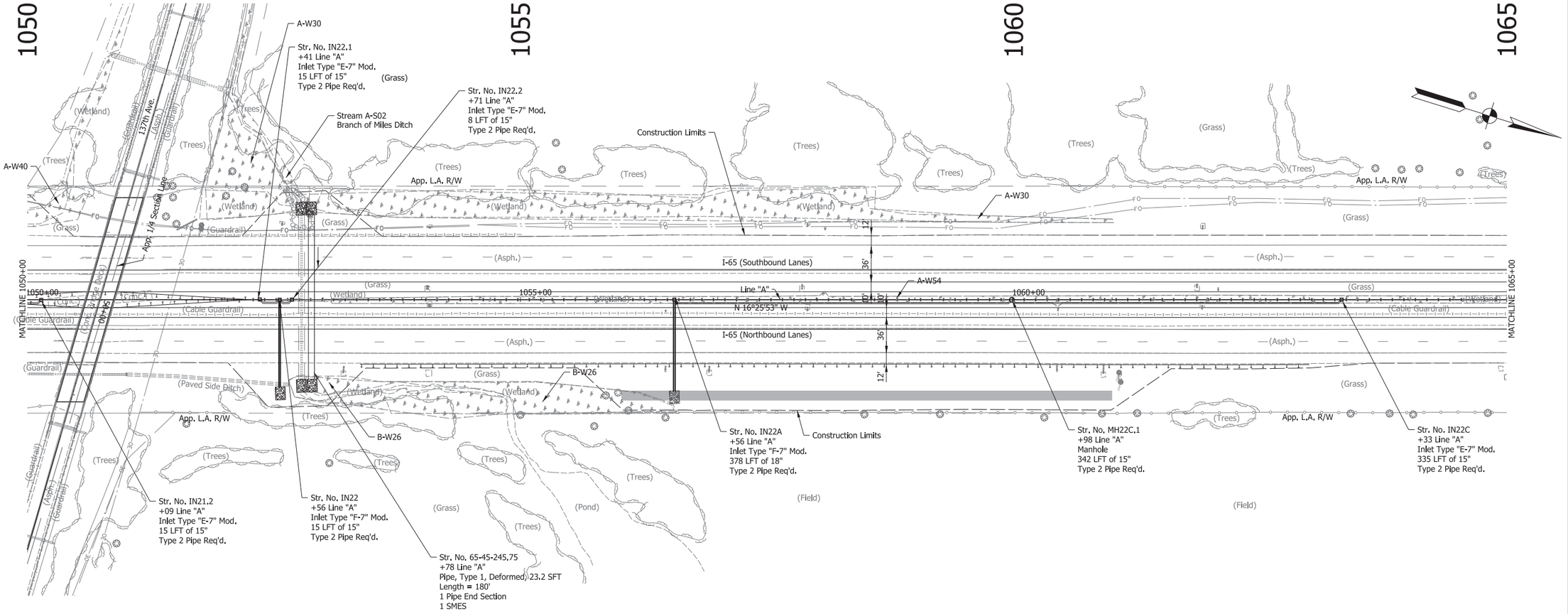
		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. D 1020+00 TO STA. D 1035+00	SURVEY BOOK: N/A	SHEET: 35 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

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		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB / DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. D 1035+00 TO STA. D 1050+00	SURVEY BOOK: N/A	SHEET: 36 of 63
		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

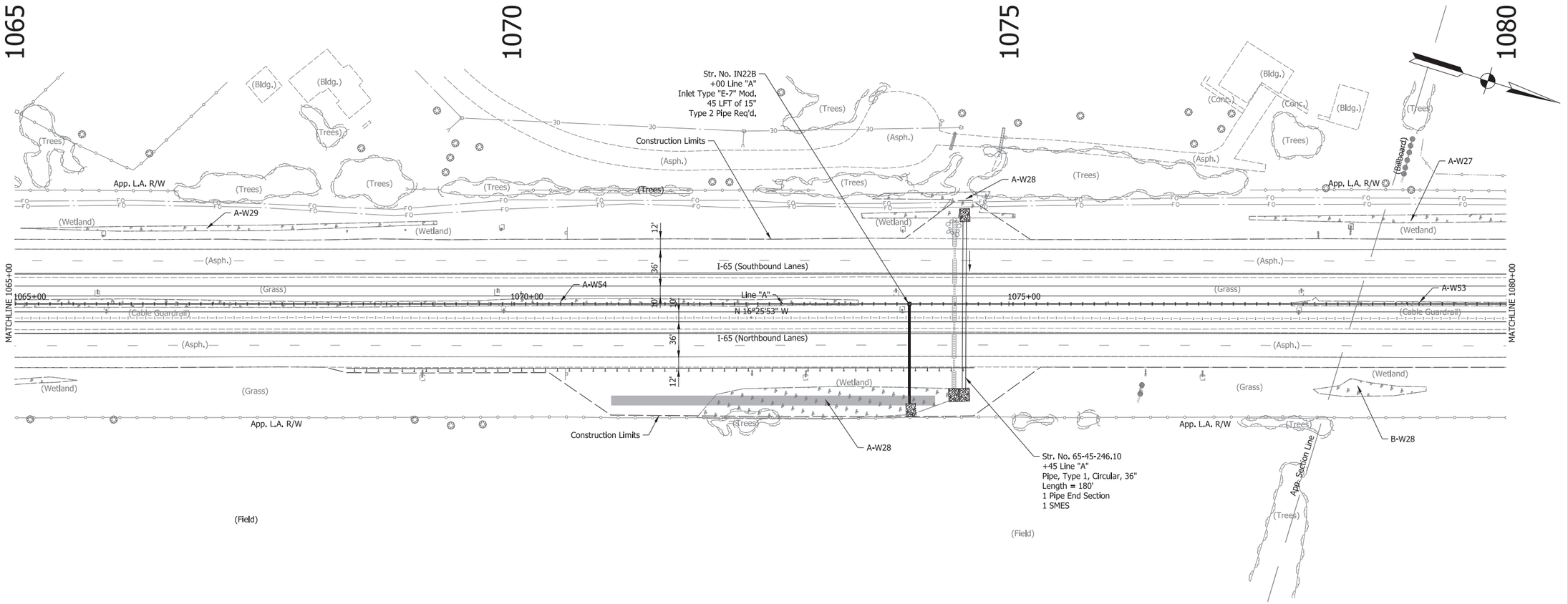
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No ITS Work On This Sheet

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE		INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50' / BRIDGE FILE: N/A / VERTICAL SCALE: / DESIGNATION: 1172430
DESIGNED: MB	DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. D 1050+00 TO STA. D 1065+00	SURVEY BOOK: N/A / SHEET: 37 of 63
CHECKED: EJT	CHECKED: JAM		CONTRACT: R-37450 / PROJECT: 1172430

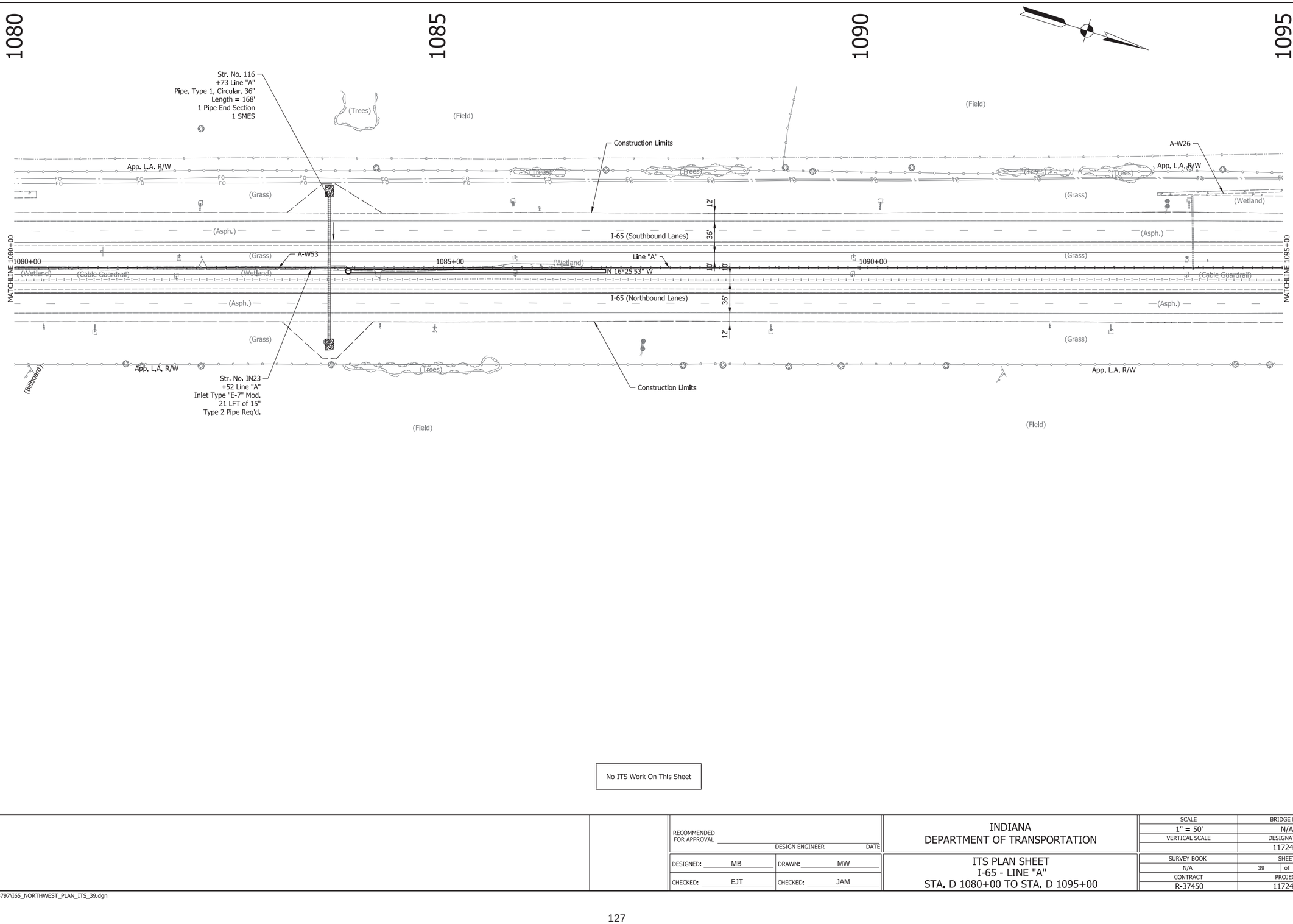
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No ITS Work On This Sheet

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE	1" = 50'	BRIDGE FILE N/A
		VERTICAL SCALE		DESIGNATION 1172430
DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. D 1065+00 TO STA. D 1080+00	SURVEY BOOK	N/A	SHEET 38 of 63
CHECKED: EJT CHECKED: JAM		CONTRACT	R-37450	PROJECT 1172430

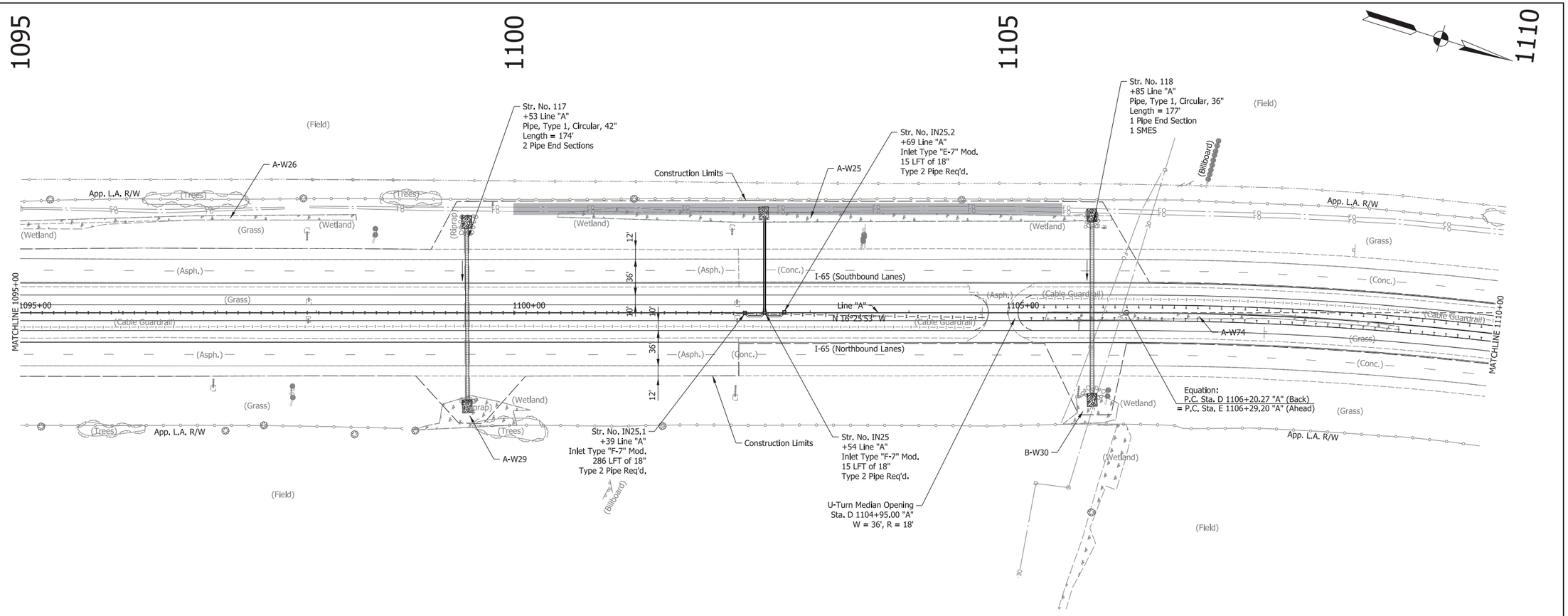
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No ITS Work On This Sheet

		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB / DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. D 1080+00 TO STA. D 1095+00	SURVEY BOOK: N/A	SHEET: 39 of 63
		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_39.dgn



No ITS Work On This Sheet

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
		VERTICAL SCALE:	DESIGNATION: 1172430
DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. D 1095+00 TO STA. E 1110+00	SURVEY BOOK: N/A	SHEET: 40 of 63
CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_40.dgn

1110 1115 1120 1125

P.I. Sta. E 1117+15.53 "A"

Install New Vault, Cabinet and RWIS ~Sta 1111+50

(Field)

A-W24

Construction Limits

Install New Fiber

App. L.A. R/W

(Trees)

(Wetland)

(Grass)

N 16°25'53" W

N 20°16'38" E

12'

48'

12'

A-W39

App. L.A. R/W

(Wetland)

(Grass)

(Conc.)

I-65 (Southbound Lanes)

1115+00

Line "A"

1120+00

36'

10'

10'

12'

(Cable Guardrail)

(Grass)

(Conc.)

SB Entrance Ramp from U.S. 231

(Conc.)

MATCHLINE 1110+00

Install New Hand Hole ~Sta 1111+50

I-65 (Northbound Lanes)

(Guardrail)

(Grass)

EL

NB Exit Ramp to U.S. 231

N 19°27'00" E

(Cable Guardrail)

(Grass)

(Conc.)

(Wetland)

App. L.A. R/W

A-W31

Construction Limits

(Bushes)

MATCHLINE 1125+00

(Conc.)

(Grass)

(Guardrail)

(Wetland)

App. L.A. R/W

Install New Loop Detector (Typ) ~Sta 1111+50

Install New Electric Service (Typ)

Curve Data
P.I. Sta. E 1117+15.53 "A"
Delta=36°42'31" Lt.
D=1°44'59"
R=3274.33'
T=1086.33'
L=2097.82'
E=175.50'

Electric Service Point

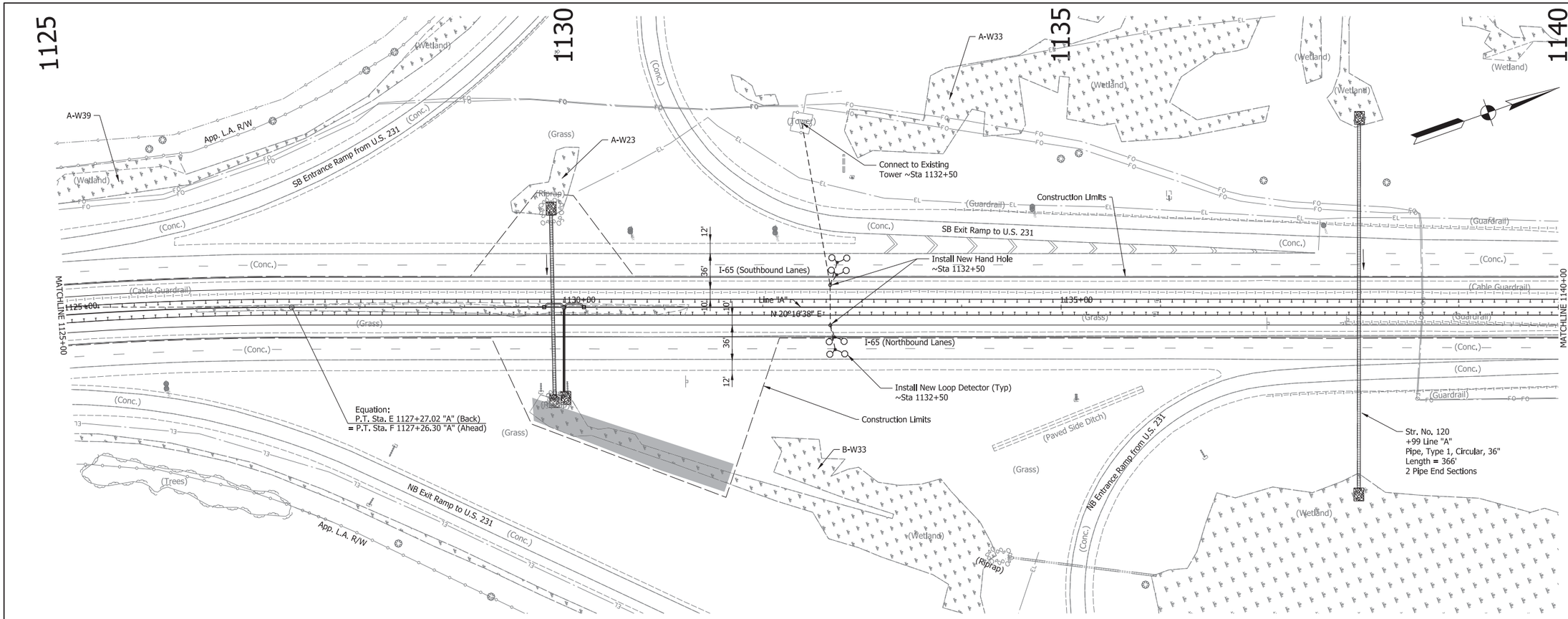
(Pond)

(Field)

(Field)

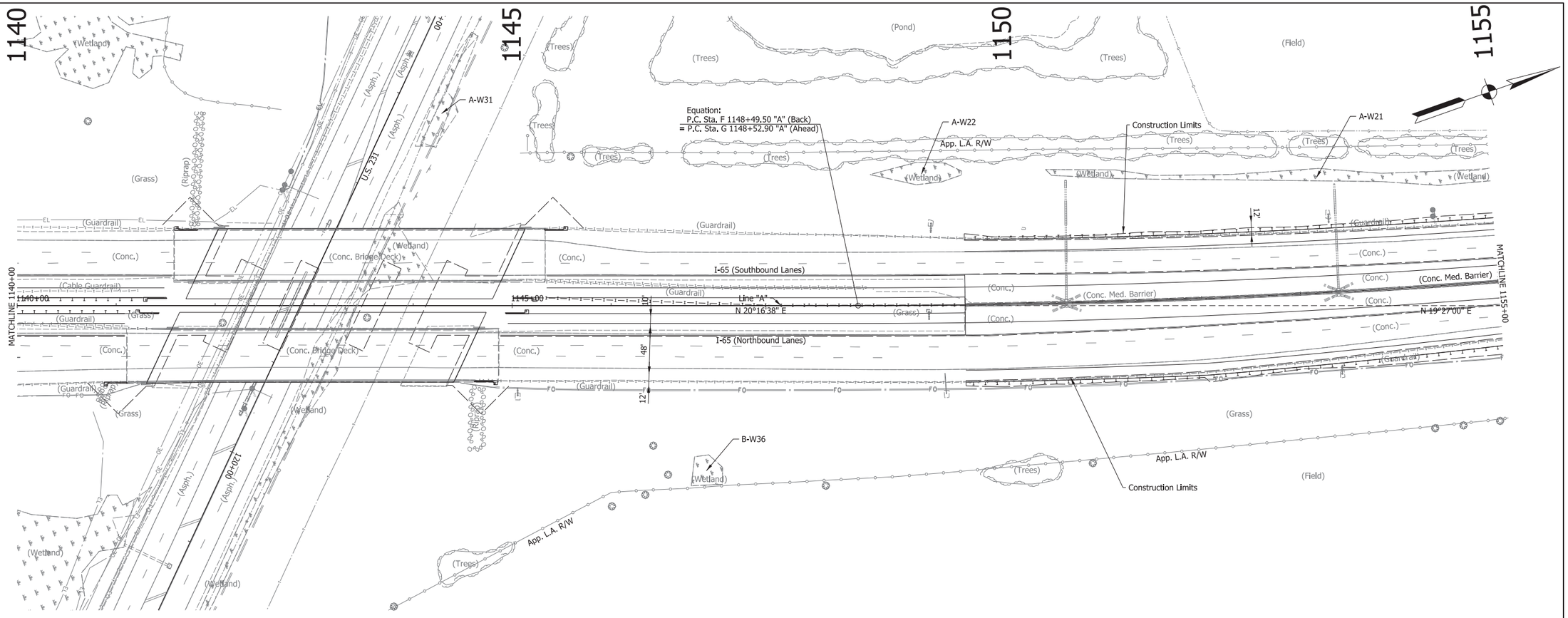
		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE 1" = 50'	BRIDGE FILE N/A
				VERTICAL SCALE	DESIGNATION 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. E 1110+00 TO STA. E 1125+00	SURVEY BOOK N/A	SHEET 41 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT R-37450	PROJECT 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_41.dgn



		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB / DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. E 1125+00 TO STA. F 1140+00	SURVEY BOOK: N/A	SHEET: 42 of 63
		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

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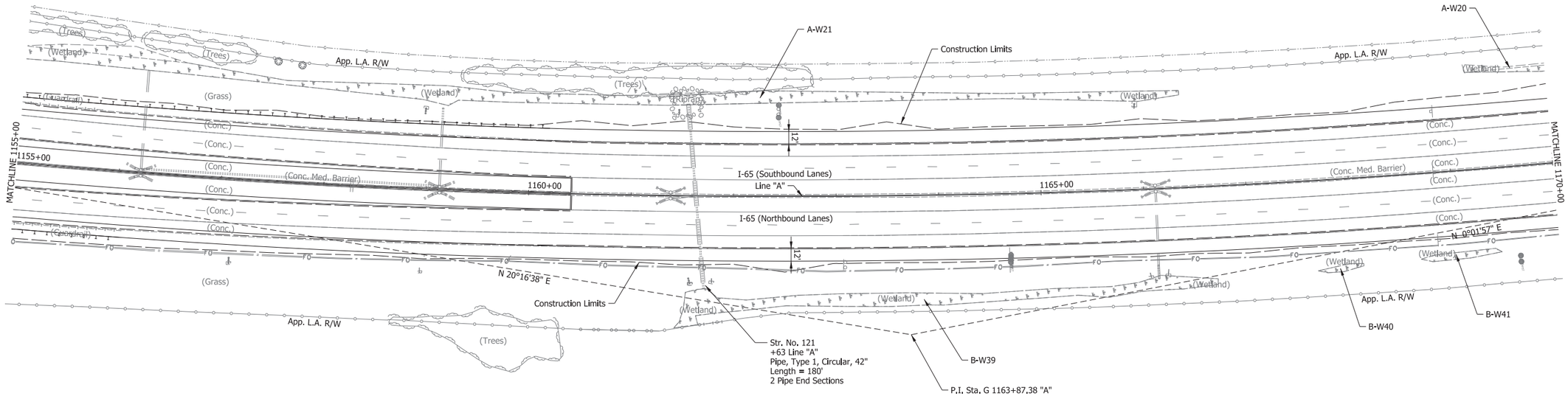
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		RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE	INDIANA DEPARTMENT OF TRANSPORTATION	SCALE: 1" = 50'	BRIDGE FILE: N/A
				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. F 1140+00 TO STA. G 1155+00	SURVEY BOOK: N/A	SHEET: 43 of 63
		CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_43.dgn

1155 1160 1165 1170

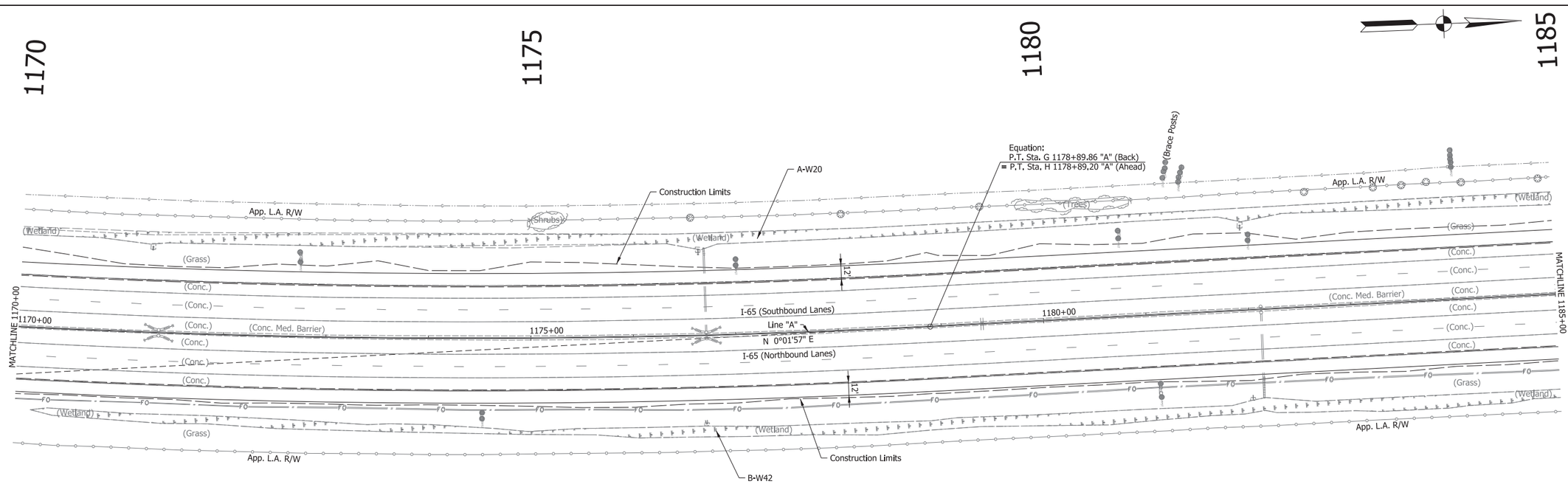
Curve Data
P.I. Sta. G 1163+87.38 "A"
Delta=20°14'41" Lt.
D=0°40'00"
R=8595.11'
T=1534.48'
L=3036.97'
E=135.90'



No ITS Work On This Sheet

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE		INDIANA DEPARTMENT OF TRANSPORTATION	SCALE	BRIDGE FILE	
			1" = 50'	N/A	
			VERTICAL SCALE	DESIGNATION	
				1172430	
DESIGNED: MB	DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. G 1155+00 TO STA. G 1170+00	SURVEY BOOK	SHEET	
			N/A	44 of 63	
CHECKED: EJT	CHECKED: JAM		CONTRACT	PROJECT	
			R-37450	1172430	

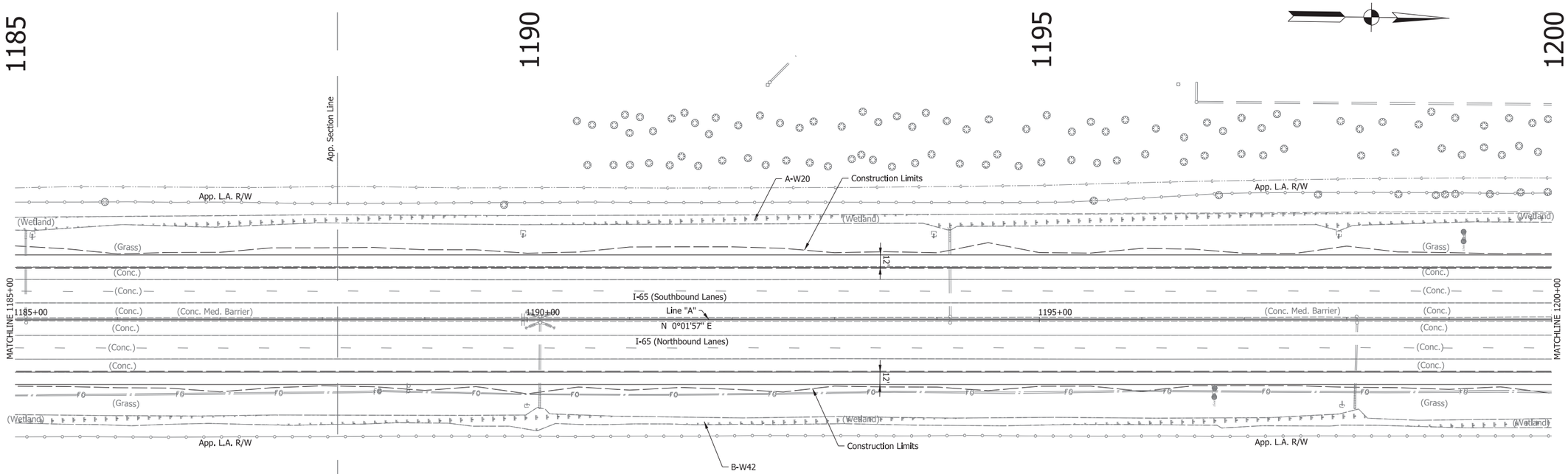
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No ITS Work On This Sheet

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				VERTICAL SCALE:	DESIGNATION: 1172430
		DESIGNED: MB / DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. G 1170+00 TO STA. H 1185+00	SURVEY BOOK: N/A	SHEET: 45 of 63
		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

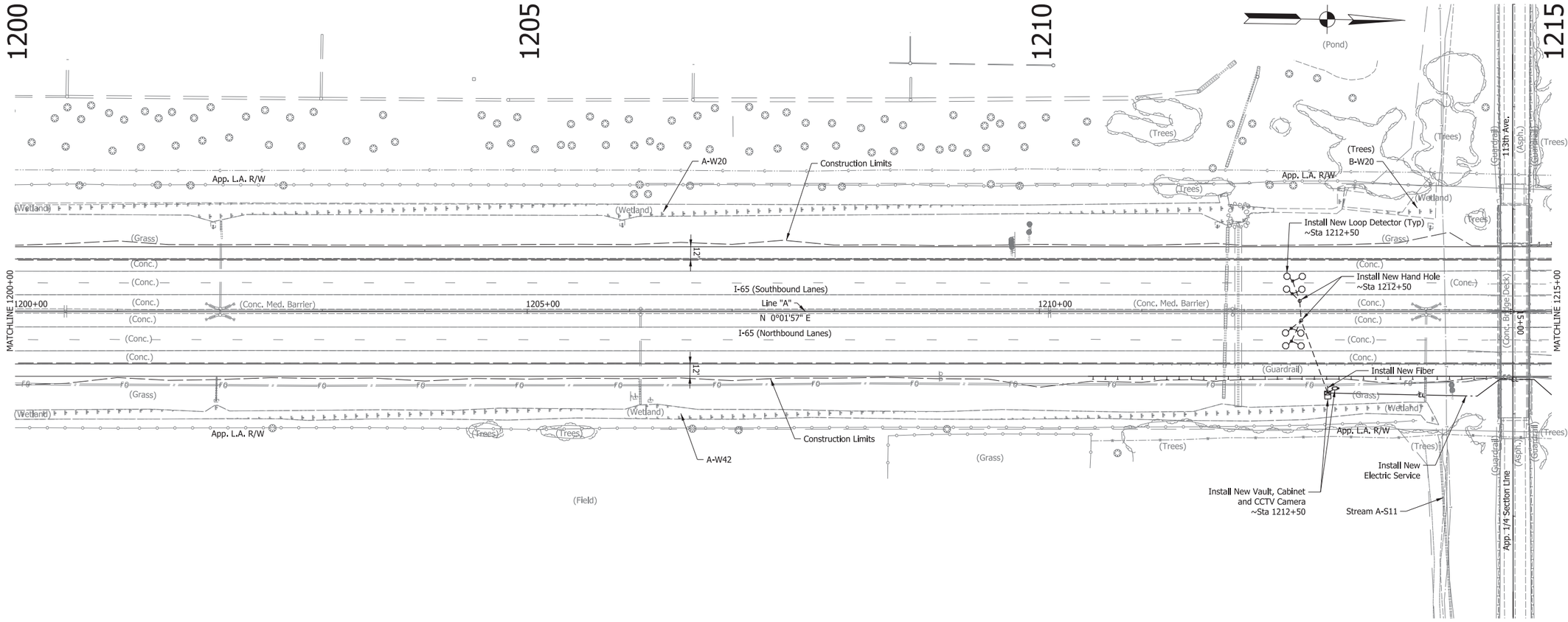
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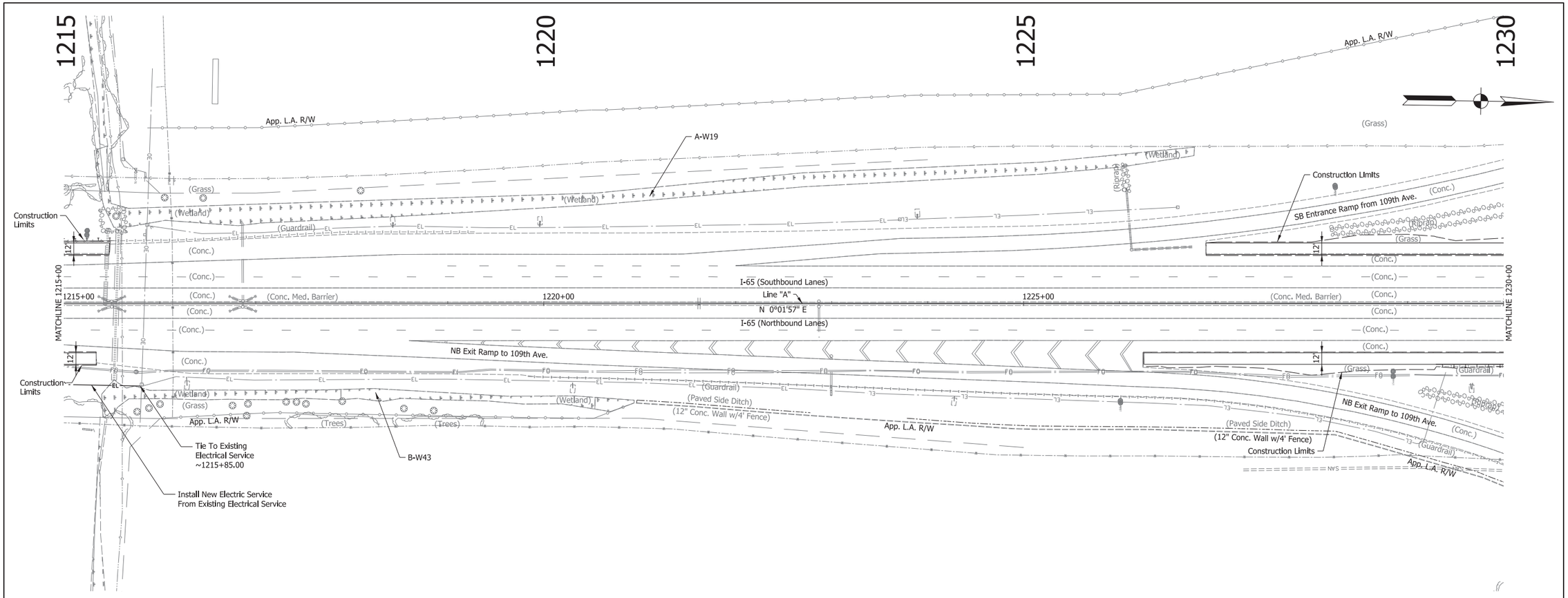
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		VERTICAL SCALE:	DESIGNATION: 1172430
DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. H 1185+00 TO STA. H 1200+00	SURVEY BOOK: N/A	SHEET: 46 of 63
CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_46.dgn



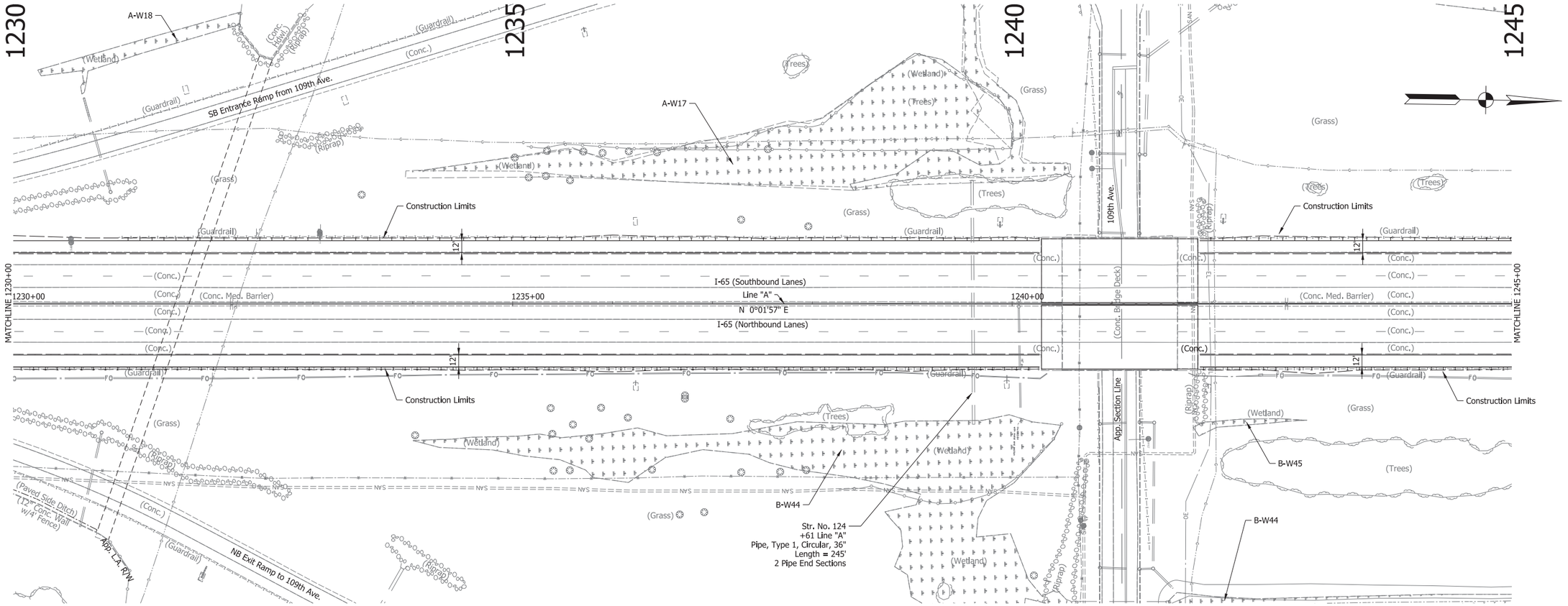
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		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

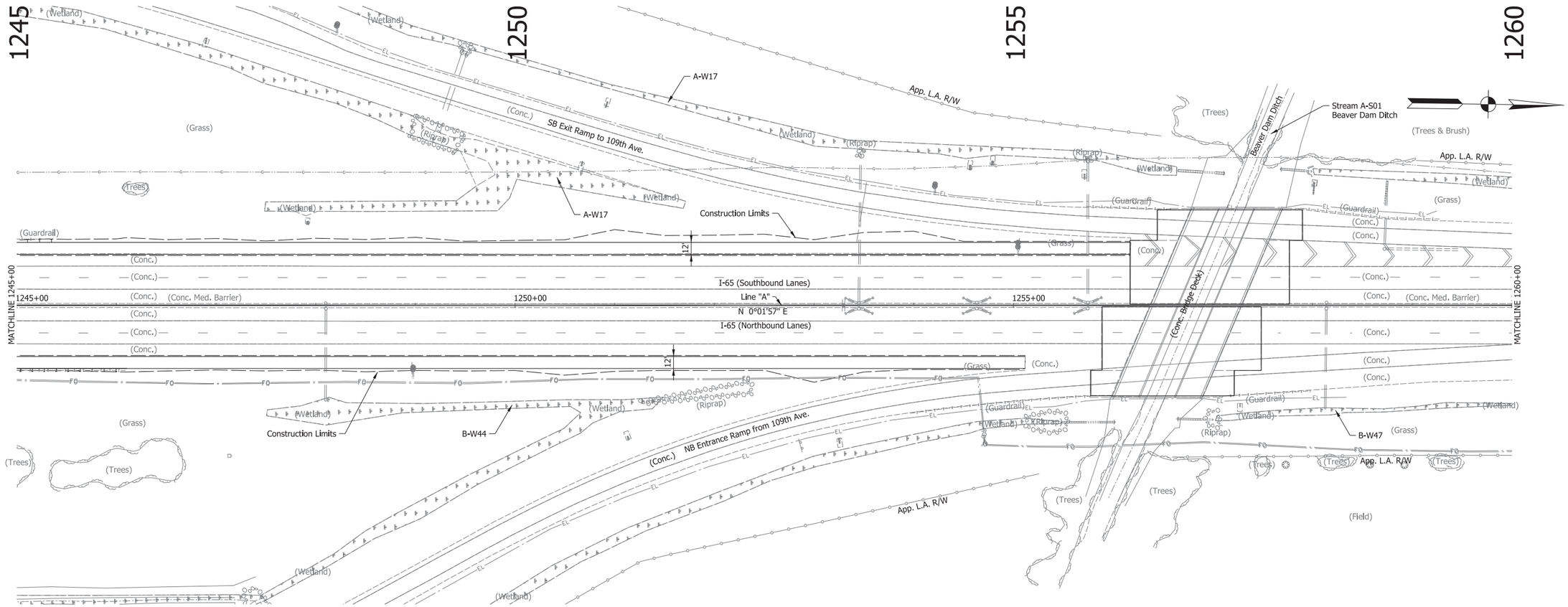
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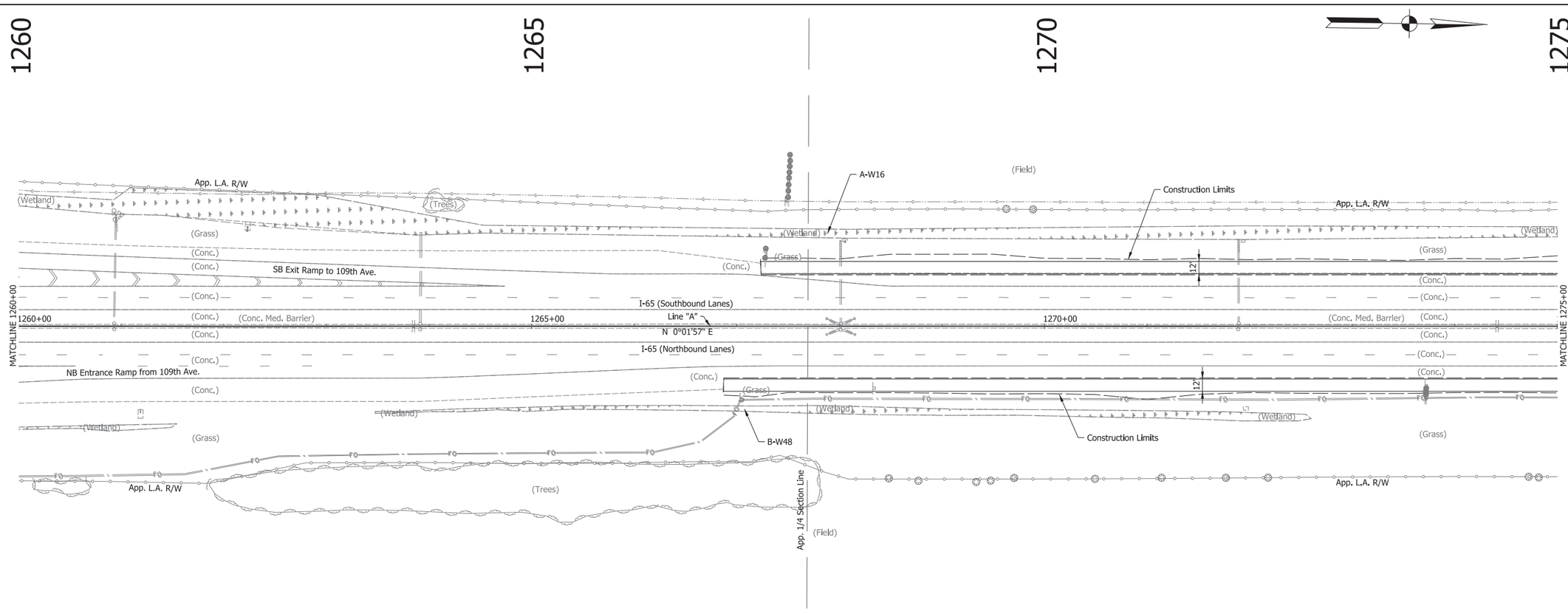

1230
1235
1240
1245
A-W18
(Wetland)
(Conc. Hdwl.)
(Riprap)
(Guardrail)
(Conc.)
SB Entrance Ramp from 109th Ave.
(Grass)
(Riprap)
A-W17
(Trees)
(Wetland)
(Trees)
(Grass)
(Trees)
109th Ave.
(Grass)
(Trees)
(Trees)
Construction Limits
(Guardrail)
12'
(Conc.)
(Conc.)
(Conc. Med. Barrier)
(Conc.)
(Conc.)
(Conc.



No ITS Work On This Sheet

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CHECKED: EJT	CHECKED: JAM		CONTRACT: R-37450 / PROJECT: 1172430

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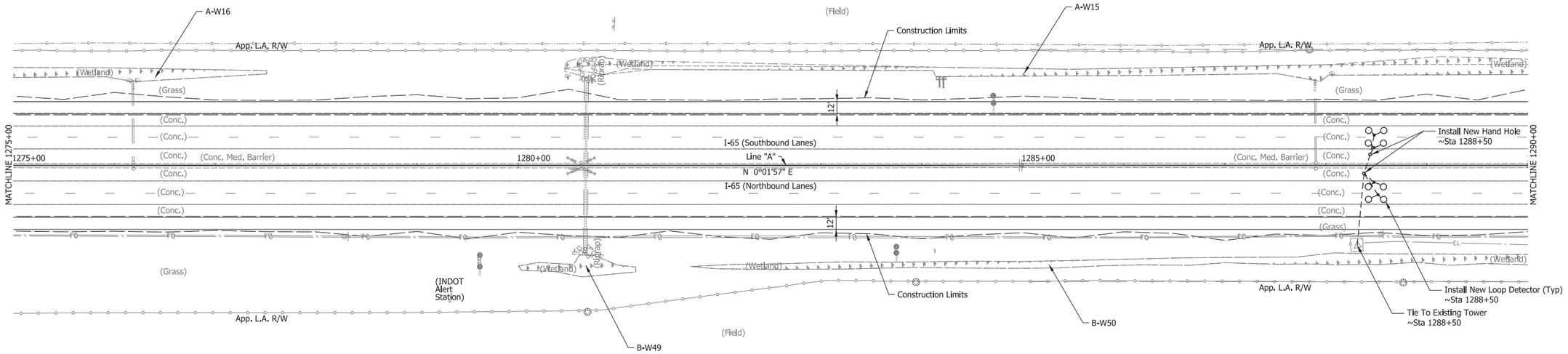


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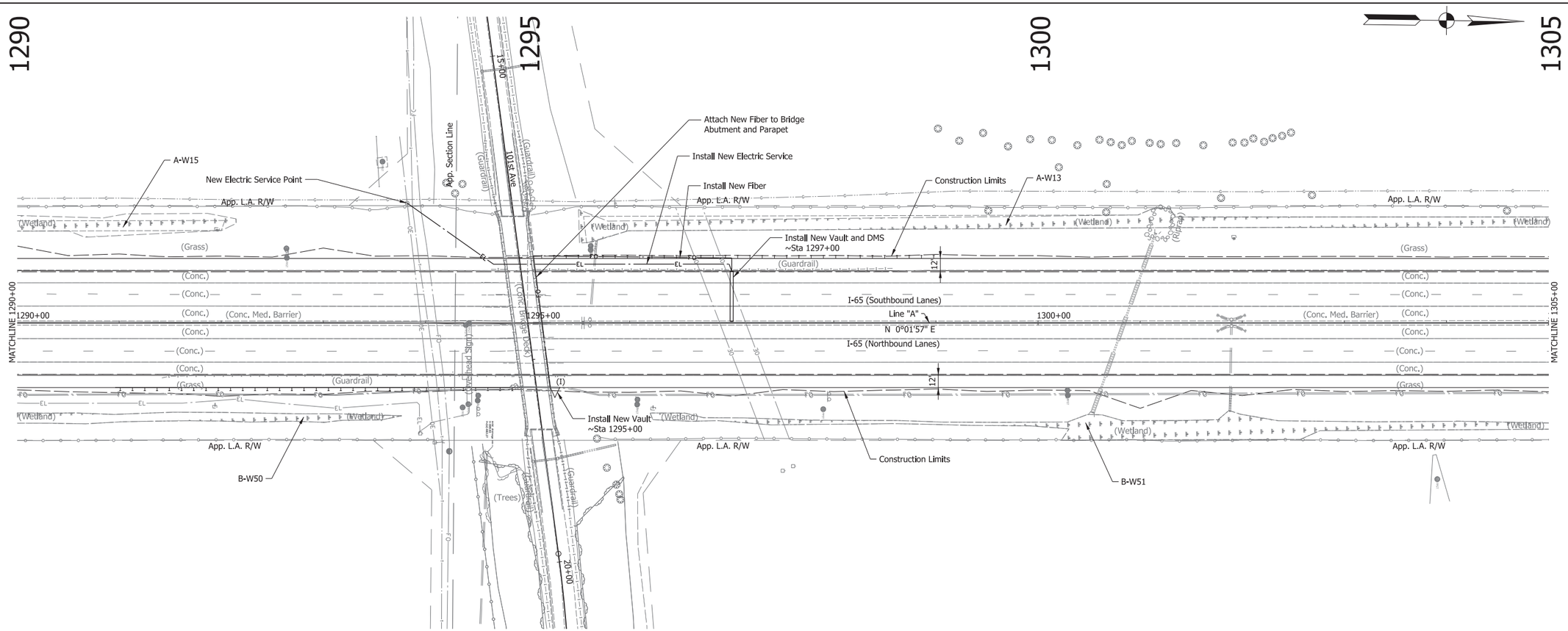
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1275 1280 1285 1290



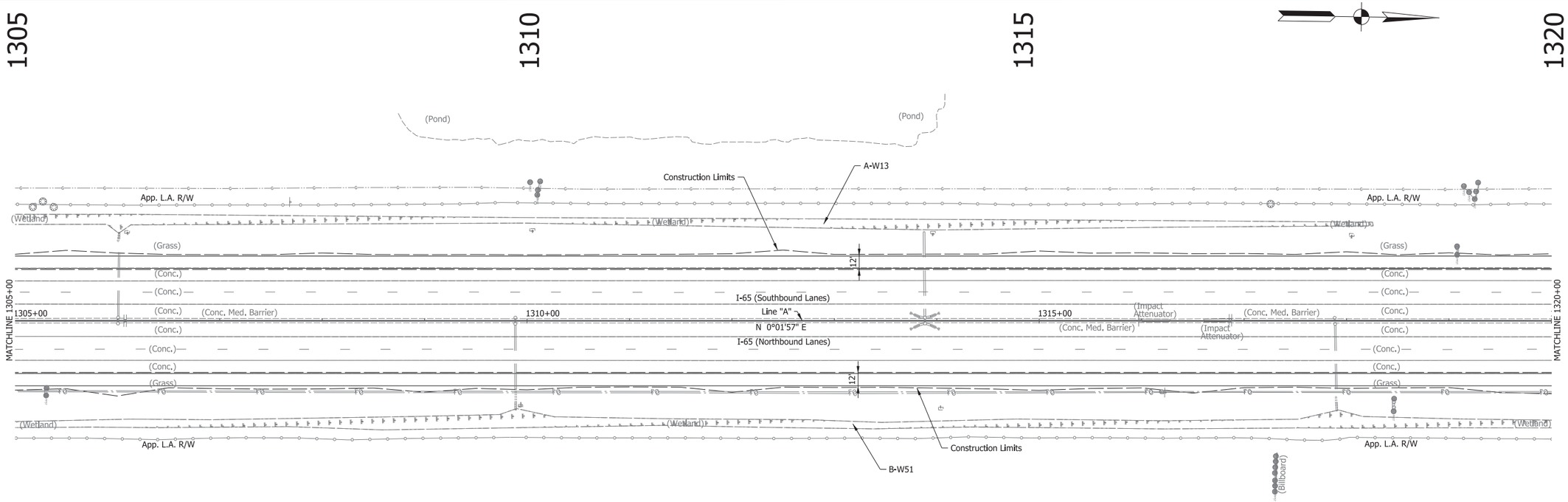
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		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

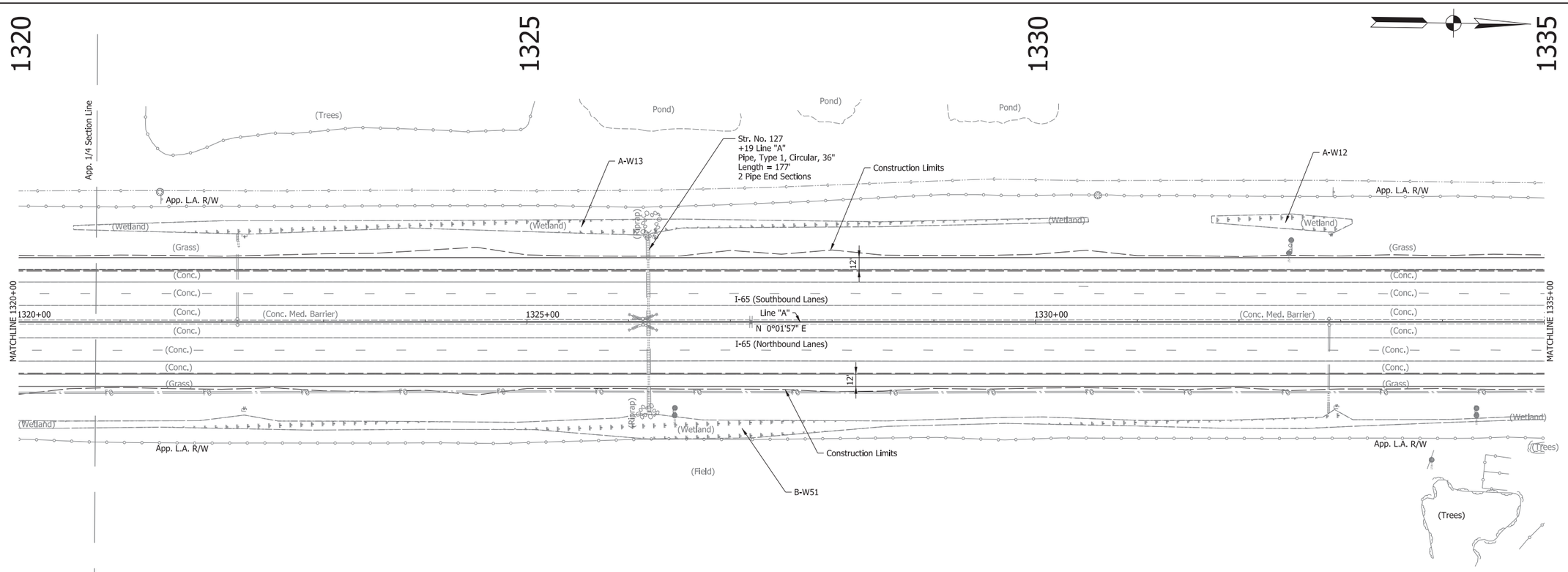
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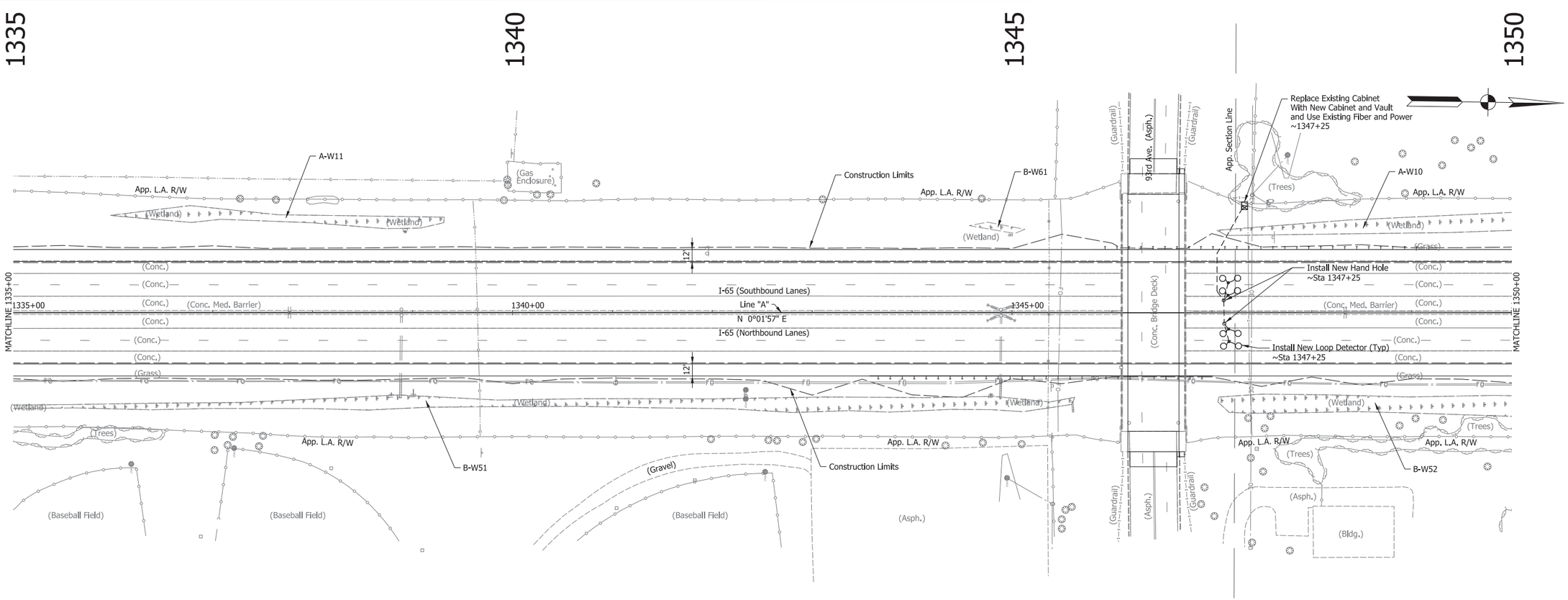
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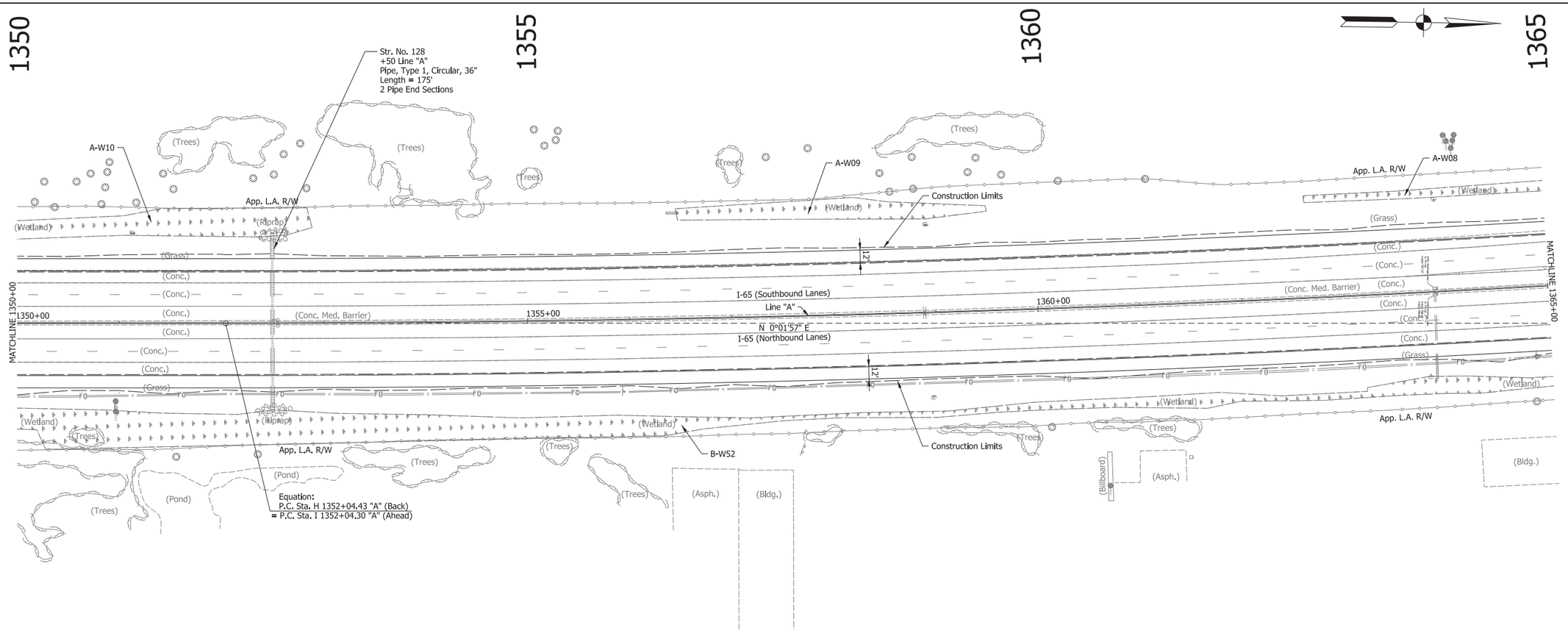
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	CHECKED: EJT CHECKED: JAM		CONTRACT R-37450	PROJECT 1172430

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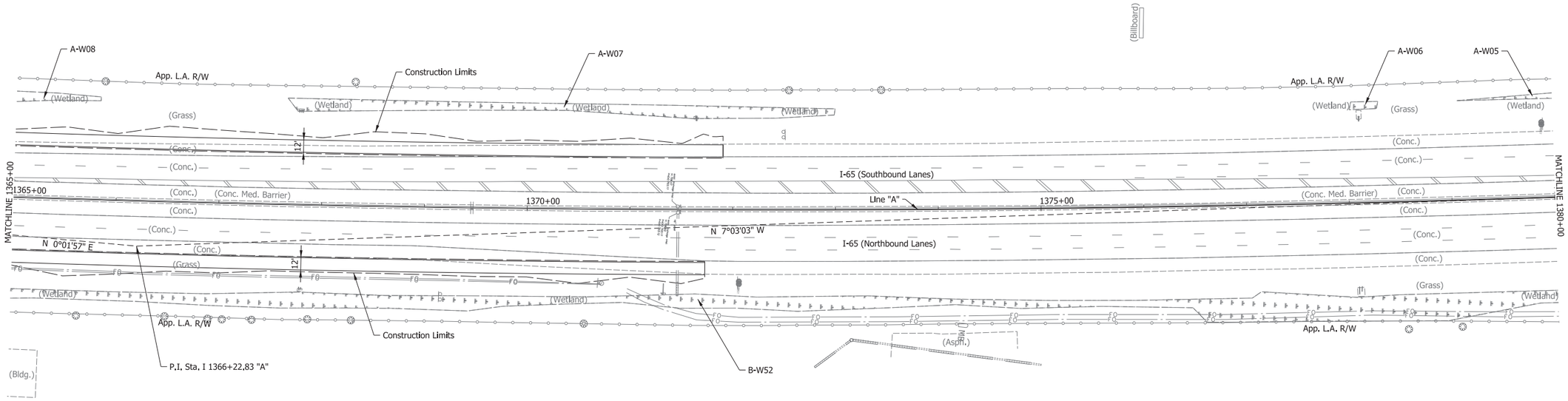
1365

1370

1375

1380

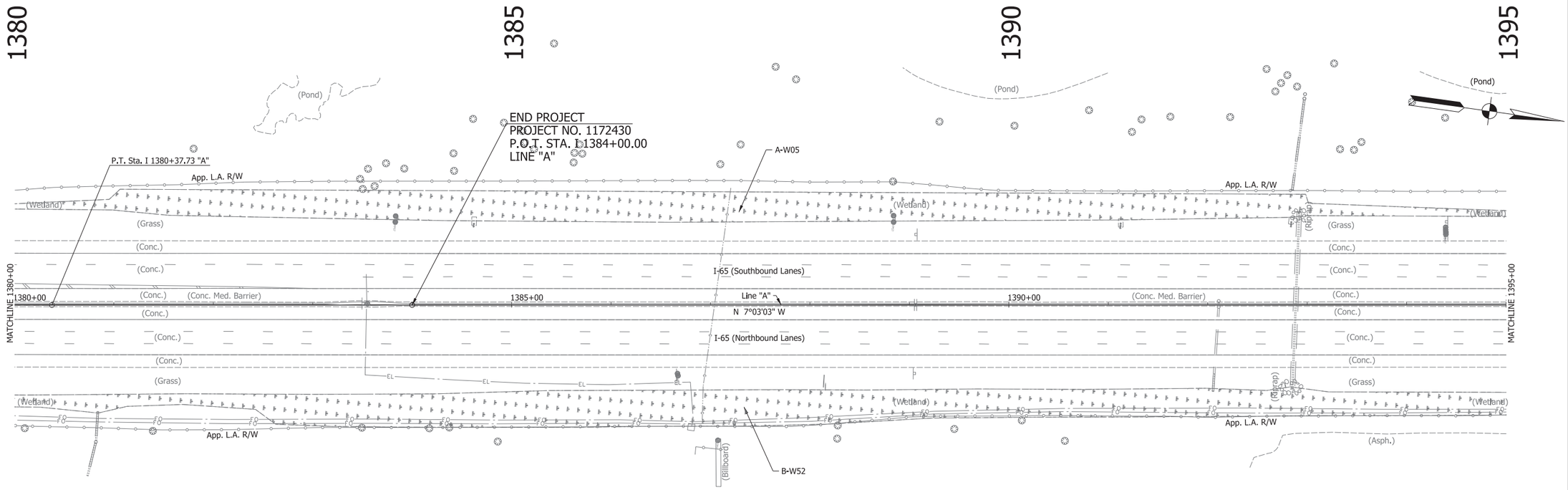
Curve Data
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D=0°15'00"
R=22918.55'
T=1418.52'
L=2833.43'
E=43,86'

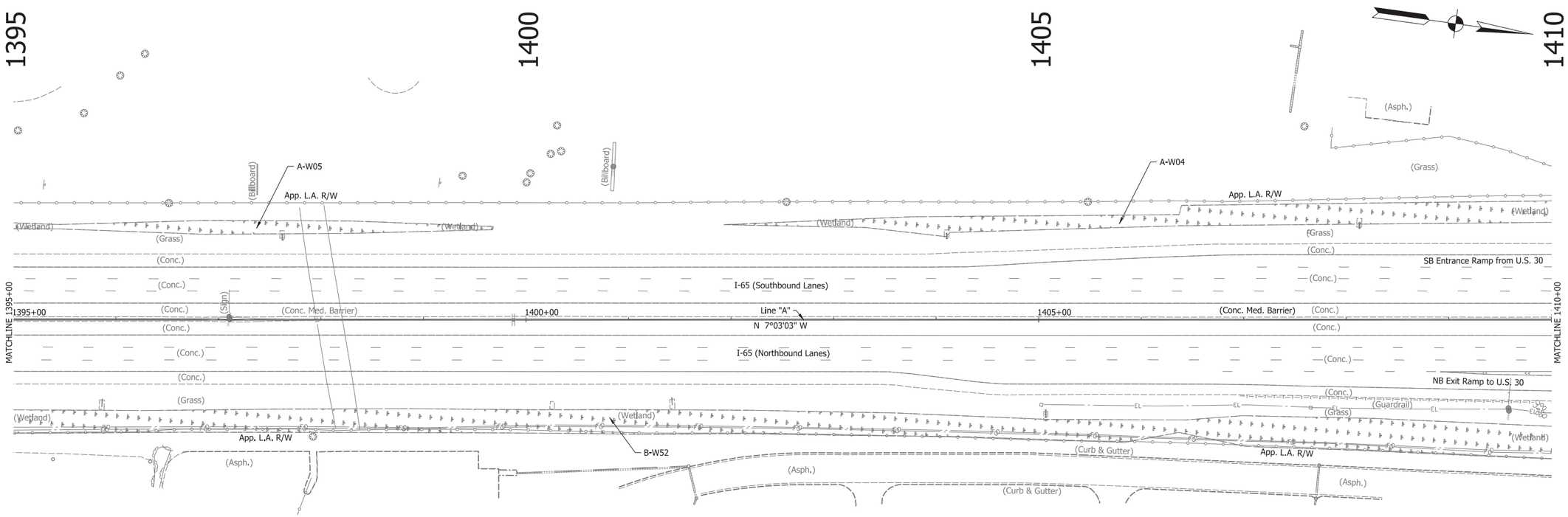


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			VERTICAL SCALE	DESIGNATION	
				1172430	
DESIGNED: MB	DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. I 1365+00 TO STA. I 1380+00	SURVEY BOOK	SHEET	
			N/A	58 of 63	
CHECKED: EJT	CHECKED: JAM		CONTRACT	PROJECT	
			R-37450	1172430	

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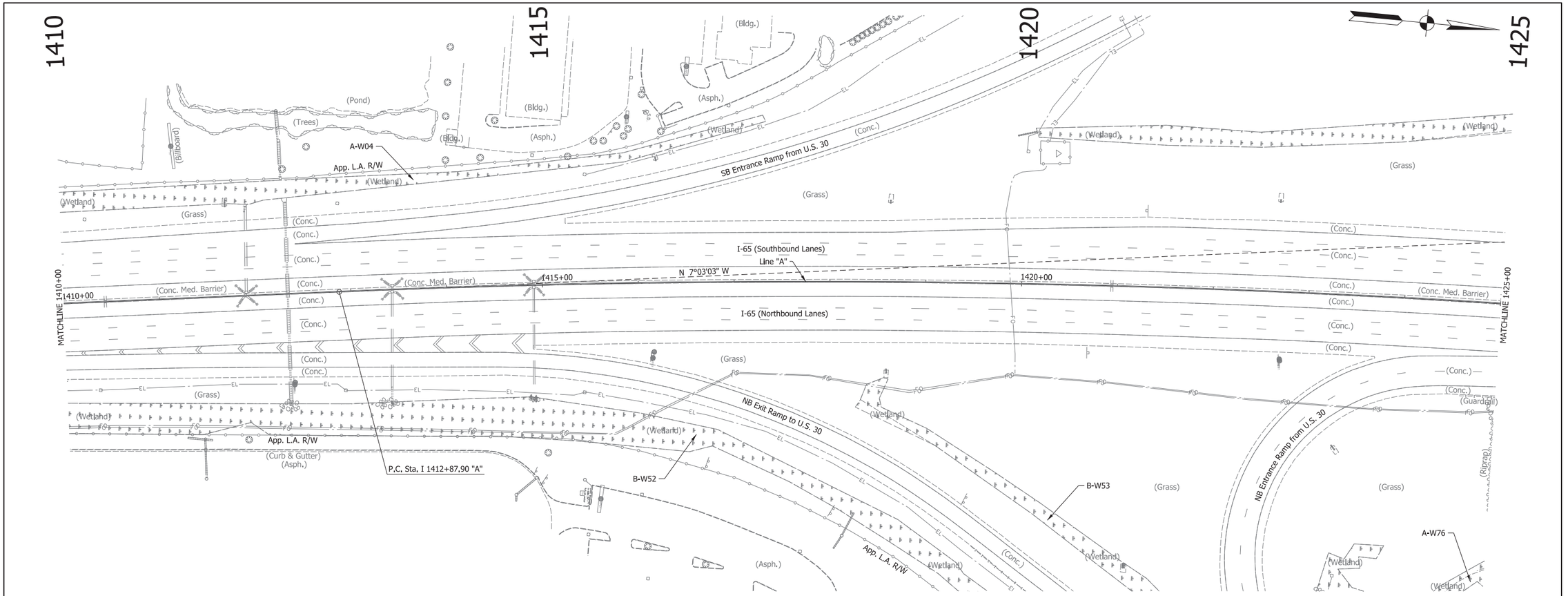

1380
1385
1390
1395
(Pond)
(Pond)
(Pond)
END PROJECT
PROJECT NO. 1172430
P.O.T. STA. I 1384+00.00
LINE "A"
P.T. Sta. I 1380+37.73 "A"
App. L.A. R/W
A-W05
App. L.A. R/W
(Wetland)
(Wetland)
(Wetland)
(Grass)
(Grass)
(Conc.)
(Conc.)
(Conc.



No ITS Work On This Sheet

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		CHECKED: EJT / CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

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DESIGNED: MB DRAWN: MW	ITS PLAN SHEET I-65 - LINE "A" STA. I 1410+00 TO STA. I 1425+00	SURVEY BOOK: N/A	SHEET: 61 of 63
CHECKED: EJT CHECKED: JAM		CONTRACT: R-37450	PROJECT: 1172430

IP_PWP:dms13797\I65_NORTHWEST_PLAN_ITS_61.dgn

1425

1430

1435

1440

(Wetland)

(Wetland)

(Wetland)

(Wetland)

P.I, Sta. I 1431+18,25 "A"

N 7°03'03" W

N 11°05'53" E

I-65 (Southbound Lanes)

I-65 (Northbound Lanes)

MATCHLINE 1425+00

1425+00

1430+00

Line "A"

1435+00

Curve Data
P.I. Sta. I 1431+18.25 "A"
Delta=18°08'56" Rt.
D=0°30'00"
R=11460.00'
T=1830.35'
L=3630.04'
E=145.25'

(Wetland)

(Wetland)

(Wetland)

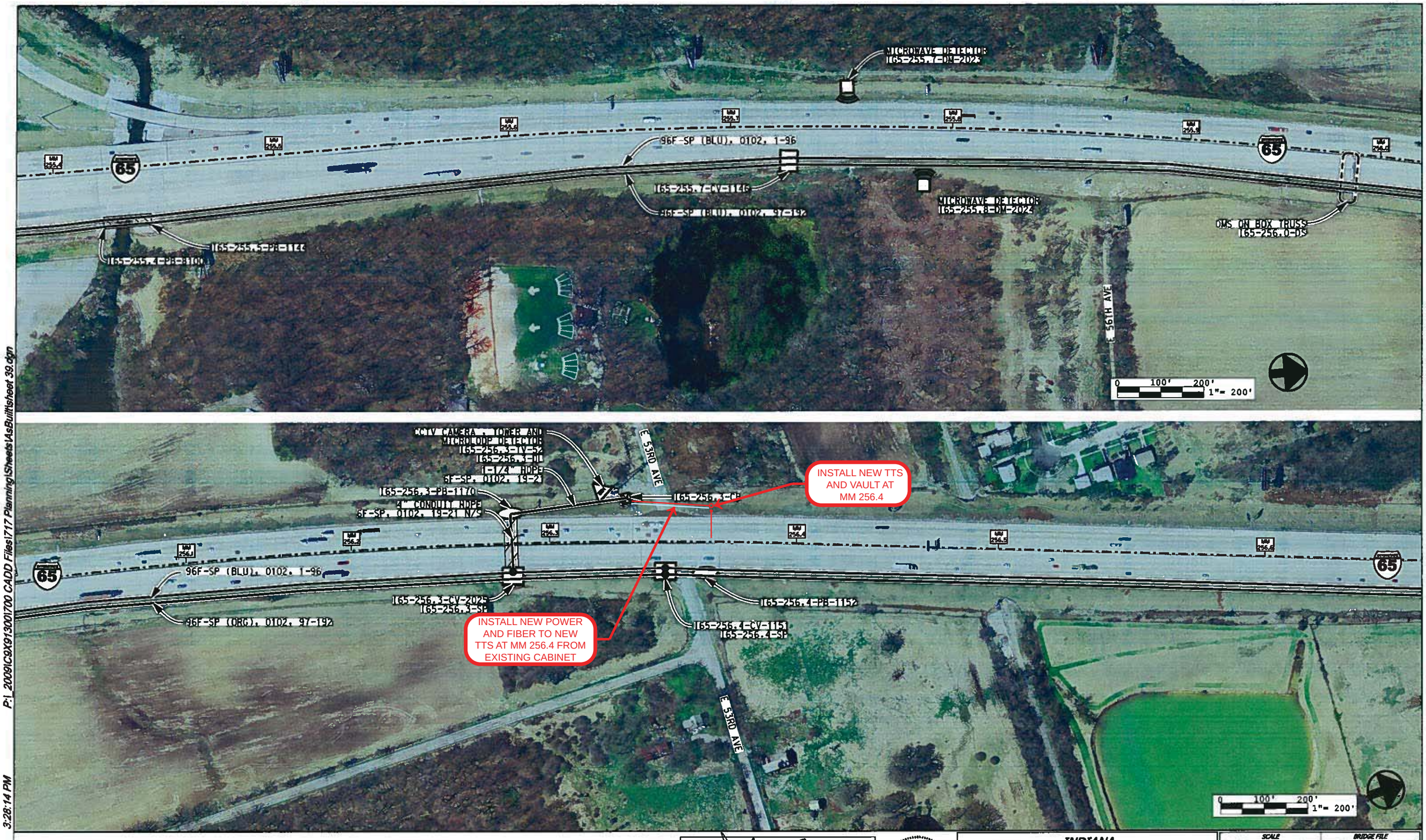
(Wetland)

(Wetland)

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1/27/2010 3:28:14 PM

MEADE Edwards AND Kelcey

SEGMENT 4-AS-BUILT
JANUARY 28, 2010

RECOMMENDED FOR APPROVAL	DESIGN ENGINEER	1/28/2010 DATE	
DESIGNED: JEZ		DRAWN: KDM	
CHECKED: JD		CHECKED: JLS	

JOHN EDWARD ZITTOM REGISTERED PE#0809586 STATE OF INDIANA PROFESSIONAL ENGINEER

INDIANA DEPARTMENT OF TRANSPORTATION

ATMS CABLE DIAGRAM
I-65 MM 255.3 TO 256.6

SCALE	BRIDGE FILE
NTS	
	DESIGNATION
	0501267
SURVEY BOOK	SHEETS
	63 of 63
CONTRACT	PROJECT
T-29786	0501267

PAVEMENT DESIGN REPORT

PAVEMENT DESIGN REPORT

I-65

WALSH PARSONS Walsh & Kelly

Pavement Design Report
I-65 Northwest
Jasper and Lake Counties

August 5, 2016

Prepared For:

Indiana Department of Transportation
100 N. Senate Avenue
Indianapolis, IN 46204

PREPARED BY:

PARSONS TRANSPORTATION GROUP, INC.
101 W. Ohio Street, Suite 2121
Indianapolis, IN 46204

WALSH CONSTRUCTION COMPANY II, LLC
1260 East Summit Street
Crown Point, IN 46307

WALSH & KELLY, INC.
1700 East Main Street
Griffith, IN 46319

Designed By: _____ Checked By: _____

Timothy J. Kent, PE Benjamin S. Carnahan, PE

Table of Contents

Executive Summary 3
Project Description 6
Pavement History and Condition 9
Methodology and Computations 11
Recommendations 19
Construction Considerations 21
Maintenance Considerations 22
Appendices
Appendix A: Traffic Projections
Appendix B: PG Binder Selection
Appendix C: Pavement ME Output

2

Executive Summary

The most significant cost component of the I-65 Northwest Major Moves project is the pavement. The Walsh DBT spent significant time optimizing the proposed pavement design and the predicted pavement failures. The optimization was influenced by the functional and structural life requirements in the TP. The Walsh DBT applied innovation to pavement design to meet or exceed these thresholds, while reducing the cost of project delivery.

Detailed in this report are the proposed pavement designs for the I-65 Northwest Major Moves project in Lake and Jasper counties. The project consists of Roadway Rehabilitation and Reconstruction as well as Bridge Rehabilitation. In accordance with the Technical Provisions (TP), Indiana Design Manual (IDM), and the Mechanistic Empirical Design Guide (MEPDG), pavement designs have been developed for each segment of the project.

Refer to the Project Description section of this report for a detailed description of the project segments and the work involved with each. The proposed pavement designs for each roadway segment are as follows:

Proposed Pavement Designs – Segment A

I-65 Mainline Outside Shoulder Construction

From Station G 1160+41.00 to Station I 1371+90.47:

Remove Compacted Aggregate, No. 53, while protecting geotextile
QC/QA-PCCP, 14 inch with
D-1 joints spaced at 18 feet with 1½-inch dowel bars at 12-inch spacing on existing/repaired subbase. Retrofitted tie bars shall be size #6 installed at 3-foot spacing.

I-65 Mainline Partial-Depth PCCP Patching

Partial-depth patching, where required, shall consist of PCCP Patching, Partial Depth per INDOT Standard Specification Section 506.

I-65 Mainline Full-Depth PCCP Patching

Full-depth patching, where required, shall consist of a minimum of 14 inch PCCP with 15 feet maximum joint spacing. Refer to the PCCP Patching, Full Depth USP in the TP.

Bridge 1 - 93rd Avenue over I-65

For Bridge Approaches:

Variable-Depth Asphalt Milling then
165 lb/yd^2 QC/QA-HMA, 3, 64, Surface, 9.5 mm on
Existing Pavement

Bridge 2 – 101st Avenue over I-65

No work is required for this structure.

Bridges 3 & 4 – I-65 NB & SB over Beaver Dam Ditch

No approach pavement construction is anticipated for this bridge.

Bridges 5 & 6 - I-65 NB & SB over 109th Avenue

No approach pavement construction is anticipated for this bridge.

Bridge 7 – 113th Avenue over I-65

No pavement work is required for this structure.

Bridges 8 & 9 – I-65 NB & SB over US 231

No approach pavement construction is anticipated for this bridge.

Proposed Pavement Designs – Segment B

Kankakee River Bridge Approach Pavement

From Station A 382+61.50 to Station A 386+44.00:

QC/QA-PCCP, 14 inch with
D-1 joints spaced at 15 feet with 1½-inch dowel bars at 12-inch spacing on
Subgrade Treatment Type IB
Retrofitted tie bars shall be size #6 installed at a 3 feet spacing

Proposed Pavement Designs – Segment C1

Bridge 10 – 137th Avenue over I-65

For Bridge Approaches:

Variable-Depth Asphalt Milling then
165 lb/yd^2 (1.5 inches) QC/QA-HMA, 3, 64, Surface, 9.5 mm on
Existing Pavement

Bridges 11 & 12 – I-65 over Wirtz Ditch

For Bridge Approaches:

Variable-Depth Asphalt Milling then
165 lb/yd^2 (1.5 inches) QC/QA-HMA, 4, 76, Surface, 9.5 mm – SMA on
Existing Pavement

Bridge 13 – 153rd Avenue over I-65

For Bridge Approaches:

Variable-Depth Asphalt Milling then
165 lb/yd^2 (1.5 inches) QC/QA-HMA, 3, 64, Surface, 9.5 mm on
Existing Pavement

Bridges 14 & 15: I-65 over SR 2

For Bridge Approaches:

Variable-Depth PCCP Milling then
165 lb/yd^2 (1.5 inches) QC/QA-HMA, 4, 76, Surface, 9.5 mm – SMA on
Existing Pavement

Proposed Pavement Designs – Segment C2

I-65 Mainline Pavement Rehabilitation

From Station C 701+67.00 to Station D 1102+27.00 (excluding Profile Correction under Bridges):

1.5 inch Asphalt Milling then
165 lb/yd^2 (1.5 inches) QC/QA-HMA, 4, 76, Surface, 9.5 mm – SMA on
Existing Pavement

I-65 Mainline Pavement Rehabilitation – Profile Correction under Bridges

From Station D 935+90.00 to Station D 943+86.00, and
From Station D 1044+25.00 to Station D 1025+71.30:

2.5 inch Asphalt Milling then
165 lb/yd^2 (1.5 inches) QC/QA-HMA, 4, 76, Surface, 9.5 mm – SMA on
Existing Pavement

I-65 Mainline Outside Shoulder Rehabilitation

From Station C 701+67.00 to Station D 1102+27.00, and

1.5 inch Asphalt Milling then
165 lb/yd^2 QC/QA-HMA, 4, 76, Surface, 9.5 mm on
Existing Pavement

I-65 Mainline Added Travel Lane and 2 feet of Inside Shoulder

From Station C 701+67.00 to Station D 1102+27.00:

330 lb/yd^2 (3.0 inches) QC/QA-HMA, 4, 76, Surface, 9.5 mm – SMA on
275 lb/yd^2 QC/QA-HMA, 4, 76, Intermediate, 19.0 mm on
275 lb/yd^2 QC/QA-HMA, 4, 64, Base, 19.0 mm on
250 lb/yd^2 QC/QA-HMA, 4, 76, Intermediate O.G., 19.0 mm on
330 lb/yd^2 QC/QA-HMA, 4, 64, Base, 19.0 mm on
11.0 inches Compacted Aggregate, No. 43, Base (variable depth to match existing adjacent composite pavement thickness) on
Subgrade Treatment Type IB (14 inches chemical soil modification per geotech recommendations)

I-65 Mainline Remaining Width of Inside Shoulder

From Station C 701+67.00 to Station D 1102+27.00:

330 lb/yd^2 QC/QA-HMA, 4, 76, Surface, 12.5 mm (for non-MOT shoulder) on
275 lb/yd^2 QC/QA-HMA, 4, 76, Intermediate, 19.0 mm on
275 lb/yd^2 QC/QA-HMA, 4, 64, Base, 19.0 mm on
250 lb/yd^2 QC/QA-HMA, 4, 76, Intermediate O.G., 19.0 mm on
330 lb/yd^2 QC/QA-HMA, 4, 64, Base, 19.0 mm on
11.0 inches Compacted Aggregate, No. 43, Base (variable depth to match existing adjacent composite pavement thickness) on
Subgrade Treatment Type IB (14 inches chemical soil modification per geotech recommendations)

I-65 Mainline Shoulder Use for MOT

No special treatment is required for shoulder use during MOT activities. See pavement designs above for required shoulder rehabilitation treatment.

I-65 PCCP Added Travel Lane and Inside Shoulder Near US 231

From Station D 1102+27 to Station G 1149+61.00 (extends into Segment A):

QC/QA-PCCP, 14 inch with
D-1 joints spaced at 15 feet with 1½-inch dowel bars at 12-inch spacing on
Existing/repaired subbase.

Proposed Pavement Design – Temporary Pavement

For temporary pavement, as needed:

935 lb/yd^2 HMA for Approaches, Type D, on
4 inches Compacted Aggregate, No. 53 (crushed stone or millings) on
Compacted Subgrade

Project Description

The project involves adding one travel lane, in each direction, along I-65 from just south of SR 2 to US 30, in Lake County. The project is broken into the following segments:

Segment A: I-65 Added Travel Lanes from US 231 to US 30 (Station F 1143+00 to I 1371+90.47)
Segment B: I-65 NB and SB Bridges over Kankakee River (Station A 382+61.50 to A 386+44)
Segment C1: I-65 Mainline and Overhead Bridges from SR 2 to US 231 (Station B 701+67 to F 1143+00)
Segment C2: I-65 Added Travel Lanes from SR 2 to US 231 (Station B 701+67 to F 1143+00)

Segment A: I-65 Added Travel Lanes from US 231 to US 30

Within Segment A, the existing outside shoulders will be restriped to accommodate the additional travel lanes and new outside shoulders will be reconstructed. The ramps at 109th Avenue will be revised to accommodate the new travel lanes and to match the proposed geometry. T
continuous throughout the entire corridor.

The following bridge work is also included in Segment A.

Bridge 1: 93rd Avenue over I-65

Bridge 1 will be rehabilitated with a polymeric bridge deck overlay. The approach slabs will also be rehabilitated. The pavement work associated with Bridge 1 includes milling and resurfacing 15 feet of the approach roadway on each end of the bridge. In accordance with TP 8.2, the overlay design will be 165 lb/yd^2 QC/QA-HMA, 3, 64, Surface, 9.5 mm.

Bridge 2: 101st Avenue over I-65

No work is associated with this structure.

Bridges 3 & 4: I-65 over Beaver Dam Ditch

The scope of work for Bridges 3 and 4 includes placing a polymeric bridge deck overlay and rehabilitating the approach slabs. No approach pavement construction is anticipated for this bridge.

Bridges 5 & 6: I-65 over 109th Avenue

The scope of work for Bridges 5 and 6 includes placing a polymeric bridge deck overlay and rehabilitating the approach slabs. No approach pavement construction is anticipated for this bridge.

Bridge 7 – 113th Avenue over I-65

The scope of work for Bridge 7 includes replacing the existing expansion joints. No approach pavement construction is anticipated for this bridge.

Bridges 8 & 9: I-65 over US 231

The scope of work for Bridges 8 and 9 includes rehabilitating and widening the existing structures. No approach pavement construction is anticipated for this bridge.

Segment B

Segment B includes construction of full-width PCCP approaches to the Kankakee River Bridges (Bridges 16 & 17).

Segment C1

For the purposes of this report, the bridge work included in Segment C1 is excluded, with the exception of Bridges 11 and 12.

Bridge 10: 137th Avenue over I-65

The scope of work for Bridge 10 includes milling and overlaying the existing bridge deck and replacing the existing approach slabs. The pavement work associated with Bridge 10 includes only the necessary milling and resurfacing of the roadway approaches to accommodate the proposed bridge rehabilitation. In accordance with TP 8.2, the overlay design will be 165 lb/yd^2 QC/QA-HMA, 3, 64, Surface, 9.5 mm.

Bridges 11 & 12: I-65 Over Wirtz Ditch

The scope of work for Bridges 11 and 12 includes rehabilitation and widening of the existing structure and reconstruction of the existing end bents. The pavement work associated with

Bridges 11 and 12 includes milling and resurfacing 30 feet of the approach roadway on each end of the bridge.

Bridge 13: 153rd Avenue over I-65

The scope of work for Bridge 13 includes removing the existing concrete overlay, patching, placing a new concrete overlay, and replacing the existing expansion joints. The pavement work associated with Bridge 13 includes only the necessary milling and resurfacing of the roadway approaches to accommodate the proposed bridge rehabilitation. In accordance with TP 8.2, the overlay design will be 165 lb/yd^2 QC/QA-HMA, 3, 64, Surface, 9.5 mm.

Bridges 14 & 15: I-65 over SR 2

The scope of work for Bridges 14 and 15 includes rehabilitation and widening of the existing structure. The pavement work associated with Bridges 14 and 15 includes milling and resurfacing of the roadway approaches to accommodate the proposed bridge rehabilitation. The pavement design for the approach roadway consists of 165 lb/yd^2 QC/QA-HMA, 4, 76, Surface, 9.5 mm, on existing pavement.

Segment C2

Within Segment C2, the existing inside shoulders will be removed and the additional travel lanes will be added on the inside. The additional lanes will be continuous throughout the entire corridor.

Design Criteria

The pavement design criteria for this project were established based on the TP, Indiana Design Manual (IDM), and other Project Standards. Table 1 depicts the design criteria that were utilized throughout the project. Supporting documentation for the traffic data is provided in Appendix A.

Interstate Design Criteria	Segment A	Segment B	Segments C1 & C2	Reference
Functional Classification	Urban Interstate	Rural Interstate	Rural Interstate	TP Table 7-1
Design Speed (mph)	70	70	70	TP Table 7-1
AADT (2016)	62,978 vpd	42,848 vpd	45,697 vpd	TP Table 7-1
AADT (2036)	67,641 vpd	60,002 vpd	55,752 vpd	Appendix A
Growth Rate	0.36%	1.70%	1.00%	Appendix A
% Trucks	28%	49%	44%	TP Table 7-1
#Trucks – AADTT (2016)	17,634 vpd	20,996 vpd	20,107 vpd	Appendix A

Table 1: Interstate Design Criteria

Pavement History and Condition

Segment A

History

The following information was provided in the project Reference Information Documents (RID):

> "This pavement was constructed in 2003 as 15 inch jointed plain concrete pavement with 18 foot joints. A Sub base for PCCP was utilized that consisted of only 6 inches of aggregate (3 inches of #8 stone on 3 inches of #53 stone). The outside shoulder was constructed as JPCP at 12 feet wide to serve as a future travel lane. An additional 10 feet was graded for a future outside shoulder and the drainage layer was extended to the underdrain trench which is outside of that 10 foot future shoulder. The #8 aggregate was covered with geotextile, and the 14 inch space next to the concrete was filled with #53 compacted aggregate. In 2014, a concrete pavement restoration project was completed that full depth patched the distressed pavements with 16 inch JPCP with a max 16 foot joint spacing. Some retrofit load transfer was performed at non faulted midpanel cracks, and some partial depth joint patches were installed. The pavement was undersealed where needed. The pavement is again experiencing cracking, and transverse and longitudinal cracking. Approximately 2800 syds of required full depth patching is concentrated in the northern 3000 feet of this project and a small amount of partial depth PCCP patching. The geotech investigation completed for the 2014 project showed that there is some mixed organic material in the northern area of the project."

Condition

The existing pavement section was developed by reviewing the pavement history, existing plans and the core data provided in the Geotechnical Report. The subgrade gradation is also provided in the Geotechnical Report. Of particular note, the existing pavement thickness shown in the plans is shown to be 14 inches, not 15 inches as shown above. The existing pavement section is taken to be as follows:

> 14 inches Jointed Plain Concrete Pavement (JPCP) on
> 9 inches Subbase for PCCP on
> Subgrade Treatment Type A on
> Natural Subgrade (A-6)

Segment B

History

The following information was provided in the project Reference Information Documents (RID):

> "The concrete pavement on each side of each bridge was constructed as 14 inch Jointed Plain Concrete Pavement with a 20 foot joint spacing. This pavement is in very good condition at this time."

Condition

The existing pavement section was developed by reviewing the pavement history, existing plans and the core data provided in the Geotechnical Report. The subgrade gradation is also provided in the Geotechnical Report. The existing pavement section is taken to be as follows:

> 14 inch Jointed Plain Concrete Pavement (JPCP) on
> 9 inches Subbase for PCCP on
> Subgrade Treatment Type A on
> Natural Subgrade (A-6)

Segment C2

History

The following information was provided in the project Reference Information Documents (RID):

> "This pavement was constructed as 10 inch Jointed Reinforced Concrete Pavement with a 40 foot joint spacing in 1966. The roadway was rehabilitated in 1990 utilizing crack and seat and overlay with HMA, geocomposite "X" drain was installed at this time. The roadway was resurfaced in 2001 with a SMA surface. In 2013/2014 the roadway received a two lift overlay with SMA surface and 6 inch retrofit underdrains on both the outside and inside edge of the travel lanes. Full depth and partial depth patching and underseal were completed. This pavement is in very good condition at this time."

Condition

The existing pavement section was developed by reviewing the pavement history, existing plans and the core data provided in the Geotechnical Report. The subgrade gradation is also provided in the Geotechnical Report. The existing pavement section is taken to be as follows:

> 1.5 inches QC/QA-HMA, 5, 76, Surface, 9.5 mm – SMA (2014) on
> 3 inches QC/QA-HMA, 5, 76, Intermediate, 19.0 mm (2014) on
> 5 inches Existing HMA (1990) on
> 10 inches Existing JRCP (1963, cracked and seated in 1990) on
> 5 inches Granular Subbase on
> Natural Subgrade (A-6)

The existing shoulder pavement section is taken to be:

> 2.5 inches QC/QA-HMA 1, 64, Surface, 12.5 mm (2014) on
> 9 inches Existing HMA (1990) on
> Natural Subgrade (A-6)

Methodology & Computations

The design methodology for this project was developed from the requirements listed in the TP and the Indiana Design Manual. AASHTOWare Pavement ME version 2.0 was used for the project pavement designs. The Federal Highway Administration's (FHWA) LTPPBind software was used for selecting the Performance Grade (PG) Binder.

Geotechnical Evaluation

Table 2 depicts the existing soil conditions and recommended treatment. Refer to the Geotechnical Report for the Subgrade Gradation. Refer to the RID for the Reference Pavement Design Memo. The RID also contains the FWD testing results.

Soil Parameter	Value
Natural Subgrade	A-6
Resilient Modulus of Natural Subgrade	3000 psi
Resilient Modulus of Treated Subgrade	6000 psi
Subgrade Treatment Type	IB (lime only) (cement only in Segment B)
Elastic Modulus of Existing HMA	528,672 psi
Elastic Modulus of Concrete (Segment A)	1,381,500 psi
Elastic Modulus of Concrete (Segment B)	1,381,500 psi
Elastic Modulus of Concrete (Segment C2)	1,592,568 psi

Table 2: Geotechnical Information

Binder Selection

Utilizing the traffic data above, TP Attachment 8-2, and IDM Figure 304-15A, an ESAL category of 4 was selected. For this traffic loading, at 98% reliability, LTPPBind recommended a PG high temperature rating of 76°C. Per IDM 304-15.01, a low temperature rating of 22°C is required. Per IDM 304-15.01, base layers are designed with a lower temperature rating and are therefore designed with a high temperature rating of 64°C. Refer to Appendix B for the LTPPBind output file.

Optimization

Optimization was driven by the functional and structural life requirements in the TP. The Walsh DBT applied innovation to pavement design to meet or exceed these thresholds, while reducing the cost of project delivery.

Pavement ME Input Values – Segments A, B, and C2 (PCCP)

Input values for PCCP designs were taken directly from IDM 304-14.03. Pavement thicknesses were chosen based on the adjacent pavement thickness. Table 3 outlines the pavement thicknesses for each segment.

Segment	Existing PCCP Thickness (in.)
A	14
B	14
C2	14

Table 3: Existing PCCP Thicknesses

Pavement ME Input Values – Segment C2 HMA Rehabilitation

Per IDM 304-14.08 (#1), the Segment C2 Rehabilitation was modeled as milling and resurfacing existing HMA over crushed stone. This resulted in a very high prediction of AC deformation. The next trial was modeled as HMA over cracked and seated JPCP. This also resulted in a very high AC deformation prediction. The pavement data from 2012 shows the existing pavement only experienced an average 0.1 inches of AC deformation during the period from 2002 to 2012. Therefore, the rehabilitation design was modeled as HMA over JPCP (not cracked and seated).

Table 4 illustrates the input values used for the Mill and Overlay portion of the project:

INPUT PARAMETER	VALUE	REFERENCE
General Information:		
Design Type	Overlay	IDM 304-14.01
Pavement Type	AC over JPCP	IDM 304-14.01
Design Life (years)	14 (Functional)/30 (Structural)	TP Section 8.2
Base Construction	May, 1990[1]	IDM 304-14.01 Reference Pavement Design Memo dated 4/14/2016
Pavement Construction	July, 2016	IDM 304-14.01 TP Table 7-1
Traffic Opening	September, 2016	IDM 304-14.01 TP Table 7-1
Performance Criteria:		
Initial IRI (in./mile)	70	IDM Figure 304-14B
Terminal IRI (in./mile)	160	IDM Figure 304-14B
AC top-down cracking (ft/mile)	2500[2]	IDM 304-14.01
AC bottom-up cracking (percent)	10	IDM Figure 304-14B
AC thermal cracking (ft/mile)	500	IDM Figure 304-14B
Permanent deformation – total pavement (in.)	0.75[3]	IDM 304-14.01
Permanent Deformation – AC only (in.)	0.4	IDM Figure 304-14B
Reliability – all parameters (percent)	90	IDM Figure 304-14B
Traffic:		
Traffic Group	D	IDM 304-14.01
Two-way AADTT (vpd)	20,107	Design Criteria
Number of Lanes	3	Project Scope
% Trucks in Design Direction	57	Reference Design Plans (Directional Distribution)
% Trucks in Design Lane	60	IDM 304-14.01
Operational Speed (mph)	65	Design Criteria (large vehicles)
Growth Rate (%)	1	Design Criteria
Growth Function	Compound[4]	Design Criteria
Climate:		
Longitude (decimal degrees)	-87.32	
Latitude (decimal degrees)	41.39	
Elevation (ft)	750	
Depth of Water Table (ft)	Annual (4)	Geotechnical Report
Climate Station	Virtual – 3 nearest stations	IDM 304-14.01

Table 4: Pavement ME Input Values - Rehabilitation

[1]Since the existing JRCP was cracked and seated and overlaid with HMA in 1990, this year was chosen as a base construction year instead of the original construction year of 1963.
[2]Per IDM 304-14.01, this parameter is ignored in the analysis.
[3]Per IDM 304-14.01, this parameter is ignored in the analysis.
[4]Per IDM 304-14.01, Linear is recommended. However, the growth rate stated was back-calculated from given traffic projections as a Compound rate. Therefore, Compound was chosen as the Growth Function.

Pavement ME Input Values – Segment C2 HMA Reconstruction

Table 5 illustrates the input values for the Full-Depth HMA portion of the project

INPUT PARAMETER	VALUE	REFERENCE
General Information:		
Design Type	New Pavement	IDM 304-14.01
Pavement Type	Flexible Pavement	IDM 304-14.01
Design Life (years)	18 (Functional)/50 (Structural)	IDM Figure 304-14A
Base Construction	May, 2016	IDM 304-14.01 TP Table 7-1
Pavement Construction	July, 2016	IDM 304-14.01 TP Table 7-1
Traffic Opening	September, 2016	IDM 304-14.01 TP Table 7-1
Performance Criteria:		
Initial IRI (in./mile)	70	IDM Figure 304-14B
Terminal IRI (in./mile)	160	IDM Figure 304-14B
AC top-down cracking (ft/mile)	2500[1]	IDM 304-14.01
AC bottom-up cracking (percent)	10	IDM Figure 304-14B
AC thermal cracking (ft/mile)	500	IDM Figure 304-14B
Permanent deformation – total pavement (in.)	0.75[2]	IDM 304-14.01
Permanent Deformation – AC only (in.)	0.4	IDM Figure 304-14B
Reliability – all parameters (percent)	90	IDM Figure 304-14B
Traffic:		
Traffic Group	D	IDM 304-14.01
Two-way AADTT (vpd)	20,107	Design Criteria
Number of Lanes	3	Project Scope
% Trucks in Design Direction	57	Reference Design Plans (Directional Distribution)
% Trucks in Design Lane	60	IDM 304-14.01
Operational Speed (mph)	65	Design Criteria (large vehicles)
Growth Rate (%)	1	Design Criteria
Growth Function	Compound[3]	Design Criteria
Climate:		
Longitude (decimal degrees)	-87.32	
Latitude (decimal degrees)	41.39	
Elevation (ft)	750	
Depth of Water Table (ft)	Annual (10)	Geotechnical Report
Climate Station	Virtual – 3 nearest stations	IDM 304-14.01

Table 5: Pavement ME Input Values – Reconstruction

[1]Per IDM 304-14.01, this parameter is ignored in the analysis.
[2]Per IDM 304-14.01, this parameter is ignored in the analysis.
[3]Per IDM 304-14.01, Linear is recommended. However, the growth rate stated was back-calculated from given traffic projections as a Compound rate. Therefore, Compound was chosen as the Growth Function.

Pavement ME Input Values – Shoulder Use for MOT

The existing shoulders were evaluated for use during Maintenance of Traffic (MOT) operations. The existing shoulders were found to be in adequate condition for use during MOT activities. Table 6 illustrates the input Pavement ME input values used for the shoulder analysis.

INPUT PARAMETER	VALUE	REFERENCE
General Information:		
Design Type	Overlay	IDM 304-14.01
Pavement Type	AC over AC	IDM 304-14.01
Design Life (years)	0.5	Expected Construction Time
Base Construction	May, 2014[1]	IDM 304-14.01 Reference Pavement Design Memo dated 4/14/2016
Pavement Construction	July, 2016	IDM 304-14.01/TP Table 7-1
Traffic Opening	September, 2016	IDM 304-14.01/TP Table 7-1
Performance Criteria:		
Initial IRI (in./mile)	88	Reference Pavement Design Memo dated 4/14/2016
Terminal IRI (in./mile)	160	IDM Figure 304-14B
AC top-down cracking (ft/mile)	2500[2]	IDM 304-14.01
AC bottom-up cracking (percent)	10	IDM Figure 304-14B
AC thermal cracking (ft/mile)	500	IDM Figure 304-14B
Permanent deformation – total pavement (in.)	0.75[3]	IDM 304-14.01
Permanent Deformation – AC only (in.)	0.4	IDM Figure 304-14B
Reliability – all parameters (%)	90	IDM Figure 304-14B
Traffic:		
Traffic Group	D	IDM 304-14.01
Two-way AADTT (vpd)	20,107	Design Criteria
Number of Lanes	2	Project Scope
% Trucks in Design Direction	57	Reference Design Plans (Directional Distribution)
% Trucks in Design Lane	90	IDM 304-14.01
Operational Speed (mph)	55	MOT Design Speed (Large Vehicles)
Growth Rate (%)	1	Design Criteria
Growth Function	Compound[4]	Design Criteria

Table 6: Pavement ME Input Values – MOT Shoulders

[1]Since the most recent two-lift overlay occurred in 2014, this year was chosen as a base construction year instead of the original construction year of 1963.
[2]Per IDM 304-14.01, this parameter is ignored in the analysis.
[3]Per IDM 304-14.01, this parameter is ignored in the analysis.
[4]Per IDM 304-14.01, Linear is recommended. However, the growth rate stated was back-calculated from given traffic projections as a Compound rate. Therefore, Compound was chosen as the Growth Function.

Design Iterations

The first step for each design was to verify the pavement design provided in the RID. After verification, several design iterations were performed to select the most efficient design.

Side Roads – All Segments

Pavement required for side road bridge approaches is defined in the Section 8.2 of the TP as:

1.5 inch Asphalt Milling then
165 lb/yd^2 (1.5 inches) QC/QA-HMA, 3, 64, Surface, 9.5 mm on
Existing Pavement

These designs could not be verified since there was no traffic data provided.

Segment A

The proposed construction of the shoulder in Segment A is required to match the existing pavement section. Therefore, the proposed shoulder consists of:

Remove Compacted Aggregate, No. 53 while protecting geotextile
QC/QA-PCCP, 14 inch with
D-1 joints spaced at 18 feet with 1½-inch dowel bars at 12-inch spacing on existing/repaired subbase. Retrofitted tie bars shall be size #6 installed at 3-foot spacing.

Maintenance of Traffic Considerations

Within Segment A, traffic may be maintained on existing full-depth pavement. No additional MOT pavement design is necessary.

Segment B

The proposed reconstructed pavement in Segment B is required to match the existing pavement section. Therefore, the proposed pavement reconstruction consists of:

QC/QA-PCCP, 14 inch with
D-1 joints spaced at 15 feet with 1½-inch dowel bars at 12-inch spacing on
Subgrade Treatment Type IB
Retrofitted tie bars shall be size #6 installed at 3 foot spacing.

The functional life of the proposed section is: 24 years
The structural life of the proposed section is: >50 years

Maintenance of Traffic Considerations

Within Segment B, traffic may be maintained on existing full-depth pavement. No additional MOT pavement design is necessary.

Segment C1

The pavement work in Segment C1 is limited to the necessary approach work for bridge rehabilitations. For I-65 bridges with HMA approaches, the Rehabilitation design outlined below under Segment C2 shall be utilized. The I-65 bridges over Wirtz Ditch and SR 2 have PCCP approaches that require special analysis.

For Bridges with PCCP pavement adjacent to the bridge approaches:

165 lb/yd^2 (1.5 inches) QC/QA-HMA, 4, 76, Surface, 9.5 mm – SMA on Existing Pavement

The functional life of the proposed section is: 36 years
The structural life of the proposed section is: >50 years

Segment C2

The pavement work in Segment C2 is broken into Rehabilitation and Reconstruction portions. Tables 7 and 8 highlight the chosen designs as well as the iterations that performed nearly as well or better than, the chosen designs for both the Rehabilitation and the Reconstruction portions of the project.

Alt. #	Pavement Section – C2 Rehabilitation	Functional/Structural Life & Failure Modes
5	1.5 inch Asphalt Milling then 165 lb/yd^2 (1.5 inches) QC/QA-HMA Surface, 9.5 mm - SMA on Existing Pavement *Modeled as AC over Cracked and Seated JPCP	Functional: 7 years (AC Deformation) Structural: > 25 years
6	1.0 inch Asphalt Milling then 165 lb/yd^2 (1.5 inches) QC/QA-HMA Surface, 9.5 mm - SMA on Existing Pavement *Modeled as AC over Cracked and Seated JPCP	Functional: 8 years (AC Deformation) Structural: > 25 years
39[3]	2.0 inch Asphalt Milling then 220 lb/yd^2 (2 inches) QC/QA-HMA Surface, 9.5 mm - SMA on Existing Pavement *Modeled as AC over Cracked and Seated JPCP	Functional: 13 years (AC Deformation) Structural: > 25 years
231-2	1.5 inch Asphalt Milling then 165 lb/yd^2 (1.5 inches) QC/QA-HMA Surface, 9.5 mm - SMA on Existing Pavement *Modeled as AC over Crushed Stone	Functional: <7 years (AC Deformation) Structural: > 25 years
I-65 C2 Overlay – Alternative 43[1,2]	**1.5 inch Asphalt Milling then 165 lb/yd^2 (1.5 inches) QC/QA-HMA, 4, 76 Surface, 9.5 mm - SMA on Existing Pavement *Modeled as AC over JPCP**	**Functional: 36 years (IRI) Structural: > 50 years**
I-65 C2 Overlay – Alternative 44[2]	***For Profile Correction under Bridges 2.5 inch Asphalt Milling then 165 lb/yd^2 (1.5 inches) QC/QA-HMA, 4, 76, Surface, 9.5 mm - SMA on Existing Pavement *Modeled as AC over JPCP**	**Functional: 35 years (IRI) Structural: > 50 years**

Table 7: Summary of Rehabilitation Design Iterations

[1]INDOT-Provided Reference Pavement Design
[2]Recommended Alternative

Alt. #	Pavement Section – C2 Reconstruction	Functional/Structural Life & Failure Modes
I-65 C2 FD Optimized Trial 1[1]	165 **lb/yd^2** (1.5 inches) QC/QA HMA, 4, 76, Surface, SMA* 9.5mm on 275 **lb/yd^2** QC-QA HMA, 4, 76, Intermediate, 19.0mm on 330 **lb/yd^2** QC-QA HMA, 4, 64, Base, 19.0mm on 330 **lb/yd^2** QC-QA HMA, 4, 64, Base, 19.0mm on 250 **lb/yd^2** QC-QA HMA, 4, 76, Intermediate OG, 19.0mm on 330 **lb/yd^2** QC-QA HMA, 4, 64, Base, 19.0mm on 7.5 inches Aggregate, #43 on Subgrade Treatment Type IB (14 inches chemical modification, Mr = 6000psi) on Subgrade Type A-6 (Mr = 4000 psi)	Functional: 18 years (IRI) Structural: > 50 years
I-65 C2 FD Optimized Trial 4	220 **lb/yd^2** (2.0 inches) QC/QA HMA, 4, 76, Surface, SMA 9.5mm on 275 **lb/yd^2** QC-QA HMA, 4, 76, Intermediate, 19.0mm on 330 **lb/yd^2** QC-QA HMA, 4, 64, Base, 19.0mm on 330 **lb/yd^2** QC-QA HMA, 4, 64, Base, 19.0mm on 250 **lb/yd^2** QC-QA HMA, 4, 76, Intermediate OG, 19.0mm on 330 **lb/yd^2** QC-QA HMA, 4, 64, Base, 19.0mm on 7.5 inches Aggregate, #43 on Subgrade Treatment Type IB (14 inches chemical modification, Mr = 6000psi) on Subgrade Type A-6 (Mr = 4000 psi)	Functional: 18 years (IRI) Structural: > 50 years
I-65 C2 FD Optimized Trial 53	220# **lb/yd^2** (2.0 inches) QC/QA HMA, 4, 76, Surface, SMA 9.5mm on 330 **lb/yd^2** QC-QA HMA, 4, 76, Intermediate, 19.0mm on 440 **lb/yd^2** QC-QA HMA, 4, 64, Base, 19.0mm on 440 **lb/yd^2** QC-QA HMA, 4, 64, Base, 19.0mm on 440 **lb/yd^2** QC-QA HMA, 4, 64, Base, 19.0mm on 300 **lb/yd^2** QC-QA HMA, 4, 76, Intermediate OG, 19.0mm on 275 **lb/yd^2** QC-QA HMA, 4, 64, Base, 19.0mm on 275 **lb/yd^2** QC-QA HMA, 4, 64, Base, 19.0mm on Subgrade Treatment Type IB (14 inches chemical modification, Mr = 6000psi) on Subgrade Type A-6 (Mr = 4000 psi)	Functional: 20 years (IRI) Structural: > 50 years
I-65 C2 FD Optimized Trial 57	165 **lb/yd^2** (1.5 inches) QC/QA HMA, 4, 76, Surface, 9.5mm - SMA on 275 **lb/yd^2** (2.5 inches) QC/QA HMA, 4, 76, Intermediate, 19.0mm - SMA on 440 **lb/yd^2** QC-QA HMA, 4, 64, Base, 19.0mm on 440 **lb/yd^2** QC-QA HMA, 4, 64, Base, 19.0mm on 350 **lb/yd^2** QC-QA HMA, 4, 76, Intermediate OG, 19.0mm on 440 **lb/yd^2** QC-QA HMA, 4, 64, Base, 19.0mm on 5.5 inches Aggregate, #43 on Subgrade Treatment Type IB (14 inches chemical modification, Mr = 6000psi) on Subgrade Type A-6 (Mr = 4000 psi)	Functional: 20 years (IRI) Structural: > 50 years
I-65 C2 FD Optimized Trial 93[2]	**330 lb/yd^2 (3.0 inches) QC/QA HMA, 4, 76, Surface, SMA 12.5mm on 275 lb/yd^2 QC-QA HMA, 4, 76, Intermediate, 19.0mm on 275 lb/yd^2 QC-QA HMA, 4, 64, Base, 19.0mm on 250 lb/yd^2 QC-QA HMA, 4, 76, Intermediate OG, 19.0mm on 330 lb/yd^2 QC-QA HMA, 4, 64, Base, 19.0mm on 11 inches Aggregate, #43 on Subgrade Treatment Type IB (14 inches chemical modification, Mr = 6000psi) on Subgrade Type A-6 (Mr = 4000 psi)**	**Functional: 18 years (IRI) Structural: > 50 years**

Table 8: Reconstruction Design Iterations

[1]INDOT-Provided Reference Pavement Design
[2]Recommended Alternative
*General Note: Unit weight of SMA is described as 110 lb/yd^2/inch. Actual unit weight is higher.

I-65 C2 FD Optimized Trial 94	165 **lb/yd²** (1.5 inches) QC/QA HMA, 4, 76, Surface, SMA 12.5mm on 330 **lb/yd²** QC-QA HMA, 4, 76, Intermediate, 19.0mm on 330 **lb/yd²** QC-QA HMA, 4, 64, Base, 25.0mm on 330 **lb/yd²** QC-QA HMA, 4, 64, Base, 25.0mm on 250 **lb/yd²** QC-QA HMA, 4, 76, Intermediate OG, 25.0mm on 330 **lb/yd²** QC-QA HMA, 4, 64, Base, 25.0mm on 8.5 inches Aggregate, #43 on Subgrade Treatment Type IB (14 inches chemical modification, Mr = 6000psi) on Subgrade Type A-6 (Mr = 4000 psi)	Functional: 18 years (IRI) Structural: > 50 years

Table 8 (continued): Reconstruction Design Iterations

[1]INDOT-Provided Reference Pavement Design
[2]Recommended Alternative
*General Note: Unit weight of SMA is described as 110 lb/yd²/inch. Actual unit weight is higher.

Segment C2 PCCP New Construction

There is a small amount of required PCCP new construction at the north end of Segment C2. The proposed pavement consists of:

QC/QA-PCCP, 14 inch with
D-1 joints spaced at 15 feet with 1½-inch dowel bars at 12-inch spacing on
Existing/repaired subbase.

Maintenance of Traffic Considerations

Within Segment C2, traffic may be maintained by utilizing the existing outside shoulder. In accordance with the TP, the shoulders will be resurfaced prior to MOT operations. The proposed MOT shoulder treatment is as follows:

1.5 inch Asphalt Milling then
165 lb/yd² (1.5 inches) QC/QA-HMA, 4, 76 Surface, 9.5 mm on
Existing Pavement

The functional life of the proposed section is: 7 months
*It is recommended to provide signs directing trucks to use the left lane only. Doing so will result in a functional life approximately 11 months.

Recommendations

I-65 Mainline Segment A

For I-65 Segment A outside shoulder construction, use:

QC/QA-PCCP, 14 inch with
D-1 joints spaced at 18 feet with 1½-inch dowel bars at 12-inch spacing on
Existing/repaired subbase.

I-65 Mainline Segment A Patching

Full and partial-depth patching will be provided per INDOT Standard Specifications.

Full-depth patching, where required, shall be PCCP Patched-Full Depth. The patch thickness shall match the adjacent concrete thickness or no less than 14 inches. Transverse joint spacing shall be a maximum of 15 feet and D-1 contraction joints shall be installed to insure joint spacing is met. Any unsuitable subgrade materials shall be excavated and replaced with Subgrade Treatment Type IC. Patches shall be tied to adjacent pavement per spec. Refer to TP Attachment 8-1 for the USP for PCCP Patching, Full Depth.
Partial-depth patching shall be PCCP Patching, Partial Depth, in accordance with INDOT Standard Specification 506.

I-65 Mainline Segment B Pavement Reconstruction

For I-65 Segment B Reconstruction, use:

QC/QA-PCCP, 14 inch with
D-1 joints spaced at 15 feet with 1½-inch dowel bars at 12-inch spacing on
Existing/repaired subbase.

I-65 Mainline Segment C2 Rehabilitation

For the rehabilitation portion of Segment C2, it is recommended to use a single-lift overlay consisting of:

1.5 inch Asphalt Milling then
165 lb/yd² (1.5 inches) QC/QA-HMA, 4, 76, Surface, 9.5 mm – SMA on
Existing Pavement

For areas where the mainline passes under crossing bridges and additional vertical clearance is required:

2.5 inch Asphalt Milling then
165 lb/yd² (1.5 inches) QC/QA-HMA, 4, 76, Surface, 9.5 mm – SMA on
Existing Pavement

For mainline shoulder rehabilitation:

1.5 inch Asphalt Milling then
165 lb/yd² QC/QA-HMA, 4, 76, Surface, 9.5 mm on
Existing Pavement

I-65 Mainline Segment C2 Reconstruction

For mainline full-depth added travel lane:

330 lb/yd² (3.0 inches) QC/QA-HMA, 4, 76, Surface, 9.5 mm – SMA on
275 lb/yd² QC/QA-HMA, 4, 76, Intermediate, 19.0 mm on
275 lb/yd² QC/QA-HMA, 4, 64, Base, 19.0 mm on
250 lb/yd² QC/QA-HMA, 4, 76, Intermediate O.G., 19.0 mm on
330 lb/yd² QC/QA-HMA, 4, 64, Base, 19.0 mm on
11.0 inches Compacted Aggregate, No. 43, Base (variable depth to match existing adjacent composite pavement thickness) on
Subgrade Treatment Type IB (14 inches chemical soil modification per geotech recommendations)

For mainline remaining width of inside shoulder:

330 lb/yd^2 QC/QA-HMA, 4, 76, Surface, 12.5 mm (for non-MOT shoulder) on
275 lb/yd^2 QC/QA-HMA, 4, 76, Intermediate, 19.0 mm on
275 lb/yd^2 QC/QA-HMA, 4, 64, Base, 19.0 mm on
250 lb/yd^2 QC/QA-HMA, 4, 76, Intermediate O.G., 19.0 mm on
330 lb/yd^2 QC/QA-HMA, 4, 64, Base, 19.0 mm on
11.0 inches Compacted Aggregate, No. 43, Base (variable depth to match existing adjacent composite pavement thickness) on
Subgrade Treatment Type IB (14 inches chemical soil modification per geotech recommendations)

For mainline PCCP widening use:

QC/QA-PCCP, 14 inch with
D-1 joints spaced at 15 feet with 1½-inch dowel bars at 12-inch spacing on
Existing/repaired subbase

I-65 Mainline Segment C2 Patching

Full-depth patching, as required for culvert replacements, shall consist of:

165 lb/yd^2 (1.5 inches) QC/QA-HMA, 4, 76, Surface, 9.5 mm – SMA on
PCC Base Patching, Variable Depth (match existing pavement thickness to bottom of Surface layer)
*Patching shall be in accordance with IDM Figure 304-21FF

I-65 Mainline Temporary Pavement

For mainline crossovers and other temporary pavement use:

935 lb/yd^2 HMA for Approaches, Type D, on
4 inches Compacted Aggregate, No. 53 (crushed stone or millings) on
Compacted Subgrade

Construction Considerations

- Subgrade under new Full-Depth pavement and Full-Depth Patching shall be appropriately compacted.
- New pavement shall have a safety edge in accordance with IDM Figure 304-21X.
- Joint adhesive, liquid asphalt sealant, and base seal shall be applied in accordance with the INDOT Standard Specifications.
- Crack sealing shall be performed after milling and prior to application of tack coat for overlay. Any crack which is ¼ inches wide or wider shall be sealed with PG64-22. Emulsion shall not be used. Cracks shall not be overbanded.

Maintenance Considerations

The following excerpt is from the Reference Pavement Design Memo.

> "The concrete joints shall be cleaned and sealed every 8 years after the installation of the pavement. HMA/SMA surface shall be crack filled/sealed on a 3 years interval after the installation. Potholes and isolated failures should be patched as soon as possible. Underdrains outlets shall be inspected ever 5 years to ensure that there are no man-made or natural obstructions to the flow. Shoulders should be clipped as required to allow surface water to freely enter the roadside ditches. Any roadside ditches shall have the flow lines validated on a 5 year cycle, and shall be regraded or cleaned as necessary to insure intended drainage flow if validation is not achieved. This list is not exclusive, and other measures can and should be taken to insure that the pavement has the intended life expectancy. A record of what maintenance measures were performed and when shall be kept for this roadway."

Appendices

Appendix A: Traffic Projections

Appendix B: Binder Selection

Appendix C: Pavement ME Output

- Segment A
- Segment B
- Segment C Rehabilitation
- Segment C Reconstruction
- Shoulder Treatment for MOT & Temporary Pavement

JOB: I-65 Northwest Major Moves — DESIGNED: BSC — DATE: 06/02/16
ITEM: Traffic Projections — CHECKED: TJK — DATE: 06/02/16

Traffic Projections

I-65 from SR 10 to SR 2

Source Traffic Data	Year	AADT	DHV	% Trucks AADT
Initial year	2016	42,848	5,310	49.00%
Final year	2035	59,000		

Calculated Growth Rate, where: $r = (y/x)^{1/n} - 1$
n= 19
Therefore, r = 1.70%

Projected Traffic Data	Year	AADT	DHV	Trucks AADTT
Initial year	2016	42,848	5,310	20,996
Final year	2036	60,002	7,436	29,401

I-65 from SR 2 to US 231

Source Traffic Data	Year	AADT	DHV	% Trucks AADT
Initial year	2016	45,697	3,868	44.00%
Final year	2035	55,200		

Calculated Growth Rate, where: $r = (y/x)^{1/n} - 1$
n= 19
Therefore, r = 1.00%

Projected Traffic Data	Year	AADT	DHV	Trucks AADTT
Initial year	2016	45,697	3,868	20,107
Final year	2036	55,752	4,719	24,531

I-65 from US 231 to 109th Avenue

Source Traffic Data	Year	AADT	DHV	% Trucks AADT
Initial year	2016	50,949	4,144	34.00%
Final year	2035	51,800		

Calculated Growth Rate, where: $r = (y/x)^{1/n} - 1$
n= 19
Therefore, r = 0.09%

Projected Traffic Data	Year	AADT	DHV	Trucks AADTT
Initial year	2016	50,949	4,144	17,323
Final year	2036	51,845	4,217	17,627

I-65 from 109th Avenue to US 30

Source Traffic Data	Year	AADT	DHV	% Trucks AADT
Initial year	2016	62,978	5,392	28.00%
Final year	2035	67,400		

P:_I-65 Northwest Major Moves 2020\Engineer Design\Roadway\Pavement Design\I-65 Traffic Projections.xlsx Tab: Projections

JOB: I-65 Northwest Major Moves
ITEM: Traffic Projections

DESIGNED: BSC DATE: 06/02/16
CHECKED: TJK DATE: 06/02/16

Traffic Projections

Calculated Growth Rate, where: $r = (y/x)^{1/n} - 1$
n= 19
Therefore, r = 0.36%

Projected Traffic Data	Year	AADT	DHV	Trucks AADTT
Initial year	2016	62,978	5,392	17,634
Final year	2036	67,641	5,791	18,940

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A-2

BindSelect-PG.txt

PG Binder Selection Report

LTPPBind V3.0 PG Binder Selection Report (Date: 5/4/2016)

Parameter	A=9 km	B=19 km	C=30 km	D=34 km	E=35 km
Station ID	IN5174	IN9511	IN4008	IN9222	IN8999
Elevation, m	617	608	594	682	743
Degree-Days >10 C	2694	2720	2777	2583	2624
Low Air Temperature, C	-26.1	-26.1	-24.8	-25.8	-25.1
Low Air Temp. Std Dev	3.5	3.8	3.8	3	3.3

Input Data

Latitude, Degree	41.3
Yearly Degree-Days>10C	2680
Lowest Yearly Air Temp., Deg. C	-25.6
Low Temp. Std. Dev., Deg. C	3.5
Base HT PG	58

Traffic Adjustments for HT

Desired Reliability, Percent	98
Traffic Loading, Million ESAL	Above 30 M. ESAL
Traffic Speed	Fast
High Temp. Adjustment	14.5

PG Temperature	HIGH	LOW
PG Temp. at 50% Reliability	53.8	-18.1
PG Temp. at Desired Reliability	56.5	-24.8
Adjustments for Traffic	14.5	
Adjustments for Depth	0.0	0.0
Adjusted PG Temperature	71.0	-24.8
Selected PG Binder Grade	76	-28

Page 1

I-65 A Trial 3 - US 231

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Design Inputs

Design Life: 50 years
Design Type: Jointed Plain Concrete Pavement (JPCP)

Existing construction: -
Pavement construction: July, 2016
Traffic opening: September, 2016

Climate Data Sources (Lat/Lon): 41.453, -87.006; 41.786, -87.752; 41.986, -87.914; 41.707, -86.333; 42.121, -87.905; 41.914, -88.246

Design Structure



Layer type	Material Type	Thickness (in.):
PCC	14" PCCP	14.0
NonStabilized	Crushed stone	3.0
NonStabilized	Crushed stone	6.0
Subgrade	A-6	14.0
Subgrade	A-6	Semi-infinite

Joint Design:

Joint spacing (ft)	15.0
Dowel diameter (in.)	1.50
Slab width (ft)	14.0 (w)

Traffic

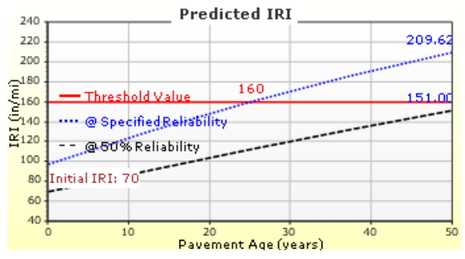
Age (year)	Heavy Trucks (cumulative)
2016 (initial)	20,107
2041 (25 years)	70,937,800
2066 (50 years)	161,911,000

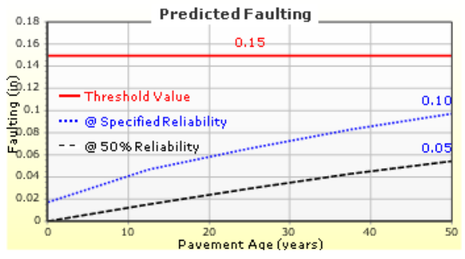
Design Outputs

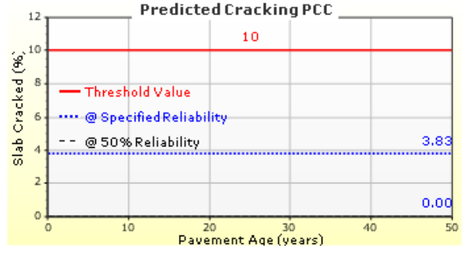
Distress Prediction Summary

Distress Type	Distress @ Specified Reliability		Reliability (%)		Criterion Satisfied?
	Target	Predicted	Target	Achieved	
Terminal IRI (in./mile)	160.00	209.62	90.00	57.80	Fail
Mean joint faulting (in.)	0.15	0.10	90.00	99.75	Pass
JPCP transverse cracking (percent slabs)	10.00	3.83	90.00	99.96	Pass

Distress Charts







I-65 A Trial 3 - US 231

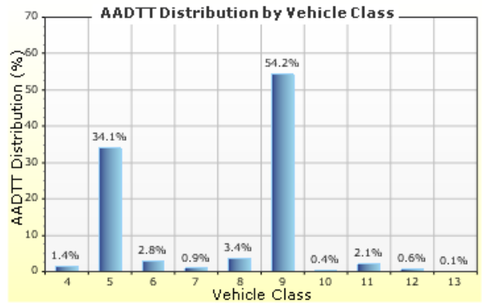
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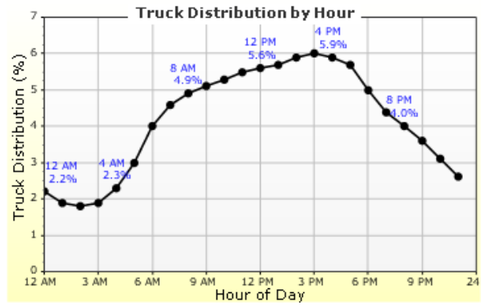
Traffic Inputs

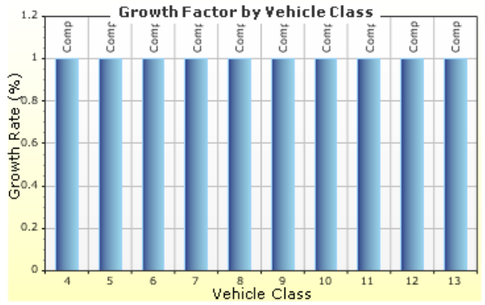
Graphical Representation of Traffic Inputs

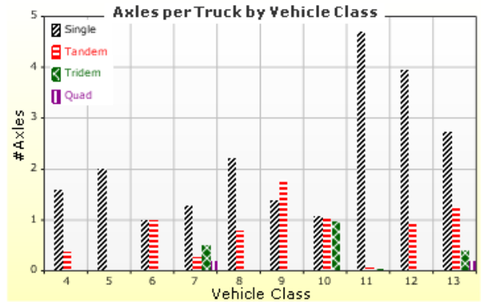
Initial two-way AADTT: 20,107
Number of lanes in design direction: 3

Percent of trucks in design direction (%): 57.0
Percent of trucks in design lane (%): 60.0
Operational speed (mph) 65.0

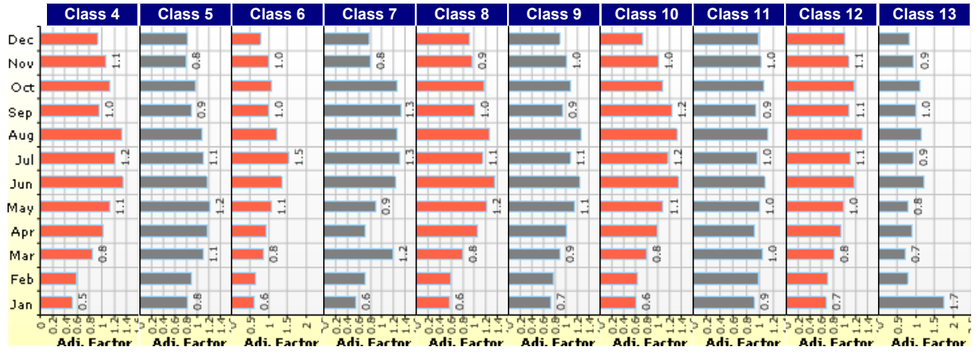








Traffic Volume Monthly Adjustment Factors



I-65 A Trial 3 - US 231

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Tabular Representation of Traffic Inputs

Volume Monthly Adjustment Factors

Level 3: Default MAF

Month	Vehicle Class									
	4	5	6	7	8	9	10	11	12	13
January	0.5	0.8	0.6	0.6	0.6	0.7	0.6	0.9	0.7	1.7
February	0.6	0.9	0.6	0.7	0.6	0.8	0.6	1.0	0.7	0.8
March	0.8	1.1	0.8	1.2	0.8	0.9	0.8	1.0	0.8	0.7
April	1.0	1.2	0.9	0.7	1.1	1.0	1.0	0.9	0.9	0.9
May	1.1	1.2	1.1	0.9	1.2	1.1	1.1	1.0	1.0	0.8
June	1.4	1.2	1.3	1.2	1.4	1.2	1.3	1.1	1.2	1.2
July	1.2	1.1	1.5	1.3	1.1	1.1	1.2	1.0	1.1	0.9
August	1.3	1.1	1.3	1.3	1.3	1.3	1.3	1.1	1.3	1.2
September	1.0	0.9	1.0	1.3	1.0	0.9	1.2	0.9	1.1	1.0
October	1.1	0.9	1.1	1.3	1.2	1.1	1.1	1.1	1.2	1.1
November	1.1	0.8	1.0	0.8	0.9	1.0	1.0	1.0	1.1	0.9
December	0.9	0.8	0.8	0.8	0.9	0.9	0.7	1.0	1.0	0.8

Distributions by Vehicle Class

Vehicle Class	AADTT Distribution (%) (Level 3)	Growth Factor	
		Rate (%)	Function
Class 4	1.4%	1%	Compound
Class 5	34.1%	1%	Compound
Class 6	2.8%	1%	Compound
Class 7	0.9%	1%	Compound
Class 8	3.4%	1%	Compound
Class 9	54.2%	1%	Compound
Class 10	0.4%	1%	Compound
Class 11	2.1%	1%	Compound
Class 12	0.6%	1%	Compound
Class 13	0.1%	1%	Compound

Truck Distribution by Hour

Hour	Distribution (%)	Hour	Distribution (%)
12 AM	2.2%	12 PM	5.6%
1 AM	1.9%	1 PM	5.7%
2 AM	1.8%	2 PM	5.9%
3 AM	1.9%	3 PM	6%
4 AM	2.3%	4 PM	5.9%
5 AM	3%	5 PM	5.7%
6 AM	4%	6 PM	5%
7 AM	4.6%	7 PM	4.4%
8 AM	4.9%	8 PM	4%
9 AM	5.1%	9 PM	3.6%
10 AM	5.3%	10 PM	3.1%
11 AM	5.5%	11 PM	2.6%
		Total	100%

Axle Configuration

Traffic Wander	
Mean wheel location (in.)	18
Traffic wander standard deviation (in.)	10
Design lane width (ft)	12

Axle Configuration	
Average axle width (ft)	8.5
Dual tire spacing (in.)	12
Tire pressure (psi)	120

Average Axle Spacing	
Tandem axle spacing (in.)	51.6
Tridem axle spacing (in.)	49.2
Quad axle spacing (in.)	49.2

Wheelbase				
Value Type	Axle Type	Short	Medium	Long
Average spacing of axles (ft)		12	15	18
Percent of Trucks (%)		33	33	34

Number of Axles per Truck

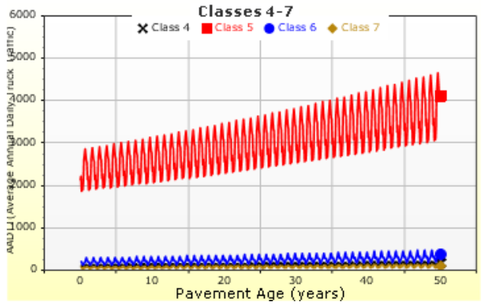
Vehicle Class	Single Axle	Tandem Axle	Tridem Axle	Quad Axle
Class 4	1.6	0.39	0	0
Class 5	2	0	0	0
Class 6	1	1	0	0
Class 7	1.29	0.29	0.5	0.19
Class 8	2.19	0.8	0	0
Class 9	1.37	1.8	0	0
Class 10	1.05	1.02	0.96	0.01
Class 11	4.71	0.08	0.03	0
Class 12	3.94	0.99	0.01	0
Class 13	2.73	1.25	0.41	0.2

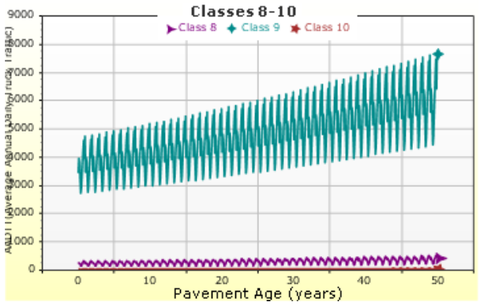
I-65 A Trial 3 - US 231

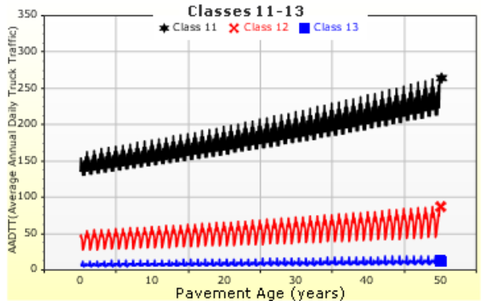
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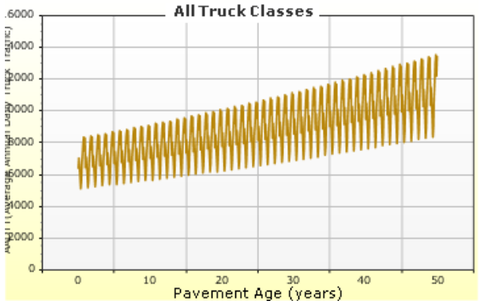
AADTT (Average Annual Daily Truck Traffic) Growth

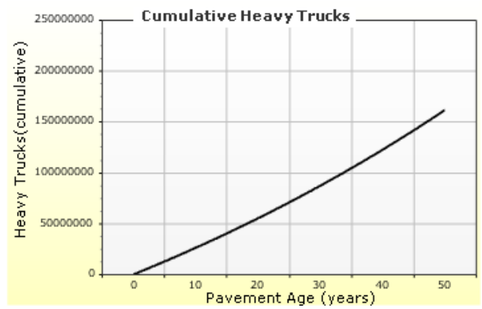
*** Traffic cap is not enforced**











I-65 A Trial 3 - US 231

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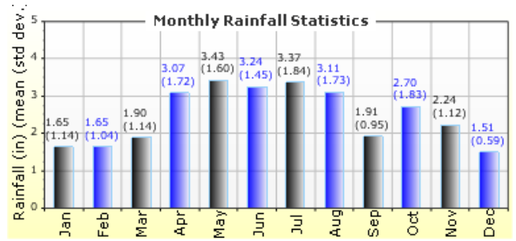
Climate Inputs

Climate Data Sources:

Climate Station Cities:	Location (lat lon elevation(ft))
VALPARAISO, IN	41.45300 -87.00600 770
CHICAGO, IL	41.78600 -87.75200 612
CHICAGO, IL	41.98600 -87.91400 662

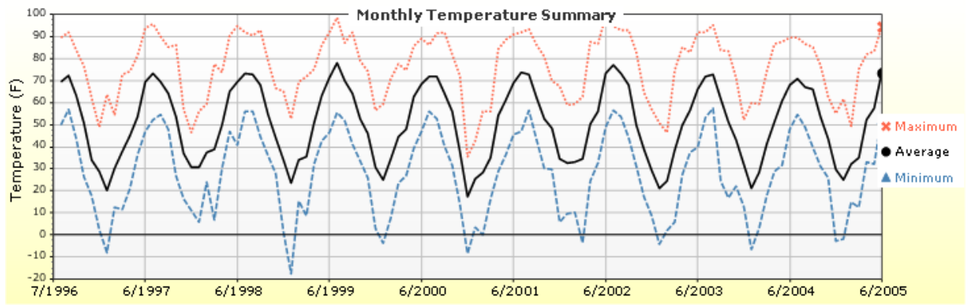
Annual Statistics:

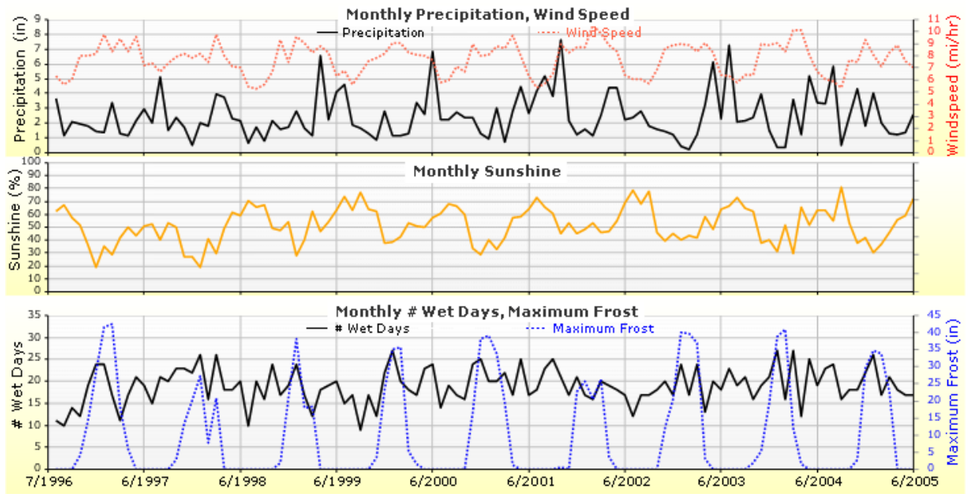
Mean annual air temperature (ºF)	50.55
Mean annual precipitation (in.)	29.78
Freezing index (ºF - days)	677.11
Average annual number of freeze/thaw cycles:	62.54



Water table depth (ft)	10.00

Monthly Climate Summary:





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Created by: on: 4/22/2016 9:41 AM

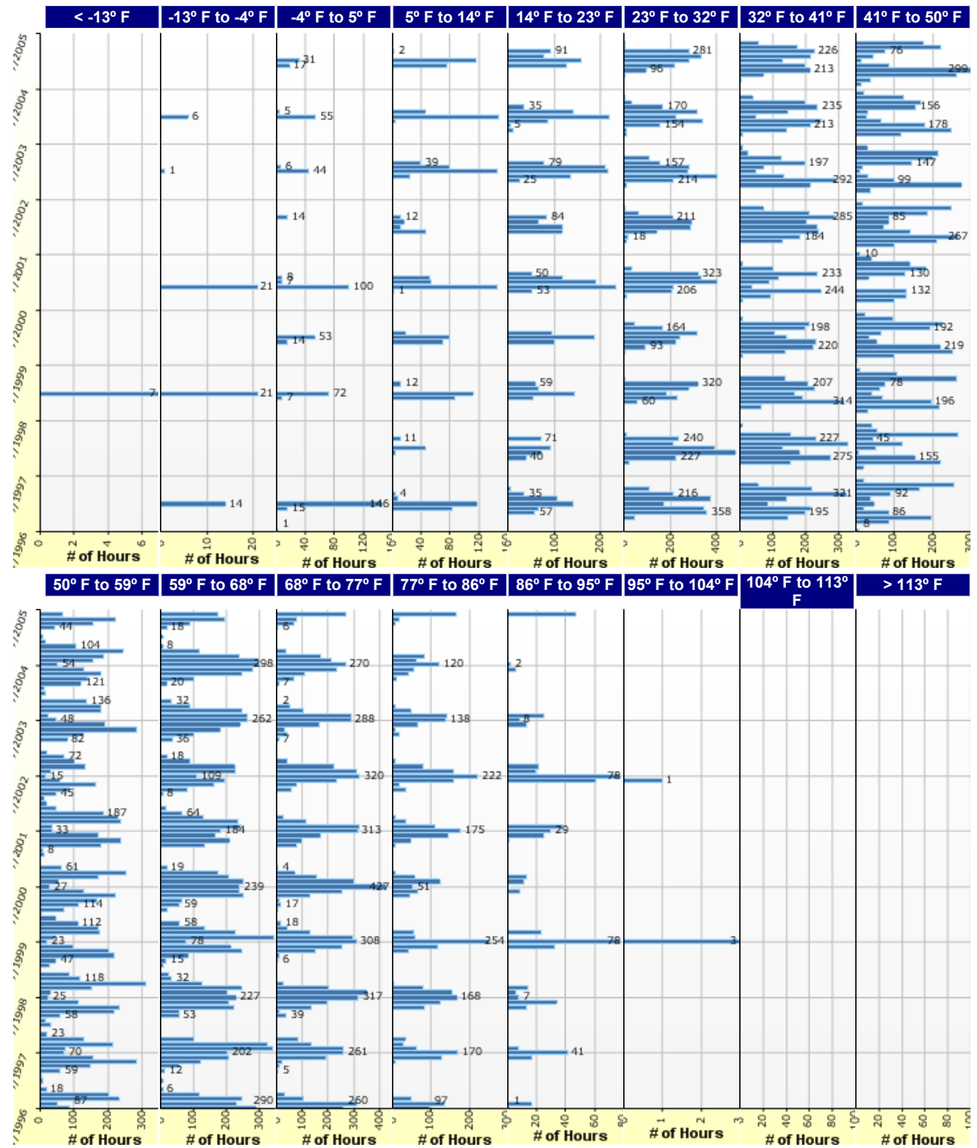
Approved by: on: 4/22/2016 9:41 AM

Pavement Design Report Appendix C

I-65 A Trial 3 - US 231

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Hourly Air Temperature Distribution by Month:



Report generated on: 7/13/2016 12:02 PM

Created by: on: 4/22/2016 9:41 AM

Approved by: on: 4/22/2016 9:41 AM

I-65 A Trial 3 - US 231

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 3 - US 231.dgpx

Design Properties

JPCP Design Properties

Structure - ICM Properties	
PCC surface shortwave absorptivity	0.85

Doweled Joints	
Is joint doweled ?	True
Dowel diameter (in.)	1.50
Dowel spacing (in.)	12.00

Tied Shoulders	
Tied shoulders	True
Load transfer efficiency (%)	60.00

PCC joint spacing (ft)	
Is joint spacing random ?	False
Joint spacing (ft)	15.00

Widened Slab	
Is slab widened ?	True
Slab width (ft)	14.00

PCC-Base Contact Friction	
PCC-Base full friction contact	True
Months until friction loss	600.00

Sealant type	Other(Including No Sealant... Liquid... Silicone)

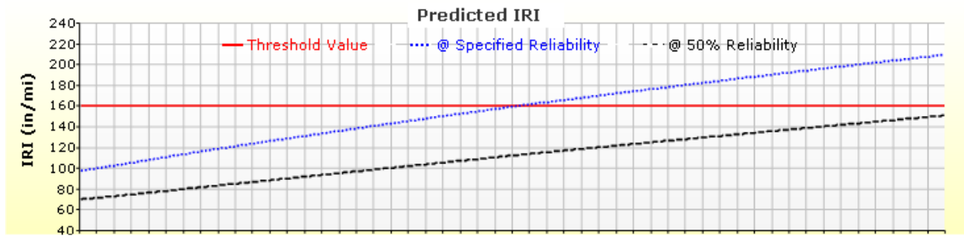
Erodibility index	2

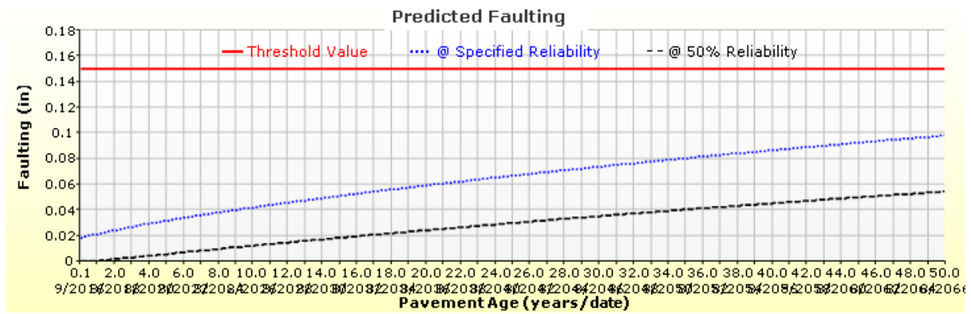
Permanent curl/warp effective temperature difference (°F)	-10.00

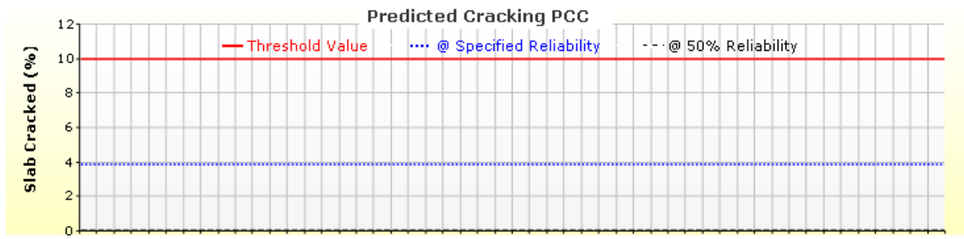
I-65 A Trial 3 - US 231

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 3 - US 231.dgpx

Analysis Output Charts

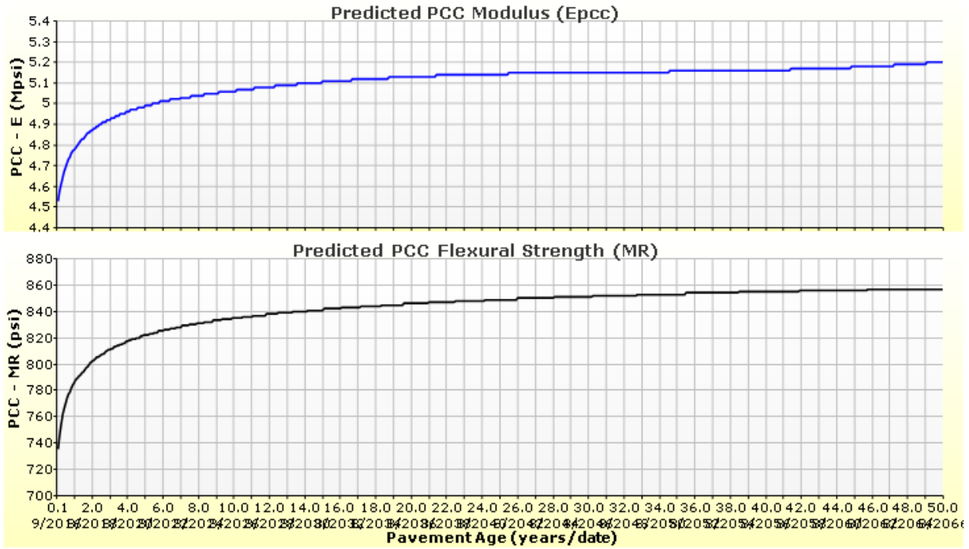


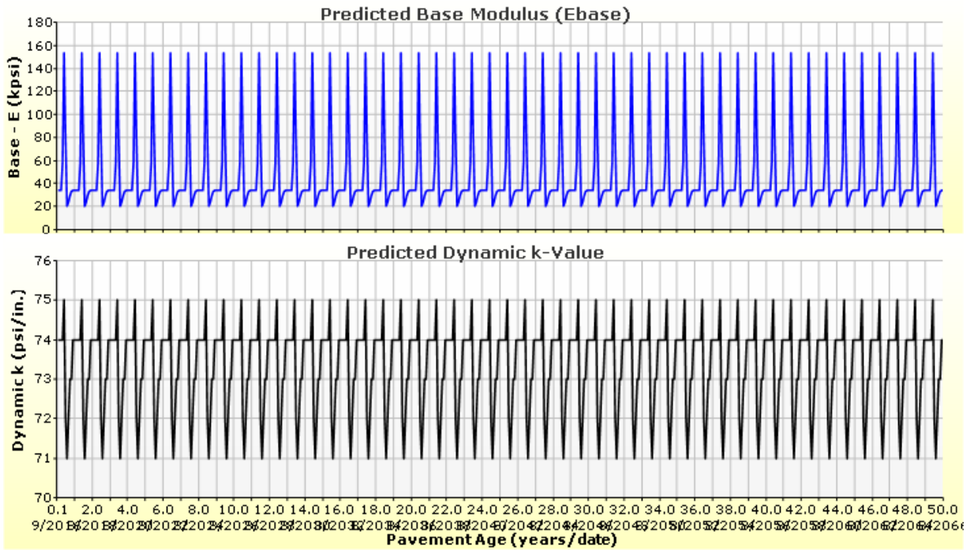




I-65 A Trial 3 - US 231

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 3 - US 231.dgpx

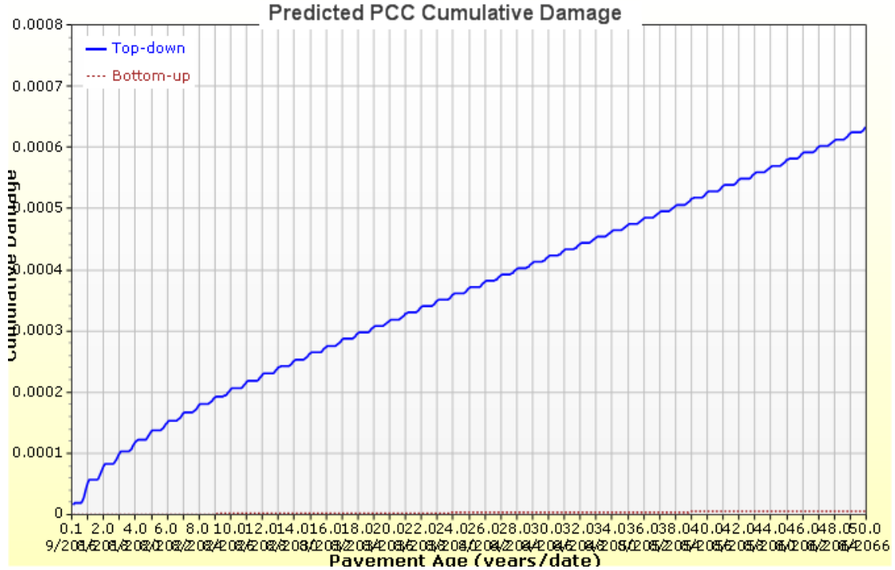


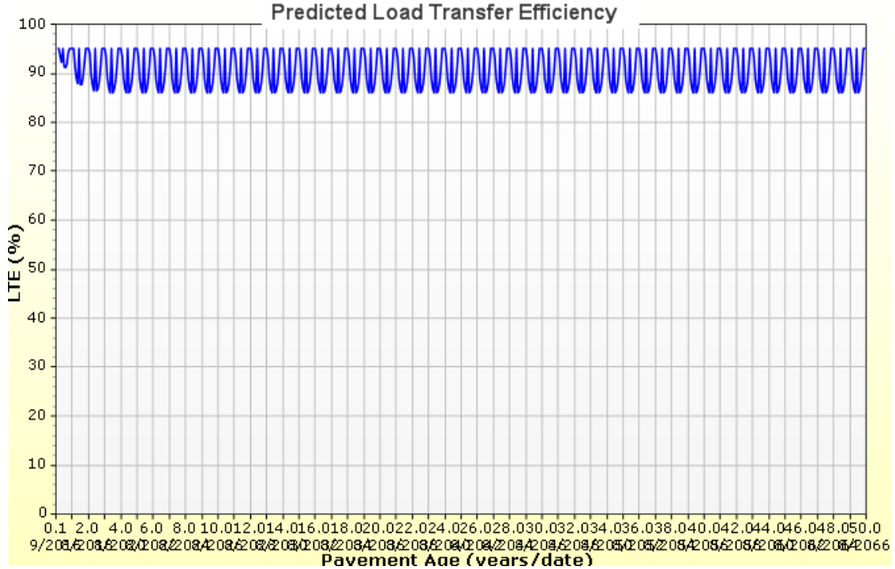


Pavement Design Report Appendix C

I-65 A Trial 3 - US 231

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 3 - US 231.dgpx





I-65 A Trial 3 - US 231

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 3 - US 231.dgpx

Layer Information

Layer 1 PCC : 14" PCCP

PCC		
Thickness (in.)		14.0
Unit weight (pcf)		145.0
Poisson's ratio		0.2

Thermal	
PCC coefficient of thermal expansion (in./in./ºF x 10^-6)	5.4
PCC thermal conductivity (BTU/hr-ft-ºF)	1.25
PCC heat capacity (BTU/lb-ºF)	0.28

Mix		
Cement type		Type I (1)
Cementitious material content (lb/yd^3)		400
Water to cement ratio		0.42
Aggregate type		Limestone (1)
PCC zero-stress temperature (ºF)	Calculated Internally?	True
	User Value	-
	Calculated Value	95.3
Ultimate shrinkage (microstrain)	Calculated Internally?	False
	User Value	483.0
	Calculated Value	-
Reversible shrinkage (%)		50
Time to develop 50% of ultimate shrinkage (days)		35
Curing method		Curing Compound

PCC strength and modulus (Input Level: 3)

28-Day PCC modulus of rupture (psi)	700.0
28-Day PCC elastic modulus (psi)	-

Identifiers

Field	Value
Display name/identifier	14" PCCP
Description of object	
Author	
Date Created	5/26/2016 2:31:33 PM
Approver	
Date approved	5/26/2016 2:31:33 PM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Pavement Design Report Appendix C

I-65 A Trial 3 - US 231

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 3 - US 231.dgpx

Layer 2 Non-stabilized Base : Crushed stone

Unbound	
Layer thickness (in.)	3.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 2)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
25000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	Crushed stone
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.2
Saturated hydraulic conductivity (ft/hr)	False	5.054e-02
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	7.4

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	7.2555
bf	1.3328
cf	0.8242
hr	117.4000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	8.7
#100	
#80	12.9
#60	
#50	
#40	20.0
#30	
#20	
#16	
#10	33.8
#8	
#4	44.7
3/8-in.	57.2
1/2-in.	63.1
3/4-in.	72.7
1-in.	78.8
1 1/2-in.	85.8
2-in.	91.6
2 1/2-in.	
3-in.	
3 1/2-in.	97.6

I-65 A Trial 3 - US 231

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 3 - US 231.dgpx

Layer 3 Non-stabilized Base : Crushed stone

Unbound	
Layer thickness (in.)	6.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 2)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
30000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	Crushed stone
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted?	True

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.7
Saturated hydraulic conductivity (ft/hr)	False	5.054e-02
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	7.4

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	7.2555
bf	1.3328
cf	0.8242
hr	117.4000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	8.7
#100	
#80	12.9
#60	
#50	
#40	20.0
#30	
#20	
#16	
#10	33.8
#8	
#4	44.7
3/8-in.	57.2
1/2-in.	63.1
3/4-in.	72.7
1-in.	78.8
1 1/2-in.	85.8
2-in.	91.6
2 1/2-in.	
3-in.	
3 1/2-in.	97.6

I-65 A Trial 3 - US 231

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 3 - US 231.dgpx

Layer 4 Subgrade : A-6

Unbound	
Layer thickness (in.)	14.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 2)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
6000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	31.1
Plasticity Index	11.5
Is layer compacted?	True

	Is User Defined?	Value
Maximum dry unit weight (pcf)	True	106
Saturated hydraulic conductivity (ft/hr)	False	2.224e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	True	18.2

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	94.5761
bf	0.7777
cf	0.3069
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	20.4
0.020mm	
#200	57.7
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	92.2
#8	
#4	
3/8-in.	
1/2-in.	
3/4-in.	
1-in.	100.0
1 1/2-in.	
2-in.	
2 1/2-in.	
3-in.	
3 1/2-in.	

I-65 A Trial 3 - US 231

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 3 - US 231.dgpx

Layer 5 Subgrade : A-6

Unbound	
Layer thickness (in.)	Semi-infinite
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 2)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
3000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	31.1
Plasticity Index	11.5
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	True	106
Saturated hydraulic conductivity (ft/hr)	False	2.224e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	True	18.2

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	94.5761
bf	0.7777
cf	0.3069
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	20.4
0.020mm	
#200	57.7
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	92.2
#8	
#4	
3/8-in.	
1/2-in.	
3/4-in.	
1-in.	100.0
1 1/2-in.	
2-in.	
2 1/2-in.	
3-in.	
3 1/2-in.	

I-65 A Trial 3 - US 231

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 3 - US 231.dgpx

Calibration Coefficients

PCC Faulting

$$C_{12} = C_1 + (C_2 * FR^{0.25})$$
$$C_{34} = C_3 + (C_4 * FR^{0.25})$$
$$FaultMax_0 = C_{12} * \delta_{curling} * \left[\log(1 + C_5 * 5.0^{EROD}) * \log\left(P_{200} * \frac{WetDays}{p_S}\right)\right]^{C_6}$$
$$FaultMax_i = FaultMax_0 + C_7 * \sum_{j=1}^{m} DE_j * \log(1 + C_5 * 5.0^{EROD})^{C_6}$$
$$\Delta Fault_i = C_{34} * (FaultMax_{i-1} - Fault_{i-1})^2 * DE_i$$
$$C_8 = DowelDeterioration$$

C1: 1.0184	C2: 0.91656	C3: 0.0021848	C4: 0.000883739
C5: 250	C6: 0.4	C7: 1.83312	C8: 400
PCC Reliability Faulting Standard Deviation			
Pow(0.0097*FAULT,0.5178)+0.014			

IRI-jpcp

C1 - Cracking	C1: 0.8203	C2: 0.4417
C2 - Spalling	C3: 1.4929	C4: 25.24
C3 - Faulting	**Reliability Standard Deviation**	
C4 - Site Factor	5.4	

PCC Cracking

$$\log(N) = C1 \cdot \left(\frac{MR}{\sigma}\right)^{C2}$$
$$CRK = \frac{100}{1 + C4\ FD^{C5}}$$

Fatigue Coefficients		Cracking Coefficients	
C1: 2	C2: 1.22	C4: 1	C5: -1.98
PCC Reliability Cracking Standard Deviation			
Pow(5.3116*CRACK,0.3903) + 2.99			

I-65 A Trial 1 - Kankakee

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx

Design Inputs

Design Life: 50 years
Design Type: Jointed Plain Concrete Pavement (JPCP)

Existing construction: -
Pavement construction: July, 2016
Traffic opening: September, 2016

Climate Data Sources (Lat/Lon): 41.453, -87.006; 41.786, -87.752; 41.986, -87.914; 41.707, -86.333; 42.121, -87.905; 41.914, -88.246

Design Structure



Layer type	Material Type	Thickness (in.):
PCC	14" PCCP	14.0
NonStabilized	Crushed stone	3.0
NonStabilized	Crushed stone	6.0
Subgrade	A-6	14.0
Subgrade	A-6	Semi-infinite

Joint Design:	
Joint spacing (ft)	15.0
Dowel diameter (in.)	1.50
Slab width (ft)	14.0 (w)

Traffic

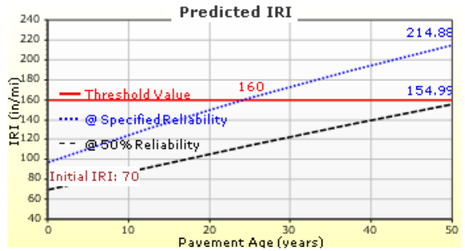
Age (year)	Heavy Trucks (cumulative)
2016 (initial)	20,996
2041 (25 years)	79,444,100
2066 (50 years)	200,528,000

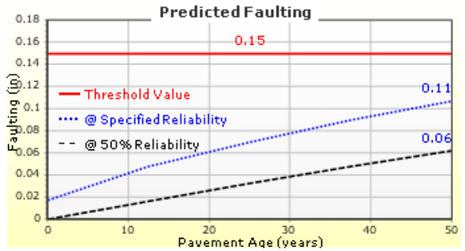
Design Outputs

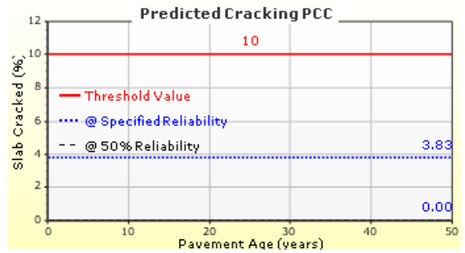
Distress Prediction Summary

Distress Type	Distress @ Specified Reliability		Reliability (%)		Criterion Satisfied?
	Target	Predicted	Target	Achieved	
Terminal IRI (in./mile)	160.00	214.88	90.00	54.27	Fail
Mean joint faulting (in.)	0.15	0.11	90.00	99.34	Pass
JPCP transverse cracking (percent slabs)	10.00	3.83	90.00	99.96	Pass

Distress Charts







Pavement Design Report Appendix C

I-65 A Trial 1 - Kankakee

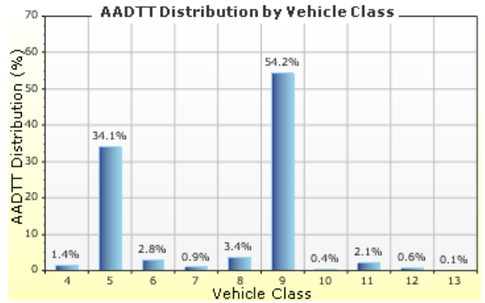
File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx

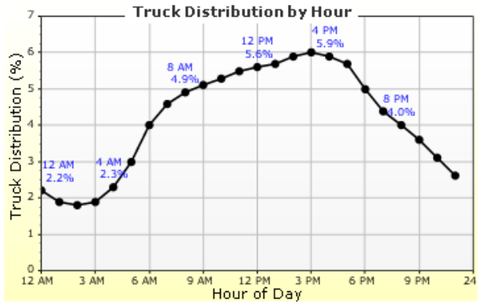
Traffic Inputs

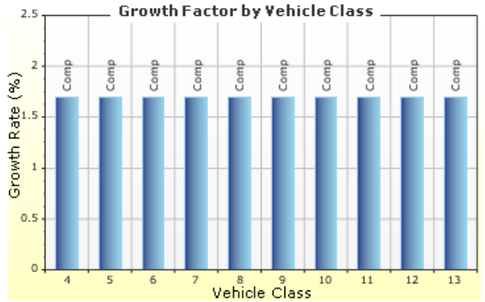
Graphical Representation of Traffic Inputs

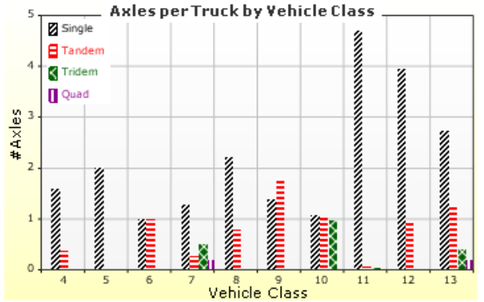
Initial two-way AADTT: 20,996
Number of lanes in design direction: 3

Percent of trucks in design direction (%): 56.0
Percent of trucks in design lane (%): 60.0
Operational speed (mph) 65.0

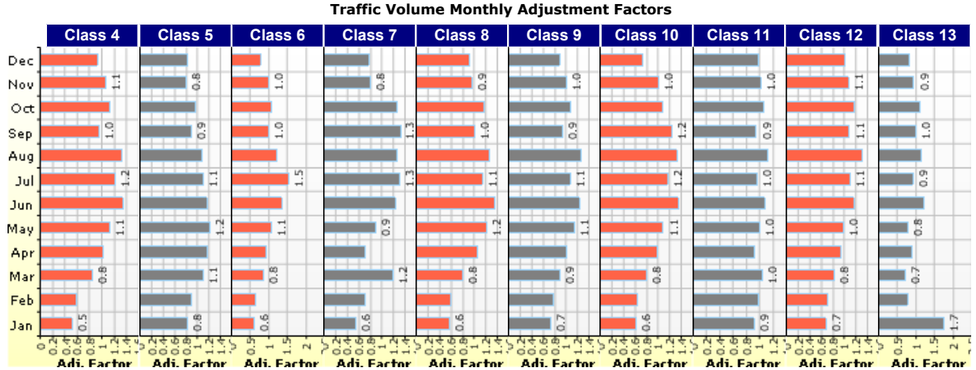








Traffic Volume Monthly Adjustment Factors



I-65 A Trial 1 - Kankakee

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Tabular Representation of Traffic Inputs

Volume Monthly Adjustment Factors

Level 3: Default MAF

Month	Vehicle Class									
	4	5	6	7	8	9	10	11	12	13
January	0.5	0.8	0.6	0.6	0.6	0.7	0.6	0.9	0.7	1.7
February	0.6	0.9	0.6	0.7	0.6	0.8	0.6	1.0	0.7	0.8
March	0.8	1.1	0.8	1.2	0.8	0.9	0.8	1.0	0.8	0.7
April	1.0	1.2	0.9	0.7	1.1	1.0	1.0	0.9	0.9	0.9
May	1.1	1.2	1.1	0.9	1.2	1.1	1.1	1.0	1.0	0.8
June	1.4	1.2	1.3	1.2	1.4	1.2	1.3	1.1	1.2	1.2
July	1.2	1.1	1.5	1.3	1.1	1.1	1.2	1.0	1.1	0.9
August	1.3	1.1	1.3	1.3	1.3	1.3	1.3	1.1	1.3	1.2
September	1.0	0.9	1.0	1.3	1.0	0.9	1.2	0.9	1.1	1.0
October	1.1	0.9	1.1	1.3	1.2	1.1	1.1	1.1	1.2	1.1
November	1.1	0.8	1.0	0.8	0.9	1.0	1.0	1.0	1.1	0.9
December	0.9	0.8	0.8	0.8	0.9	0.9	0.7	1.0	1.0	0.8

Distributions by Vehicle Class

Vehicle Class	AADTT Distribution (%) (Level 3)	Growth Factor	
		Rate (%)	Function
Class 4	1.4%	1.7%	Compound
Class 5	34.1%	1.7%	Compound
Class 6	2.8%	1.7%	Compound
Class 7	0.9%	1.7%	Compound
Class 8	3.4%	1.7%	Compound
Class 9	54.2%	1.7%	Compound
Class 10	0.4%	1.7%	Compound
Class 11	2.1%	1.7%	Compound
Class 12	0.6%	1.7%	Compound
Class 13	0.1%	1.7%	Compound

Truck Distribution by Hour

Hour	Distribution (%)	Hour	Distribution (%)
12 AM	2.2%	12 PM	5.6%
1 AM	1.9%	1 PM	5.7%
2 AM	1.8%	2 PM	5.9%
3 AM	1.9%	3 PM	6%
4 AM	2.3%	4 PM	5.9%
5 AM	3%	5 PM	5.7%
6 AM	4%	6 PM	5%
7 AM	4.6%	7 PM	4.4%
8 AM	4.9%	8 PM	4%
9 AM	5.1%	9 PM	3.6%
10 AM	5.3%	10 PM	3.1%
11 AM	5.5%	11 PM	2.6%
		Total	100%

Axle Configuration

Traffic Wander	
Mean wheel location (in.)	18
Traffic wander standard deviation (in.)	10
Design lane width (ft)	12

Axle Configuration	
Average axle width (ft)	8.5
Dual tire spacing (in.)	12
Tire pressure (psi)	120

Average Axle Spacing	
Tandem axle spacing (in.)	51.6
Tridem axle spacing (in.)	49.2
Quad axle spacing (in.)	49.2

Wheelbase				
Value Type	Axle Type	Short	Medium	Long
Average spacing of axles (ft)		12	15	18
Percent of Trucks (%)		33	33	34

Number of Axles per Truck

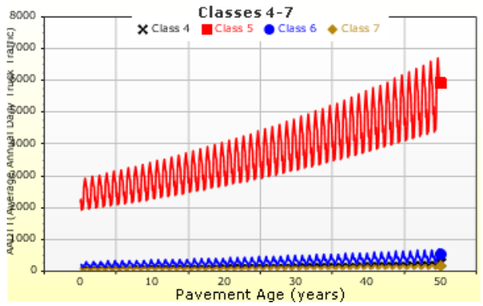
Vehicle Class	Single Axle	Tandem Axle	Tridem Axle	Quad Axle
Class 4	1.6	0.39	0	0
Class 5	2	0	0	0
Class 6	1	1	0	0
Class 7	1.29	0.29	0.5	0.19
Class 8	2.19	0.8	0	0
Class 9	1.37	1.8	0	0
Class 10	1.05	1.02	0.96	0.01
Class 11	4.71	0.08	0.03	0
Class 12	3.94	0.99	0.01	0
Class 13	2.73	1.25	0.41	0.2

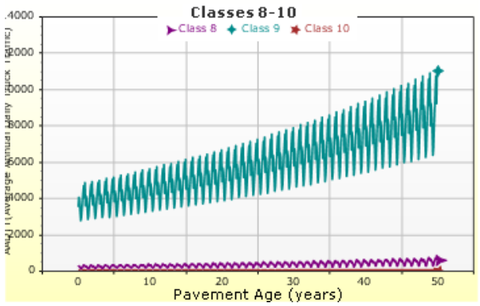
I-65 A Trial 1 - Kankakee

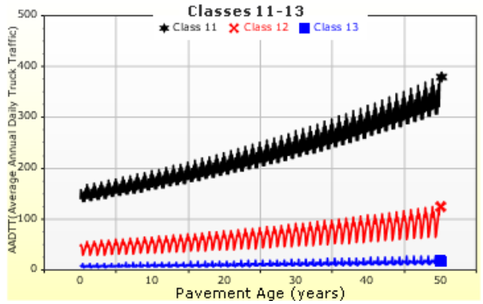
File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx

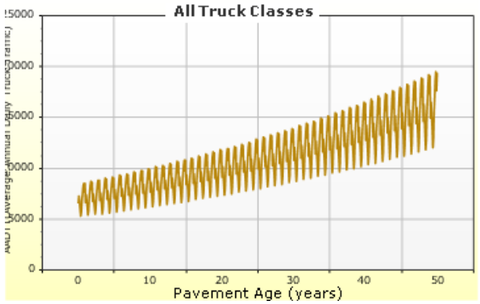
AADTT (Average Annual Daily Truck Traffic) Growth

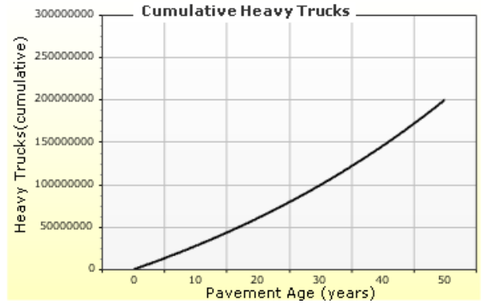
*** Traffic cap is not enforced**











I-65 A Trial 1 - Kankakee

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx

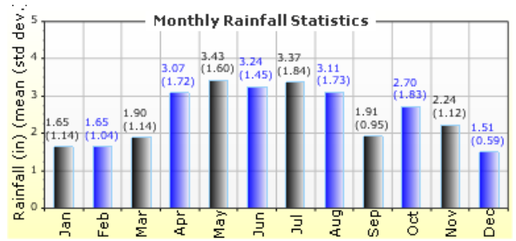
Climate Inputs

Climate Data Sources:

Climate Station Cities:	Location (lat lon elevation(ft))
VALPARAISO, IN	41.45300 -87.00600 770
CHICAGO, IL	41.78600 -87.75200 612
CHICAGO, IL	41.98600 -87.91400 662

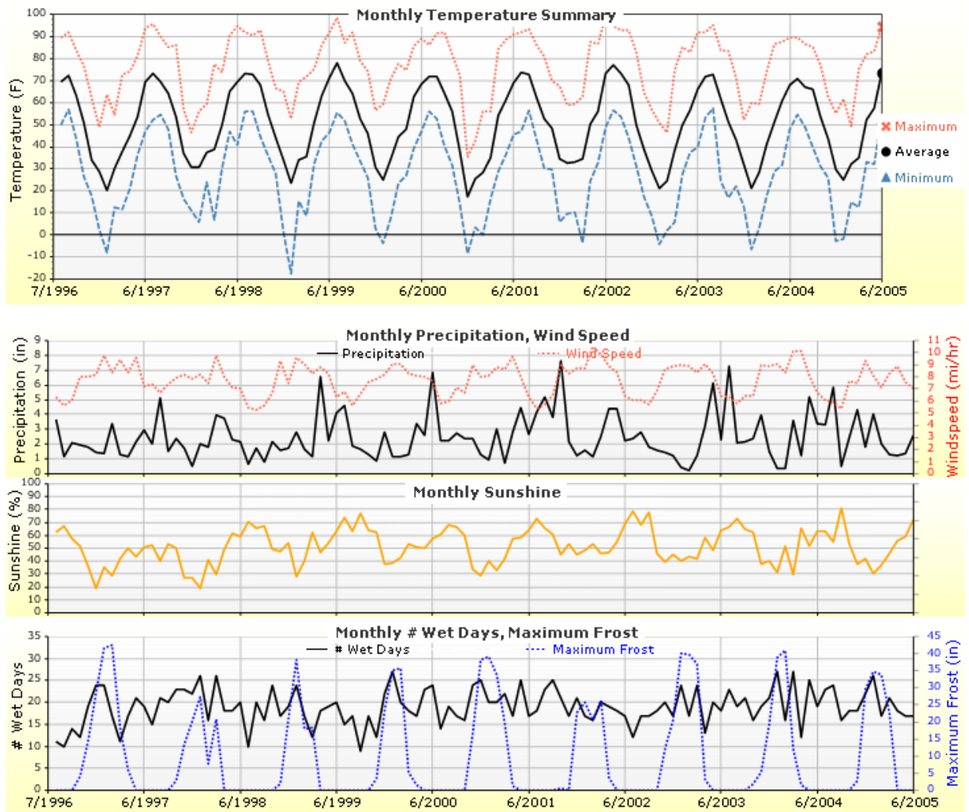
Annual Statistics:

Mean annual air temperature (ºF)	50.55
Mean annual precipitation (in.)	29.78
Freezing index (ºF - days)	677.11
Average annual number of freeze/thaw cycles:	62.54



Water table depth (ft)	10.00

Monthly Climate Summary:

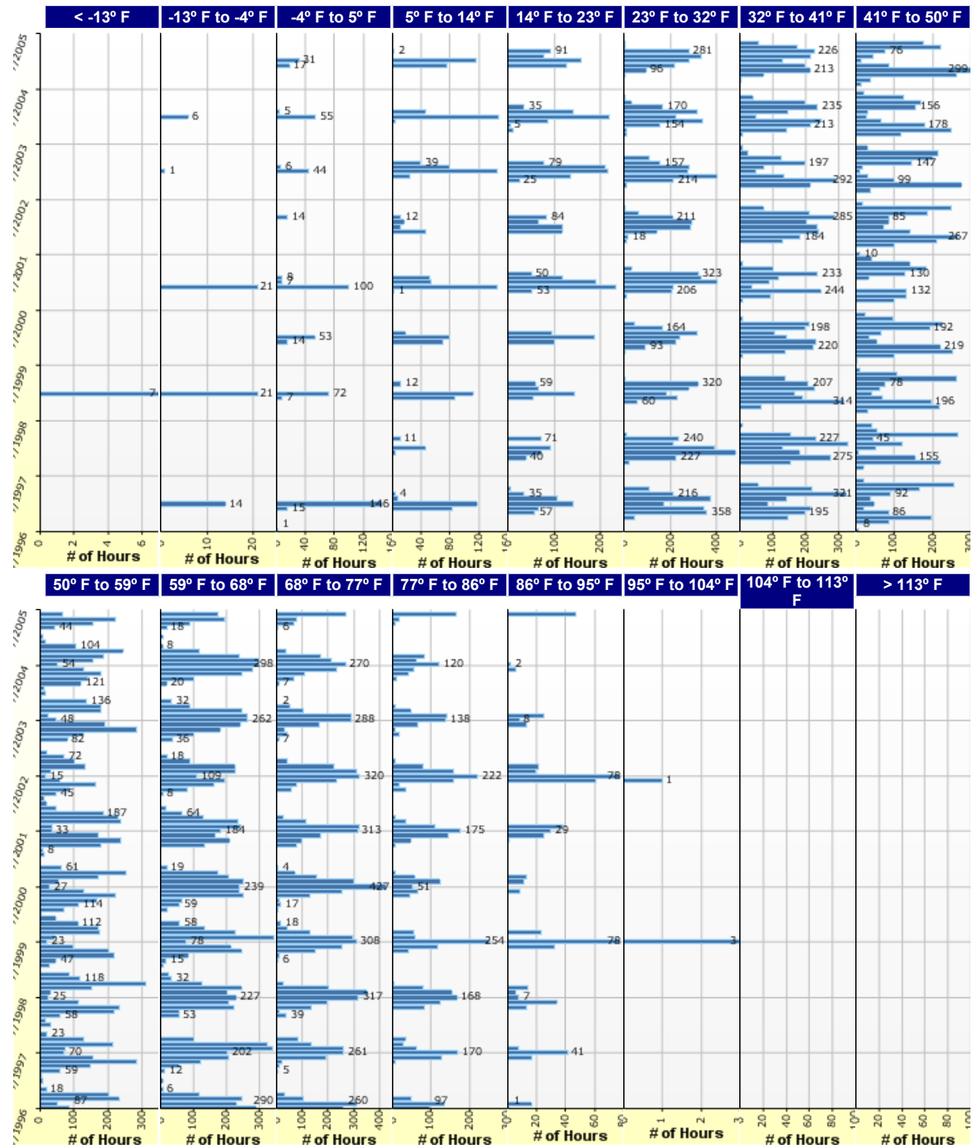


Pavement Design Report Appendix C

I-65 A Trial 1 - Kankakee

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx

Hourly Air Temperature Distribution by Month:



I-65 A Trial 1 - Kankakee

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx

Design Properties

JPCP Design Properties

Structure - ICM Properties	
PCC surface shortwave absorptivity	0.85

PCC joint spacing (ft)	
Is joint spacing random ?	False
Joint spacing (ft)	15.00

Doweled Joints	
Is joint doweled ?	True
Dowel diameter (in.)	1.50
Dowel spacing (in.)	12.00

Widened Slab	
Is slab widened ?	True
Slab width (ft)	14.00

Sealant type	Other(Including No Sealant... Liquid... Silicone)

Tied Shoulders	
Tied shoulders	True
Load transfer efficiency (%)	60.00

PCC-Base Contact Friction	
PCC-Base full friction contact	True
Months until friction loss	600.00

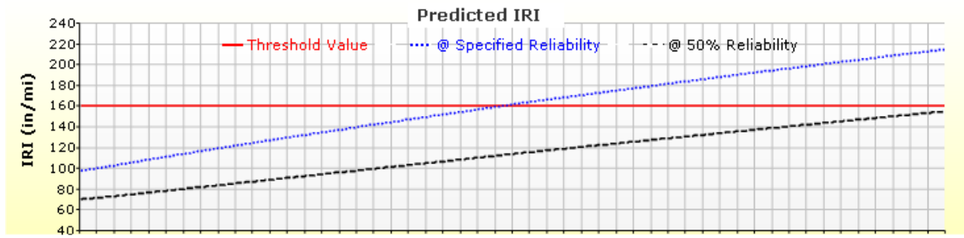
Erodibility index	2

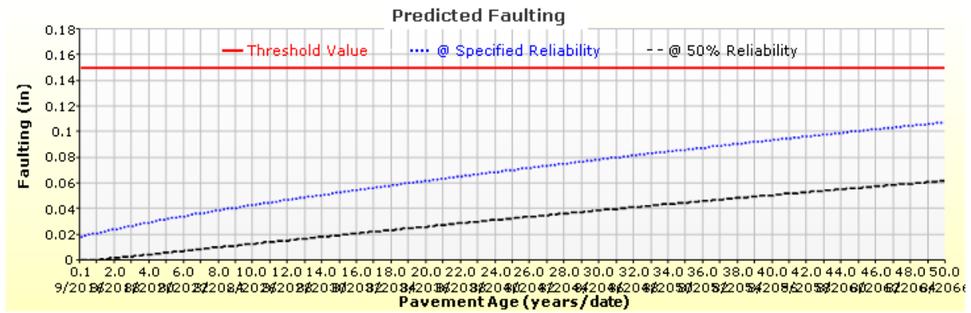
Permanent curl/warp effective temperature difference (°F)	-10.00

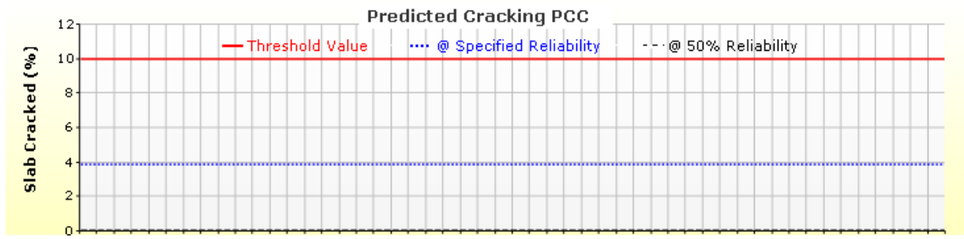
I-65 A Trial 1 - Kankakee

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx

Analysis Output Charts

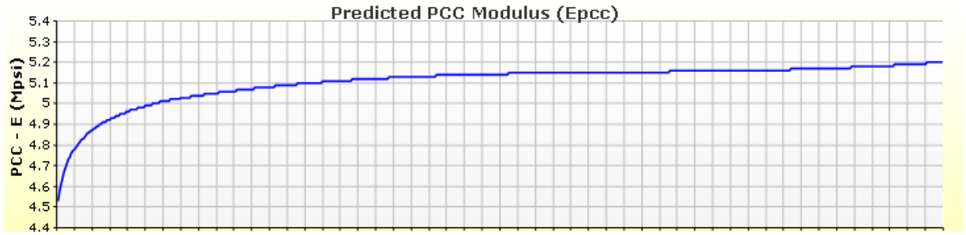


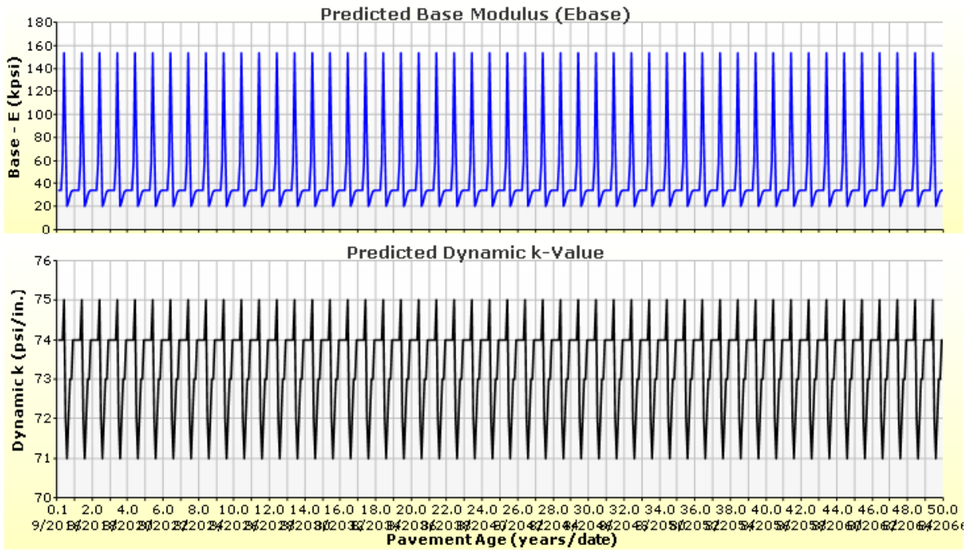




I-65 A Trial 1 - Kankakee

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx

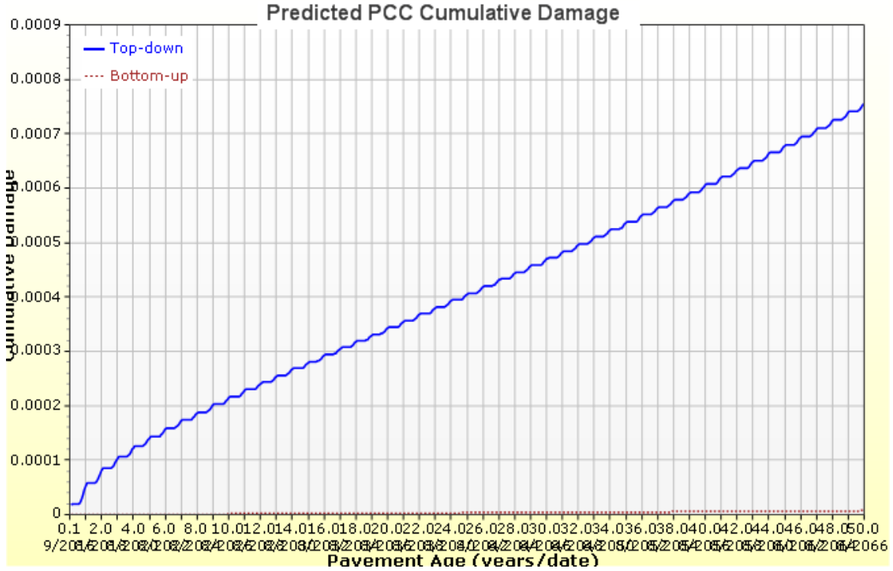


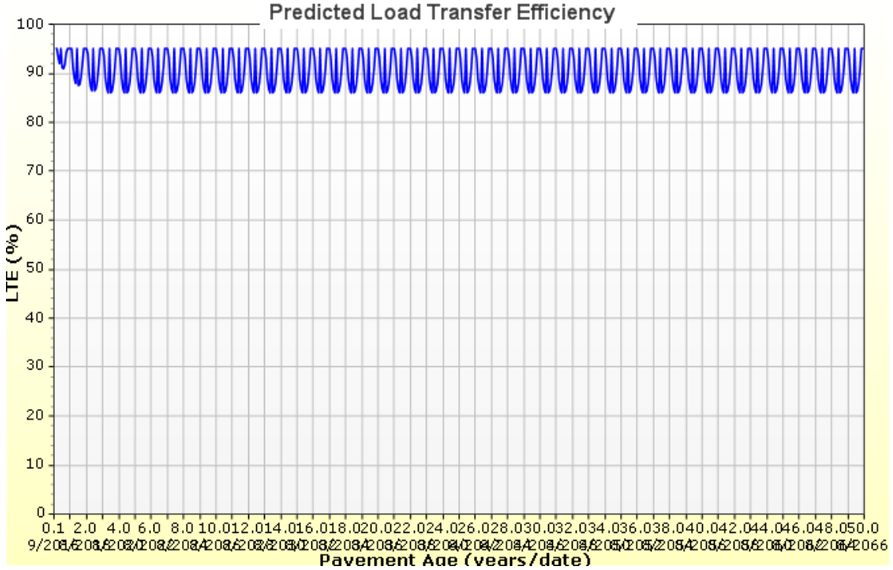


Pavement Design Report Appendix C

I-65 A Trial 1 - Kankakee

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx





I-65 A Trial 1 - Kankakee

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx

Layer Information

Layer 1 PCC : 14" PCCP

PCC		
Thickness (in.)		14.0
Unit weight (pcf)		145.0
Poisson's ratio		0.2

Thermal	
PCC coefficient of thermal expansion (in./in./ºF x 10^-6)	5.4
PCC thermal conductivity (BTU/hr-ft-ºF)	1.25
PCC heat capacity (BTU/lb-ºF)	0.28

Mix		
Cement type		Type I (1)
Cementitious material content (lb/yd^3)		400
Water to cement ratio		0.42
Aggregate type		Limestone (1)
PCC zero-stress temperature (ºF)	Calculated Internally?	True
	User Value	-
	Calculated Value	95.3
Ultimate shrinkage (microstrain)	Calculated Internally?	False
	User Value	483.0
	Calculated Value	-
Reversible shrinkage (%)		50
Time to develop 50% of ultimate shrinkage (days)		35
Curing method		Curing Compound

PCC strength and modulus (Input Level: 3)

28-Day PCC modulus of rupture (psi)	700.0
28-Day PCC elastic modulus (psi)	-

Identifiers

Field	Value
Display name/identifier	14" PCCP
Description of object	
Author	
Date Created	5/26/2016 2:31:33 PM
Approver	
Date approved	5/26/2016 2:31:33 PM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

I-65 A Trial 1 - Kankakee

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx

Layer 2 Non-stabilized Base : Crushed stone

Unbound	
Layer thickness (in.)	3.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 2)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
25000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	Crushed stone
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.2
Saturated hydraulic conductivity (ft/hr)	False	5.054e-02
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	7.4

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	7.2555
bf	1.3328
cf	0.8242
hr	117.4000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	8.7
#100	
#80	12.9
#60	
#50	
#40	20.0
#30	
#20	
#16	
#10	33.8
#8	
#4	44.7
3/8-in.	57.2
1/2-in.	63.1
3/4-in.	72.7
1-in.	78.8
1 1/2-in.	85.8
2-in.	91.6
2 1/2-in.	
3-in.	
3 1/2-in.	97.6

I-65 A Trial 1 - Kankakee

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx

Layer 3 Non-stabilized Base : Crushed stone

Unbound	
Layer thickness (in.)	6.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 2)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
30000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	Crushed stone
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted?	True

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.7
Saturated hydraulic conductivity (ft/hr)	False	5.054e-02
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	7.4

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	7.2555
bf	1.3328
cf	0.8242
hr	117.4000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	8.7
#100	
#80	12.9
#60	
#50	
#40	20.0
#30	
#20	
#16	
#10	33.8
#8	
#4	44.7
3/8-in.	57.2
1/2-in.	63.1
3/4-in.	72.7
1-in.	78.8
1 1/2-in.	85.8
2-in.	91.6
2 1/2-in.	
3-in.	
3 1/2-in.	97.6

I-65 A Trial 1 - Kankakee

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx

Layer 4 Subgrade : A-6

Unbound	
Layer thickness (in.)	14.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 2)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
6000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	31.1
Plasticity Index	11.5
Is layer compacted?	True

	Is User Defined?	Value
Maximum dry unit weight (pcf)	True	106
Saturated hydraulic conductivity (ft/hr)	False	2.224e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	True	18.2

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	94.5761
bf	0.7777
cf	0.3069
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	20.4
0.020mm	
#200	57.7
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	92.2
#8	
#4	
3/8-in.	
1/2-in.	
3/4-in.	
1-in.	100.0
1 1/2-in.	
2-in.	
2 1/2-in.	
3-in.	
3 1/2-in.	

I-65 A Trial 1 - Kankakee

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx

Layer 5 Subgrade : A-6

Unbound	
Layer thickness (in.)	Semi-infinite
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 2)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
3000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	31.1
Plasticity Index	11.5
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	True	106
Saturated hydraulic conductivity (ft/hr)	False	2.224e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	True	18.2

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	94.5761
bf	0.7777
cf	0.3069
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	20.4
0.020mm	
#200	57.7
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	92.2
#8	
#4	
3/8-in.	
1/2-in.	
3/4-in.	
1-in.	100.0
1 1/2-in.	
2-in.	
2 1/2-in.	
3-in.	
3 1/2-in.	

I-65 A Trial 1 - Kankakee

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\PCCP\I-65 A Trial 1 - Kankakee.dgpx

Calibration Coefficients

PCC Faulting

$$C_{12} = C_1 + (C_2 * FR^{0.25})$$
$$C_{34} = C_3 + (C_4 * FR^{0.25})$$
$$FaultMax_0 = C_{12} * \delta_{curling} * \left[\log(1 + C_5 * 5.0^{EROD}) * \log\left(P_{200} * \frac{WetDays}{p_S}\right)\right]^{C_6}$$
$$FaultMax_i = FaultMax_0 + C_7 * \sum_{j=1}^{m} DE_j * \log(1 + C_5 * 5.0^{EROD})^{C_6}$$
$$\Delta Fault_i = C_{34} * (FaultMax_{i-1} - Fault_{i-1})^2 * DE_i$$
$$C_8 = DowelDeterioration$$

C1: 1.0184	C2: 0.91656	C3: 0.0021848	C4: 0.000883739
C5: 250	C6: 0.4	C7: 1.83312	C8: 400
PCC Reliability Faulting Standard Deviation			
Pow(0.0097*FAULT,0.5178)+0.014			

IRI-jpcp

C1 - Cracking	C1: 0.8203	C2: 0.4417
C2 - Spalling	C3: 1.4929	C4: 25.24
C3 - Faulting	**Reliability Standard Deviation**	
C4 - Site Factor	5.4	

PCC Cracking

$$\log(N) = C1 \cdot \left(\frac{MR}{\sigma}\right)^{C2}$$
$$CRK = \frac{100}{1 + C4\ FD^{C5}}$$

Fatigue Coefficients		Cracking Coefficients	
C1: 2	C2: 1.22	C4: 1	C5: -1.98
PCC Reliability Cracking Standard Deviation			
Pow(5.3116*CRACK,0.3903) + 2.99			

I-65 C2 Overlay - Alternative 43

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Revised Designs for PCCP Change\I-65 C2 Overlay - Alternative 43.dgpx

Design Inputs

Design Life: 50 years
Design Type: AC over JPCP

Existing construction: May, 1990
Pavement construction: July, 2016
Traffic opening: September, 2016

Climate Data Sources (Lat/Lon): 41.453, -87.006; 41.786, -87.752; 41.986, -87.914

Design Structure



Layer type	Material Type	Thickness (in.):
Flexible	LaPorte QC/QA-HMA, 5, 76, Surface, 9.5 mm - SMA	1.5
Flexible	Asphalt concrete	8.0
PCC	JPCP Default	10.0
Subgrade	Crushed Stone	5.0
Subgrade	A-6	Semi-infinite

Volumetric at Construction:	
Effective binder content (%)	13.4
Air voids (%)	7.0

Traffic

Age (year)	Heavy Trucks (cumulative)
2016 (initial)	20,107
2041 (25 years)	70,937,800
2066 (50 years)	161,911,000

Design Outputs

Distress Prediction Summary

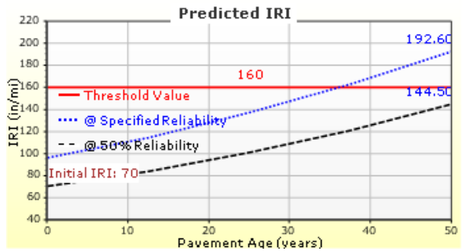
Distress Type	Distress @ Specified Reliability		Reliability (%)		Criterion Satisfied?
	Target	Predicted	Target	Achieved	
Terminal IRI (in./mile)	160.00	192.60	90.00	66.00	Fail
Permanent deformation - total pavement (in.)	0.75	0.42	90.00	100.00	Pass
Total Cracking (Reflective + Alligator) (percent)	50	5.00	-	-	Pass
AC thermal cracking (ft/mile)	500.00	217.40	90.00	100.00	Pass
JPCP transverse cracking (percent slabs)	10.00	3.83	90.00	99.96	Pass
AC bottom-up fatigue cracking (percent)	10.00	1.45	90.00	100.00	Pass
AC top-down fatigue cracking (ft/mile)	2500.00	6902.56	90.00	28.54	Fail
Permanent deformation - AC only (in.)	0.40	0.42	90.00	86.70	Fail

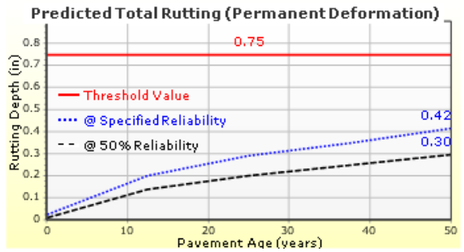
Pavement Design Report Appendix C

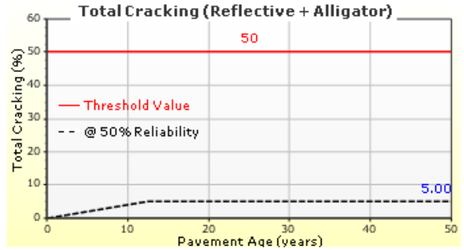
I-65 C2 Overlay - Alternative 43

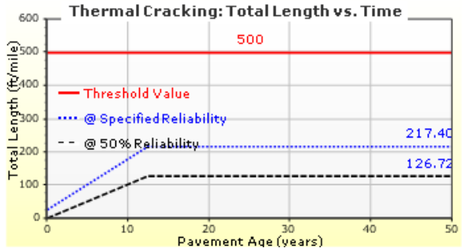
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Distress Charts









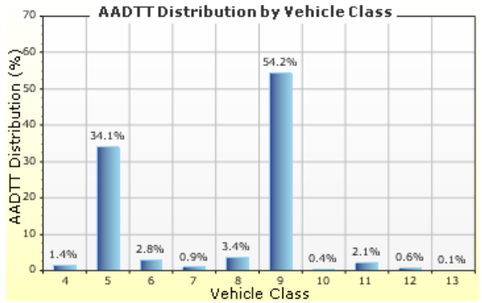
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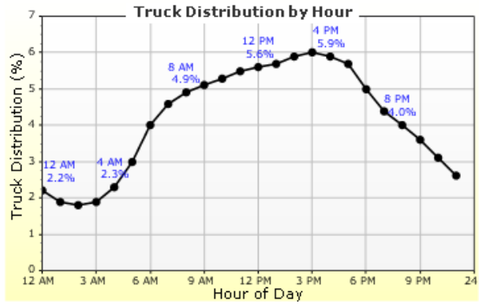
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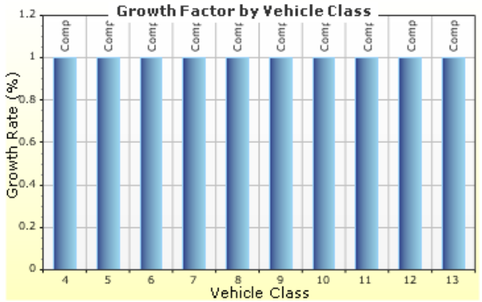
Traffic Inputs

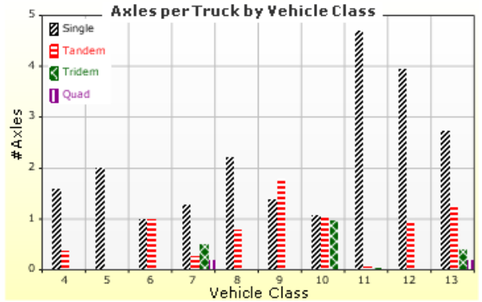
Graphical Representation of Traffic Inputs

Initial two-way AADTT:	20,107	Percent of trucks in design direction (%):	57.0
Number of lanes in design direction:	3	Percent of trucks in design lane (%):	60.0
		Operational speed (mph)	65.0

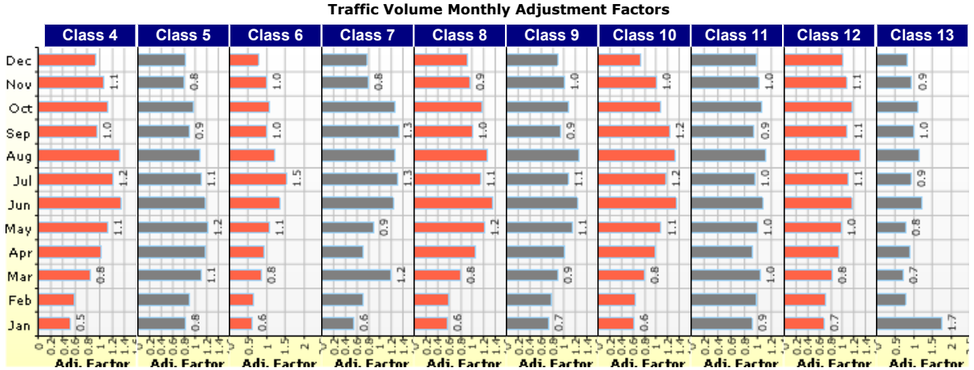








Traffic Volume Monthly Adjustment Factors



I-65 C2 Overlay - Alternative 43

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Tabular Representation of Traffic Inputs

Volume Monthly Adjustment Factors

Level 3: Default MAF

Month	Vehicle Class									
	4	5	6	7	8	9	10	11	12	13
January	0.5	0.8	0.6	0.6	0.6	0.7	0.6	0.9	0.7	1.7
February	0.6	0.9	0.6	0.7	0.6	0.8	0.6	1.0	0.7	0.8
March	0.8	1.1	0.8	1.2	0.8	0.9	0.8	1.0	0.8	0.7
April	1.0	1.2	0.9	0.7	1.1	1.0	1.0	0.9	0.9	0.9
May	1.1	1.2	1.1	0.9	1.2	1.1	1.1	1.0	1.0	0.8
June	1.4	1.2	1.3	1.2	1.4	1.2	1.3	1.1	1.2	1.2
July	1.2	1.1	1.5	1.3	1.1	1.1	1.2	1.0	1.1	0.9
August	1.3	1.1	1.3	1.3	1.3	1.3	1.3	1.1	1.3	1.2
September	1.0	0.9	1.0	1.3	1.0	0.9	1.2	0.9	1.1	1.0
October	1.1	0.9	1.1	1.3	1.2	1.1	1.1	1.1	1.2	1.1
November	1.1	0.8	1.0	0.8	0.9	1.0	1.0	1.0	1.1	0.9
December	0.9	0.8	0.8	0.8	0.9	0.9	0.7	1.0	1.0	0.8

Distributions by Vehicle Class

Vehicle Class	AADTT Distribution (%) (Level 3)	Growth Factor	
		Rate (%)	Function
Class 4	1.4%	1%	Compound
Class 5	34.1%	1%	Compound
Class 6	2.8%	1%	Compound
Class 7	0.9%	1%	Compound
Class 8	3.4%	1%	Compound
Class 9	54.2%	1%	Compound
Class 10	0.4%	1%	Compound
Class 11	2.1%	1%	Compound
Class 12	0.6%	1%	Compound
Class 13	0.1%	1%	Compound

Truck Distribution by Hour

Hour	Distribution (%)	Hour	Distribution (%)
12 AM	2.2%	12 PM	5.6%
1 AM	1.9%	1 PM	5.7%
2 AM	1.8%	2 PM	5.9%
3 AM	1.9%	3 PM	6%
4 AM	2.3%	4 PM	5.9%
5 AM	3%	5 PM	5.7%
6 AM	4%	6 PM	5%
7 AM	4.6%	7 PM	4.4%
8 AM	4.9%	8 PM	4%
9 AM	5.1%	9 PM	3.6%
10 AM	5.3%	10 PM	3.1%
11 AM	5.5%	11 PM	2.6%
		Total	100%

Axle Configuration

Traffic Wander	
Mean wheel location (in.)	18
Traffic wander standard deviation (in.)	10
Design lane width (ft)	12

Axle Configuration	
Average axle width (ft)	8.5
Dual tire spacing (in.)	12
Tire pressure (psi)	120

Average Axle Spacing	
Tandem axle spacing (in.)	51.6
Tridem axle spacing (in.)	49.2
Quad axle spacing (in.)	49.2

Wheelbase			
Value Type	Axle Type	Short	Medium	Long
Average spacing of axles (ft)		12	15	18
Percent of Trucks (%)		33	33	34

Number of Axles per Truck

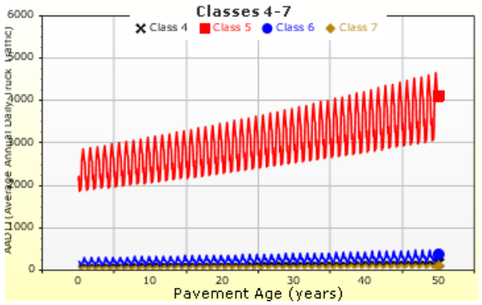
Vehicle Class	Single Axle	Tandem Axle	Tridem Axle	Quad Axle
Class 4	1.6	0.39	0	0
Class 5	2	0	0	0
Class 6	1	1	0	0
Class 7	1.29	0.29	0.5	0.19
Class 8	2.19	0.8	0	0
Class 9	1.37	1.8	0	0
Class 10	1.05	1.02	0.96	0.01
Class 11	4.71	0.08	0.03	0
Class 12	3.94	0.99	0.01	0
Class 13	2.73	1.25	0.41	0.2

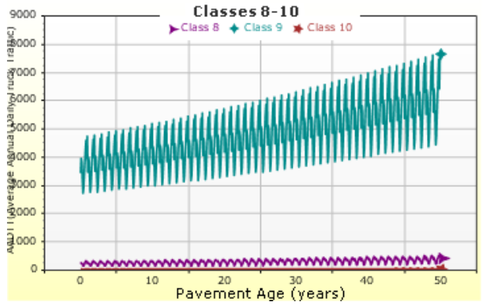
I-65 C2 Overlay - Alternative 43

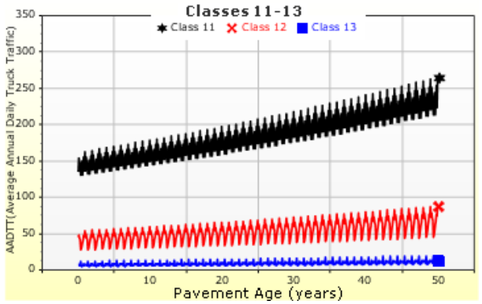
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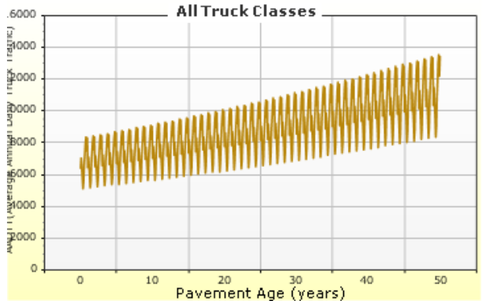
AADTT (Average Annual Daily Truck Traffic) Growth

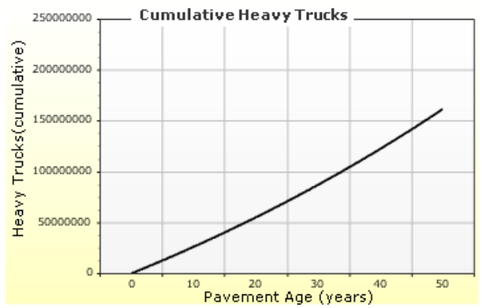
*** Traffic cap is not enforced**











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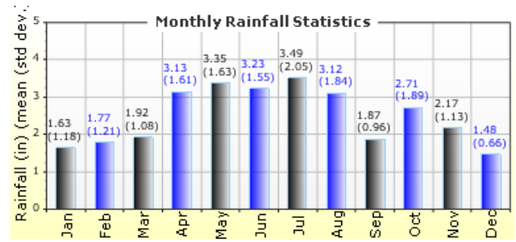
Climate Inputs

Climate Data Sources:

Climate Station Cities:	Location (lat lon elevation(ft))
VALPARAISO, IN	41.45300 -87.00600 770
CHICAGO, IL	41.78600 -87.75200 612
CHICAGO, IL	41.98600 -87.91400 662

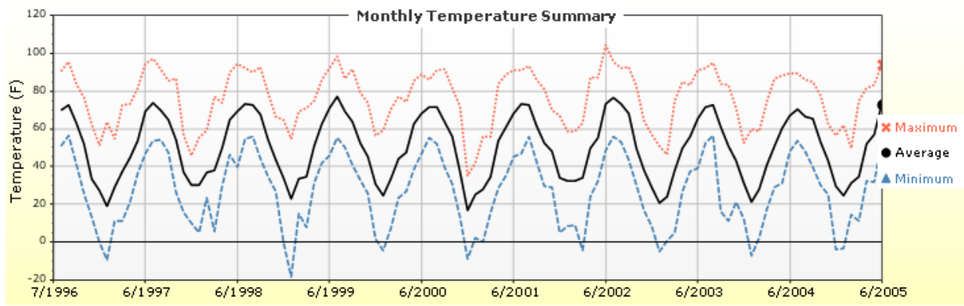
Annual Statistics:

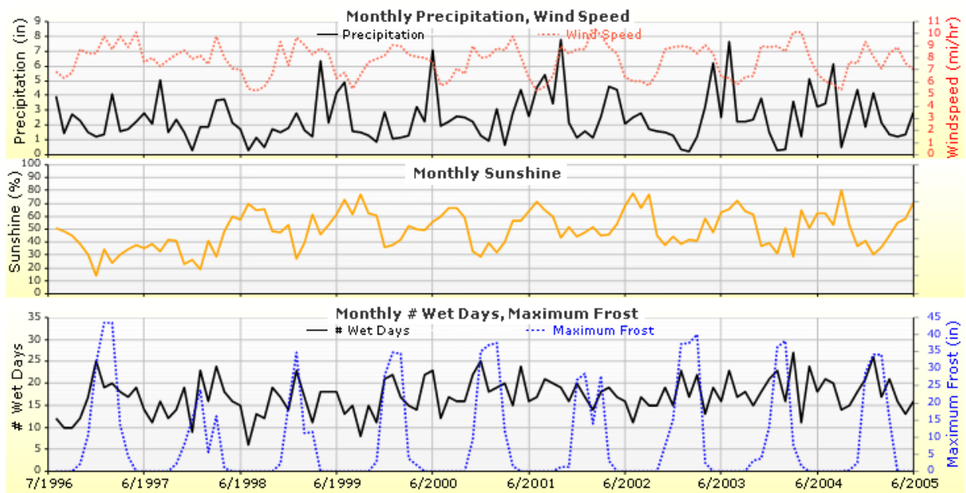
Mean annual air temperature (°F)	50.22
Mean annual precipitation (in.)	29.87
Freezing index (°F - days)	712.28
Average annual number of freeze/thaw cycles:	67.21



Water table depth (ft) 4.00

Monthly Climate Summary:





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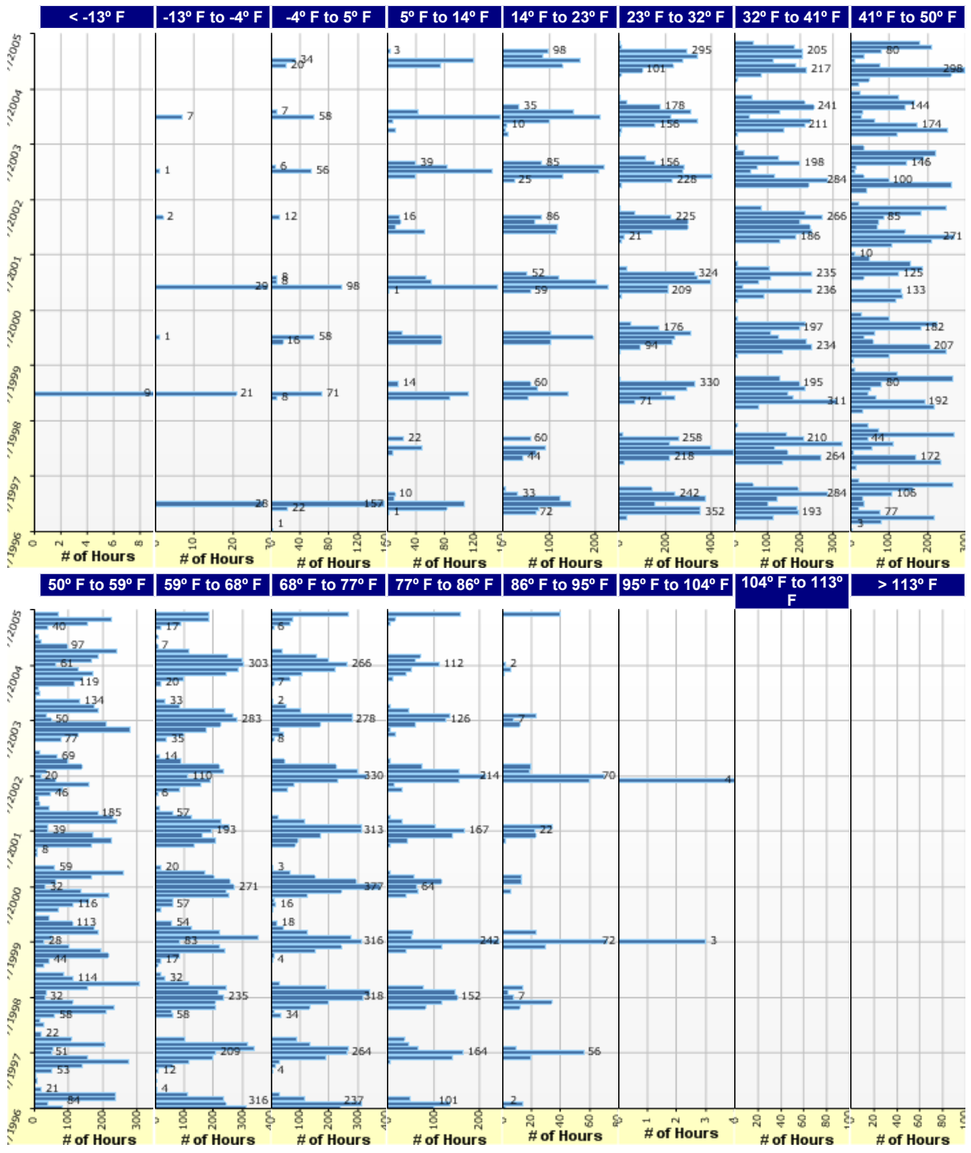
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Hourly Air Temperature Distribution by Month:



Pavement Design Report Appendix C

I-65 C2 Overlay - Alternative 43

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Design Properties

HMA Design Properties

Use Multilayer Rutting Model	False
Using G* based model (not nationally calibrated)	False
Is NCHRP 1-37A HMA Rutting Model Coefficients	True
Endurance Limit	-
Use Reflective Cracking	True

Layer Name	Layer Type	Interface Friction
Layer 1 Flexible : LaPorte QC/QA -HMA, 5, 76, Surface, 9.5 mm - SMA	Flexible (1)	1.00
Layer 2 Flexible : Asphalt concrete	Flexible (1)	1.00
Layer 3 PCC : JPCP Default	PCC (0)	1.00
Layer 4 Subgrade : Crushed Stone	Subgrade (5)	1.00
Layer 5 Subgrade : A-6	Subgrade (5)	-

JPCP Design Properties

Structure - ICM Properties	
PCC surface shortwave absorptivity	0.85

Doweled Joints	
Is joint doweled ?	True
Dowel diameter (in.)	1.25
Dowel spacing (in.)	12.00

Tied Shoulders	
Tied shoulders	False
Load transfer efficiency (%)	-

PCC joint spacing (ft)	
Is joint spacing random ?	False
Joint spacing (ft)	20.00

Widened Slab	
Is slab widened ?	False
Slab width (ft)	12.00

PCC-Base Contact Friction	
PCC-Base full friction contact	True
Months until friction loss	600.00

Sealant type	Other(Including No Sealant... Liquid... Silicone)

Erodibility index	3

Permanent curl/warp effective temperature difference (ºF)	-10.00

JPCP Rehabilitation Properties

Slabs distressed/replaced before restoration (%)	1.00
Slabs repaired/replaced after restoration (%)	1.00

Modulus Subgrade Reaction	
Is modulus of subgrade reaction measured?	True
Month modulus of subgrade reaction measured	8
Dynamic modulus of subgrade reaction (psi/in.)	622.00

I-65 C2 Overlay - Alternative 43

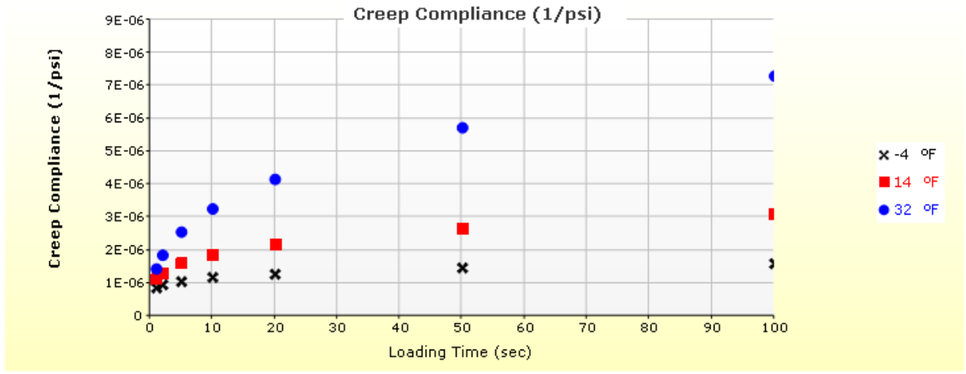
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Thermal Cracking (Input Level: 3)

Indirect tensile strength at 14 °F (psi)	404.62

Thermal Contraction	
Is thermal contraction calculated?	True
Mix coefficient of thermal contraction (in./in./°F)	-
Aggregate coefficient of thermal contraction (in./in./°F)	6.1e-006
Voids in Mineral Aggregate (%)	20.4

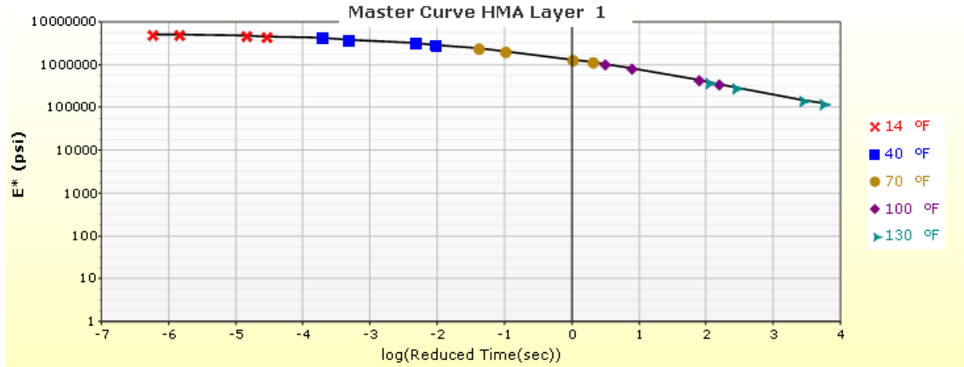
	Creep Compliance (1/psi)		
Loading time (sec)	**-4 °F**	**14 °F**	**32 °F**
1	8.77e-007	1.13e-006	1.47e-006
2	9.61e-007	1.31e-006	1.87e-006
5	1.09e-006	1.61e-006	2.58e-006
10	1.19e-006	1.87e-006	3.28e-006
20	1.31e-006	2.18e-006	4.18e-006
50	1.47e-006	2.67e-006	5.75e-006
100	1.62e-006	3.11e-006	7.32e-006

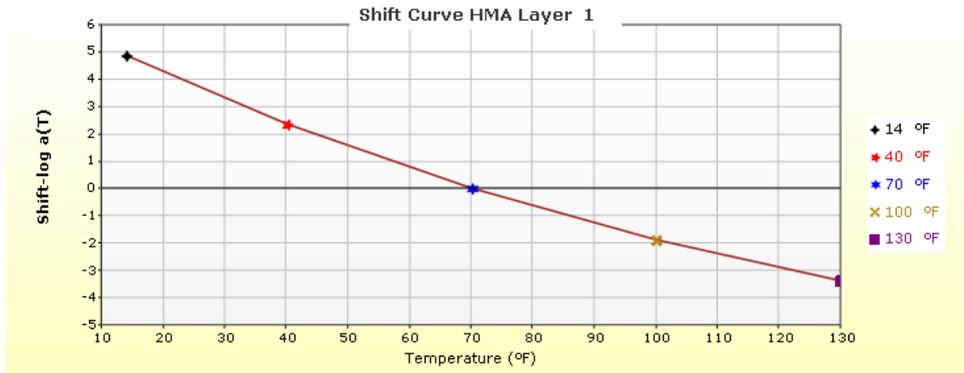


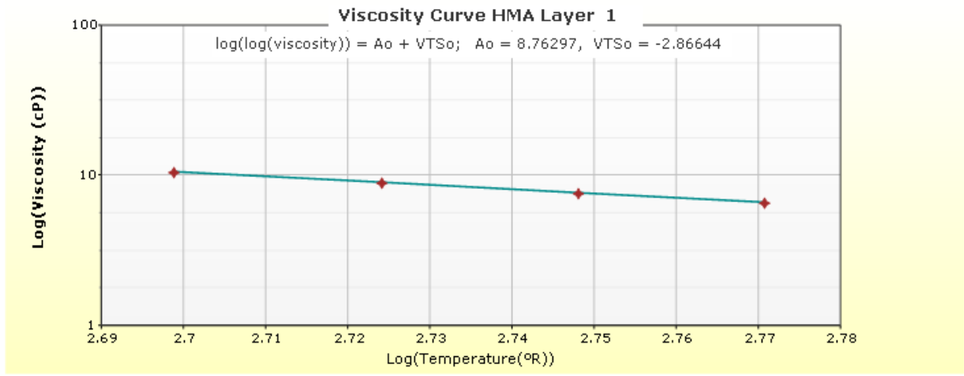
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HMA Layer 1: Layer 1 Flexible : LaPorte QC/QA-HMA, 5, 76, Surface, 9.5 mm - SMA



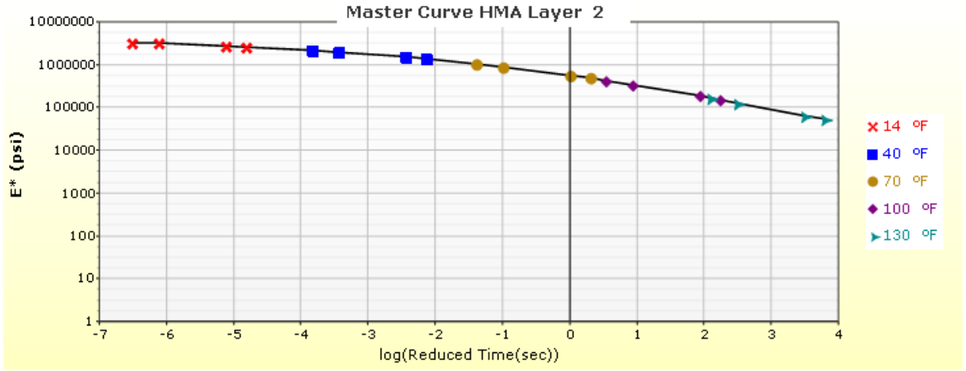


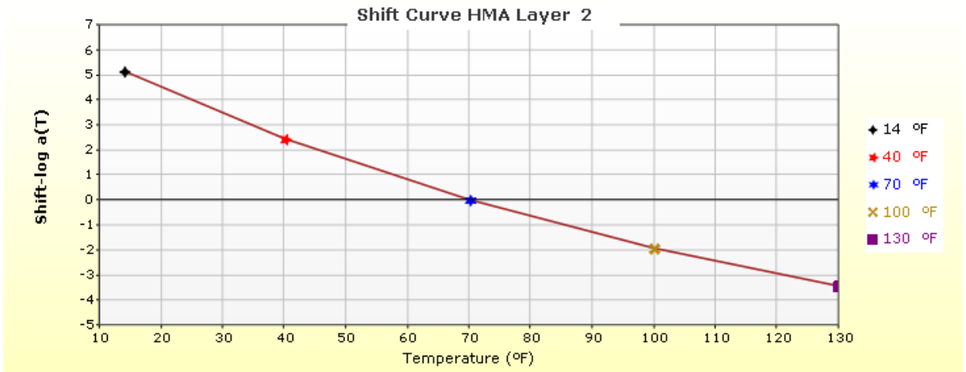


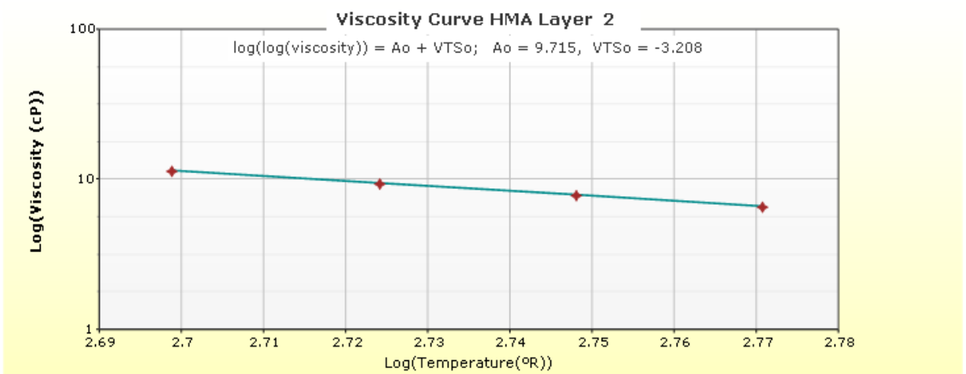
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HMA Layer 2: Layer 2 Flexible : Asphalt concrete



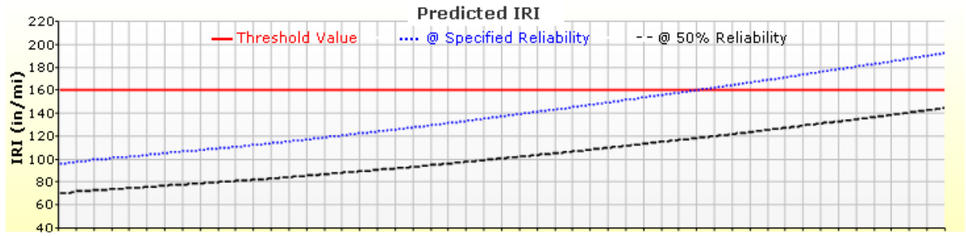


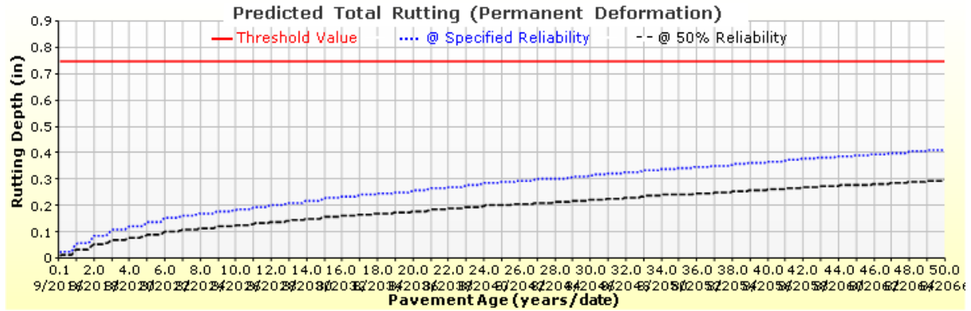


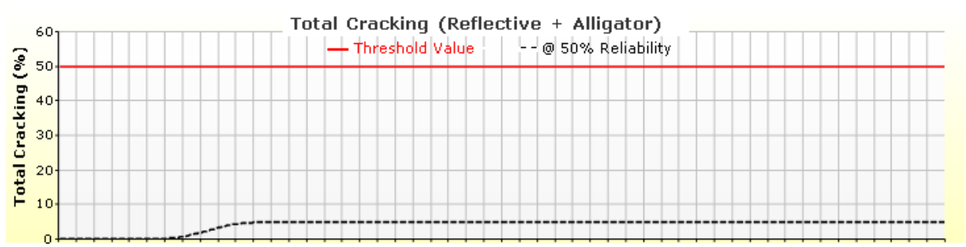
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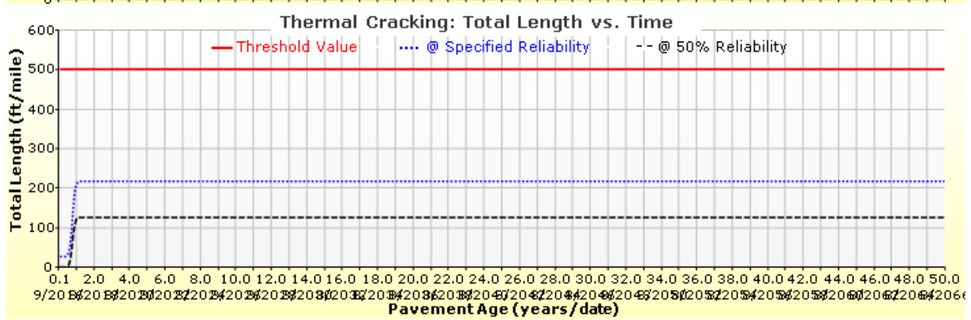
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Analysis Output Charts



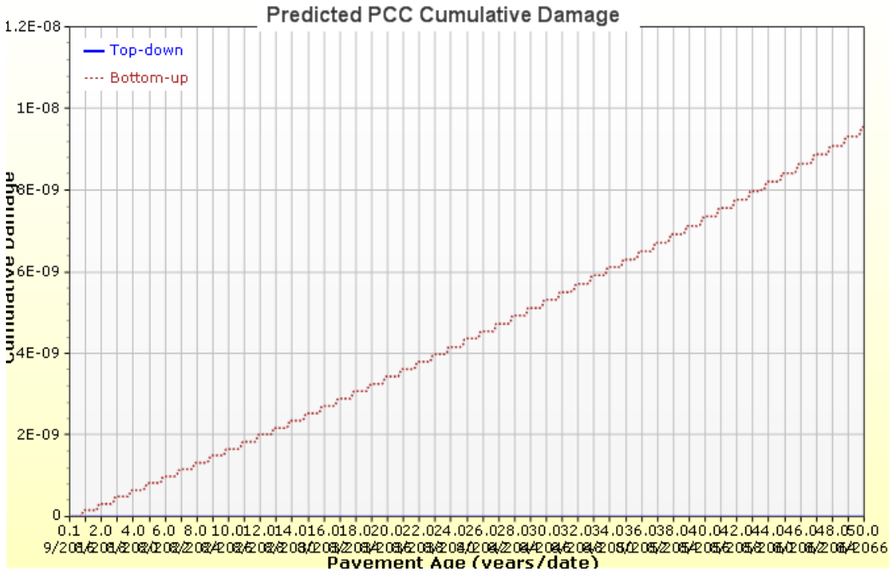


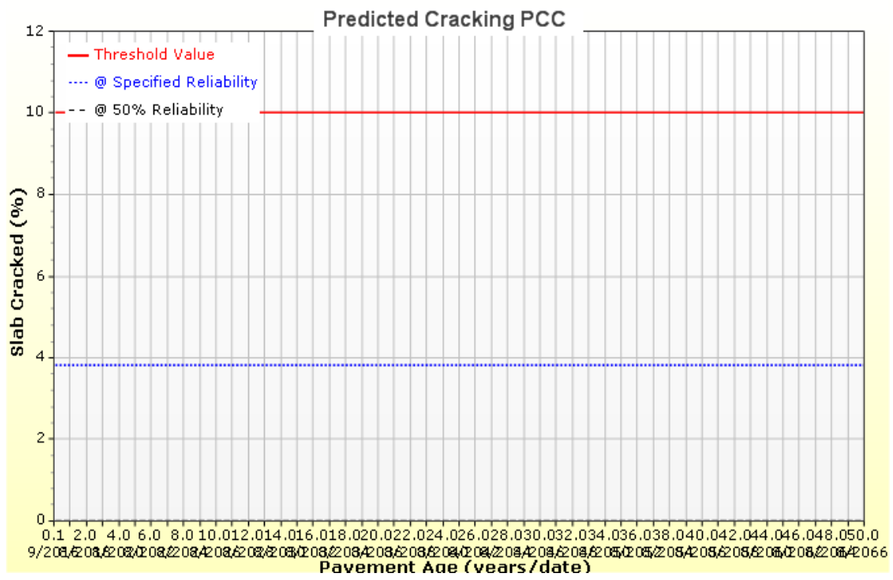




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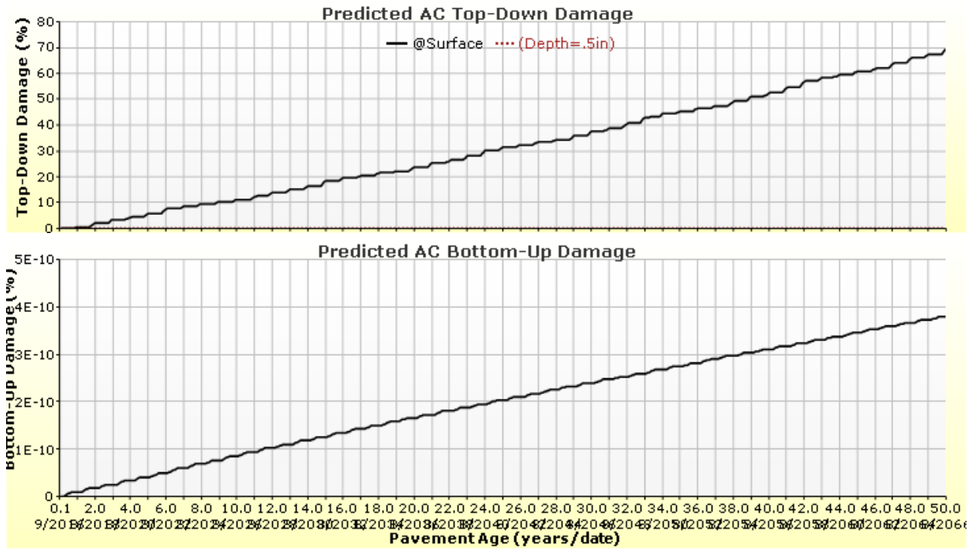
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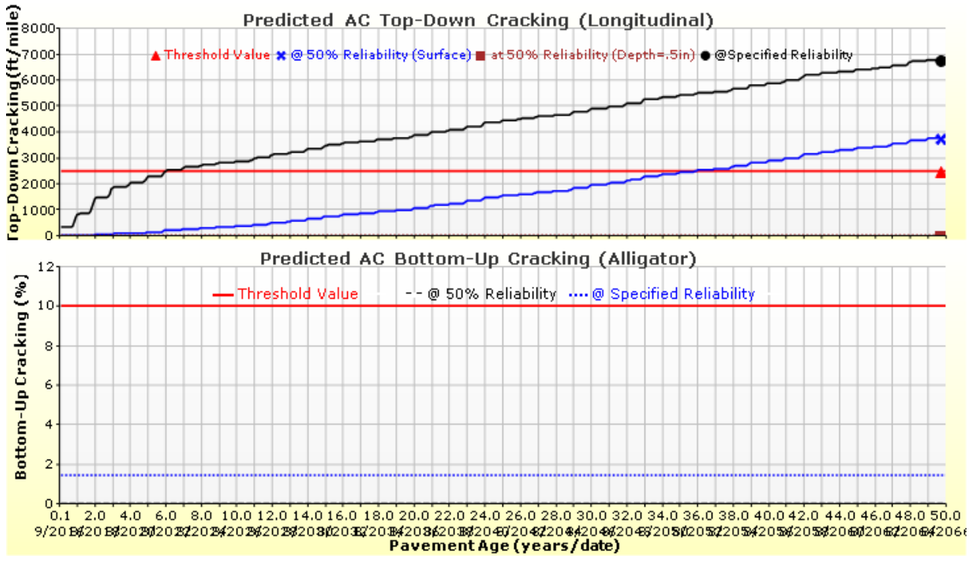
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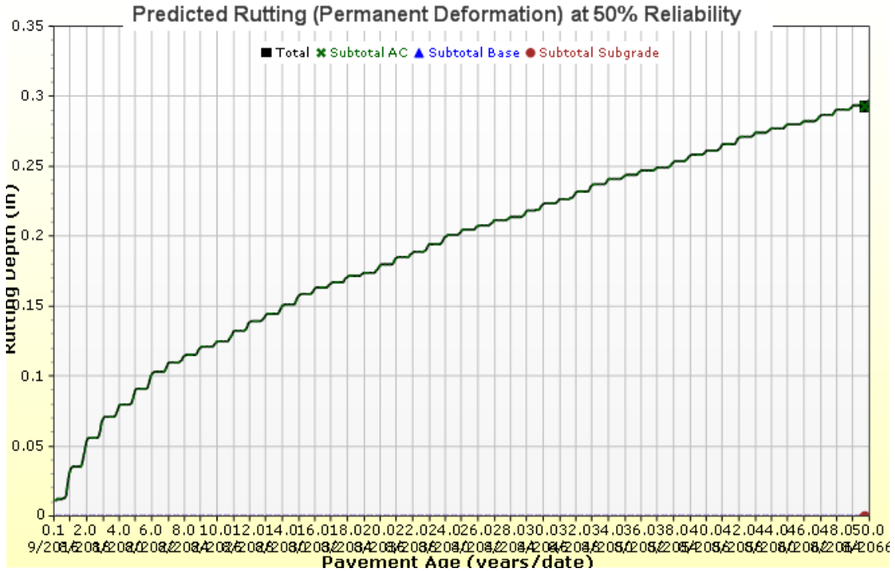
Approved by: on: 5/9/2016 10:08 AM

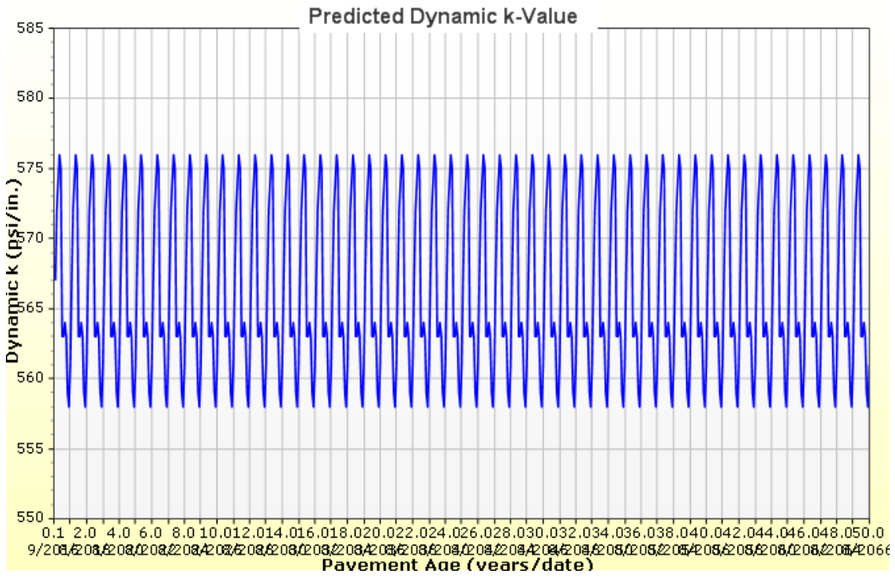
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I-65 C2 Overlay - Alternative 43

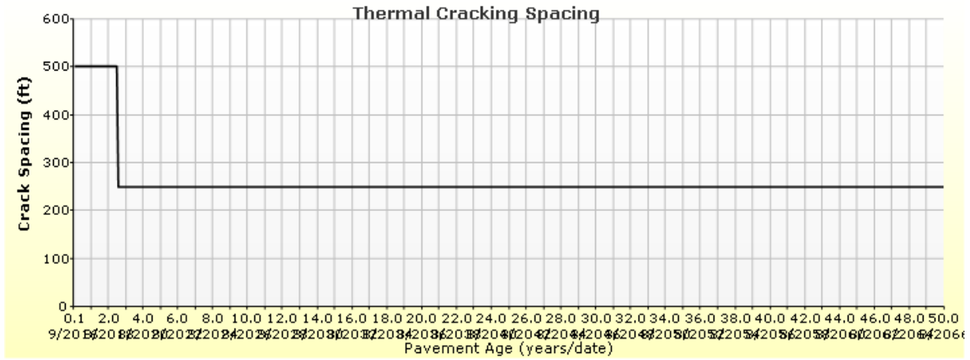
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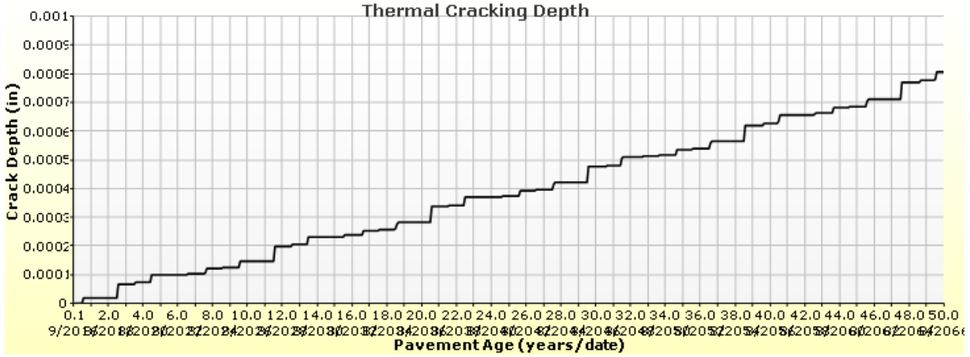




I-65 C2 Overlay - Alternative 43

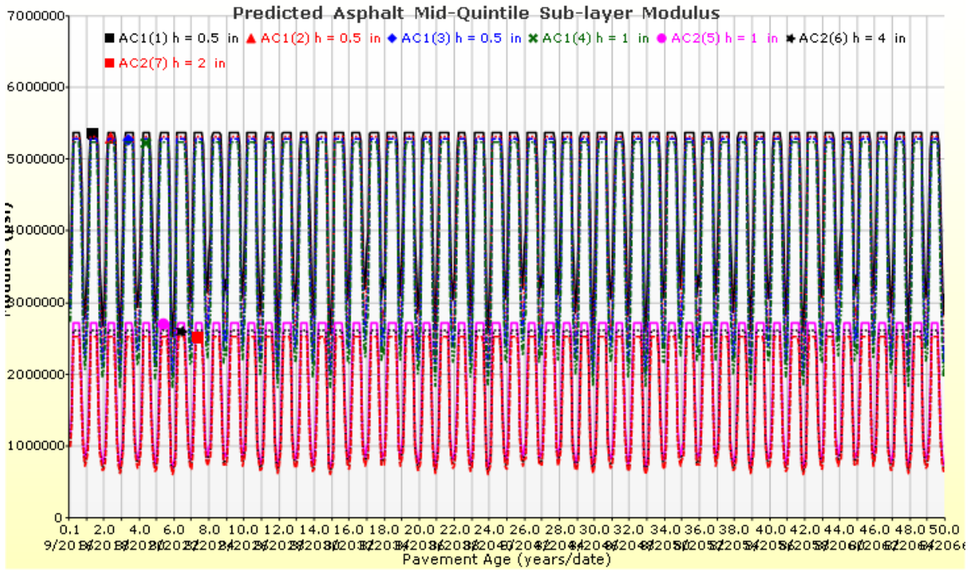
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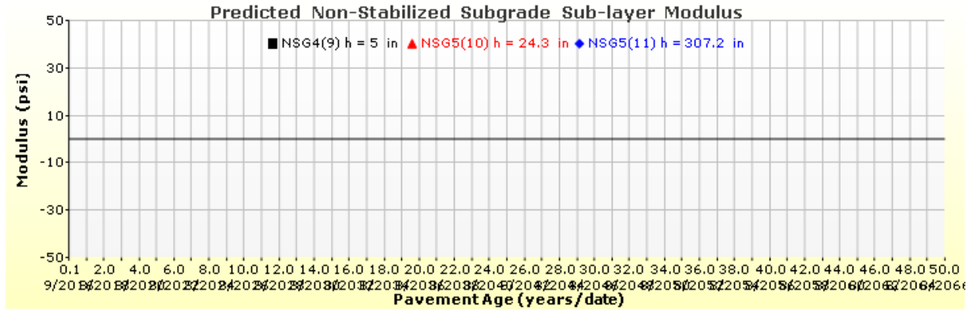




I-65 C2 Overlay - Alternative 43

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Revised Designs for PCCP Change\I-65 C2 Overlay - Alternative 43.dgpx





I-65 C2 Overlay - Alternative 43

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Layer Information

Layer 1 Flexible : LaPorte QC/QA-HMA, 5, 76, Surface, 9.5 mm - SMA

Asphalt		
Thickness (in.)	1.5	
Unit weight (pcf)	160.0	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 1)

T (°F)	0.1 Hz	1 Hz	10 Hz	25 Hz
10	3647648	4669504	5000000	5000000
40	2415742	3373281	4392981	4797248
70	763973	1296571	2030073	2372323
100	228891	438683	796159	989704
130	80754	159253	310900	401763

Asphalt Binder

Temperature (°F)	Binder Gstar (Pa)	Phase angle (deg)
40	19627632.35	32.71
55	9199787.41	42.43
70	3072091.94	50.32
85	926086.84	56.76
100	278615.81	62.04
115	87586.86	66.4
130	29373.15	70.01

General Info

Name	Value
Reference temperature (°F)	70
Effective binder content (%)	13.4
Air voids (%)	7
Thermal conductivity (BTU/hr-ft-°F)	0.63
Heat capacity (BTU/lb-°F)	0.31

Identifiers

Field	Value
Display name/identifier	LaPorte QC/QA-HMA, 5, 76,
Description of object	
Author	
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

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Layer 2 Flexible : Asphalt concrete

Asphalt		
Thickness (in.)	8.0	
Unit weight (pcf)	143.8	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 3)

Gradation	Percent Passing
3/4-inch sieve	97
3/8-inch sieve	69
No.4 sieve	43
No.200 sieve	2

Asphalt Binder

Parameter	Value
Grade	Superpave Performance Grade
Binder Type	76-22
A	9.715
VTS	-3.208

General Info

Name	Value
Reference temperature (ºF)	70
Effective binder content (%)	10
Air voids (%)	6
Thermal conductivity (BTU/hr-ft-ºF)	0.63
Heat capacity (BTU/lb-ºF)	0.31

Identifiers

Field	Value
Display name/identifier	Asphalt concrete
Description of object	
Author	
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

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Layer 3 PCC : JPCP Default

PCC	
Thickness (in.)	10.0
Unit weight (pcf)	145.0
Poisson's ratio	0.2

Thermal	
PCC coefficient of thermal expansion (in./in./ºF x 10^-6)	5.4
PCC thermal conductivity (BTU/hr-ft-ºF)	1.25
PCC heat capacity (BTU/lb-ºF)	0.28

Mix		
Cement type		Type I (1)
Cementitious material content (lb/yd^3)		510
Water to cement ratio		0.42
Aggregate type		Limestone (1)
PCC zero-stress temperature (ºF)	Calculated Internally?	True
	User Value	-
	Calculated Value	101
Ultimate shrinkage (microstrain)	Calculated Internally?	True
	User Value	-
	Calculated Value	543.2
Reversible shrinkage (%)		50
Time to develop 50% of ultimate shrinkage (days)		35
Curing method		Curing Compound

PCC strength and modulus (Input Level: 3)

28-Day PCC modulus of rupture (psi)	700.0
28-Day PCC elastic modulus (psi)	-

Identifiers

Field	Value
Display name/identifier	JPCP Default
Description of object	
Author	
Date Created	6/16/2016 2:09:56 PM
Approver	
Date approved	6/16/2016 2:09:56 PM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

I-65 C2 Overlay - Alternative 43

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Layer 4 Subgrade : Crushed Stone

Unbound	
Layer thickness (in.)	5.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
9248.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	Crushed Stone
Description of object	Crushed Stone
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.2
Saturated hydraulic conductivity (ft/hr)	False	5.054e-02
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	7.4

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	7.2555
bf	1.3328
cf	0.8242
hr	117.4000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	8.7
#100	
#80	12.9
#60	
#50	
#40	20.0
#30	
#20	
#16	
#10	33.8
#8	
#4	44.7
3/8-in.	57.2
1/2-in.	63.1
3/4-in.	72.7
1-in.	78.8
1 1/2-in.	85.8
2-in.	91.6
2 1/2-in.	
3-in.	
3 1/2-in.	97.6

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Layer 5 Subgrade : A-6

Unbound	
Layer thickness (in.)	Semi-infinite
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
9248.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	31.1
Plasticity Index	11.5
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	True	106
Saturated hydraulic conductivity (ft/hr)	False	2.224e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	True	18.2

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	94.5761
bf	0.7777
cf	0.3069
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	20.4
0.020mm	
#200	57.7
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	92.2
#8	
#4	
3/8-in.	
1/2-in.	
3/4-in.	
1-in.	100.0
1 1/2-in.	
2-in.	
2 1/2-in.	
3-in.	
3 1/2-in.	

I-65 C2 Overlay - Alternative 43

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Calibration Coefficients

AC Fatigue	
$N_f = 0.00432 * C * \beta_{f1} k_1 \left(\frac{1}{\varepsilon_1}\right)^{k_2\beta_{f2}} \left(\frac{1}{E}\right)^{k_3\beta_{f3}}$	k1: 0.007566
	k2: 3.9492
$C = 10^M$	k3: 1.281
	Bf1: 1
$M = 4.84\left(\frac{V_b}{V_a+V_b} - 0.69\right)$	Bf2: 1
	Bf3: 1

AC Rutting

$$\frac{\varepsilon_p}{\varepsilon_r} = k_z \beta_{r1} 10^{k_1} T^{k_2\beta_{r2}} N^{k_3\beta_{r3}}$$

$$k_z = (C_1 + C_2 * depth) * 0.328196^{depth}$$

$$C_1 = -0.1039 * H_a^2 + 2.4868 * H_a - 17.342$$

$$C_2 = 0.0172 * H_a^2 - 1.7331 * H_a + 27.428$$

Where:

$H_{ac} = total\ AC\ thickness(in)$

$\varepsilon_p = plastic\ strain\left(^{in}/_{in}\right)$
$\varepsilon_r = resilient\ strain\left(^{in}/_{in}\right)$
$T = layer\ temperature(^{\circ}F)$
$N = number\ of\ load\ repetitions$

AC Rutting Standard Deviation	0.24*Pow(RUT,0.8026)+0.001	
AC Layer	K1:-3.35412 K2:1.5606 K3:0.4791	Br1:1 Br2:1 Br3:1

Thermal Fracture

$$C_f = 400 * N\left(\frac{\log C / h_{ac}}{\sigma}\right)$$

$$\Delta C = (k * \beta t)^{n+1} * A * \Delta K^n$$

$$A = 10^{(4.389 - 2.52 * \log(E * \sigma_m * n))}$$

C_f = observed amount of thermal cracking($ft/500ft$)
k = refression coefficient determined through field calibration
$N()$ = standard normal distribution evaluated at( )
σ = standard deviation of the log of the depth of cracks in the pavments
C = crack depth(in)
h_{ac} = thickness of asphalt layer(in)
ΔC = Change in the crack depth due to a cooling cycle
ΔK = Change in the stress intensity factor due to a cooling cycle
A, n = Fracture parameters for the asphalt mixture
E = mixture stiffness
σ_M = Undamaged mixture tensile strength
β_t = Calibration parameter

Level 1 K: 1.5	Level 1 Standard Deviation: 0.1468 * THERMAL + 65.027
Level 2 K: 0.5	Level 2 Standard Deviation: 0.2841 *THERMAL + 55.462
Level 3 K: 1.5	Level 3 Standard Deviation: 0.3972 * THERMAL + 20.422

CSM Fatigue

$$N_f = 10^{\left(\frac{k_1 \beta_{c1}\left(\frac{\sigma_s}{M_r}\right)}{k_2 \beta_{c2}}\right)}$$

$N_f = number\ of\ repetitions\ to\ fatigue\ cracking$
$\sigma_s = Tensile\ stress(psi)$
$M_r = modulus\ of\ rupture(psi)$

k1: 1	k2: 1	Bc1: 1	Bc2:1

Pavement Design Report Appendix C

I-65 C2 Overlay - Alternative 43

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Subgrade Rutting

$$\delta_a(N) = \beta_{s_1} k_1 \varepsilon_v h \left(\frac{\varepsilon_0}{\varepsilon_r}\right) \left| e^{-\left(\frac{\rho}{N}\right)^{\beta}} \right|$$

$\delta_a = permanent\ deformation\ for\ the\ layer$
$N = number\ of\ repetitions$
$\varepsilon_v = average\ veritcal\ strain(in/in)$
$\varepsilon_0, \beta, \rho = material\ properties$
$\varepsilon_r = resilient\ strain(in/in)$

Granular		Fine	
k1: 2.03	Bs1: 1	k1: 1.35	Bs1: 1
Standard Deviation (BASERUT) 0.1477*Pow(BASERUT,0.6711)+0.001		Standard Deviation (BASERUT) 0.1235*Pow(SUBRUT,0.5012)+0.001	

AC Cracking

AC Top Down Cracking				AC Bottom Up Cracking		
$FC_{top} = \left(\frac{C_4}{1 + e^{(C_1 - C_2 * log_{10}(Damage))}}\right) * 10.56$				$FC = \left(\frac{6000}{1 + e^{(C_1 * C_1' + C_2 * C_2' * log_{10}(D * 100))}}\right) * \left(\frac{1}{60}\right)$ $C_2' = -2.40874 - 39.748 * (1 + h_{ac})^{-2.856}$ $C_1' = -2 * C_2'$		
c1: 7	c2: 3.5	c3: 0	c4: 1000	c1: 1	c2: 1	c3: 6000
AC Cracking Top Standard Deviation				AC Cracking Bottom Standard Deviation		
200 + 2300/(1+exp(1.072-2.1654*LOG10 (TOP+0.0001)))				1.13+13/(1+exp(7.57-15.5*LOG10 (BOTTOM+0.0001)))		

CSM Cracking				IRI Flexible over PCC			
$FC_{ctb} = C_1 + \frac{C_2}{1 + e^{C_3 - C_4(Damage)}}$				C1 - Rutting C2 - Fatigue Crack		C3 - Transverse Crack C4 - Site Factors	
C1: 1	C2: 1	C3: 0	C4: 1000	C1: 40.8	C2: 0.575	C3: 0.0014	C4: 0.00825
CSM Standard Deviation							
CTB*11							

PCC Cracking

$$\log(N) = C1 \cdot \left(\frac{MR}{\sigma}\right)^{C2}$$

$$CRK = \frac{100}{1 + C4\ FD^{C5}}$$

Fatigue Coefficients		Cracking Coefficients	
C1: 2	C2: 1.22	C4: 1	C5: -1.98
PCC Reliability Cracking Standard Deviation			
Pow(5.3116*CRACK,0.3903) + 2.99			

I-65 C2 Overlay - Alternative 43

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Reflective Cracking

$$RC = \frac{100}{1 + e^{c.a + d.b.t}}$$

RC = Percent of cracks reflected, %
t = Time, years
h_{ac} = Overlay thickness(in)
a = 3.5 + 0.75(Heff)
b = -0.688584 – 3.37302(Heff)$^{-0.915459}$
c = 1
d = Calibration parameter (user input)

	AC over AC	AC over Rigid, Good Load Transfer	AC over Rigid, Poor Load Transfer
Heff	h_{ac}	$h_{ac} - 1$	$h_{ac} - 3$

Heff	Recommended Calibration Parameter - d	
	Delay Cracking by 2 years	Accelerate Cracking by 2 years
< 4"	0.6	3
4 – 6"	0.7	1.7
> 6"	0.8	1.4

C: 1 | D: 1

I-65 C2 Overlay - Alternative 44

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Design Inputs

Design Life: 50 years
Design Type: AC over JPCP
Existing construction: May, 1990
Pavement construction: July, 2016
Traffic opening: September, 2016
Climate Data Sources (Lat/Lon): 41.453, -87.006; 41.786, -87.752; 41.986, -87.914

Design Structure



Layer type	Material Type	Thickness (in.):
Flexible	LaPorte QC/QA-HMA, 5, 76, Surface, 9.5 mm - SMA	1.5
Flexible	Asphalt concrete	7.0
PCC	JPCP Default	10.0
Subgrade	Crushed Stone	5.0
Subgrade	A-6	Semi-infinite

Volumetric at Construction:

Effective binder content (%)	13.4
Air voids (%)	7.0

Traffic

Age (year)	Heavy Trucks (cumulative)
2016 (initial)	20,107
2041 (25 years)	70,937,800
2066 (50 years)	161,911,000

Design Outputs

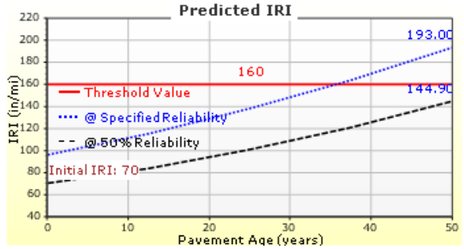
Distress Prediction Summary

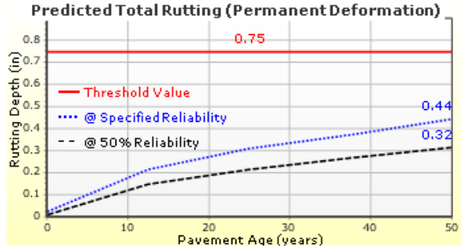
Distress Type	Distress @ Specified Reliability		Reliability (%)		Criterion Satisfied?
	Target	Predicted	Target	Achieved	
Terminal IRI (in./mile)	160.00	193.01	90.00	65.66	Fail
Permanent deformation - total pavement (in.)	0.75	0.44	90.00	100.00	Pass
Total Cracking (Reflective + Alligator) (percent)	50	5.00	-	-	Pass
AC thermal cracking (ft/mile)	500.00	217.40	90.00	100.00	Pass
JPCP transverse cracking (percent slabs)	10.00	3.83	90.00	99.96	Pass
AC bottom-up fatigue cracking (percent)	10.00	1.45	90.00	100.00	Pass
AC top-down fatigue cracking (ft/mile)	2500.00	6319.90	90.00	36.91	Fail
Permanent deformation - AC only (in.)	0.40	0.44	90.00	79.87	Fail

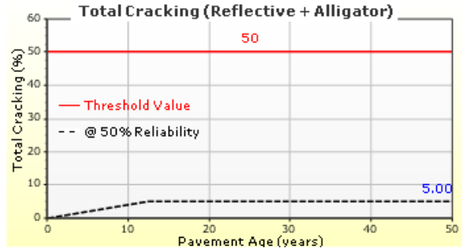
I-65 C2 Overlay - Alternative 44

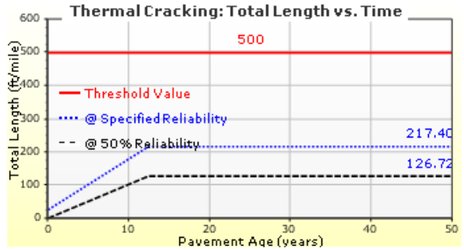
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Distress Charts









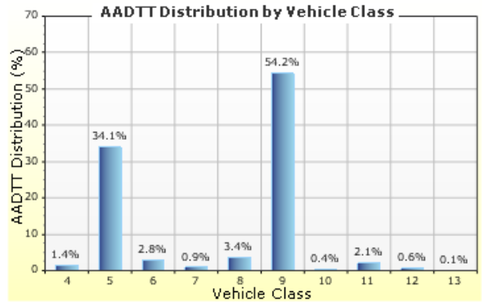
I-65 C2 Overlay - Alternative 44

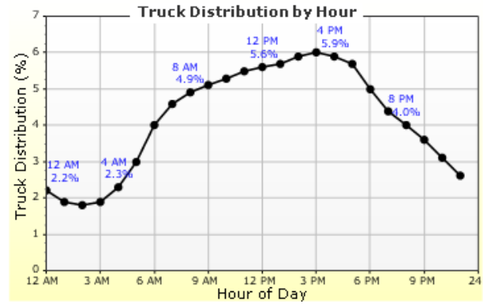
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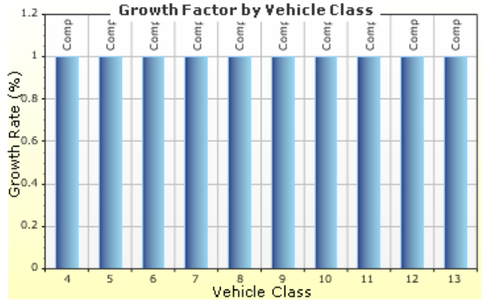
Traffic Inputs

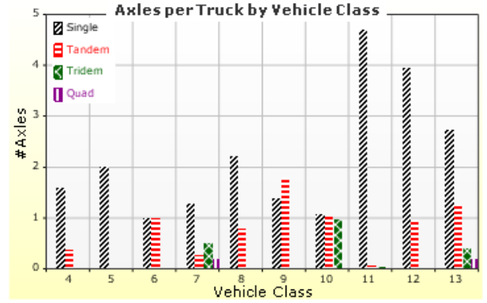
Graphical Representation of Traffic Inputs

Initial two-way AADTT:	20,107	Percent of trucks in design direction (%):	57.0
Number of lanes in design direction:	3	Percent of trucks in design lane (%):	60.0
		Operational speed (mph)	65.0

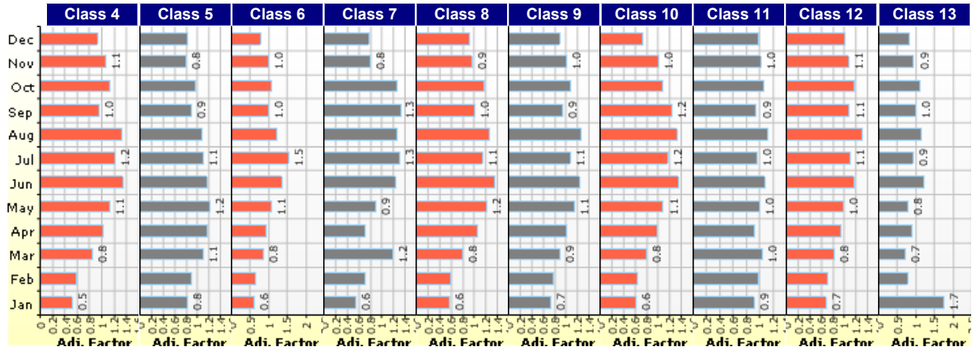








Traffic Volume Monthly Adjustment Factors



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Tabular Representation of Traffic Inputs

Volume Monthly Adjustment Factors

Level 3: Default MAF

Month	Vehicle Class									
	4	5	6	7	8	9	10	11	12	13
January	0.5	0.8	0.6	0.6	0.6	0.7	0.6	0.9	0.7	1.7
February	0.6	0.9	0.6	0.7	0.6	0.8	0.6	1.0	0.7	0.8
March	0.8	1.1	0.8	1.2	0.8	0.9	0.8	1.0	0.8	0.7
April	1.0	1.2	0.9	0.7	1.1	1.0	1.0	0.9	0.9	0.9
May	1.1	1.2	1.1	0.9	1.2	1.1	1.1	1.0	1.0	0.8
June	1.4	1.2	1.3	1.2	1.4	1.2	1.3	1.1	1.2	1.2
July	1.2	1.1	1.5	1.3	1.1	1.1	1.2	1.0	1.1	0.9
August	1.3	1.1	1.3	1.3	1.3	1.3	1.3	1.1	1.3	1.2
September	1.0	0.9	1.0	1.3	1.0	0.9	1.2	0.9	1.1	1.0
October	1.1	0.9	1.1	1.3	1.2	1.1	1.1	1.1	1.2	1.1
November	1.1	0.8	1.0	0.8	0.9	1.0	1.0	1.0	1.1	0.9
December	0.9	0.8	0.8	0.8	0.9	0.9	0.7	1.0	1.0	0.8

Distributions by Vehicle Class

Vehicle Class	AADTT Distribution (%) (Level 3)	Growth Factor	
		Rate (%)	Function
Class 4	1.4%	1%	Compound
Class 5	34.1%	1%	Compound
Class 6	2.8%	1%	Compound
Class 7	0.9%	1%	Compound
Class 8	3.4%	1%	Compound
Class 9	54.2%	1%	Compound
Class 10	0.4%	1%	Compound
Class 11	2.1%	1%	Compound
Class 12	0.6%	1%	Compound
Class 13	0.1%	1%	Compound

Truck Distribution by Hour

Hour	Distribution (%)	Hour	Distribution (%)
12 AM	2.2%	12 PM	5.6%
1 AM	1.9%	1 PM	5.7%
2 AM	1.8%	2 PM	5.9%
3 AM	1.9%	3 PM	6%
4 AM	2.3%	4 PM	5.9%
5 AM	3%	5 PM	5.7%
6 AM	4%	6 PM	5%
7 AM	4.6%	7 PM	4.4%
8 AM	4.9%	8 PM	4%
9 AM	5.1%	9 PM	3.6%
10 AM	5.3%	10 PM	3.1%
11 AM	5.5%	11 PM	2.6%
		Total	100%

Axle Configuration

Traffic Wander	
Mean wheel location (in.)	18
Traffic wander standard deviation (in.)	10
Design lane width (ft)	12

Axle Configuration	
Average axle width (ft)	8.5
Dual tire spacing (in.)	12
Tire pressure (psi)	120

Average Axle Spacing	
Tandem axle spacing (in.)	51.6
Tridem axle spacing (in.)	49.2
Quad axle spacing (in.)	49.2

Wheelbase			
Value Type / Axle Type	Short	Medium	Long
Average spacing of axles (ft)	12	15	18
Percent of Trucks (%)	33	33	34

Number of Axles per Truck

Vehicle Class	Single Axle	Tandem Axle	Tridem Axle	Quad Axle
Class 4	1.6	0.39	0	0
Class 5	2	0	0	0
Class 6	1	1	0	0
Class 7	1.29	0.29	0.5	0.19
Class 8	2.19	0.8	0	0
Class 9	1.37	1.8	0	0
Class 10	1.05	1.02	0.96	0.01
Class 11	4.71	0.08	0.03	0
Class 12	3.94	0.99	0.01	0
Class 13	2.73	1.25	0.41	0.2

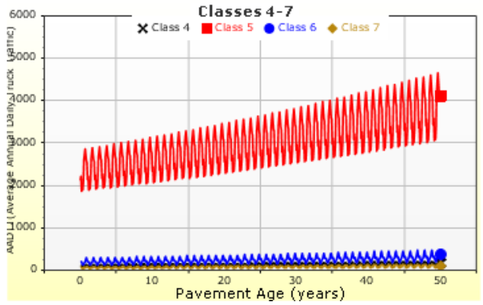
Pavement Design Report Appendix C

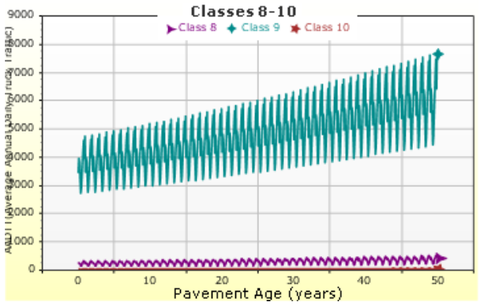
I-65 C2 Overlay - Alternative 44

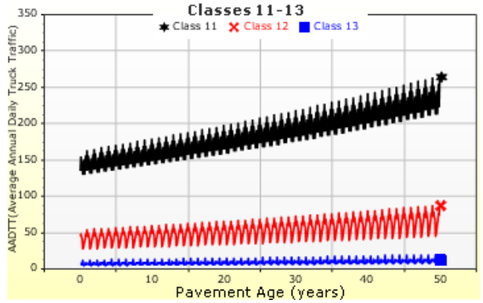
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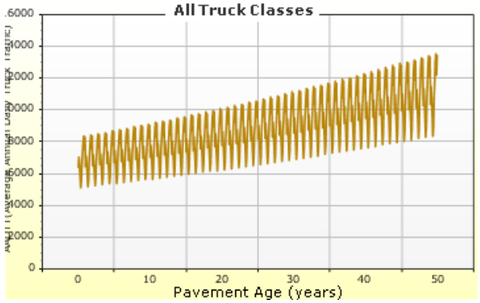
AADTT (Average Annual Daily Truck Traffic) Growth

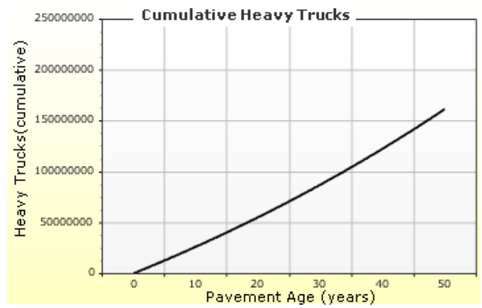
*** Traffic cap is not enforced**











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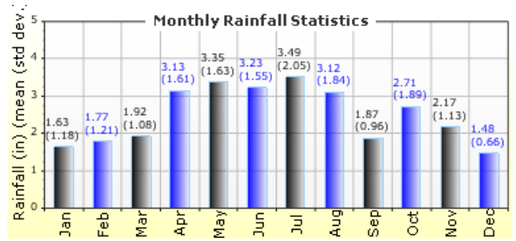
Climate Inputs

Climate Data Sources:

Climate Station Cities:	Location (lat lon elevation(ft))
VALPARAISO, IN	41.45300 -87.00600 770
CHICAGO, IL	41.78600 -87.75200 612
CHICAGO, IL	41.98600 -87.91400 662

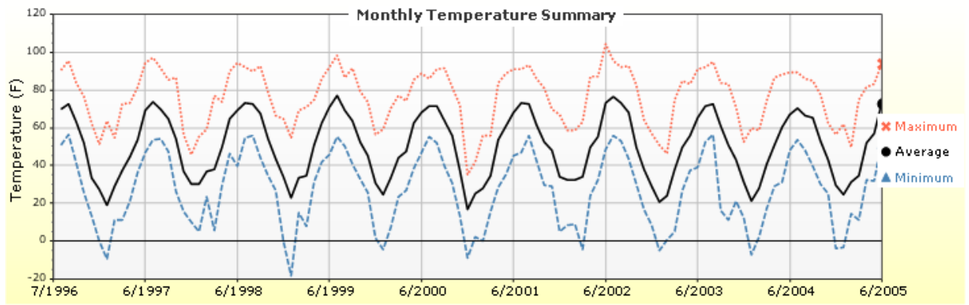
Annual Statistics:

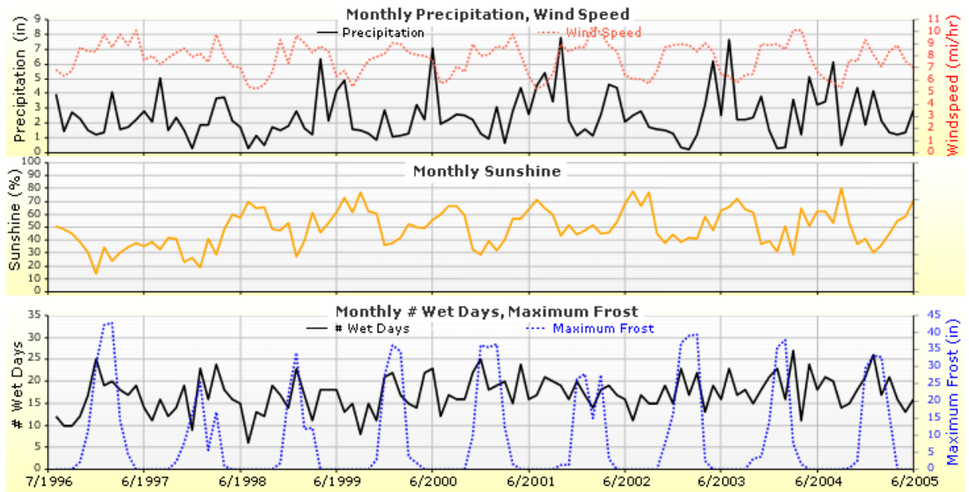
Mean annual air temperature (ºF)	50.22
Mean annual precipitation (in.)	29.87
Freezing index (ºF - days)	712.28
Average annual number of freeze/thaw cycles:	67.21



Water table depth (ft) 4.00

Monthly Climate Summary:



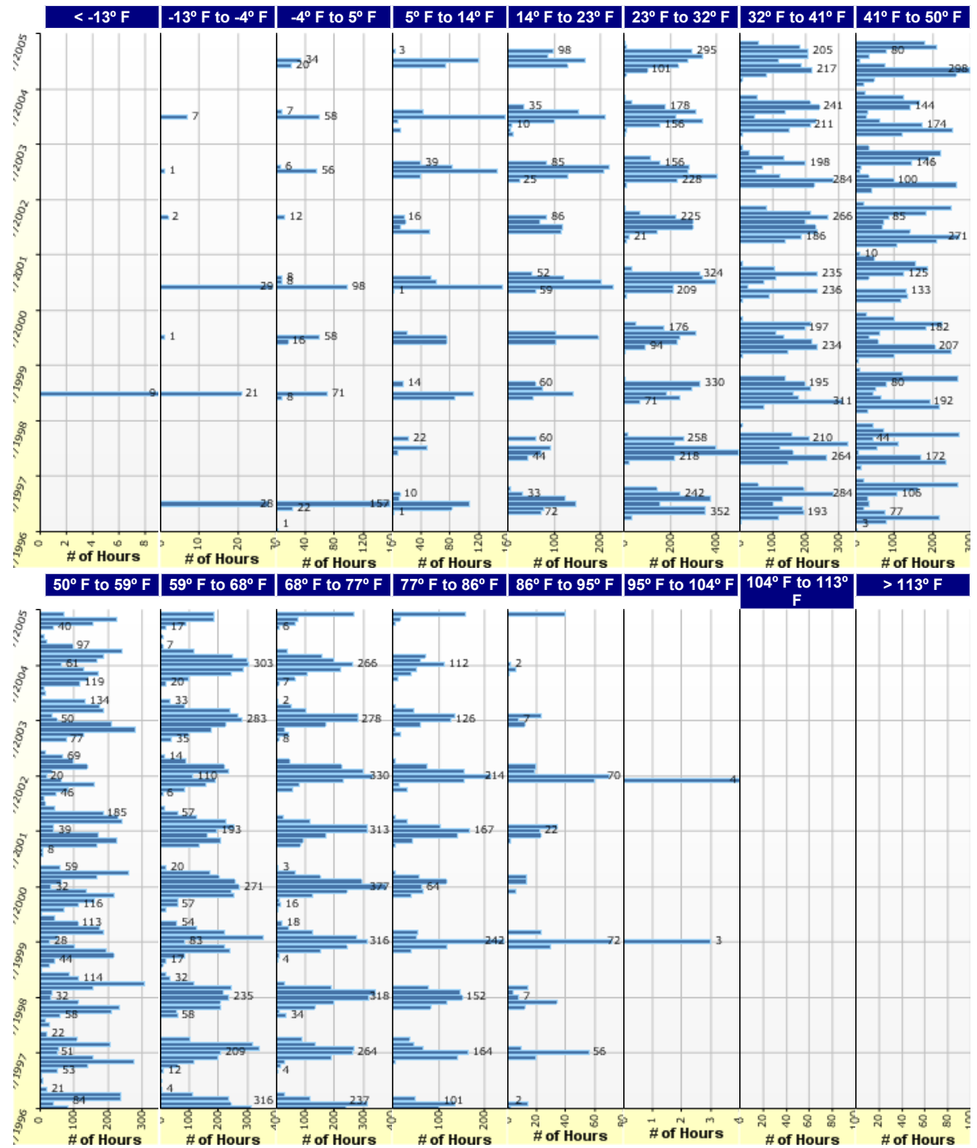


Pavement Design Report Appendix C

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Hourly Air Temperature Distribution by Month:



I-65 C2 Overlay - Alternative 44

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Design Properties

HMA Design Properties

Use Multilayer Rutting Model	False
Using G* based model (not nationally calibrated)	False
Is NCHRP 1-37A HMA Rutting Model Coefficients	True
Endurance Limit	-
Use Reflective Cracking	True

Layer Name	Layer Type	Interface Friction
Layer 1 Flexible : LaPorte QC/QA -HMA, 5, 76, Surface, 9.5 mm - SMA	Flexible (1)	1.00
Layer 2 Flexible : Asphalt concrete	Flexible (1)	1.00
Layer 3 PCC : JPCP Default	PCC (0)	1.00
Layer 4 Subgrade : Crushed Stone	Subgrade (5)	1.00
Layer 5 Subgrade : A-6	Subgrade (5)	-

JPCP Design Properties

Structure - ICM Properties	
PCC surface shortwave absorptivity	0.85

PCC joint spacing (ft)	
Is joint spacing random ?	False
Joint spacing (ft)	20.00

Doweled Joints	
Is joint doweled ?	True
Dowel diameter (in.)	1.25
Dowel spacing (in.)	12.00

Widened Slab	
Is slab widened ?	False
Slab width (ft)	12.00

Sealant type	Other(Including No Sealant... Liquid... Silicone)

Tied Shoulders	
Tied shoulders	False
Load transfer efficiency (%)	-

PCC-Base Contact Friction	
PCC-Base full friction contact	True
Months until friction loss	600.00

Erodibility index	3

Permanent curl/warp effective temperature difference (ºF)	-10.00

JPCP Rehabilitation Properties

Slabs distressed/replaced before restoration (%)	1.00
Slabs repaired/replaced after restoration (%)	1.00

Modulus Subgrade Reaction	
Is modulus of subgrade reaction measured?	True
Month modulus of subgrade reaction measured	8
Dynamic modulus of subgrade reaction (psi/in.)	622.00

I-65 C2 Overlay - Alternative 44

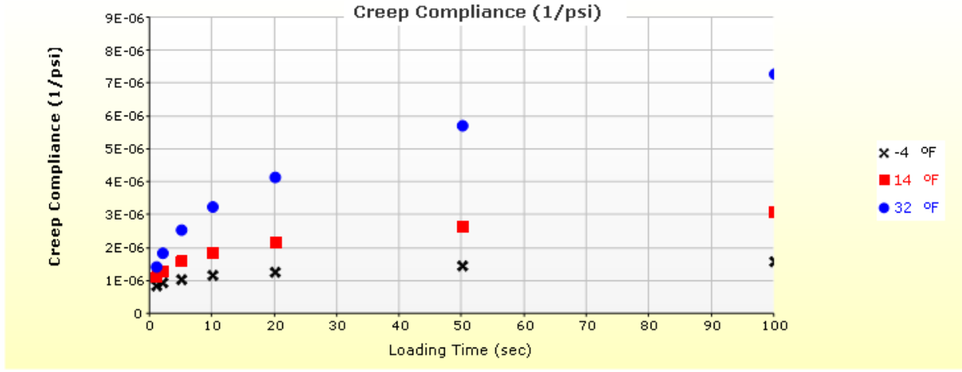
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Thermal Cracking (Input Level: 3)

Indirect tensile strength at 14 ºF (psi)	404.62

Thermal Contraction	
Is thermal contraction calculated?	True
Mix coefficient of thermal contraction (in./in./ºF)	-
Aggregate coefficient of thermal contraction (in./in./ºF)	6.1e-006
Voids in Mineral Aggregate (%)	20.4

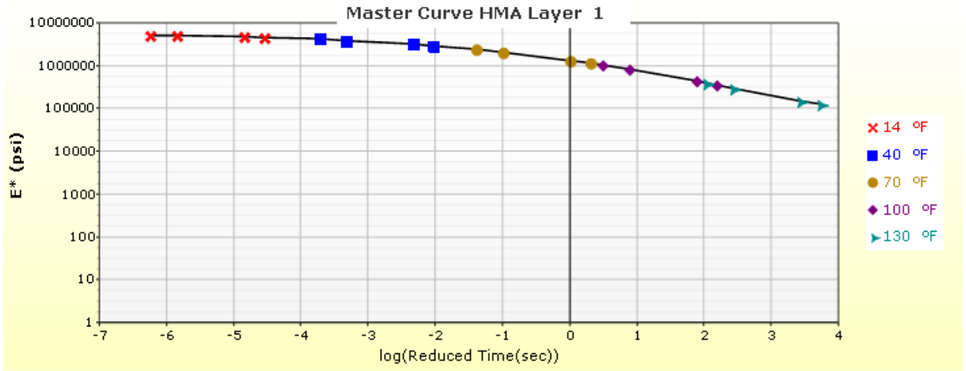
	Creep Compliance (1/psi)		
Loading time (sec)	**-4 ºF**	**14 ºF**	**32 ºF**
1	8.77e-007	1.13e-006	1.47e-006
2	9.61e-007	1.31e-006	1.87e-006
5	1.09e-006	1.61e-006	2.58e-006
10	1.19e-006	1.87e-006	3.28e-006
20	1.31e-006	2.18e-006	4.18e-006
50	1.47e-006	2.67e-006	5.75e-006
100	1.62e-006	3.11e-006	7.32e-006

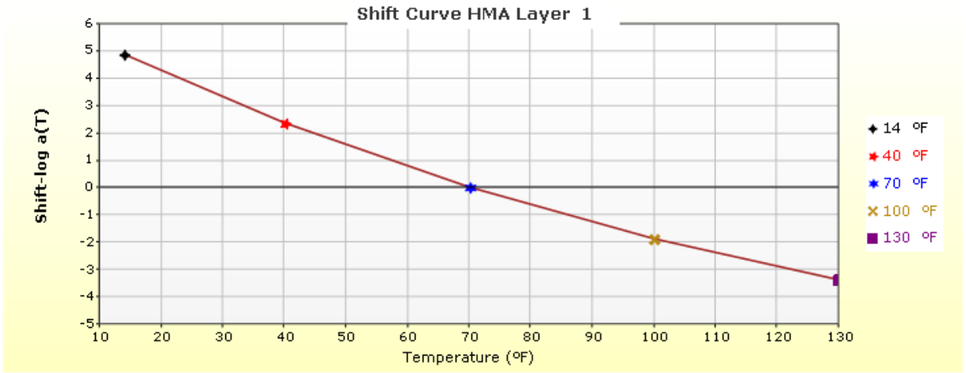


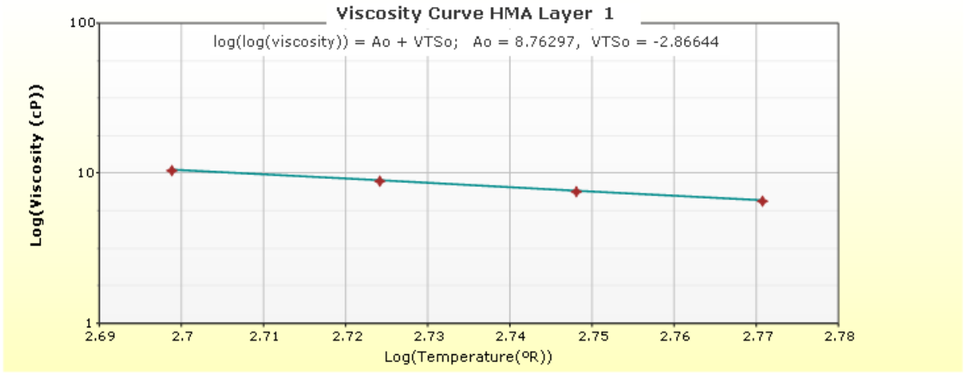
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HMA Layer 1: Layer 1 Flexible : LaPorte QC/QA-HMA, 5, 76, Surface, 9.5 mm - SMA







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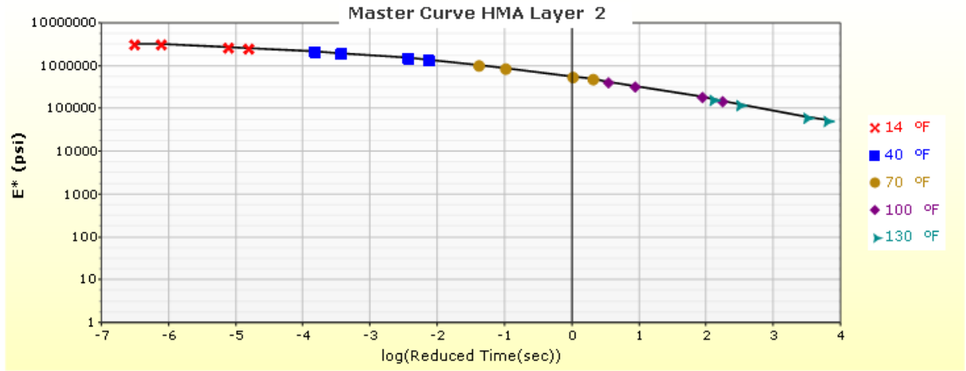
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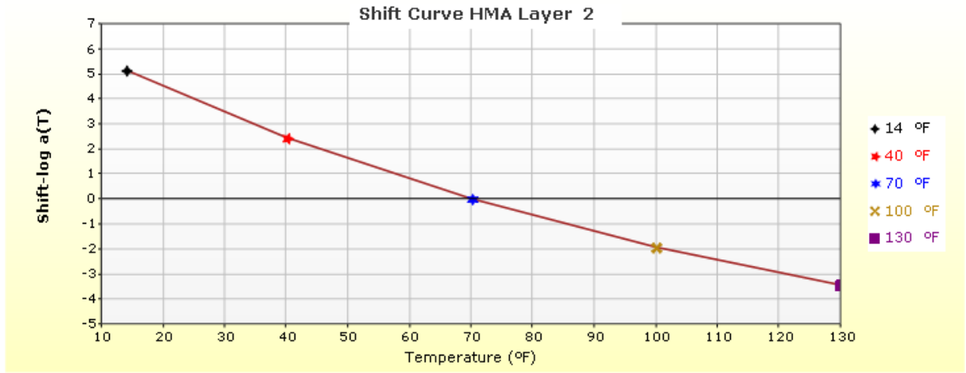
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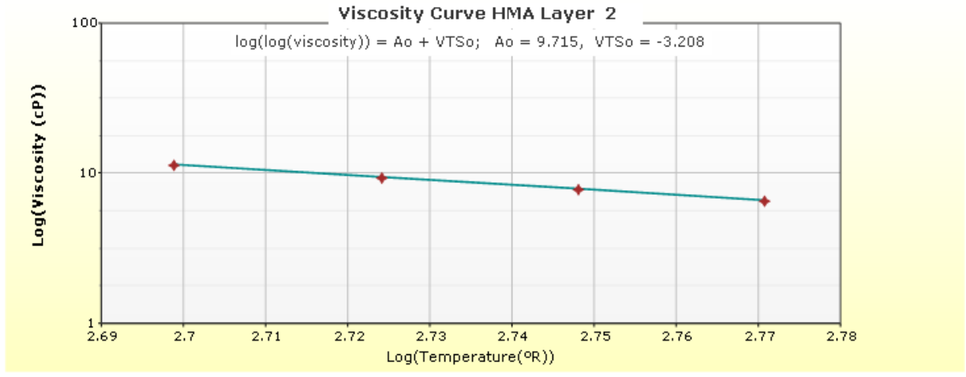
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HMA Layer 2: Layer 2 Flexible : Asphalt concrete







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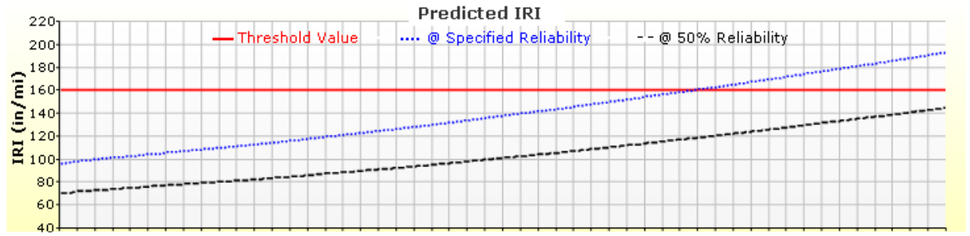
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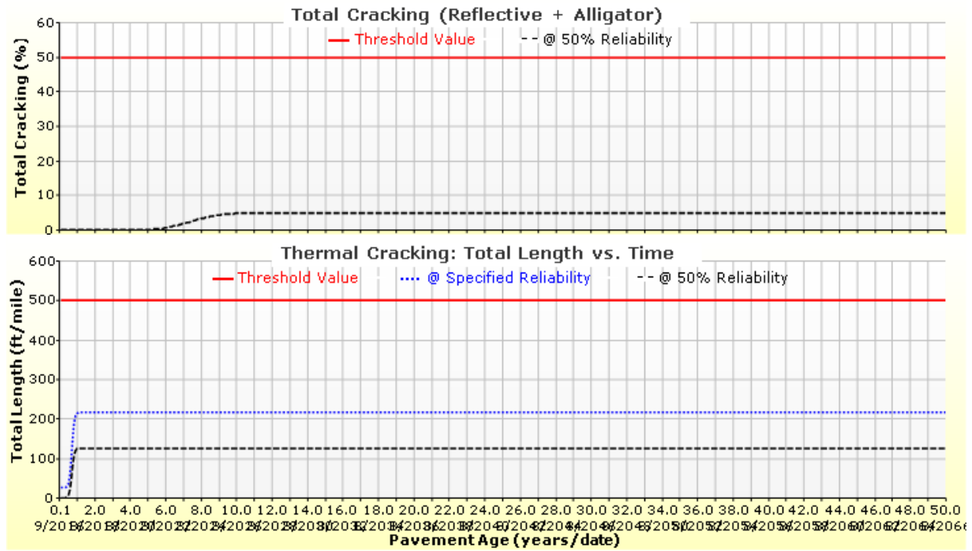
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Analysis Output Charts

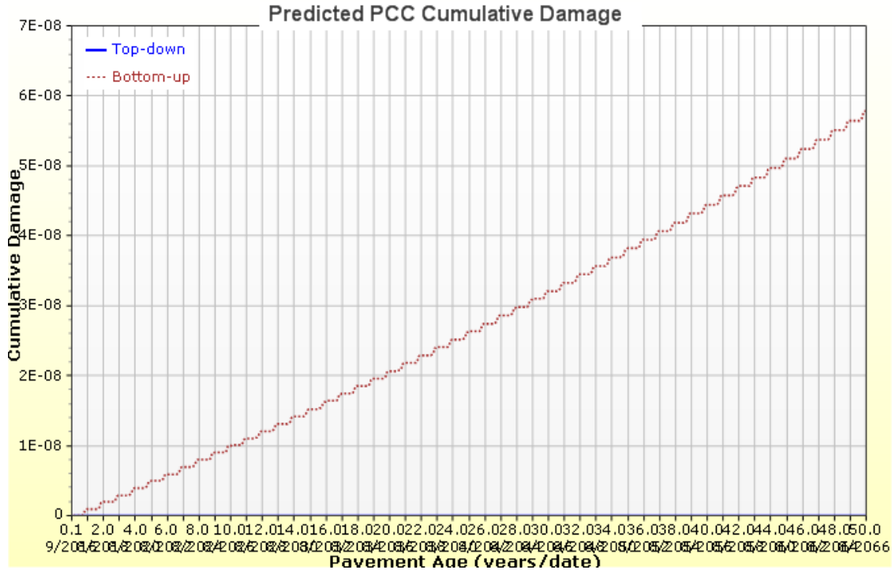


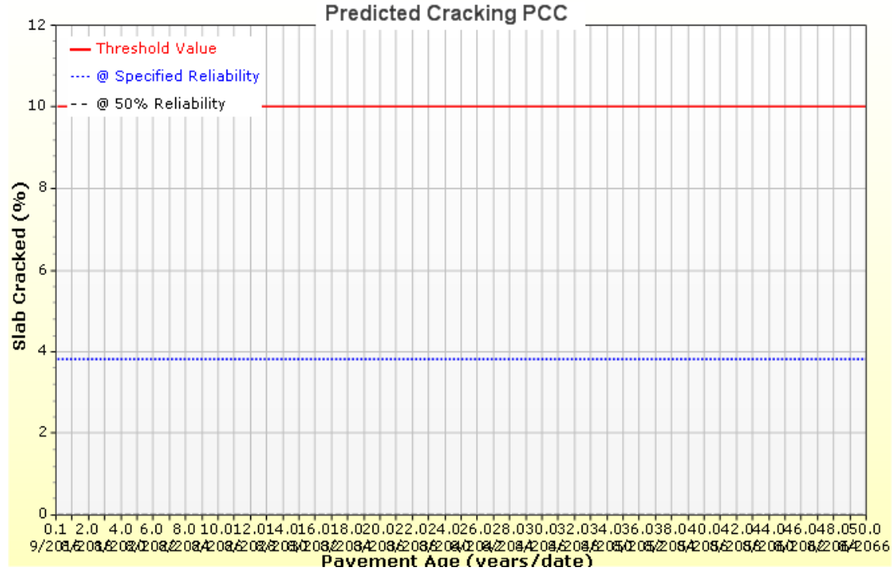


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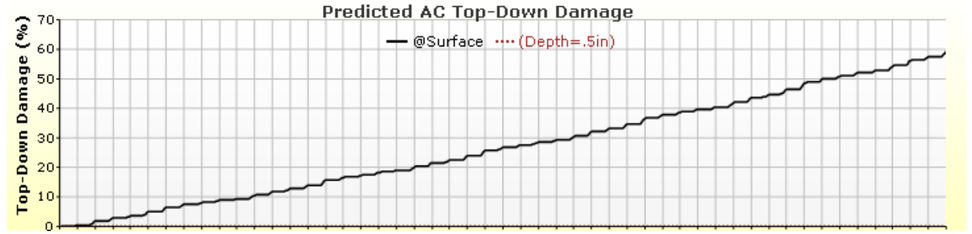
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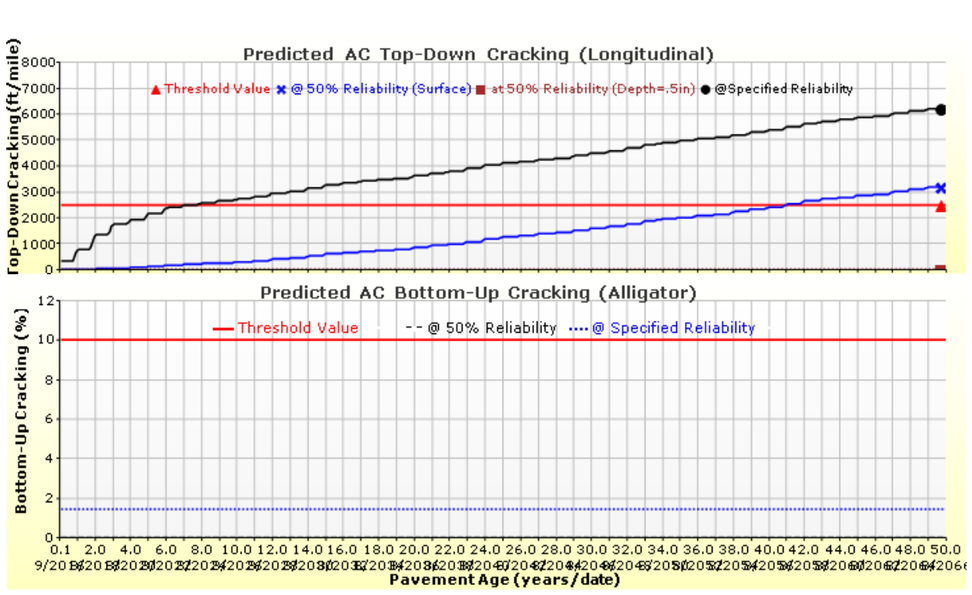




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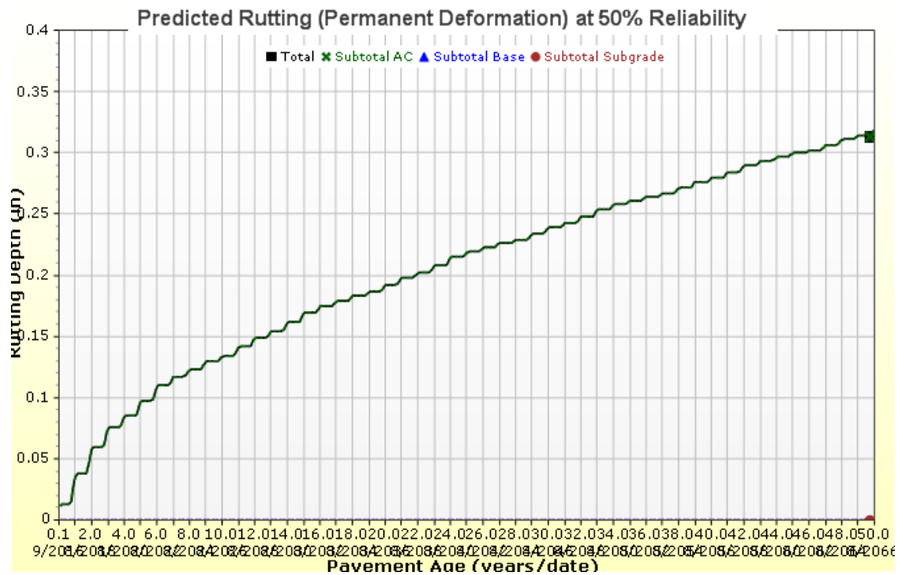
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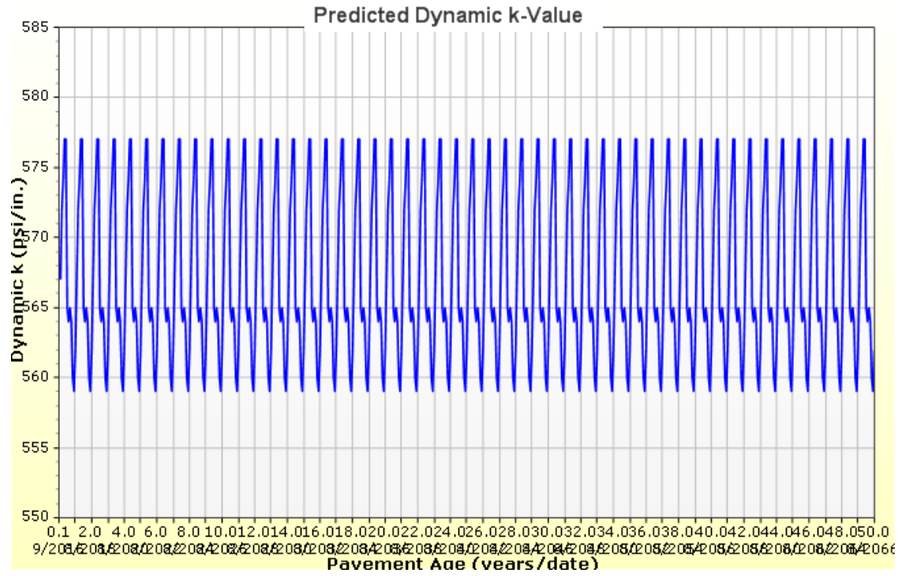
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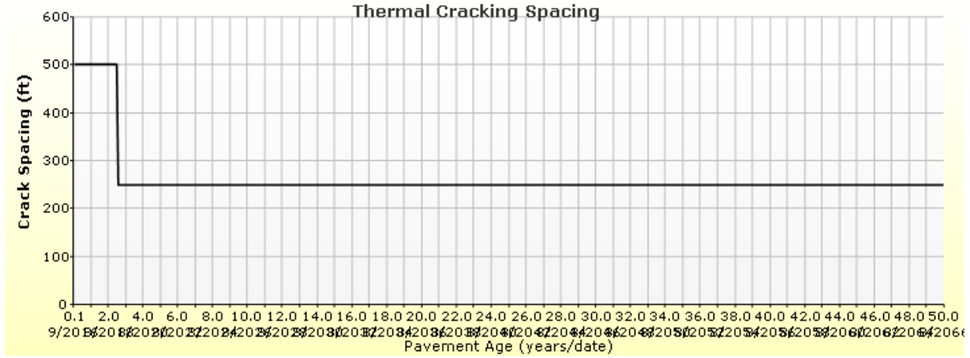
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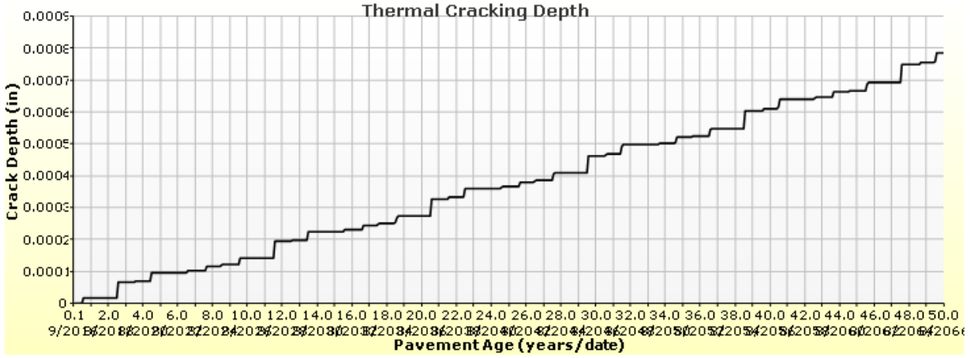
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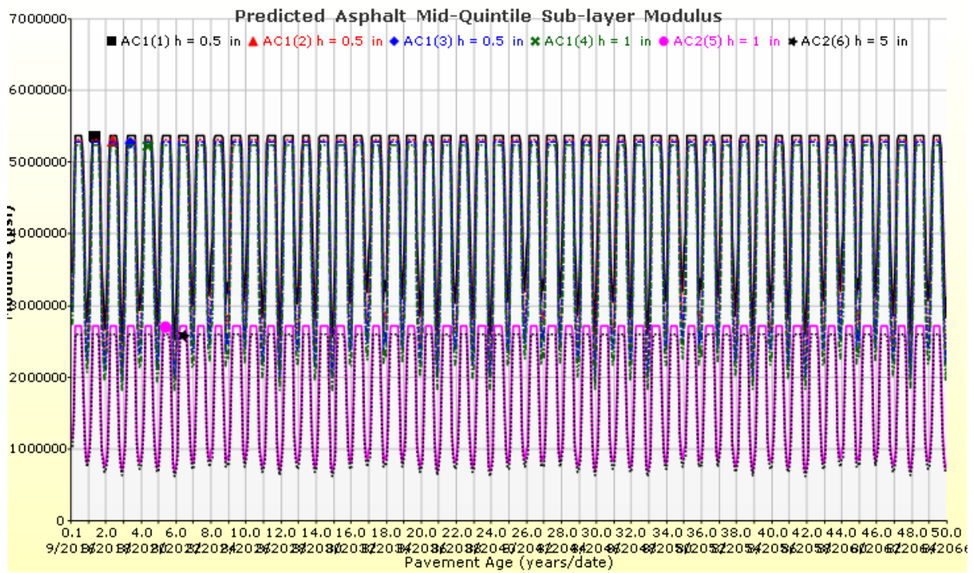
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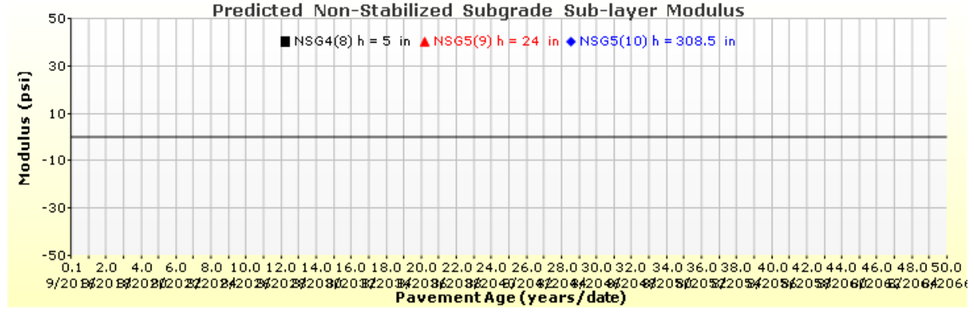




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Layer Information

Layer 1 Flexible : LaPorte QC/QA-HMA, 5, 76, Surface, 9.5 mm - SMA

Asphalt		
Thickness (in.)	1.5	
Unit weight (pcf)	160.0	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 1)

T (ºF)	0.1 Hz	1 Hz	10 Hz	25 Hz
10	3647648	4669504	5000000	5000000
40	2415742	3373281	4392981	4797248
70	763973	1296571	2030073	2372323
100	228891	438683	796159	989704
130	80754	159253	310900	401763

Asphalt Binder

Temperature (ºF)	Binder Gstar (Pa)	Phase angle (deg)
40	19627632.35	32.71
55	9199787.41	42.43
70	3072091.94	50.32
85	926086.84	56.76
100	278615.81	62.04
115	87586.86	66.4
130	29373.15	70.01

General Info

Name	Value
Reference temperature (ºF)	70
Effective binder content (%)	13.4
Air voids (%)	7
Thermal conductivity (BTU/hr-ft-ºF)	0.63
Heat capacity (BTU/lb-ºF)	0.31

Identifiers

Field	Value
Display name/identifier	LaPorte QC/QA-HMA, 5, 76,
Description of object	
Author	
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

I-65 C2 Overlay - Alternative 44

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Layer 2 Flexible : Asphalt concrete

Asphalt		
Thickness (in.)	7.0	
Unit weight (pcf)	143.8	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 3)

Gradation	Percent Passing
3/4-inch sieve	97
3/8-inch sieve	69
No.4 sieve	43
No.200 sieve	2

Asphalt Binder

Parameter	Value
Grade	Superpave Performance Grade
Binder Type	76-22
A	9.715
VTS	-3.208

General Info

Name	Value
Reference temperature (ºF)	70
Effective binder content (%)	10
Air voids (%)	6
Thermal conductivity (BTU/hr-ft-ºF)	0.63
Heat capacity (BTU/lb-ºF)	0.31

Identifiers

Field	Value
Display name/identifier	Asphalt concrete
Description of object	
Author	
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

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Layer 3 PCC : JPCP Default

PCC	
Thickness (in.)	10.0
Unit weight (pcf)	145.0
Poisson's ratio	0.2

Thermal	
PCC coefficient of thermal expansion (in./in./°F x 10^-6)	5.4
PCC thermal conductivity (BTU/hr-ft-°F)	1.25
PCC heat capacity (BTU/lb-°F)	0.28

Mix		
Cement type		Type I (1)
Cementitious material content (lb/yd^3)		510
Water to cement ratio		0.42
Aggregate type		Limestone (1)
PCC zero-stress temperature (°F)	Calculated Internally?	True
	User Value	-
	Calculated Value	101
Ultimate shrinkage (microstrain)	Calculated Internally?	True
	User Value	-
	Calculated Value	543.2
Reversible shrinkage (%)		50
Time to develop 50% of ultimate shrinkage (days)		35
Curing method		Curing Compound

PCC strength and modulus (Input Level: 3)

28-Day PCC modulus of rupture (psi)	700.0
28-Day PCC elastic modulus (psi)	-

Identifiers

Field	Value
Display name/identifier	JPCP Default
Description of object	
Author	
Date Created	6/16/2016 2:09:56 PM
Approver	
Date approved	6/16/2016 2:09:56 PM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

I-65 C2 Overlay - Alternative 44

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Layer 4 Subgrade : Crushed Stone

Unbound	
Layer thickness (in.)	5.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
9248.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	Crushed Stone
Description of object	Crushed Stone
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.2
Saturated hydraulic conductivity (ft/hr)	False	5.054e-02
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	7.4

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	7.2555
bf	1.3328
cf	0.8242
hr	117.4000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	8.7
#100	
#80	12.9
#60	
#50	
#40	20.0
#30	
#20	
#16	
#10	33.8
#8	
#4	44.7
3/8-in.	57.2
1/2-in.	63.1
3/4-in.	72.7
1-in.	78.8
1 1/2-in.	85.8
2-in.	91.6
2 1/2-in.	
3-in.	
3 1/2-in.	97.6

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Layer 5 Subgrade : A-6

Unbound	
Layer thickness (in.)	Semi-infinite
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
9248.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	31.1
Plasticity Index	11.5
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	True	106
Saturated hydraulic conductivity (ft/hr)	False	2.224e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	True	18.2

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	94.5761
bf	0.7777
cf	0.3069
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	20.4
0.020mm	
#200	57.7
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	92.2
#8	
#4	
3/8-in.	
1/2-in.	
3/4-in.	
1-in.	100.0
1 1/2-in.	
2-in.	
2 1/2-in.	
3-in.	
3 1/2-in.	

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Calibration Coefficients

AC Fatigue	
$N_f = 0.00432 * C * \beta_{f1} k_1 \left(\frac{1}{\varepsilon_1}\right)^{k_2\beta_{f2}} \left(\frac{1}{E}\right)^{k_3\beta_{f3}}$	k1: 0.007566
	k2: 3.9492
	k3: 1.281
$C = 10^M$	Bf1: 1
$M = 4.84\left(\frac{V_b}{V_a + V_b} - 0.69\right)$	Bf2: 1
	Bf3: 1

AC Rutting

$$\frac{\varepsilon_p}{\varepsilon_r} = k_z \beta_{r1} 10^{k_1} T^{k_2\beta_{r2}} N^{k_3\beta_{r3}}$$

$$k_z = (C_1 + C_2 * depth) * 0.328196^{depth}$$

$$C_1 = -0.1039 * H_a^2 + 2.4868 * H_a - 17.342$$

$$C_2 = 0.0172 * H_a^2 - 1.7331 * H_a + 27.428$$

Where:

$H_{ac} = total\ AC\ thickness(in)$

$\varepsilon_p = plastic\ strain\left(^{in}/_{in}\right)$
$\varepsilon_r = resilient\ strain\left(^{in}/_{in}\right)$
$T = layer\ temperature\left(^{\circ}F\right)$
$N = number\ of\ load\ repetitions$

AC Rutting Standard Deviation	0.24*Pow(RUT,0.8026)+0.001	
AC Layer	K1:-3.35412 K2:1.5606 K3:0.4791	Br1:1 Br2:1 Br3:1

Thermal Fracture

$$C_f = 400 * N\left(\frac{\log C / h_{ac}}{\sigma}\right)$$

$$\Delta C = (k * \beta t)^{n+1} * A * \Delta K^n$$

$$A = 10^{(4.389 - 2.52 * \log(E * \sigma_m * n))}$$

$C_f = observed\ amount\ of\ thermal\ cracking(ft/500ft)$
$k = refression\ coefficient\ determined\ through\ field\ calibration$
$N() = standard\ normal\ distribution\ evaluated\ at()$
$\sigma = standard\ deviation\ of\ the \log\ of\ the\ depth\ of\ cracks\ in\ the\ pavments$
$C = crack\ depth(in)$
$h_{ac} = thickness\ of\ asphalt\ layer(in)$
$\Delta C = Change\ in\ the\ crack\ depth\ due\ to\ a\ cooling\ cycle$
$\Delta K = Change\ in\ the\ stress\ intensity\ factor\ due\ to\ a\ cooling\ cycle$
$A, n = Fracture\ parameters\ for\ the\ asphalt\ mixture$
$E = mixture\ stiffness$
$\sigma_M = Undamaged\ mixture\ tensile\ strength$
$\beta_t = Calibration\ parameter$

Level 1 K: 1.5	Level 1 Standard Deviation: 0.1468 * THERMAL + 65.027
Level 2 K: 0.5	Level 2 Standard Deviation: 0.2841 *THERMAL + 55.462
Level 3 K: 1.5	Level 3 Standard Deviation: 0.3972 * THERMAL + 20.422

CSM Fatigue

$$N_f = 10^{\left(\frac{k_1 \beta_{c1} \left(\frac{\sigma_s}{M_r}\right)}{k_2 \beta_{c2}}\right)}$$

$N_f = number\ of\ repetitions\ to\ fatigue\ cracking$
$\sigma_s = Tensile\ stress(psi)$
$M_r = modulus\ of\ rupture(psi)$

k1: 1	k2: 1	Bc1: 1	Bc2:1

I-65 C2 Overlay - Alternative 44

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Subgrade Rutting

$$\delta_a(N) = \beta_{s_1} k_1 \varepsilon_v h \left(\frac{\varepsilon_0}{\varepsilon_r}\right) \left| e^{-\left(\frac{\rho}{N}\right)^{\beta}} \right|$$

δ_a = permanent deformation for the layer
N = number of repetitions
ε_v = average veritcal strain(in/in)
$\varepsilon_0, \beta, \rho$ = material properties
ε_r = resilient strain(in/in)

Granular		Fine	
k1: 2.03	Bs1: 1	k1: 1.35	Bs1: 1
Standard Deviation (BASERUT) 0.1477*Pow(BASERUT,0.6711)+0.001		Standard Deviation (BASERUT) 0.1235*Pow(SUBRUT,0.5012)+0.001	

AC Cracking

AC Top Down Cracking

$$FC_{top} = \left(\frac{C_4}{1 + e^{(C_1 - C_2 * log_{10}(Damage))}}\right) * 10.56$$

c1: 7	c2: 3.5	c3: 0	c4: 1000

AC Cracking Top Standard Deviation

200 + 2300/(1+exp(1.072-2.1654*LOG10 (TOP+0.0001)))

AC Bottom Up Cracking

$$FC = \left(\frac{6000}{1 + e^{(C_1 * C_1' + C_2 * C_2' log_{10}(D * 100))}}\right) * \left(\frac{1}{60}\right)$$

$$C_2' = -2.40874 - 39.748 * (1 + h_{ac})^{-2.856}$$

$$C_1' = -2 * C_2'$$

c1: 1	c2: 1	c3: 6000

AC Cracking Bottom Standard Deviation

1.13+13/(1+exp(7.57-15.5*LOG10 (BOTTOM+0.0001)))

CSM Cracking

$$FC_{ctb} = C_1 + \frac{C_2}{1 + e^{C_3 - C_4 (Damage)}}$$

C1: 1	C2: 1	C3: 0	C4: 1000

CSM Standard Deviation

CTB*11

IRI Flexible over PCC

C1 - Rutting
C2 - Fatigue Crack
C3 - Transverse Crack
C4 - Site Factors

C1: 40.8	C2: 0.575	C3: 0.0014	C4: 0.00825

PCC Cracking

$$\log(N) = C1 \cdot \left(\frac{MR}{\sigma}\right)^{C2}$$

$$CRK = \frac{100}{1 + C4\ FD^{C5}}$$

Fatigue Coefficients		Cracking Coefficients	
C1: 2	C2: 1.22	C4: 1	C5: -1.98

PCC Reliability Cracking Standard Deviation

Pow(5.3116*CRACK,0.3903) + 2.99

Pavement Design Report Appendix C

I-65 C2 Overlay - Alternative 44

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Reflective Cracking

$$RC = \frac{100}{1 + e^{c.a + d.b.t}}$$

RC = Percent of cracks reflected, %
t = Time, years
h_{ac} = Overlay thickness(in)
a = 3.5 + 0.75(Heff)
b = -0.688584 – 3.37302(Heff)$^{-0.915459}$
c = 1
d = Calibration parameter (user input)

	AC over AC	AC over Rigid, Good Load Transfer	AC over Rigid, Poor Load Transfer
Heff	h_{ac}	$h_{ac} - 1$	$h_{ac} - 3$

Heff	Recommended Calibration Parameter - d	
	Delay Cracking by 2 years	Accelerate Cracking by 2 years
< 4"	0.6	3
4 – 6"	0.7	1.7
> 6"	0.8	1.4

C: 1	D: 1

I-65 C2 FD Optimized Trial 93

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Design Inputs

Design Life: 50 years
Design Type: Flexible Pavement

Base construction: May, 2016
Pavement construction: July, 2016
Traffic opening: September, 2016

Climate Data Sources (Lat/Lon): 41.453, -87.006; 41.786, -87.752; 41.986, -87.914; 41.707, -86.333; 42.121, -87.905; 41.914, -88.246

Design Structure



Layer type	Material Type	Thickness (in.):
Flexible	3" QC/QA HMA, 5, 76, Surface 9.5mm, SMA, 9.5mm	3.0
Flexible	2.5" QC/QA HMA, 5, 76, Intermediate 19.0 mm	2.5
Flexible	275-250-330 #/SY QC/QA HMA, 5, 64, Base, 19.0mm	8.0
NonStabilized	Crushed stone	11.0
Subgrade	A-6	14.0
Subgrade	A-6	Semi-infinite

Volumetric at Construction:	
Effective binder content (%)	13.4
Air voids (%)	7.0

Traffic

Age (year)	Heavy Trucks (cumulative)
2016 (initial)	20,107
2041 (25 years)	70,937,800
2066 (50 years)	161,911,000

Design Outputs

Distress Prediction Summary

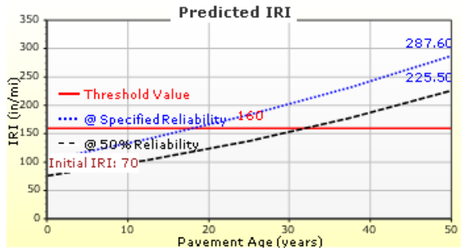
Distress Type	Distress @ Specified Reliability		Reliability (%)		Criterion Satisfied?
	Target	Predicted	Target	Achieved	
Terminal IRI (in./mile)	160.00	287.60	90.00	8.79	Fail
Permanent deformation - total pavement (in.)	0.75	0.76	90.00	88.99	Fail
AC bottom-up fatigue cracking (percent)	10.00	5.79	90.00	99.62	Pass
AC thermal cracking (ft/mile)	500.00	27.17	90.00	100.00	Pass
AC top-down fatigue cracking (ft/mile)	2500.00	259.52	90.00	100.00	Pass
Permanent deformation - AC only (in.)	0.40	0.34	90.00	98.17	Pass

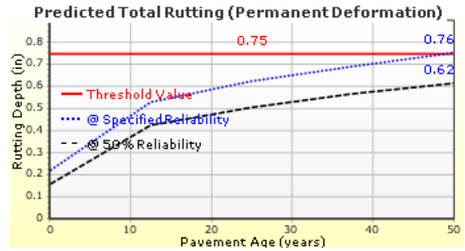
Pavement Design Report Appendix C

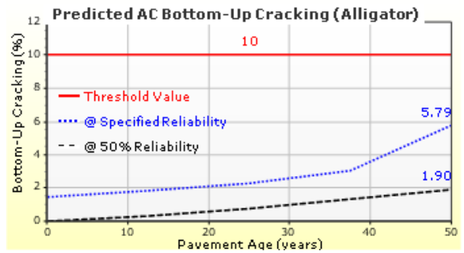
I-65 C2 FD Optimized Trial 93

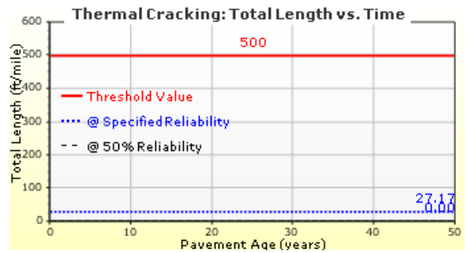
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Distress Charts









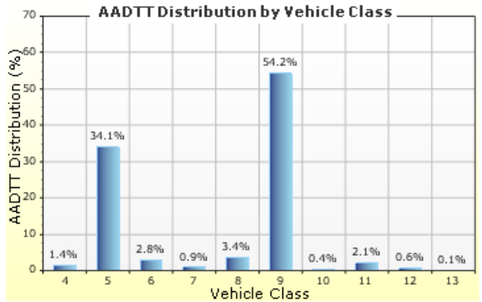
I-65 C2 FD Optimized Trial 93

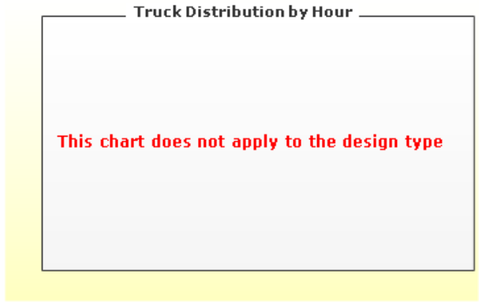
File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Revised Designs for Addendum 1\I-65 C2 FD Optimized Trial 93.dgpx

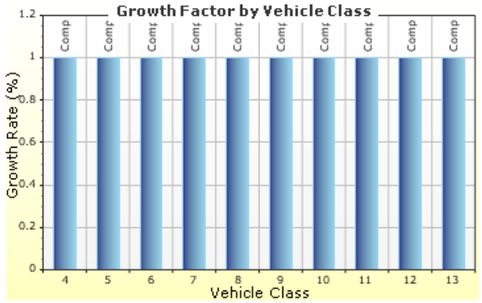
Traffic Inputs

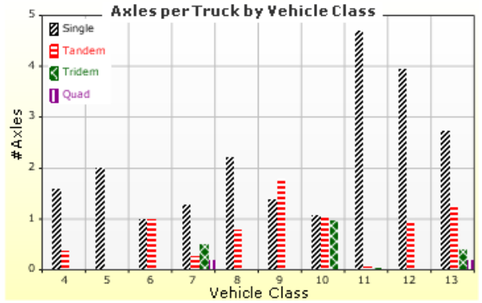
Graphical Representation of Traffic Inputs

Initial two-way AADTT:	20,107	Percent of trucks in design direction (%):	57.0
Number of lanes in design direction:	3	Percent of trucks in design lane (%):	60.0
		Operational speed (mph)	65.0

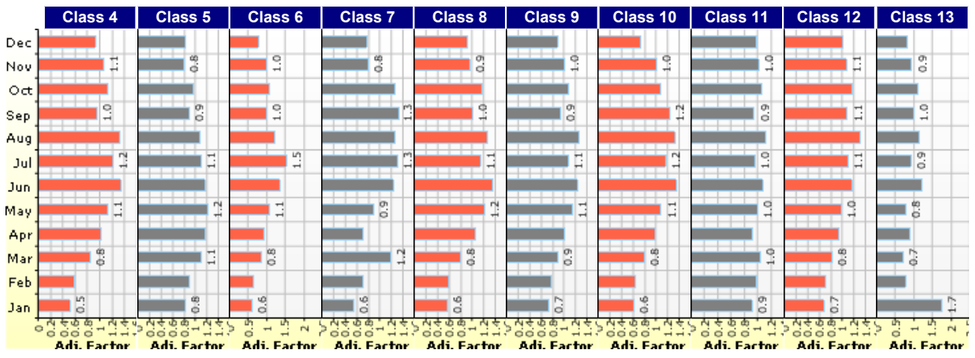








Traffic Volume Monthly Adjustment Factors



I-65 C2 FD Optimized Trial 93

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Tabular Representation of Traffic Inputs

Volume Monthly Adjustment Factors

Level 3: Default MAF

Month	Vehicle Class									
	4	5	6	7	8	9	10	11	12	13
January	0.5	0.8	0.6	0.6	0.6	0.7	0.6	0.9	0.7	1.7
February	0.6	0.9	0.6	0.7	0.6	0.8	0.6	1.0	0.7	0.8
March	0.8	1.1	0.8	1.2	0.8	0.9	0.8	1.0	0.8	0.7
April	1.0	1.2	0.9	0.7	1.1	1.0	1.0	0.9	0.9	0.9
May	1.1	1.2	1.1	0.9	1.2	1.1	1.1	1.0	1.0	0.8
June	1.4	1.2	1.3	1.2	1.4	1.2	1.3	1.1	1.2	1.2
July	1.2	1.1	1.5	1.3	1.1	1.1	1.2	1.0	1.1	0.9
August	1.3	1.1	1.3	1.3	1.3	1.3	1.3	1.1	1.3	1.2
September	1.0	0.9	1.0	1.3	1.0	0.9	1.2	0.9	1.1	1.0
October	1.1	0.9	1.1	1.3	1.2	1.1	1.1	1.1	1.2	1.1
November	1.1	0.8	1.0	0.8	0.9	1.0	1.0	1.0	1.1	0.9
December	0.9	0.8	0.8	0.8	0.9	0.9	0.7	1.0	1.0	0.8

Distributions by Vehicle Class

Truck Distribution by Hour does not apply

Vehicle Class	AADTT Distribution (%) (Level 3)	Growth Factor	
		Rate (%)	Function
Class 4	1.4%	1%	Compound
Class 5	34.1%	1%	Compound
Class 6	2.8%	1%	Compound
Class 7	0.9%	1%	Compound
Class 8	3.4%	1%	Compound
Class 9	54.2%	1%	Compound
Class 10	0.4%	1%	Compound
Class 11	2.1%	1%	Compound
Class 12	0.6%	1%	Compound
Class 13	0.1%	1%	Compound

Axle Configuration

Traffic Wander	
Mean wheel location (in.)	18
Traffic wander standard deviation (in.)	10
Design lane width (ft)	12

Axle Configuration	
Average axle width (ft)	8.5
Dual tire spacing (in.)	12
Tire pressure (psi)	120

Average Axle Spacing	
Tandem axle spacing (in.)	51.6
Tridem axle spacing (in.)	49.2
Quad axle spacing (in.)	49.2

Wheelbase does not apply

Number of Axles per Truck

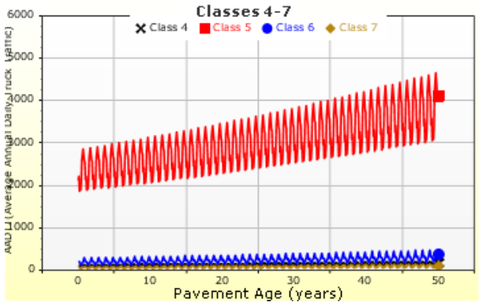
Vehicle Class	Single Axle	Tandem Axle	Tridem Axle	Quad Axle
Class 4	1.6	0.39	0	0
Class 5	2	0	0	0
Class 6	1	1	0	0
Class 7	1.29	0.29	0.5	0.19
Class 8	2.19	0.8	0	0
Class 9	1.37	1.8	0	0
Class 10	1.05	1.02	0.96	0.01
Class 11	4.71	0.08	0.03	0
Class 12	3.94	0.99	0.01	0
Class 13	2.73	1.25	0.41	0.2

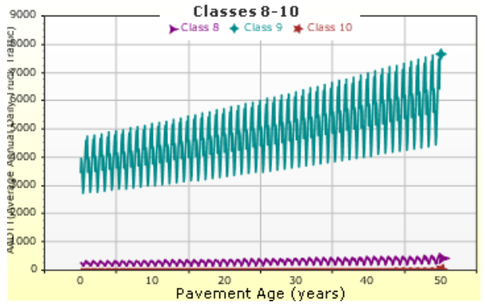
I-65 C2 FD Optimized Trial 93

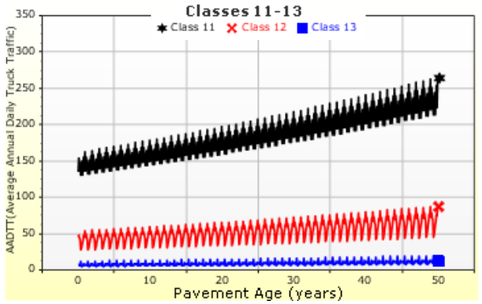
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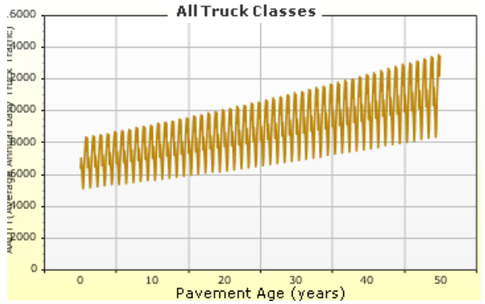
AADTT (Average Annual Daily Truck Traffic) Growth

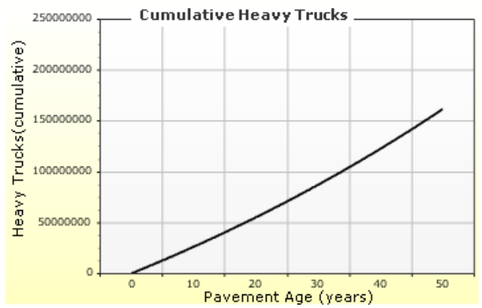
*** Traffic cap is not enforced**











Report generated on: 7/12/2016 7:53 AM

Created by: on: 4/22/2016 9:41 AM

Approved by: on: 4/22/2016 9:41 AM

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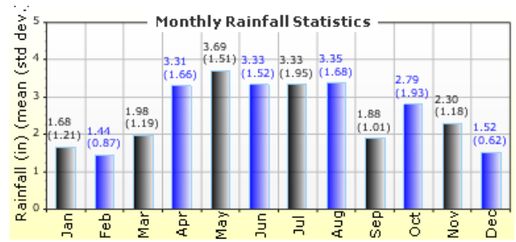
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File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Revised Designs for Addendum 1\I-65 C2 FD Optimized Trial 93.dgpx

Climate Inputs

Climate Data Sources:

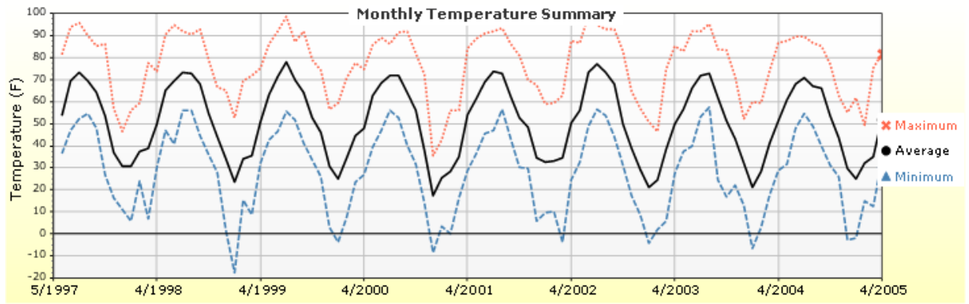
Climate Station Cities:	Location (lat lon elevation(ft))
VALPARAISO, IN	41.45300 -87.00600 770
CHICAGO, IL	41.78600 -87.75200 612
CHICAGO, IL	41.98600 -87.91400 662

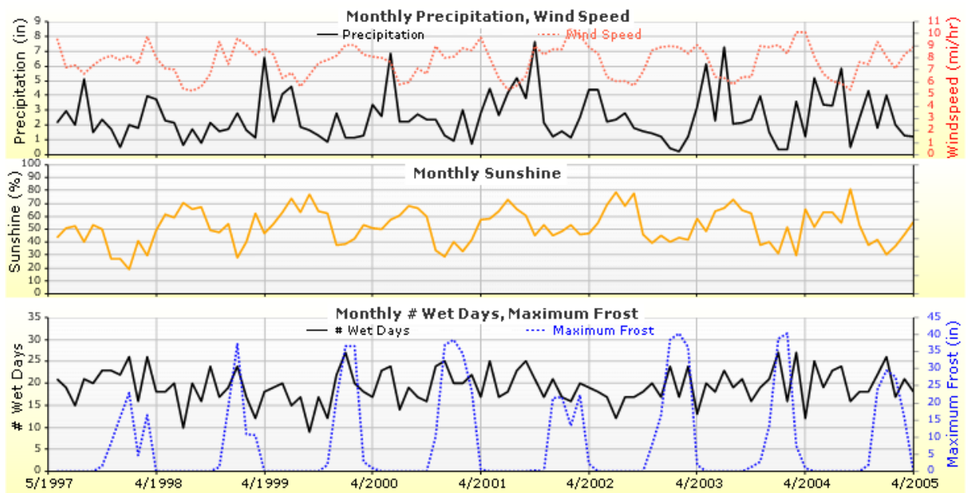


Annual Statistics:

Mean annual air temperature (°F)	50.79
Mean annual precipitation (in.)	30.60
Freezing index (°F - days)	653.48
Average annual number of freeze/thaw cycles:	61.98
Water table depth (ft)	10.00

Monthly Climate Summary:





Report generated on: 7/12/2016 7:53 AM

Created by: on: 4/22/2016 9:41 AM

Approved by: on: 4/22/2016 9:41 AM

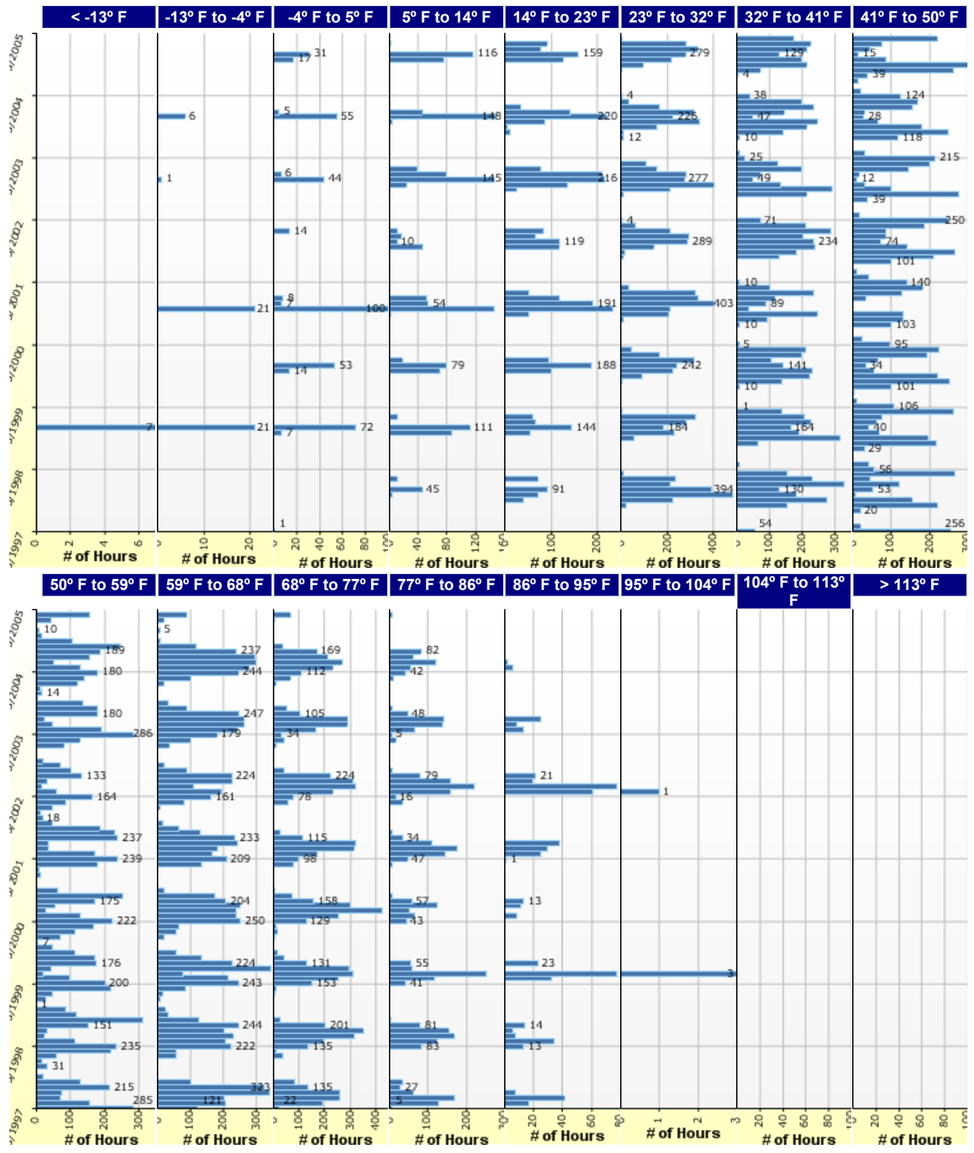
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Hourly Air Temperature Distribution by Month:



I-65 C2 FD Optimized Trial 93

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Design Properties

HMA Design Properties

Use Multilayer Rutting Model	False
Using G* based model (not nationally calibrated)	False
Is NCHRP 1-37A HMA Rutting Model Coefficients	True
Endurance Limit	-
Use Reflective Cracking	True

Structure - ICM Properties	
AC surface shortwave absorptivity	0.85

Layer Name	Layer Type	Interface Friction
Layer 1 Flexible : 3" QC/QA HMA, 5, 76, Surface 9.5mm, SMA, 9.5mm	Flexible (1)	1.00
Layer 2 Flexible : 2.5" QC/QA HMA, 5, 76, Intermediate 19.0 mm	Flexible (1)	1.00
Layer 3 Flexible : 275-250-330 #/SY QC/QA HMA, 5, 64, Base, 19.0mm	Flexible (1)	1.00
Layer 4 Non-stabilized Base : Crushed stone	Non-stabilized Base (4)	1.00
Layer 5 Subgrade : A-6	Subgrade (5)	1.00
Layer 6 Subgrade : A-6	Subgrade (5)	-

I-65 C2 FD Optimized Trial 93

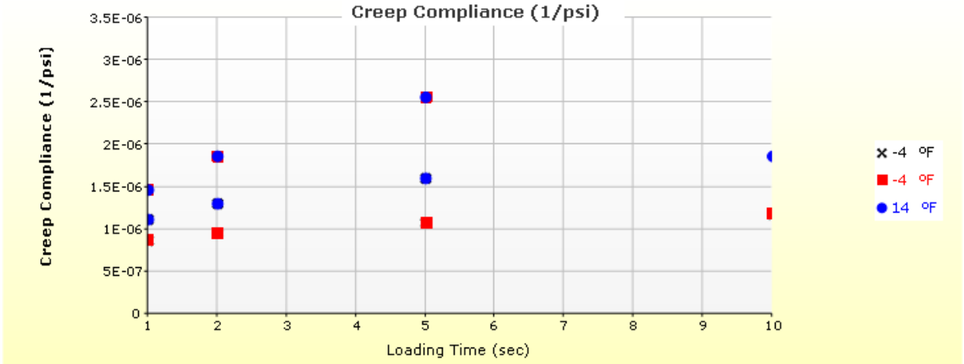
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Thermal Cracking (Input Level: 3)

Indirect tensile strength at 14 °F (psi)	404.62

Thermal Contraction	
Is thermal contraction calculated?	True
Mix coefficient of thermal contraction (in./in./°F)	-
Aggregate coefficient of thermal contraction (in./in./°F)	6.1e-006
Voids in Mineral Aggregate (%)	20.4

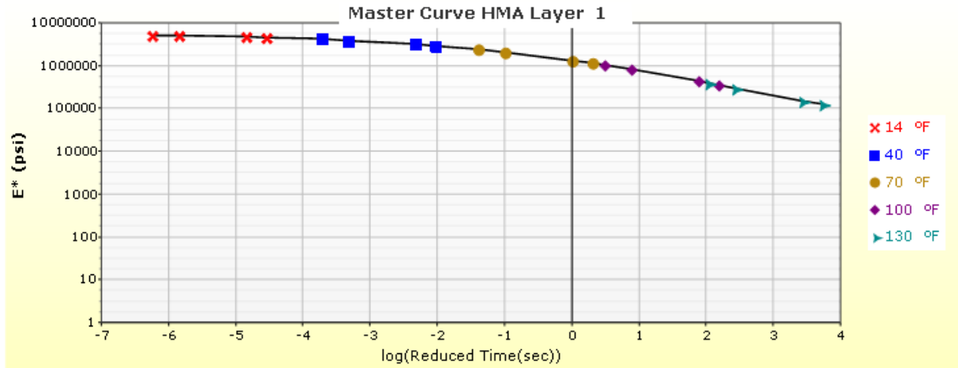
	Creep Compliance (1/psi)		
Loading time (sec)	-4 °F	-4 °F	14 °F
1	8.77e-007	8.77e-007	1.13e-006
1	1.13e-006	1.47e-006	1.47e-006
2	9.61e-007	9.61e-007	1.31e-006
2	1.31e-006	1.87e-006	1.87e-006
5	1.09e-006	1.09e-006	1.61e-006
5	1.61e-006	2.58e-006	2.58e-006
10	1.19e-006	1.19e-006	1.87e-006

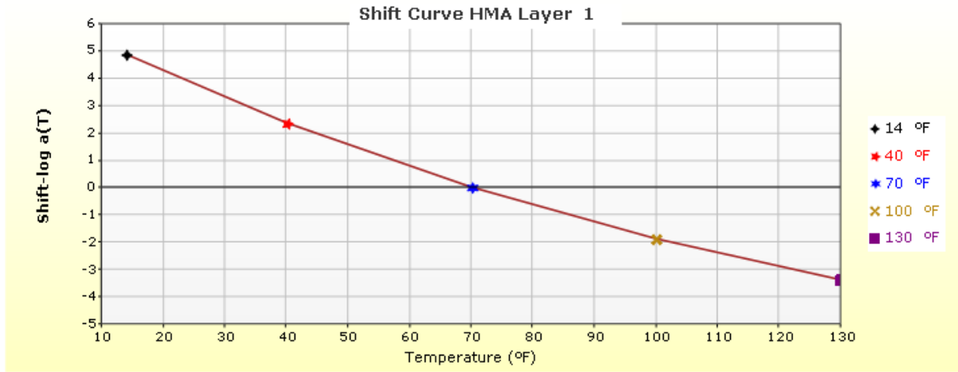


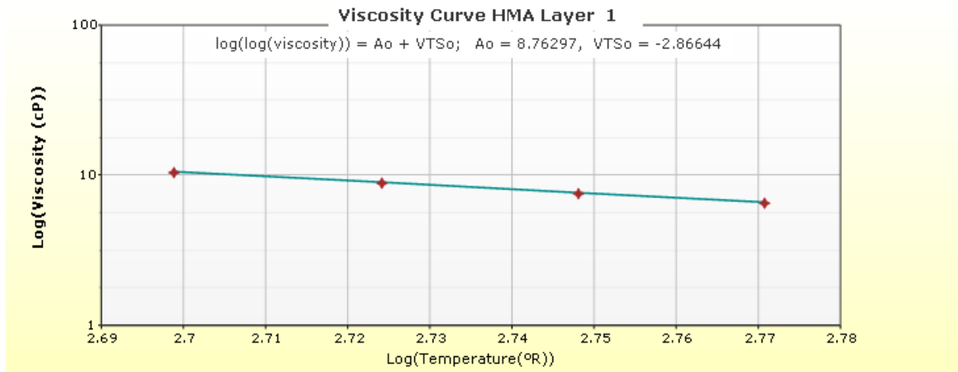
I-65 C2 FD Optimized Trial 93

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HMA Layer 1: Layer 1 Flexible : 3" QC/QA HMA, 5, 76, Surface 9.5mm, SMA, 9.5mm



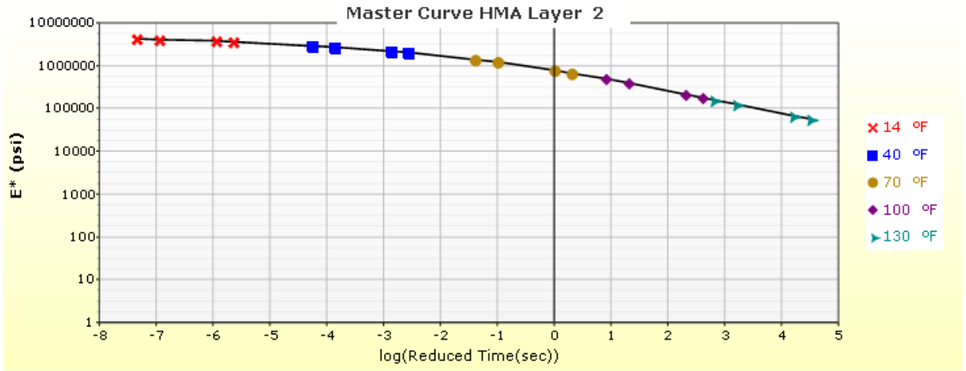


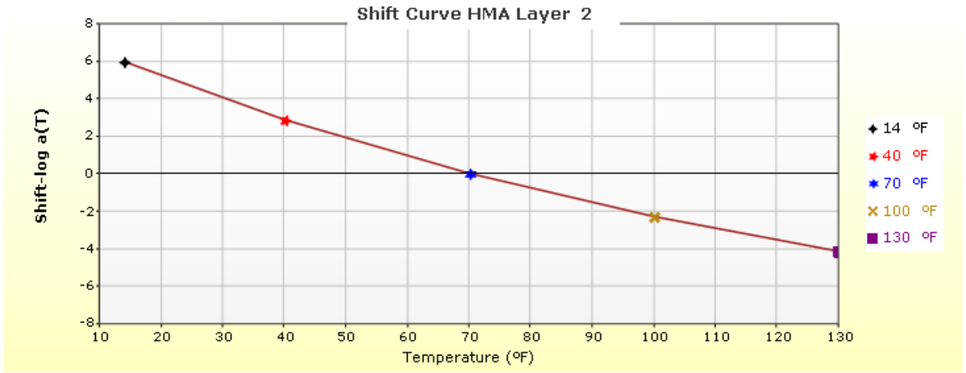


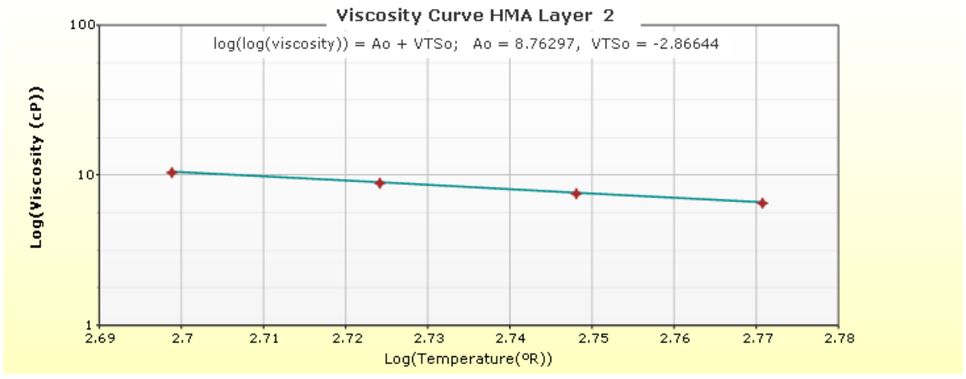
I-65 C2 FD Optimized Trial 93

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HMA Layer 2: Layer 2 Flexible : 2.5" QC/QA HMA, 5, 76, Intermediate 19.0 mm



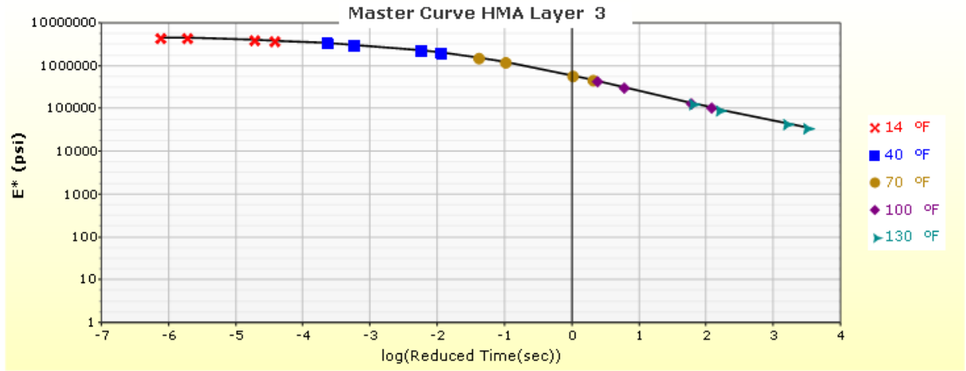


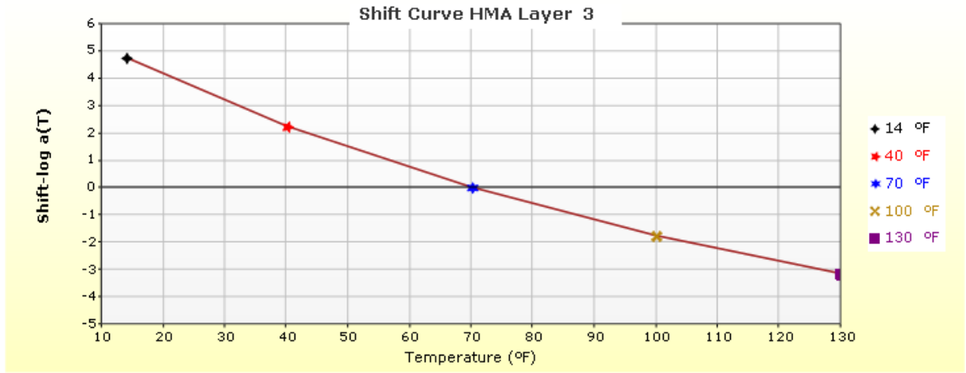


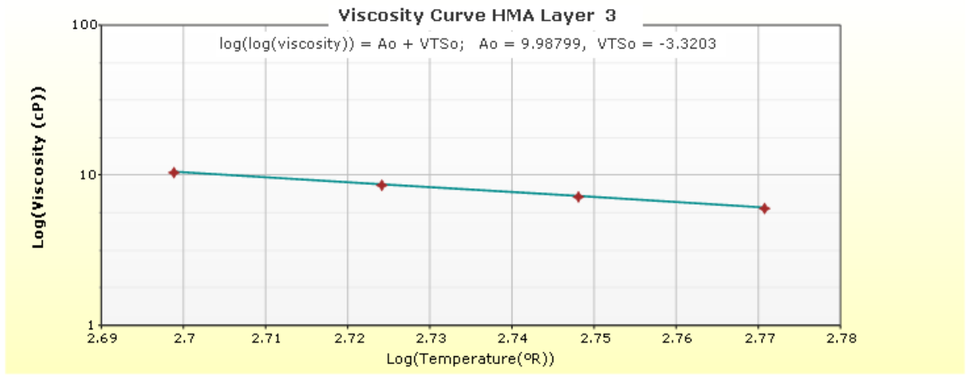
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HMA Layer 3: Layer 3 Flexible : 275-250-330 #/SY QC/QA HMA, 5, 64, Base, 19.0mm



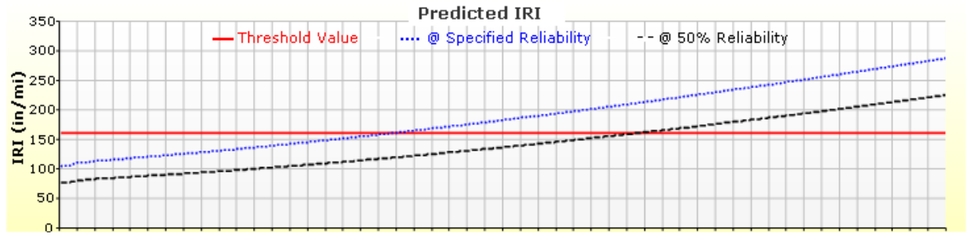


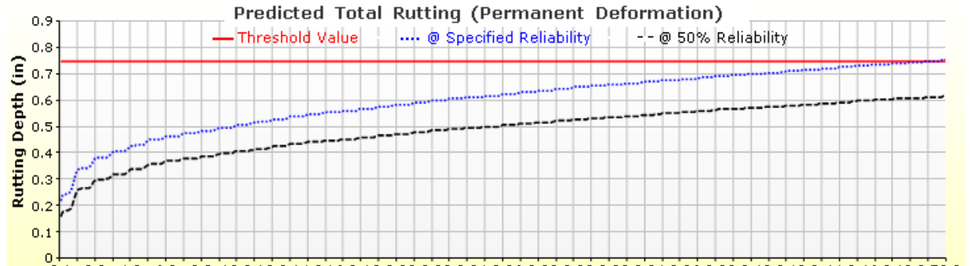


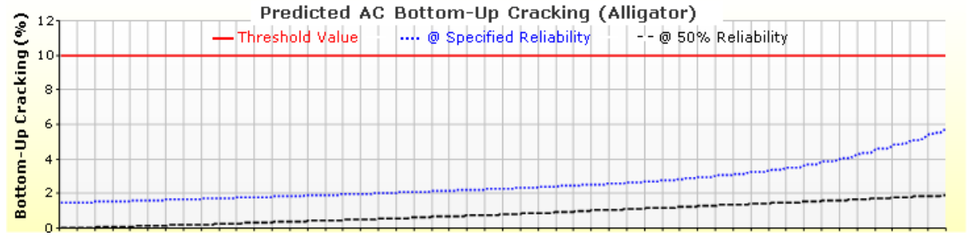
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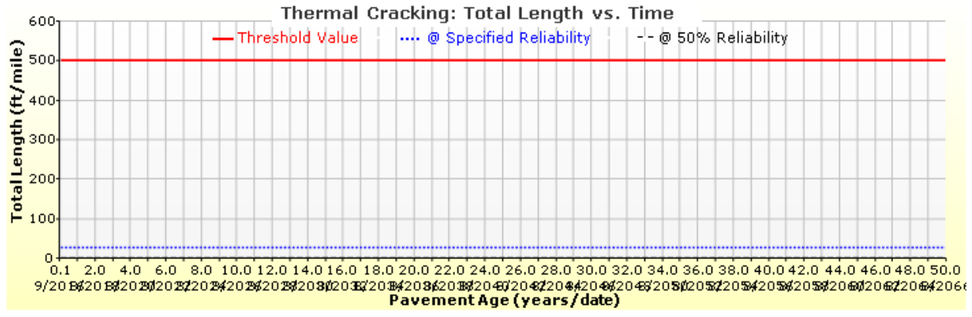
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Analysis Output Charts





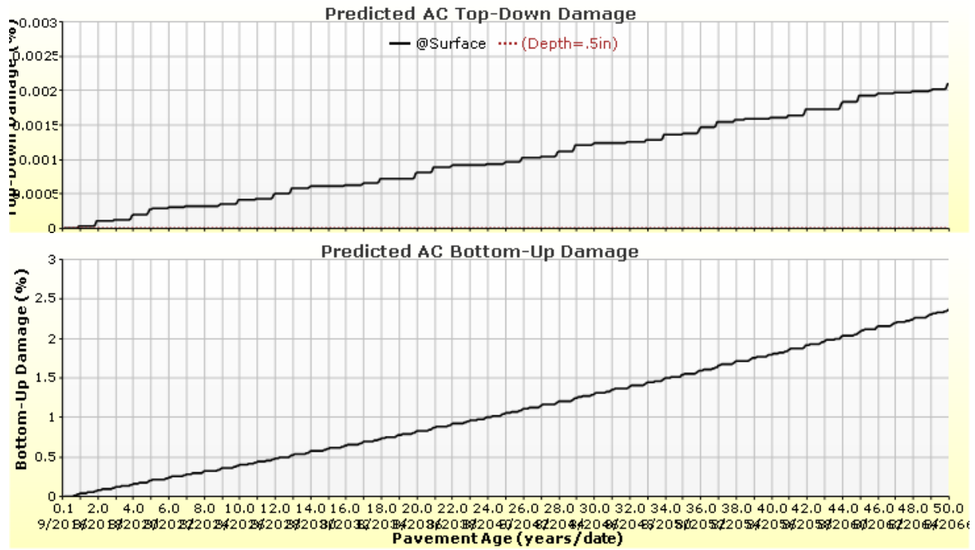


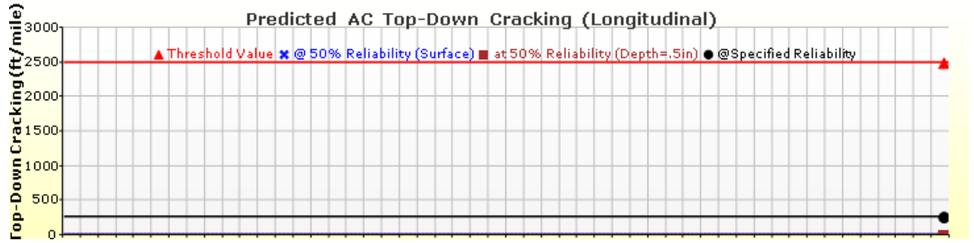


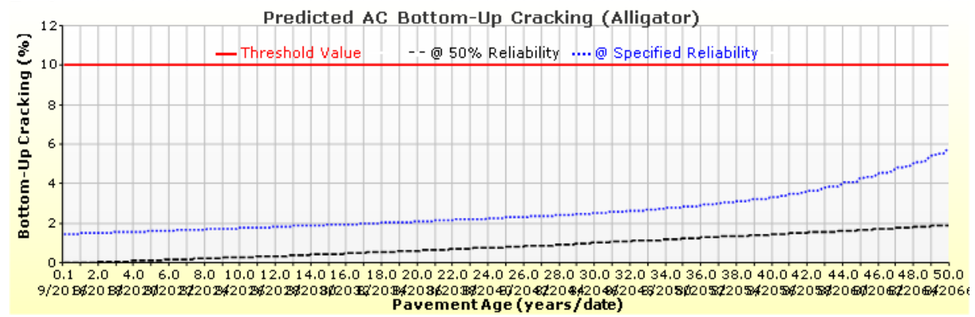
Pavement Design Report Appendix C

I-65 C2 FD Optimized Trial 93

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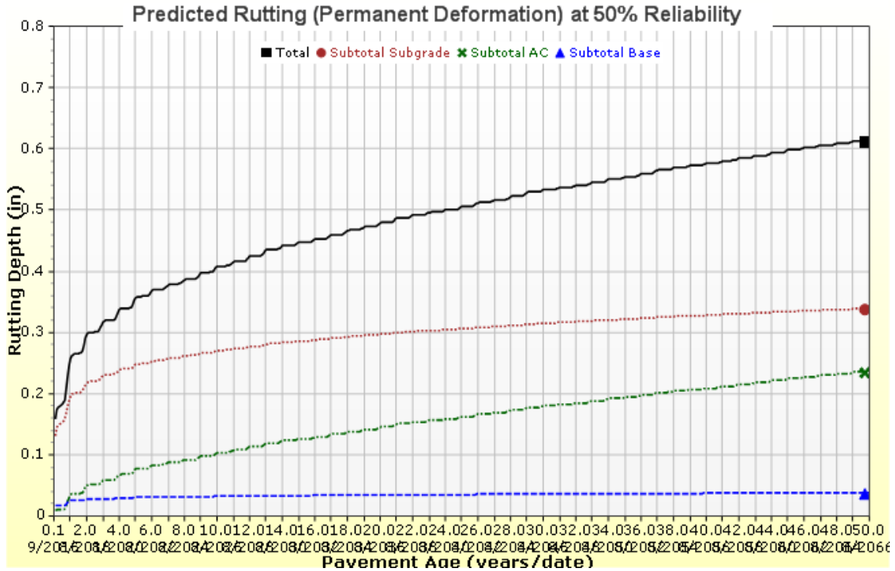






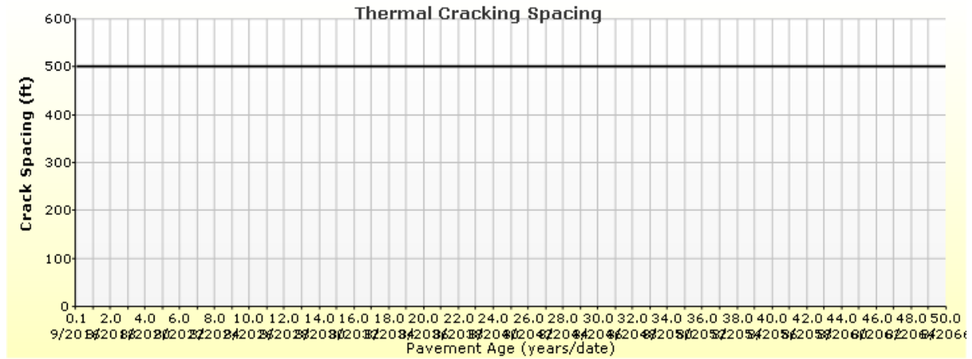
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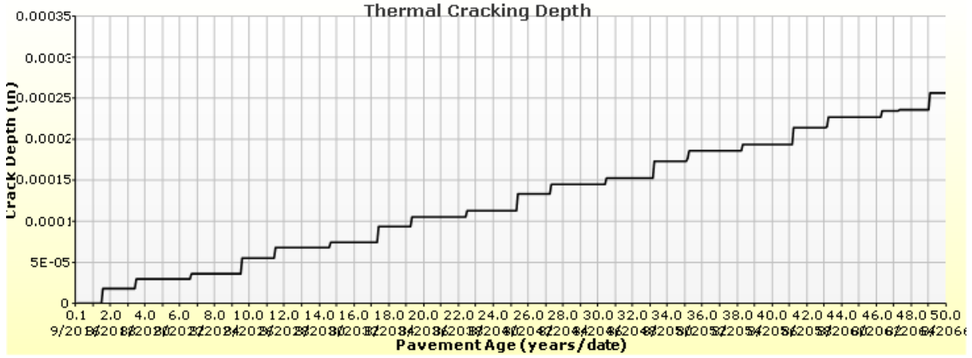
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I-65 C2 FD Optimized Trial 93

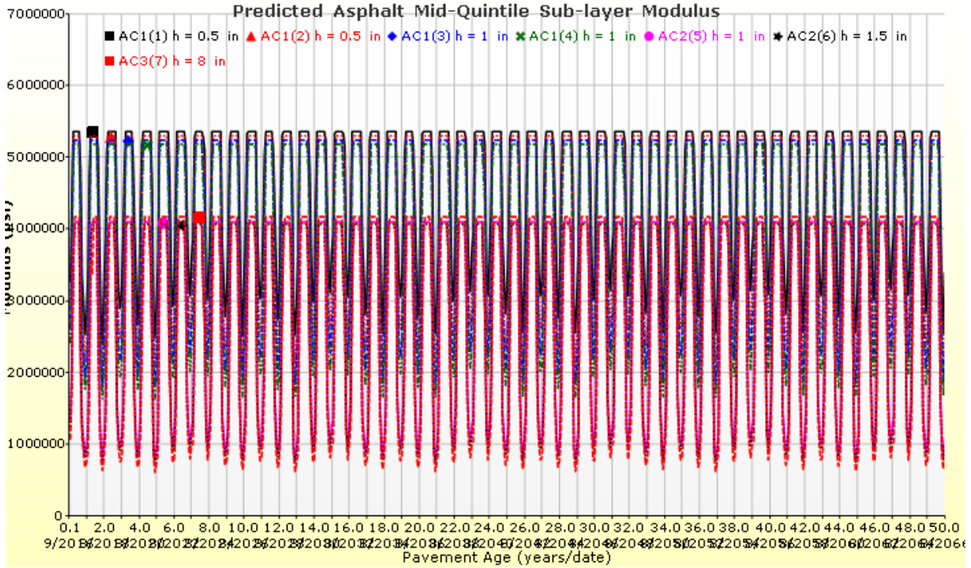
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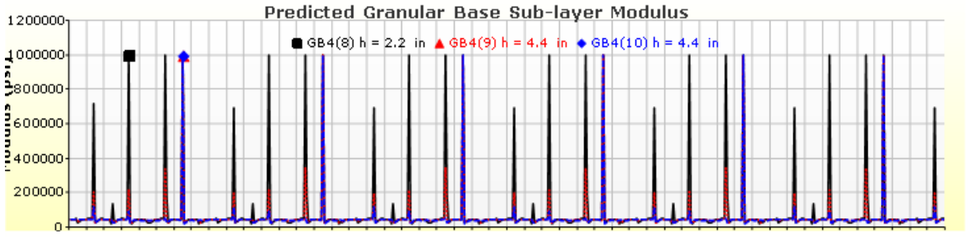


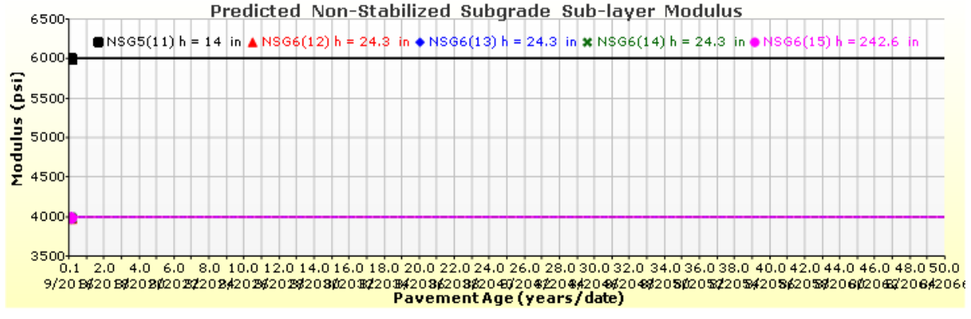


I-65 C2 FD Optimized Trial 93

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Pavement Design Report Appendix C

I-65 C2 FD Optimized Trial 93

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Revised Designs for Addendum 1\I-65 C2 FD Optimized Trial 93.dgpx

Layer Information

Layer 1 Flexible : 3" QC/QA HMA, 5, 76, Surface 9.5mm, SMA, 9.5mm

Asphalt		
Thickness (in.)	3.0	
Unit weight (pcf)	160.0	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 1)

T (°F)	0.1 Hz	1 Hz	10 Hz	25 Hz
10	3647648	4669504	5000000	5000000
40	2415742	3373281	4392981	4797248
70	763973	1296571	2030073	2372323
100	228891	438683	796159	989704
130	80754	159253	310900	401763

Asphalt Binder

Temperature (°F)	Binder Gstar (Pa)	Phase angle (deg)
40	19627632.35	32.71
55	9199787.41	42.43
70	3072091.94	50.32
85	926086.84	56.76
100	278615.81	62.04
115	87586.86	66.4
130	29373.15	70.01

General Info

Name	Value
Reference temperature (°F)	70
Effective binder content (%)	13.4
Air voids (%)	7
Thermal conductivity (BTU/hr-ft-°F)	0.63
Heat capacity (BTU/lb-°F)	0.31

Identifiers

Field	Value
Display name/identifier	3" QC/QA HMA, 5, 76, Surface
Description of object	
Author	
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

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File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Revised Designs for Addendum 1\I-65 C2 FD Optimized Trial 93.dgpx

Layer 2 Flexible : 2.5" QC/QA HMA, 5, 76, Intermediate 19.0 mm

Asphalt		
Thickness (in.)	2.5	
Unit weight (pcf)	143.8	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 1)

T (°F)	0.1 Hz	1 Hz	10 Hz	25 Hz
10	2785639	3444764	3998971	4863576
40	2446711	2488049	2605196	2900603
70	490152	763705	1037088	1225069
100	96515	199613	360215	460768
130	37445	72052	142777	190406

Asphalt Binder

Temperature (°F)	Binder Gstar (Pa)	Phase angle (deg)
40	19627632.35	32.71
55	9199787.41	42.43
70	3072091.94	50.32
85	926086.84	56.76
100	278615.81	62.04
115	87586.86	66.4
130	29373.15	70.01

General Info

Name	Value
Reference temperature (°F)	70
Effective binder content (%)	9.53
Air voids (%)	8
Thermal conductivity (BTU/hr-ft-°F)	0.63
Heat capacity (BTU/lb-°F)	0.31

Identifiers

Field	Value
Display name/identifier	2.5" QC/QA HMA, 5, 76,
Description of object	
Author	
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

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File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Revised Designs for Addendum 1\I-65 C2 FD Optimized Trial 93.dgpx

Layer 3 Flexible : 275-250-330 #/SY QC/QA HMA, 5, 64, Base, 19.0mm

Asphalt		
Thickness (in.)	8.0	
Unit weight (pcf)	143.8	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 1)

T (°F)	0.1 Hz	1 Hz	10 Hz	25 Hz
10	2979507	3637477	4026752	5000000
40	1960005	2530031	2976767	3408679
70	249172	602243	1061925	1330032
100	51267	131480	310103	429158
130	25880	48780	111016	157714

Asphalt Binder

Temperature (°F)	Binder Gstar (Pa)	Phase angle (deg)
40	25339156.98	34.85
55	9930922.35	46.6
70	2585999.72	55.79
85	613653.8	63
100	149927.8	68.71
115	39662.01	73.23
130	11579.02	76.83

General Info

Name	Value
Reference temperature (°F)	70
Effective binder content (%)	9.53
Air voids (%)	8
Thermal conductivity (BTU/hr-ft-°F)	0.63
Heat capacity (BTU/lb-°F)	0.31

Identifiers

Field	Value
Display name/identifier	275-250-330 #/SY QC/QA HMA, 5,
Description of object	
Author	
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

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Layer 4 Non-stabilized Base : Crushed stone

Unbound	
Layer thickness (in.)	11.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Modify input values by temperature/moisture
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
25000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	Crushed stone
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	122.4
Saturated hydraulic conductivity (ft/hr)	False	3.415e+00
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	9.8

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	2.0621
bf	3.3404
cf	0.9439
hr	106.0000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	3.0
#100	
#80	
#60	
#50	
#40	
#30	12.5
#20	
#16	
#10	
#8	25.0
#4	30.0
3/8-in.	
1/2-in.	42.5
3/4-in.	60.0
1-in.	80.0
1 1/2-in.	100.0
2-in.	
2 1/2-in.	
3-in.	
3 1/2-in.	

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Layer 5 Subgrade : A-6

Unbound	
Layer thickness (in.)	14.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
6000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	31.1
Plasticity Index	11.5
Is layer compacted?	True

	Is User Defined?	Value
Maximum dry unit weight (pcf)	True	106
Saturated hydraulic conductivity (ft/hr)	False	2.224e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	True	18.2

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	94.5761
bf	0.7777
cf	0.3069
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	20.4
0.020mm	
#200	57.7
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	92.2
#8	
#4	
3/8-in.	
1/2-in.	
3/4-in.	
1-in.	100.0
1 1/2-in.	
2-in.	
2 1/2-in.	
3-in.	
3 1/2-in.	

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Layer 6 Subgrade : A-6

Unbound	
Layer thickness (in.)	Semi-infinite
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
4000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	31.1
Plasticity Index	11.5
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	True	106
Saturated hydraulic conductivity (ft/hr)	False	2.224e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	True	18.2

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	94.5761
bf	0.7777
cf	0.3069
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	20.4
0.020mm	
#200	57.7
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	92.2
#8	
#4	
3/8-in.	
1/2-in.	97.4
3/4-in.	
1-in.	100.0
1 1/2-in.	
2-in.	
2 1/2-in.	
3-in.	
3 1/2-in.	

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Calibration Coefficients

AC Fatigue	
$N_f = 0.00432 * C * \beta_{f1} k_1 \left(\frac{1}{\varepsilon_1}\right)^{k_2\beta_{f2}} \left(\frac{1}{E}\right)^{k_3\beta_{f3}}$	k1: 0.007566
	k2: 3.9492
	k3: 1.281
$C = 10^M$	Bf1: 1
$M = 4.84\left(\frac{V_b}{V_a + V_b} - 0.69\right)$	Bf2: 1
	Bf3: 1

AC Rutting

$$\frac{\varepsilon_p}{\varepsilon_r} = k_z \beta_{r1} 10^{k_1} T^{k_2\beta_{r2}} N^{k_3\beta_{r3}}$$

$$k_z = (C_1 + C_2 * depth) * 0.328196^{depth}$$

$$C_1 = -0.1039 * H_a^2 + 2.4868 * H_a - 17.342$$

$$C_2 = 0.0172 * H_a^2 - 1.7331 * H_a + 27.428$$

Where:

$H_{ac} = total\ AC\ thickness(in)$

$\varepsilon_p = plastic\ strain\left(^{in}/_{in}\right)$
$\varepsilon_r = resilient\ strain\left(^{in}/_{in}\right)$
$T = layer\ temperature(^{\circ}F)$
$N = number\ of\ load\ repetitions$

AC Rutting Standard Deviation	0.24 * Pow(RUT,0.8026) + 0.001	
AC Layer	K1:-3.35412 K2:1.5606 K3:0.4791	Br1:1 Br2:1 Br3:1

Thermal Fracture

$$C_f = 400 * N\left(\frac{\log C / h_{ac}}{\sigma}\right)$$

$$\Delta C = (k * \beta t)^{n+1} * A * \Delta K^n$$

$$A = 10^{(4.389 - 2.52 * \log(E * \sigma_m * n))}$$

$C_f = observed\ amount\ of\ thermal\ cracking(ft/500ft)$
$k = refression\ coefficient\ determined\ through\ field\ calibration$
$N() = standard\ normal\ distribution\ evaluated\ at()$
$\sigma = standard\ deviation\ of\ the \log\ of\ the\ depth\ of\ cracks\ in\ the\ pavments$
$C = crack\ depth(in)$
$h_{ac} = thickness\ of\ asphalt\ layer(in)$
$\Delta C = Change\ in\ the\ crack\ depth\ due\ to\ a\ cooling\ cycle$
$\Delta K = Change\ in\ the\ stress\ intensity\ factor\ due\ to\ a\ cooling\ cycle$
$A, n = Fracture\ parameters\ for\ the\ asphalt\ mixture$
$E = mixture\ stiffness$
$\sigma_M = Undamaged\ mixture\ tensile\ strength$
$\beta_t = Calibration\ parameter$

Level 1 K: 1.5	Level 1 Standard Deviation: 0.1468 * THERMAL + 65.027
Level 2 K: 0.5	Level 2 Standard Deviation: 0.2841 * THERMAL + 55.462
Level 3 K: 1.5	Level 3 Standard Deviation: 0.3972 * THERMAL + 20.422

CSM Fatigue

$$N_f = 10^{\left(\frac{k_1 \beta_{c1} \left(\frac{\sigma_s}{M_r}\right)}{k_2 \beta_{c2}}\right)}$$

$N_f = number\ of\ repetitions\ to\ fatigue\ cracking$
$\sigma_s = Tensile\ stress(psi)$
$M_r = modulus\ of\ rupture(psi)$

k1: 1	k2: 1	Bc1: 0.75	Bc2:1.1

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Subgrade Rutting			
$\delta_a(N) = \beta_{s_1} k_1 \varepsilon_v h \left(\frac{\varepsilon_0}{\varepsilon_r}\right) \left\| e^{-\left(\frac{\rho}{N}\right)^{\beta}} \right\|$	δ_a = permanent deformation for the layer N = number of repetitions ε_v = average veritcal strain(in/in) $\varepsilon_0, \beta, \rho$ = material properties ε_r = resilient strain(in/in)		
Granular		**Fine**	
k1: 2.03	Bs1: 1	k1: 1.35	Bs1: 1
Standard Deviation (BASERUT) 0.1477 * Pow(BASERUT,0.6711) + 0.001		Standard Deviation (BASERUT) 0.1235 * Pow(SUBRUT,0.5012) + 0.001	

AC Cracking						
AC Top Down Cracking				**AC Bottom Up Cracking**		
$FC_{top} = \left(\frac{C_4}{1 + e^{(C_1 - C_2 * log_{10}(Damage))}}\right) * 10.56$				$FC = \left(\frac{6000}{1 + e^{(C_1 * C_1' + C_2 * C_2' * log_{10}(D * 100))}}\right) * \left(\frac{1}{60}\right)$ $C_2' = -2.40874 - 39.748 * (1 + h_{ac})^{-2.856}$ $C_1' = -2 * C_2'$		
c1: 7	c2: 3.5	c3: 0	c4: 1000	c1: 1	c2: 1	c3: 6000
AC Cracking Top Standard Deviation				**AC Cracking Bottom Standard Deviation**		
200 + 2300/(1+exp(1.072-2.1654*LOG10 (TOP+0.0001)))				1.13 + 13/(1+exp(7.57-15.5*LOG10 (BOTTOM+0.0001)))		

CSM Cracking				IRI Flexible Pavements			
$FC_{ctb} = C_1 + \frac{C_2}{1 + e^{C_3 - C_4 (Damage)}}$				C1 - Rutting C2 - Fatigue Crack		C3 - Transverse Crack C4 - Site Factors	
C1: 0	C2: 75	C3: 5	C4: 3	C1: 40	C2: 0.4	C3: 0.008	C4: 0.015
CSM Standard Deviation							
CTB*1							

I-65 C2 OS Shldrs-Proposed MOT Treatment

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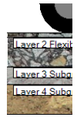
Design Inputs

Design Life: 2 years
Design Type: AC over AC

Existing construction: May, 2014
Pavement construction: June, 2016
Traffic opening: September, 2016

Climate Data Sources (Lat/Lon): 41.453, -87.006; 41.786, -87.752; 41.986, -87.914

Design Structure



Layer type	Material Type	Thickness (in.):
Flexible	PG76-22 HMA Surface 9.5mm	1.5
Flexible	HMA	10.0
Subgrade	A-6	6.0
Subgrade	A-6	Semi-infinite

Volumetric at Construction:	
Effective binder content (%)	11.6
Air voids (%)	8.0

Traffic

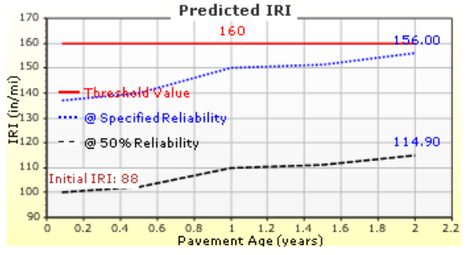
Age (year)	Heavy Trucks (cumulative)
2016 (initial)	20,107
2017 (1 years)	3,767,510
2018 (2 years)	7,572,700

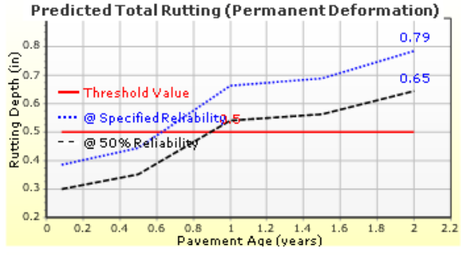
Design Outputs

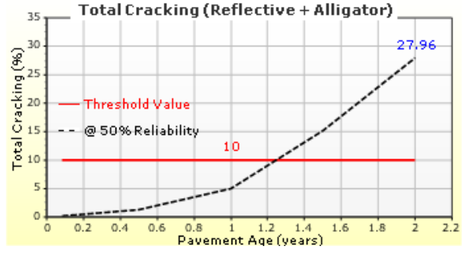
Distress Prediction Summary

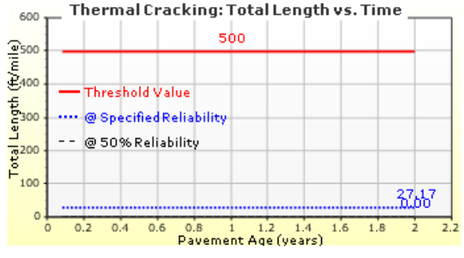
Distress Type	Distress @ Specified Reliability		Reliability (%)		Criterion Satisfied?
	Target	Predicted	Target	Achieved	
Terminal IRI (in./mile)	160.00	156.01	90.00	92.01	Pass
Permanent deformation - total pavement (in.)	0.50	0.79	90.00	8.55	Fail
Total Cracking (Reflective + Alligator) (percent)	10	27.96	-	-	Fail
AC thermal cracking (ft/mile)	500.00	27.17	90.00	100.00	Pass
AC bottom-up fatigue cracking (percent)	10.00	1.45	90.00	100.00	Pass
AC top-down fatigue cracking (ft/mile)	2500.00	379.12	90.00	100.00	Pass
Permanent deformation - AC only (in.)	0.40	0.30	90.00	99.75	Pass

Distress Charts









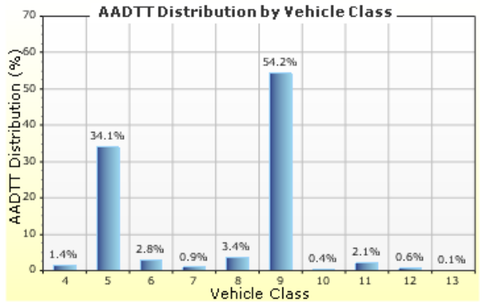
I-65 C2 OS Shldrs-Proposed MOT Treatment

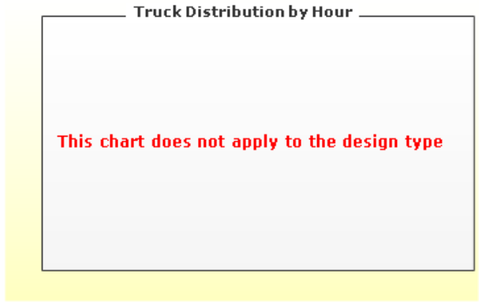
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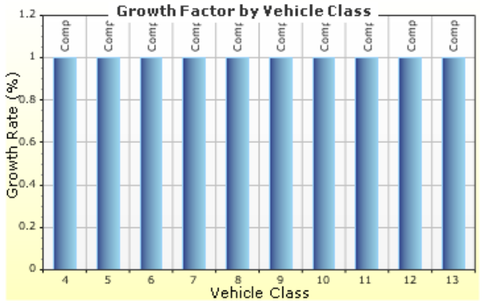
Traffic Inputs

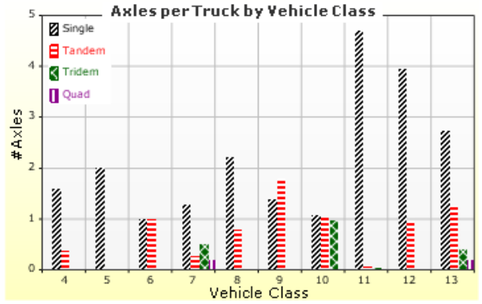
Graphical Representation of Traffic Inputs

Initial two-way AADTT:	20,107	Percent of trucks in design direction (%):	57.0
Number of lanes in design direction:	2	Percent of trucks in design lane (%):	90.0
		Operational speed (mph)	55.0

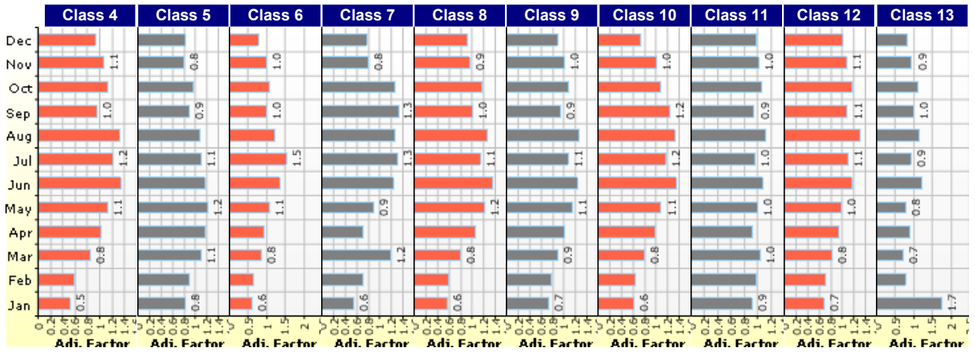








Traffic Volume Monthly Adjustment Factors



Pavement Design Report Appendix C

I-65 C2 OS Shldrs-Proposed MOT Treatment

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Tabular Representation of Traffic Inputs

Volume Monthly Adjustment Factors

Level 3: Default MAF

Month	Vehicle Class									
	4	5	6	7	8	9	10	11	12	13
January	0.5	0.8	0.6	0.6	0.6	0.7	0.6	0.9	0.7	1.7
February	0.6	0.9	0.6	0.7	0.6	0.8	0.6	1.0	0.7	0.8
March	0.8	1.1	0.8	1.2	0.8	0.9	0.8	1.0	0.8	0.7
April	1.0	1.2	0.9	0.7	1.1	1.0	1.0	0.9	0.9	0.9
May	1.1	1.2	1.1	0.9	1.2	1.1	1.1	1.0	1.0	0.8
June	1.4	1.2	1.3	1.2	1.4	1.2	1.3	1.1	1.2	1.2
July	1.2	1.1	1.5	1.3	1.1	1.1	1.2	1.0	1.1	0.9
August	1.3	1.1	1.3	1.3	1.3	1.3	1.3	1.1	1.3	1.2
September	1.0	0.9	1.0	1.3	1.0	0.9	1.2	0.9	1.1	1.0
October	1.1	0.9	1.1	1.3	1.2	1.1	1.1	1.1	1.2	1.1
November	1.1	0.8	1.0	0.8	0.9	1.0	1.0	1.0	1.1	0.9
December	0.9	0.8	0.8	0.8	0.9	0.9	0.7	1.0	1.0	0.8

Distributions by Vehicle Class

Truck Distribution by Hour does not apply

Vehicle Class	AADTT Distribution (%) (Level 3)	Growth Factor	
		Rate (%)	Function
Class 4	1.4%	1%	Compound
Class 5	34.1%	1%	Compound
Class 6	2.8%	1%	Compound
Class 7	0.9%	1%	Compound
Class 8	3.4%	1%	Compound
Class 9	54.2%	1%	Compound
Class 10	0.4%	1%	Compound
Class 11	2.1%	1%	Compound
Class 12	0.6%	1%	Compound
Class 13	0.1%	1%	Compound

Axle Configuration

Traffic Wander	
Mean wheel location (in.)	18
Traffic wander standard deviation (in.)	10
Design lane width (ft)	12

Axle Configuration	
Average axle width (ft)	8.5
Dual tire spacing (in.)	12
Tire pressure (psi)	120

Average Axle Spacing	
Tandem axle spacing (in.)	51.6
Tridem axle spacing (in.)	49.2
Quad axle spacing (in.)	49.2

Wheelbase does not apply

Number of Axles per Truck

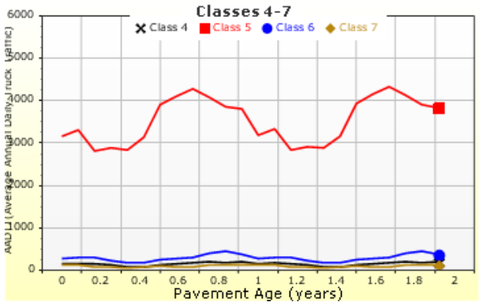
Vehicle Class	Single Axle	Tandem Axle	Tridem Axle	Quad Axle
Class 4	1.6	0.39	0	0
Class 5	2	0	0	0
Class 6	1	1	0	0
Class 7	1.29	0.29	0.5	0.19
Class 8	2.19	0.8	0	0
Class 9	1.37	1.8	0	0
Class 10	1.05	1.02	0.96	0.01
Class 11	4.71	0.08	0.03	0
Class 12	3.94	0.99	0.01	0
Class 13	2.73	1.25	0.41	0.2

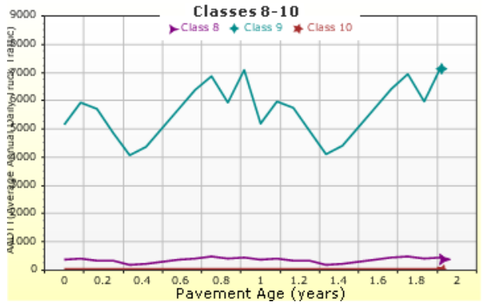
I-65 C2 OS Shldrs-Proposed MOT Treatment

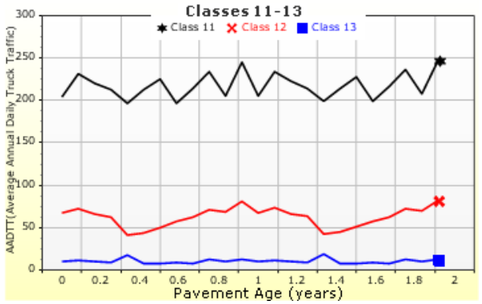
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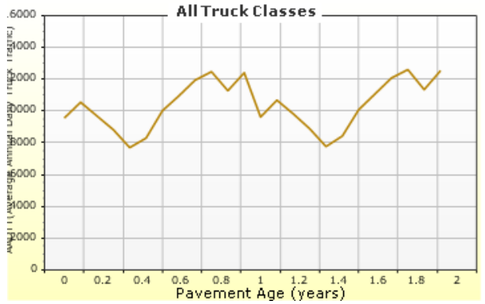
AADTT (Average Annual Daily Truck Traffic) Growth

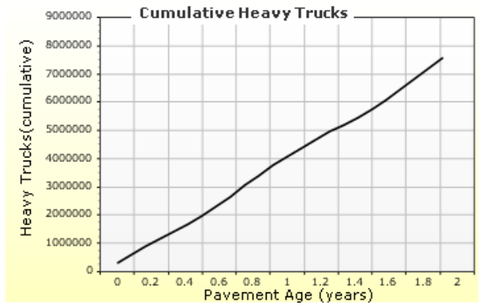
*** Traffic cap is not enforced**











Pavement Design Report Appendix C

I-65 C2 OS Shldrs-Proposed MOT Treatment

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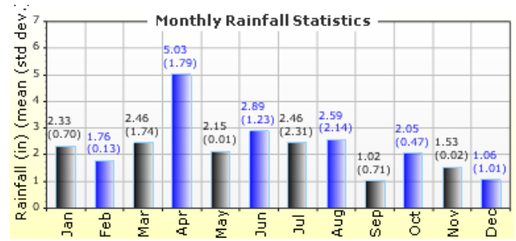
Climate Inputs

Climate Data Sources:

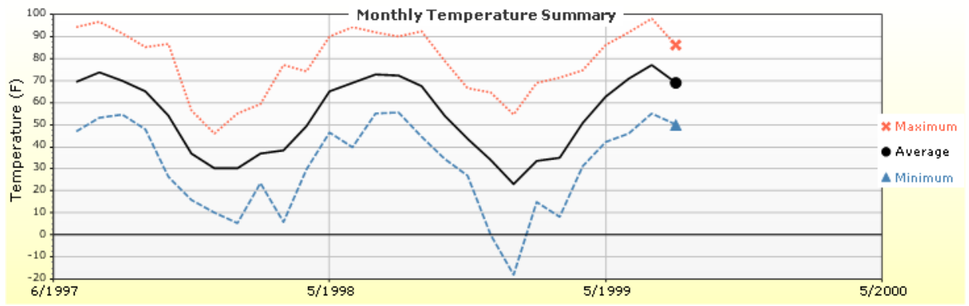
Climate Station Cities:	Location (lat lon elevation(ft))
VALPARAISO, IN	41.45300 -87.00600 770
CHICAGO, IL	41.78600 -87.75200 612
CHICAGO, IL	41.98600 -87.91400 662

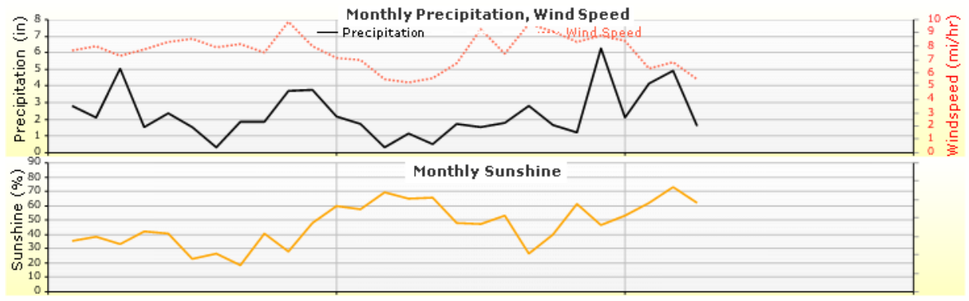
Annual Statistics:

Mean annual air temperature (°F)	54.23
Mean annual precipitation (in.)	27.49
Freezing index (°F - days)	453.96
Average annual number of freeze/thaw cycles:	66.35
Water table depth (ft)	4.00



Monthly Climate Summary:

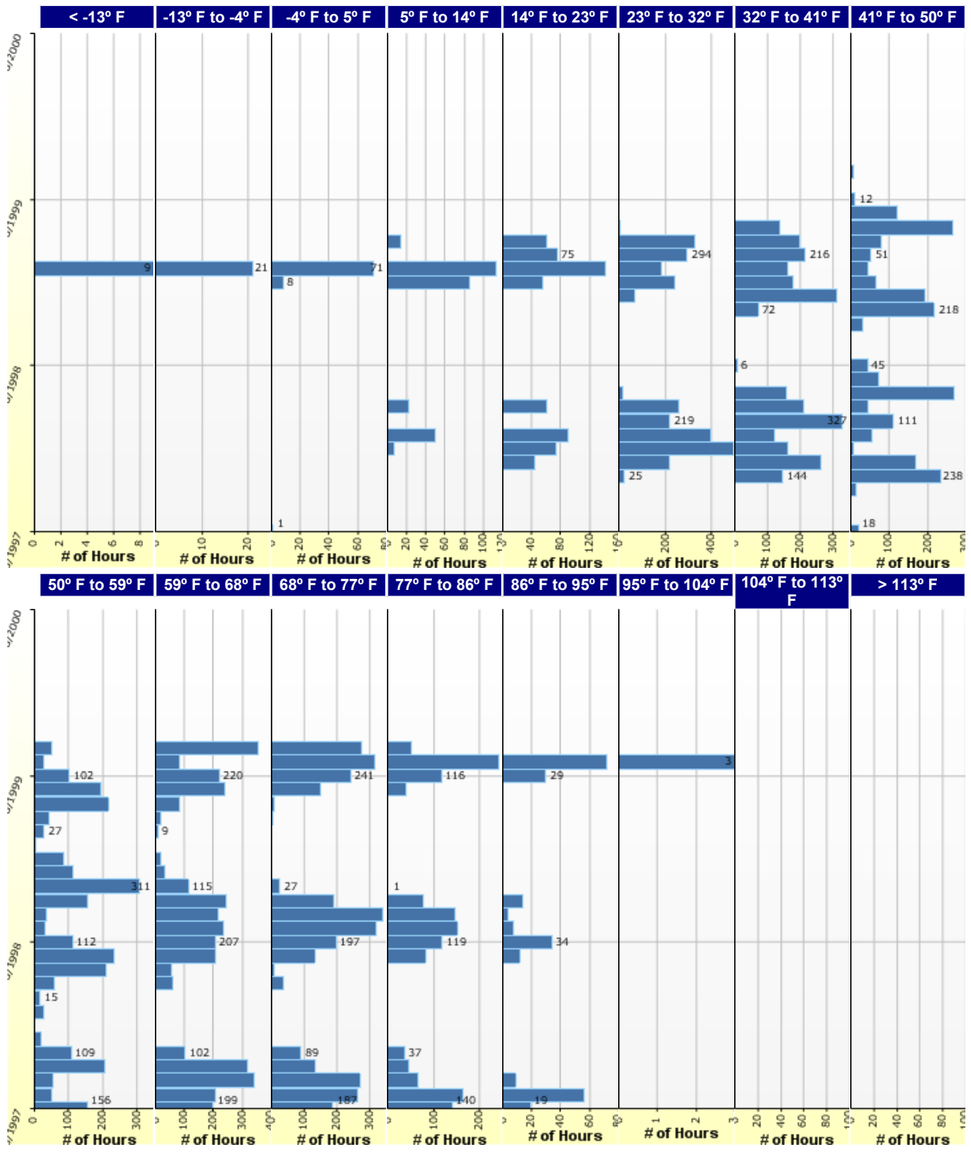




I-65 C2 OS Shldrs-Proposed MOT Treatment

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Hourly Air Temperature Distribution by Month:



I-65 C2 OS Shldrs-Proposed MOT Treatment

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Design Properties

HMA Design Properties

Use Multilayer Rutting Model	False
Using G* based model (not nationally calibrated)	False
Is NCHRP 1-37A HMA Rutting Model Coefficients	True
Endurance Limit	-
Use Reflective Cracking	True

Layer Name	**Layer Type**	**Interface Friction**
Layer 1 Flexible : PG76-22 HMA Surface 9.5mm	Flexible (1)	1.00
Layer 2 Flexible : HMA(existing)	Flexible (1)	1.00
Layer 3 Subgrade : A-6	Subgrade (5)	1.00
Layer 4 Subgrade : A-6	Subgrade (5)	-

Structure - ICM Properties	
AC surface shortwave absorptivity	0.85

HMA Rehabilitation (Input Level: 3)

Milled thickness (in.)	-
Fatigue cracking (%)	-
Pavement rating	Fair
Total rut depth (in.)	0.00

I-65 C2 OS Shldrs-Proposed MOT Treatment

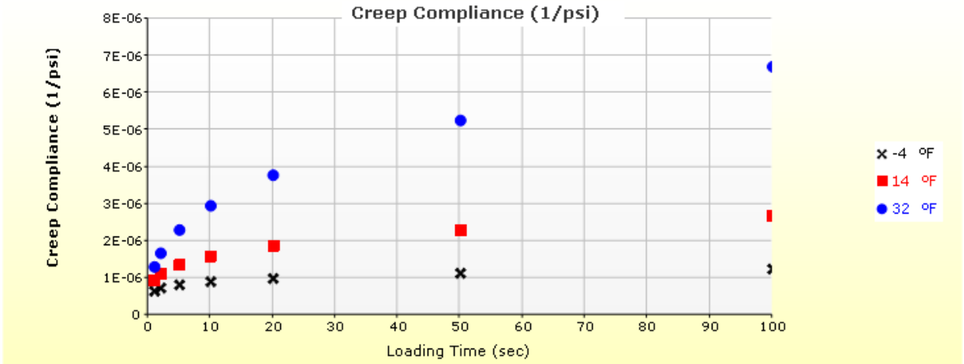
File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\MOT Shoulders - Revised\I-65 C2 OS Shldrs-Proposed MOT Treatment.dgpx

Thermal Cracking (Input Level: 3)

Indirect tensile strength at 14 °F (psi)	467.26

Thermal Contraction	
Is thermal contraction calculated?	True
Mix coefficient of thermal contraction (in./in./°F)	-
Aggregate coefficient of thermal contraction (in./in./°F)	6.1e-006
Voids in Mineral Aggregate (%)	19.6

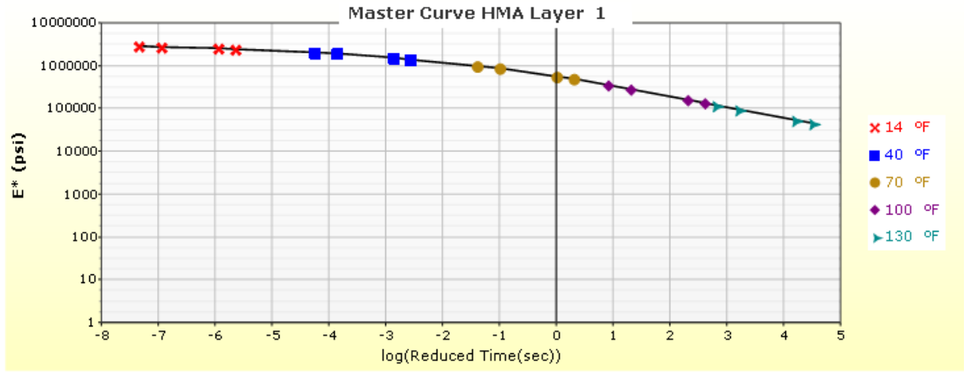
	Creep Compliance (1/psi)		
Loading time (sec)	-4 °F	14 °F	32 °F
1	6.73e-007	9.61e-007	1.32e-006
2	7.41e-007	1.12e-006	1.69e-006
5	8.40e-007	1.38e-006	2.33e-006
10	9.25e-007	1.61e-006	2.98e-006
20	1.02e-006	1.88e-006	3.81e-006
50	1.15e-006	2.31e-006	5.27e-006
100	1.27e-006	2.70e-006	6.74e-006

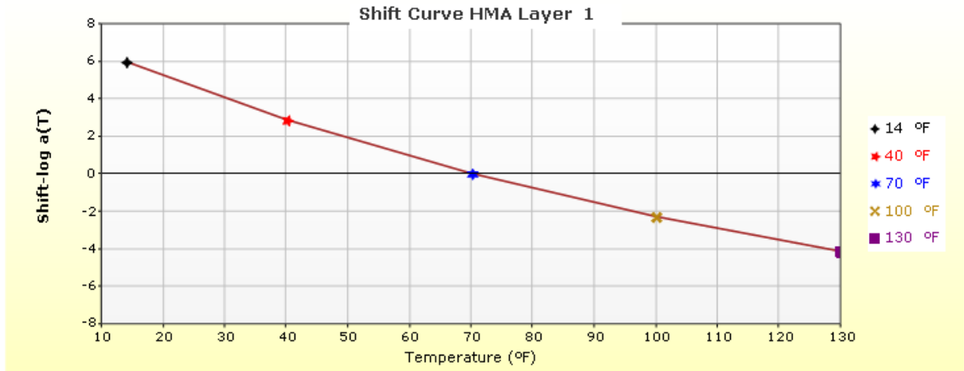


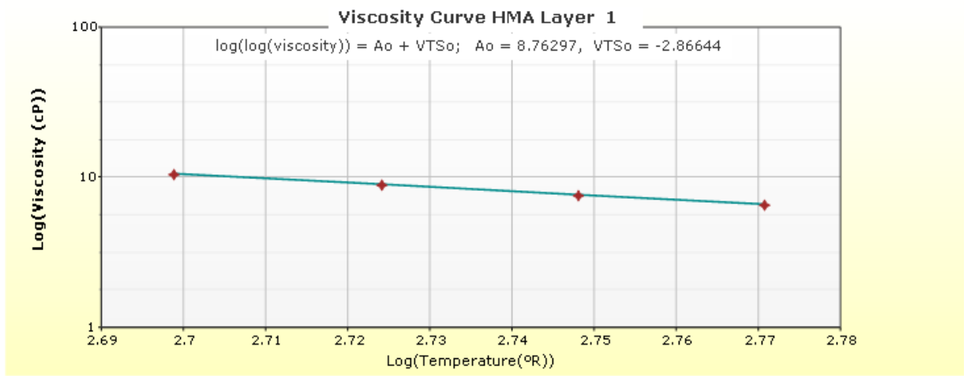
I-65 C2 OS Shldrs-Proposed MOT Treatment

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HMA Layer 1: Layer 1 Flexible : PG76-22 HMA Surface 9.5mm



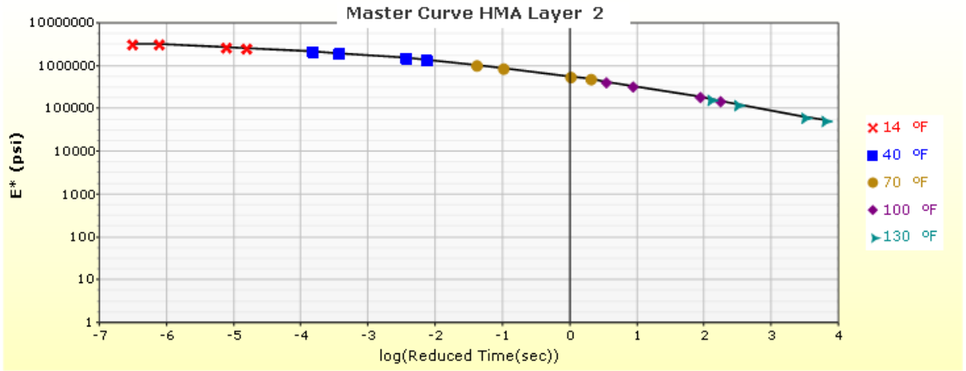


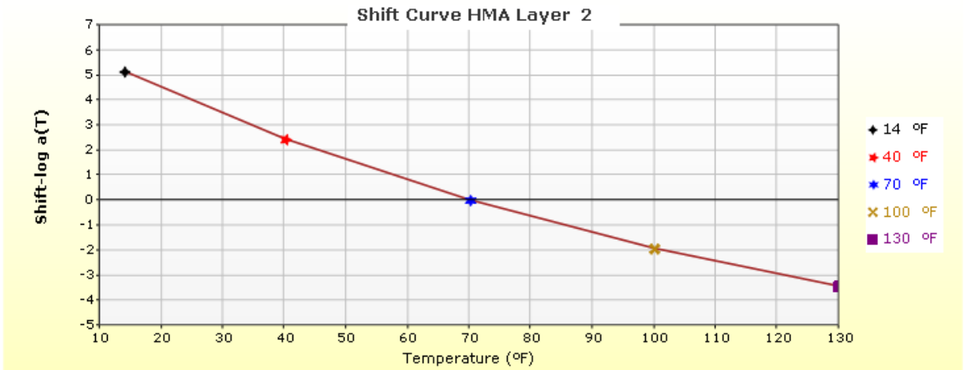


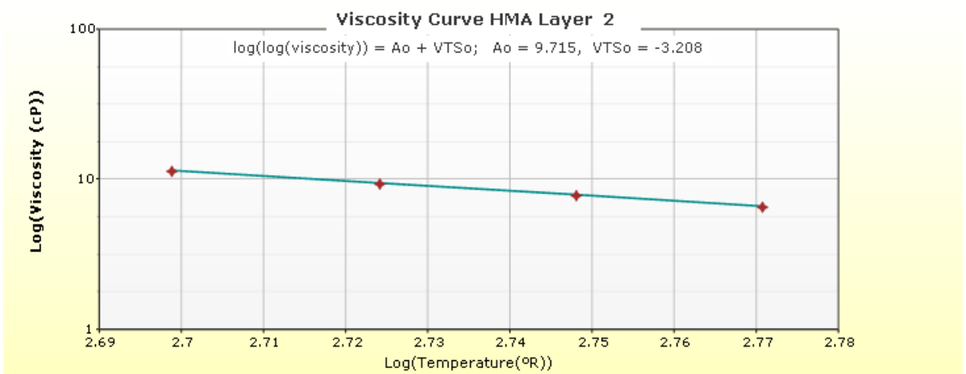
I-65 C2 OS Shldrs-Proposed MOT Treatment

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HMA Layer 2: Layer 2 Flexible : HMA(existing)







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Approved by: on: 5/9/2016 10:08 AM

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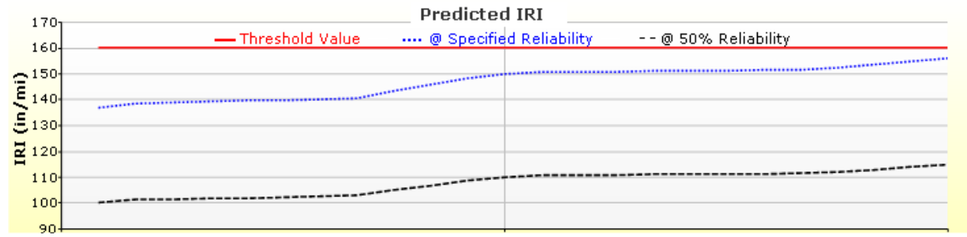
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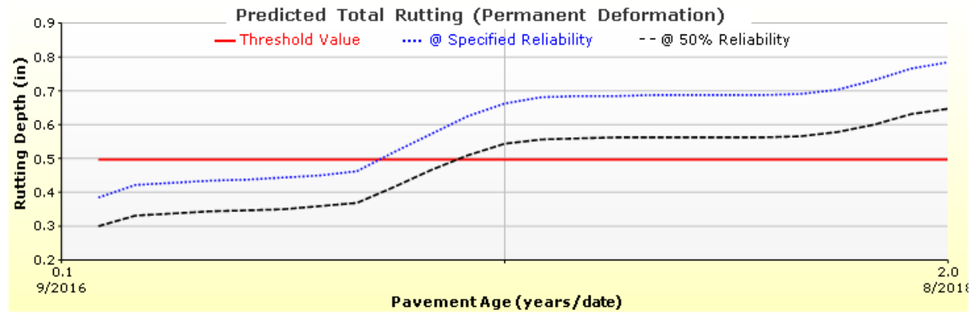
Pavement Design Report Appendix C

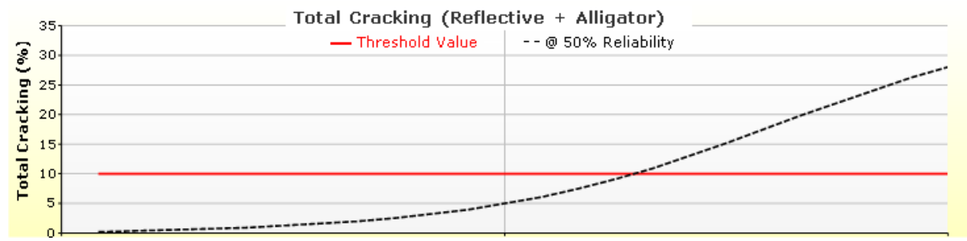
I-65 C2 OS Shldrs-Proposed MOT Treatment

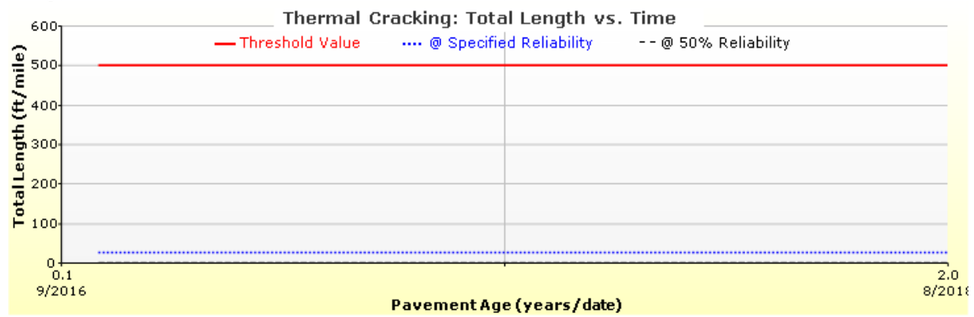
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Analysis Output Charts









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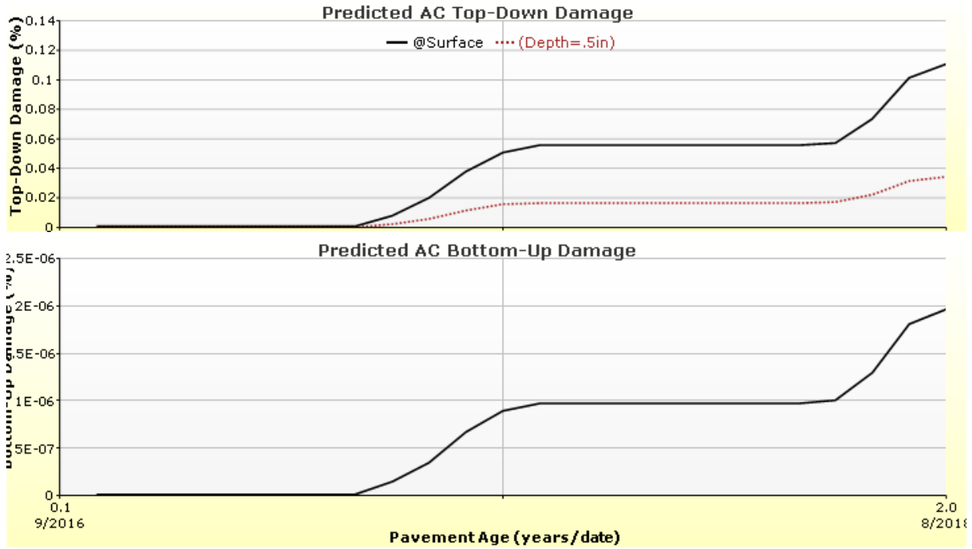
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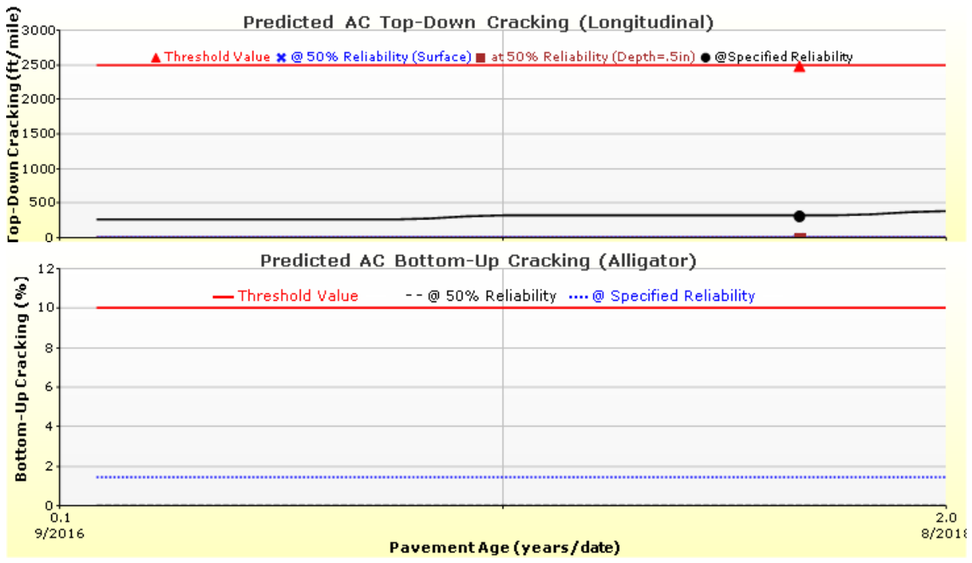
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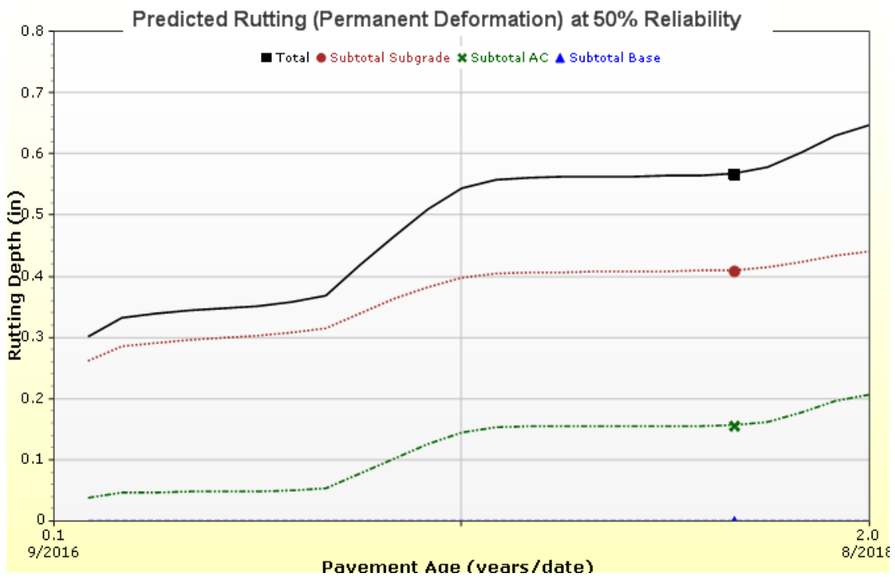
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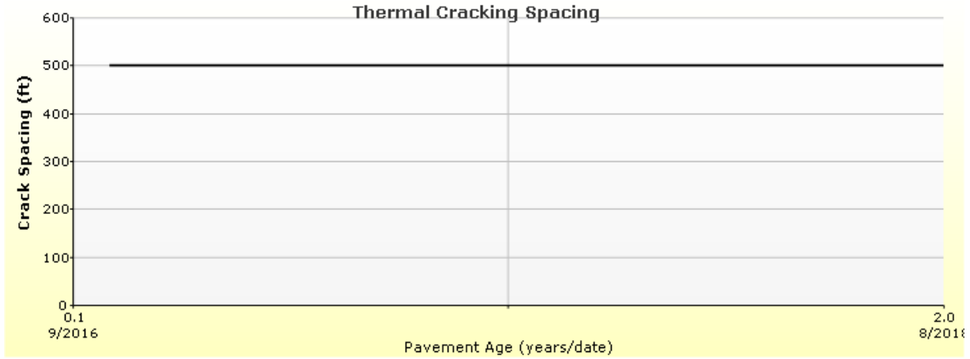
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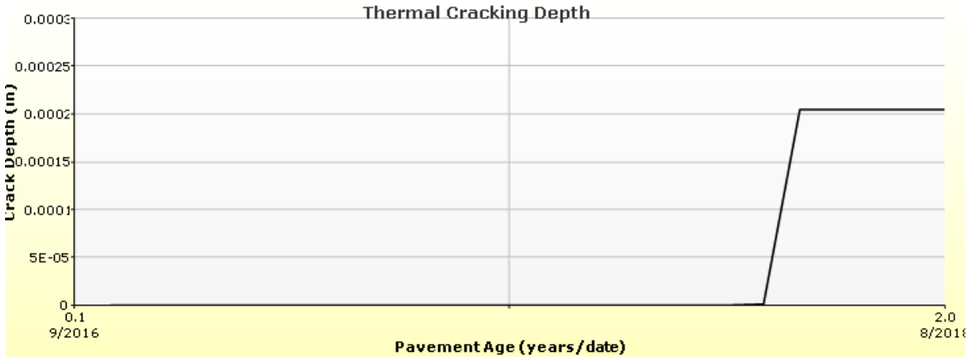
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C-120

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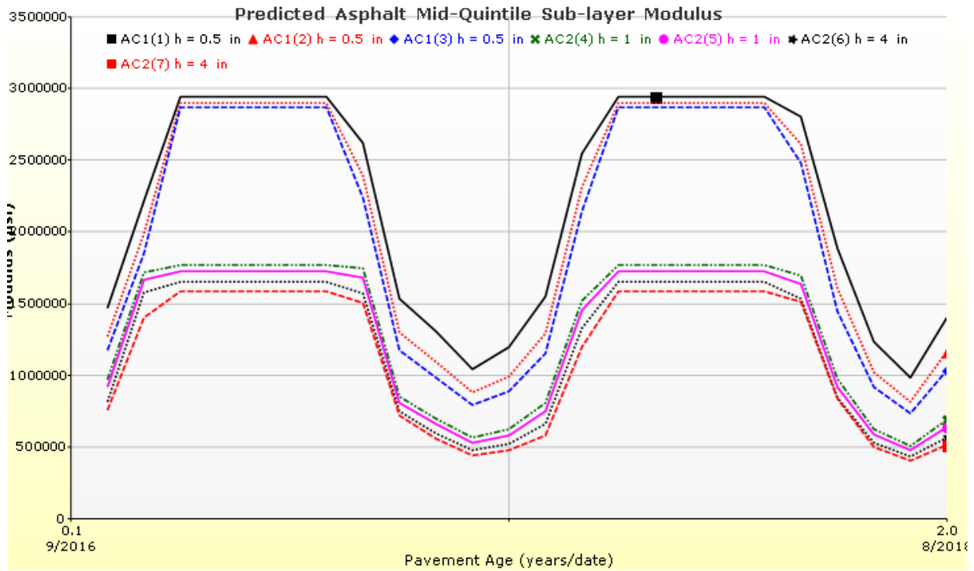
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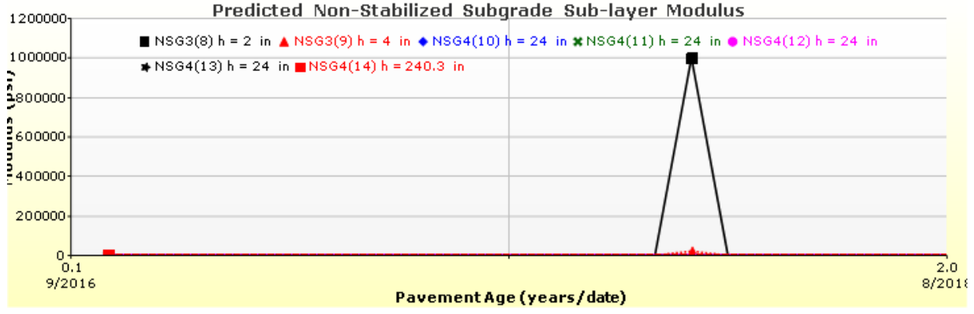




I-65 C2 OS Shldrs-Proposed MOT Treatment

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Layer Information

Layer 1 Flexible : PG76-22 HMA Surface 9.5mm

Asphalt		
Thickness (in.)	1.5	
Unit weight (pcf)	142.6	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 1)

T (ºF)	0.1 Hz	1 Hz	10 Hz	25 Hz
10	1922414	2359663	2741196	3289403
40	1696544	1724379	1802622	1998998
70	360428	552631	742187	871404
100	75322	151689	267916	339650
130	30281	56848	109847	144957

Asphalt Binder

Temperature (ºF)	Binder Gstar (Pa)	Phase angle (deg)
40	19627632.35	32.71
55	9199787.41	42.43
70	3072091.94	50.32
85	926086.84	56.76
100	278615.81	62.04
115	87586.86	66.4
130	29373.15	70.01

General Info

Name	Value
Reference temperature (ºF)	70
Effective binder content (%)	11.61
Air voids (%)	8
Thermal conductivity (BTU/hr-ft-ºF)	0.63
Heat capacity (BTU/lb-ºF)	0.31

Identifiers

Field	Value
Display name/identifier	PG76-22 HMA Surface 9.5mm
Description of object	
Author	
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

I-65 C2 OS Shldrs-Proposed MOT Treatment

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Layer 2 Flexible : HMA(existing)

Asphalt		
Thickness (in.)	10.0	
Unit weight (pcf)	143.8	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 3)

Gradation	Percent Passing
3/4-inch sieve	97
3/8-inch sieve	69
No.4 sieve	43
No.200 sieve	2

Asphalt Binder

Parameter	Value
Grade	Superpave Performance Grade
Binder Type	76-22
A	9.715
VTS	-3.208

General Info

Name	Value
Reference temperature (ºF)	70
Effective binder content (%)	10
Air voids (%)	6
Thermal conductivity (BTU/hr-ft-ºF)	0.63
Heat capacity (BTU/lb-ºF)	0.31

Identifiers

Field	Value
Display name/identifier	HMA
Description of object	
Author	
Date Created	10/30/2010 1:00:00 AM
Approver	
Date approved	10/30/2010 1:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

I-65 C2 OS Shldrs-Proposed MOT Treatment

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Layer 3 Subgrade : A-6

Unbound	
Layer thickness (in.)	6.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Modify input values by temperature/moisture
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
4000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	33.0
Plasticity Index	16.0
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	107.9
Saturated hydraulic conductivity (ft/hr)	False	1.95e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	17.1

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	108.4091
bf	0.6801
cf	0.2161
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	63.2
#100	
#80	73.5
#60	
#50	
#40	82.4
#30	
#20	
#16	
#10	90.2
#8	
#4	93.5
3/8-in.	96.4
1/2-in.	97.4
3/4-in.	98.4
1-in.	99.0
1 1/2-in.	99.5
2-in.	99.8
2 1/2-in.	
3-in.	
3 1/2-in.	100.0

I-65 C2 OS Shldrs-Proposed MOT Treatment

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Layer 4 Subgrade : A-6

Unbound	
Layer thickness (in.)	Semi-infinite
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
4000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	33.0
Plasticity Index	16.0
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	107.9
Saturated hydraulic conductivity (ft/hr)	False	1.95e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	17.1

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	108.4091
bf	0.6801
cf	0.2161
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	63.2
#100	
#80	73.5
#60	
#50	
#40	82.4
#30	
#20	
#16	
#10	90.2
#8	
#4	93.5
3/8-in.	96.4
1/2-in.	97.4
3/4-in.	98.4
1-in.	99.0
1 1/2-in.	99.5
2-in.	99.8
2 1/2-in.	
3-in.	
3 1/2-in.	100.0

I-65 C2 OS Shldrs-Proposed MOT Treatment

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Calibration Coefficients

AC Fatigue

$$N_f = 0.00432 * C * \beta_{f1} k_1 \left(\frac{1}{\varepsilon_1}\right)^{k_2\beta_{f2}} \left(\frac{1}{E}\right)^{k_3\beta_{f3}}$$

$$C = 10^M$$

$$M = 4.84\left(\frac{V_b}{V_a + V_b} - 0.69\right)$$

k1: 0.007566	
k2: 3.9492	
k3: 1.281	
Bf1: 1	
Bf2: 1	
Bf3: 1	

AC Rutting

$$\frac{\varepsilon_p}{\varepsilon_r} = k_z \beta_{r1} 10^{k_1} T^{k_2\beta_{r2}} N^{k_3\beta_{r3}}$$

$$k_z = (C_1 + C_2 * depth) * 0.328196^{depth}$$

$$C_1 = -0.1039 * H_a^2 + 2.4868 * H_a - 17.342$$

$$C_2 = 0.0172 * H_a^2 - 1.7331 * H_a + 27.428$$

Where:

$H_{ac} = total\ AC\ thickness(in)$

$\varepsilon_p = plastic\ strain\left(^{in}/_{in}\right)$
$\varepsilon_r = resilient\ strain\left(^{in}/_{in}\right)$
$T = layer\ temperature(^{\circ}F)$
$N = number\ of\ load\ repetitions$

AC Rutting Standard Deviation	0.24*Pow(RUT,0.8026)+0.001	
AC Layer	K1:-3.35412 K2:1.5606 K3:0.4791	Br1:1 Br2:1 Br3:1

Thermal Fracture

$$C_f = 400 * N\left(\frac{\log C / h_{ac}}{\sigma}\right)$$

$$\Delta C = (k * \beta t)^{n+1} * A * \Delta K^n$$

$$A = 10^{(4.389 - 2.52 * \log(E * \sigma_m * n))}$$

C_f = observed amount of thermal cracking(ft/500ft)
k = refression coefficient determined through field calibration
$N()$ = standard normal distribution evaluated at()
σ = standard deviation of the log of the depth of cracks in the pavments
C = crack depth(in)
h_{ac} = thickness of asphalt layer(in)
ΔC = Change in the crack depth due to a cooling cycle
ΔK = Change in the stress intensity factor due to a cooling cycle
A, n = Fracture parameters for the asphalt mixture
E = mixture stiffness
σ_M = Undamaged mixture tensile strength
β_t = Calibration parameter

Level 1 K: 1.5	Level 1 Standard Deviation: 0.1468 * THERMAL + 65.027
Level 2 K: 0.5	Level 2 Standard Deviation: 0.2841 *THERMAL + 55.462
Level 3 K: 1.5	Level 3 Standard Deviation: 0.3972 * THERMAL + 20.422

CSM Fatigue

$$N_f = 10^{\left(\frac{k_1 \beta_{c1}\left(\frac{\sigma_s}{M_r}\right)}{k_2 \beta_{c2}}\right)}$$

N_f = number of repetitions to fatigue cracking
σ_s = Tensile stress(psi)
M_r = modulus of rupture(psi)

k1: 1	k2: 1	Bc1: 1	Bc2:1

Pavement Design Report Appendix C

I-65 C2 OS Shldrs-Proposed MOT Treatment

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Subgrade Rutting

$$\delta_a(N) = \beta_{s_1} k_1 \varepsilon_v h \left(\frac{\varepsilon_0}{\varepsilon_r}\right) \left| e^{-\left(\frac{\rho}{N}\right)^{\beta}} \right|$$

δ_a = permanent deformation for the layer
N = number of repetitions
ε_v = average veritcal strain(in/in)
$\varepsilon_0, \beta, \rho$ = material properties
ε_r = resilient strain(in/in)

Granular		Fine	
k1: 2.03	Bs1: 1	k1: 1.35	Bs1: 1
Standard Deviation (BASERUT) 0.1477*Pow(BASERUT,0.6711)+0.001		Standard Deviation (BASERUT) 0.1235*Pow(SUBRUT,0.5012)+0.001	

AC Cracking

AC Top Down Cracking

$$FC_{top} = \left(\frac{C_4}{1 + e^{(C_1 - C_2 * \log_{10}(Damage))}}\right) * 10.56$$

c1: 7	c2: 3.5	c3: 0	c4: 1000
AC Cracking Top Standard Deviation			
200 + 2300/(1+exp(1.072-2.1654*LOG10 (TOP+0.0001)))			

AC Bottom Up Cracking

$$FC = \left(\frac{6000}{1 + e^{(C_1 * C_1' + C_2 * C_2' * \log_{10}(D * 100))}}\right) * \left(\frac{1}{60}\right)$$

$$C_2' = -2.40874 - 39.748 * (1 + h_{ac})^{-2.856}$$

$$C_1' = -2 * C_2'$$

c1: 1	c2: 1	c3: 6000
AC Cracking Bottom Standard Deviation		
1.13+13/(1+exp(7.57-15.5*LOG10 (BOTTOM+0.0001)))		

CSM Cracking

$$FC_{ctb} = C_1 + \frac{C_2}{1 + e^{C_3 - C_4(Damage)}}$$

C1 - Rutting
C2 - Fatigue Crack
C3 - Transverse Crack
C4 - Site Factors

C1: 1	C2: 1	C3: 0	C4: 1000
CSM Standard Deviation			
CTB*11			

IRI Flexible Pavements

C1: 40	C2: 0.4	C3: 0.008	C4: 0.015

Reflective Cracking

$$RC = \frac{100}{1 + e^{c.a + d.b.t}}$$

RC = Percent of cracks reflected, %
t = Time, years
h_{ac} = Overlay thickness(in)
a = 3.5 + 0.75(Heff)
b = -0.688584 – 3.37302(Heff)$^{-0.915459}$
c = 1
d = Calibration parameter (user input)

	AC over AC	AC over Rigid, Good Load Transfer	AC over Rigid, Poor Load Transfer
Heff	h_{ac}	$h_{ac} - 1$	$h_{ac} - 3$

Heff	Recommended Calibration Parameter - d	
	Delay Cracking by 2 years	Accelerate Cracking by 2 years
< 4"	0.6	3
4 – 6"	0.7	1.7
> 6"	0.8	1.4

C: 1	D: 1

US 231 OS Shldrs-Proposed Condition (LowTrucks)

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Design Inputs

Design Life: 2 years
Design Type: AC over AC

Existing construction: May, 2014
Pavement construction: June, 2016
Traffic opening: September, 2016

Climate Data Sources (Lat/Lon): 41.453, -87.006; 41.786, -87.752; 41.986, -87.914

Design Structure



Layer type	Material Type	Thickness (in.):
Flexible	PG76-22 9.5mm Surface	1.5
Flexible	HMA	4.0
Subgrade	A-6	6.0
Subgrade	A-6	Semi-infinite

Volumetric at Construction:	
Effective binder content (%)	11.6
Air voids (%)	8.0

Traffic

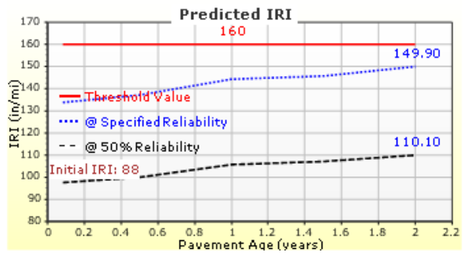
Age (year)	Heavy Trucks (cumulative)
2016 (initial)	1,096
2017 (1 years)	84,866
2018 (2 years)	176,522

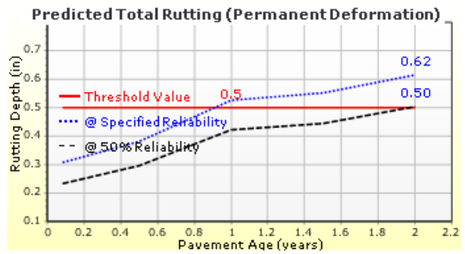
Design Outputs

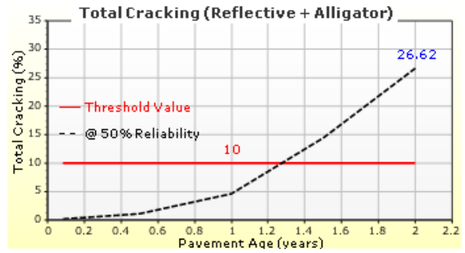
Distress Prediction Summary

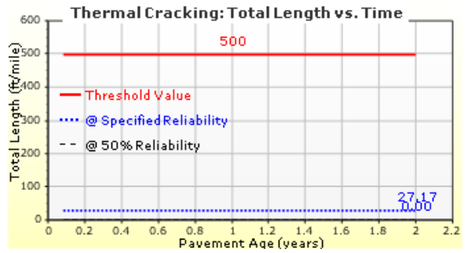
Distress Type	Distress @ Specified Reliability		Reliability (%)		Criterion Satisfied?
	Target	Predicted	Target	Achieved	
Terminal IRI (in./mile)	160.00	149.93	90.00	94.58	Pass
Permanent deformation - total pavement (in.)	0.50	0.62	90.00	48.27	Fail
Total Cracking (Reflective + Alligator) (percent)	10	26.62	-	-	Fail
AC thermal cracking (ft/mile)	500.00	27.17	90.00	100.00	Pass
AC bottom-up fatigue cracking (percent)	10.00	1.45	90.00	100.00	Pass
AC top-down fatigue cracking (ft/mile)	2500.00	4338.96	90.00	67.93	Fail
Permanent deformation - AC only (in.)	0.40	0.11	90.00	100.00	Pass

Distress Charts









Pavement Design Report Appendix C

US 231 OS Shldrs-Proposed Condition (LowTrucks)

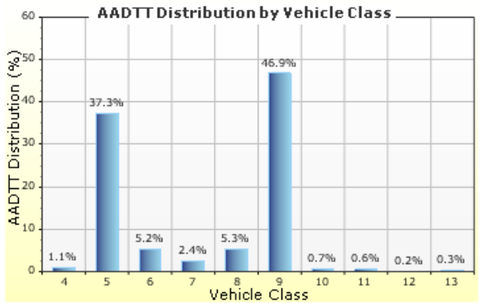
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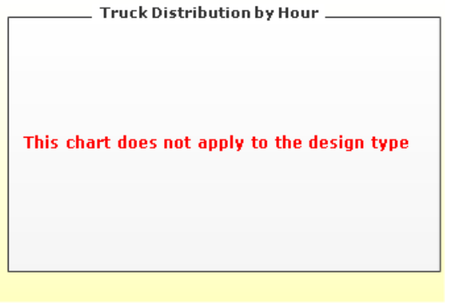
Traffic Inputs

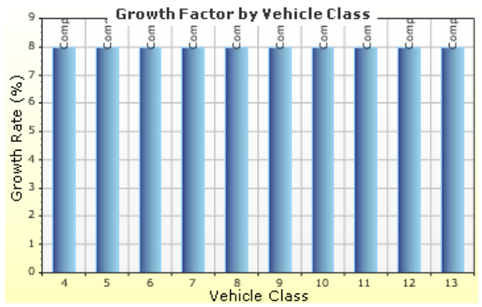
Graphical Representation of Traffic Inputs

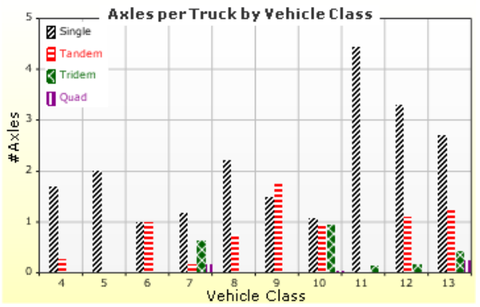
Initial two-way AADTT: 1,096
Number of lanes in design direction: 2

Percent of trucks in design direction (%): 53.0
Percent of trucks in design lane (%): 40.0
Operational speed (mph) 55.0

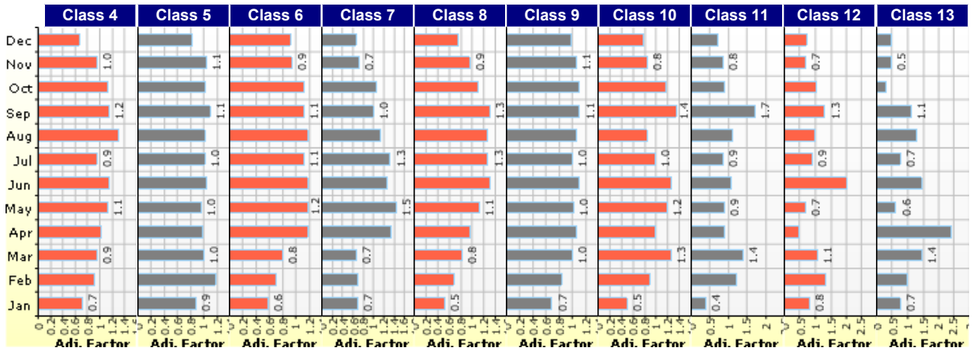








Traffic Volume Monthly Adjustment Factors



US 231 OS Shldrs-Proposed Condition (LowTrucks)

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Tabular Representation of Traffic Inputs

Volume Monthly Adjustment Factors

Level 3: Default MAF

Month	Vehicle Class									
	4	5	6	7	8	9	10	11	12	13
January	0.7	0.9	0.6	0.7	0.5	0.7	0.5	0.4	0.8	0.7
February	0.9	1.2	0.7	0.7	0.7	0.8	0.9	1.2	1.3	1.0
March	0.9	1.0	0.8	0.7	0.8	1.0	1.3	1.4	1.1	1.4
April	1.0	1.0	1.2	1.4	1.0	1.1	1.0	0.9	0.5	2.4
May	1.1	1.0	1.2	1.5	1.1	1.0	1.2	0.9	0.7	0.6
June	1.2	1.0	1.2	1.3	1.3	1.1	1.3	1.1	2.0	1.4
July	0.9	1.0	1.1	1.3	1.3	1.0	1.0	0.9	0.9	0.7
August	1.3	1.0	1.2	1.1	1.3	1.1	0.8	1.1	1.0	1.3
September	1.2	1.1	1.1	1.0	1.3	1.1	1.4	1.7	1.3	1.1
October	1.1	1.0	1.1	1.1	1.1	1.1	1.2	0.9	1.1	0.3
November	1.0	1.1	0.9	0.7	0.9	1.1	0.8	0.8	0.7	0.5
December	0.7	0.8	0.9	0.7	0.7	1.0	0.8	0.7	0.7	0.5

Distributions by Vehicle Class

Truck Distribution by Hour does not apply

Vehicle Class	AADTT Distribution (%) (Level 3)	Growth Factor	
		Rate (%)	Function
Class 4	1.1%	8%	Compound
Class 5	37.3%	8%	Compound
Class 6	5.2%	8%	Compound
Class 7	2.4%	8%	Compound
Class 8	5.3%	8%	Compound
Class 9	46.9%	8%	Compound
Class 10	0.7%	8%	Compound
Class 11	0.6%	8%	Compound
Class 12	0.2%	8%	Compound
Class 13	0.3%	8%	Compound

Axle Configuration

Traffic Wander	
Mean wheel location (in.)	18
Traffic wander standard deviation (in.)	10
Design lane width (ft)	12

Axle Configuration	
Average axle width (ft)	8.5
Dual tire spacing (in.)	12
Tire pressure (psi)	120

Average Axle Spacing	
Tandem axle spacing (in.)	51.6
Tridem axle spacing (in.)	49.2
Quad axle spacing (in.)	49.2

Wheelbase does not apply

Number of Axles per Truck

Vehicle Class	Single Axle	Tandem Axle	Tridem Axle	Quad Axle
Class 4	1.7	0.29	0	0
Class 5	2	0	0	0
Class 6	1	1	0	0
Class 7	1.18	0.18	0.63	0.18
Class 8	2.21	0.78	0	0
Class 9	1.48	1.75	0	0
Class 10	1.08	0.99	0.94	0.03
Class 11	4.43	0.03	0.16	0
Class 12	3.29	1.09	0.17	0
Class 13	2.7	1.22	0.43	0.24

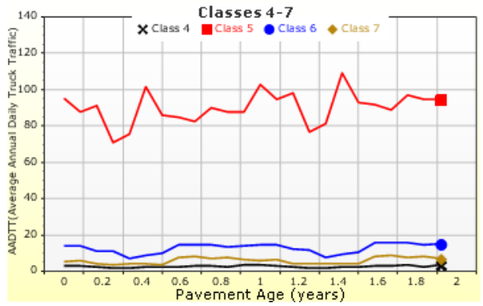
Pavement Design Report Appendix C

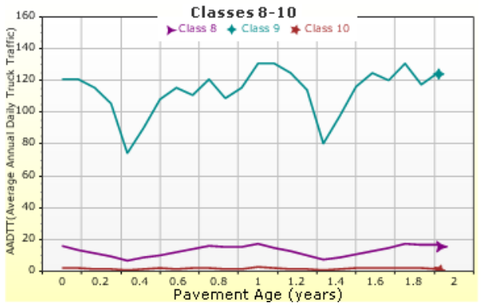
US 231 OS Shldrs-Proposed Condition (LowTrucks)

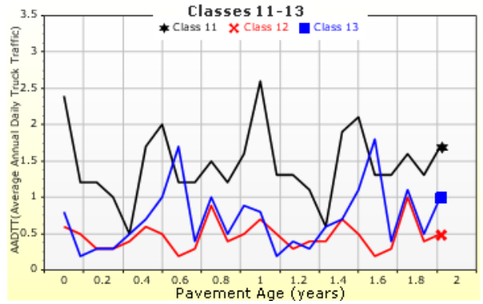
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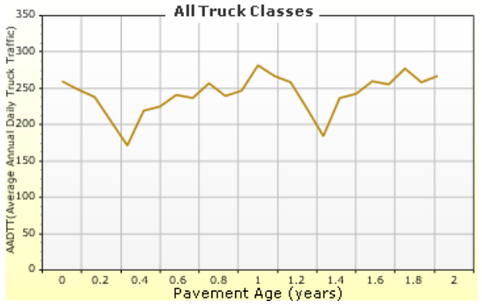
AADTT (Average Annual Daily Truck Traffic) Growth

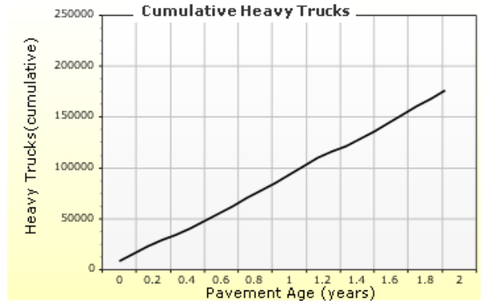
* Traffic cap is not enforced











US 231 OS Shldrs-Proposed Condition (LowTrucks)

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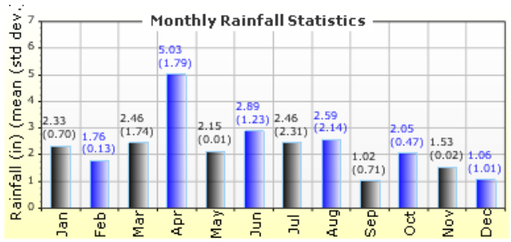
Climate Inputs

Climate Data Sources:

Climate Station Cities:	Location (lat lon elevation(ft))
VALPARAISO, IN	41.45300 -87.00600 770
CHICAGO, IL	41.78600 -87.75200 612
CHICAGO, IL	41.98600 -87.91400 662

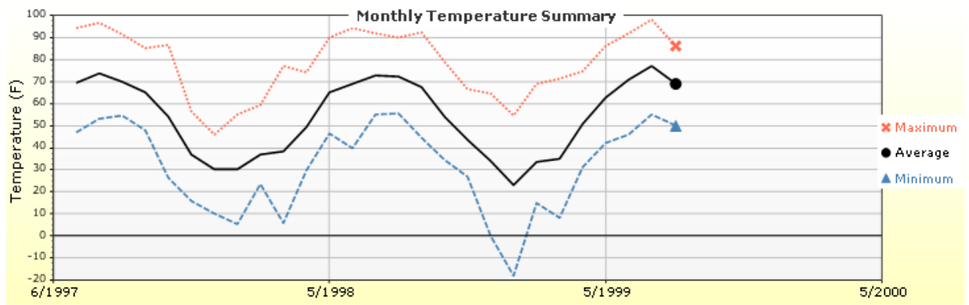
Annual Statistics:

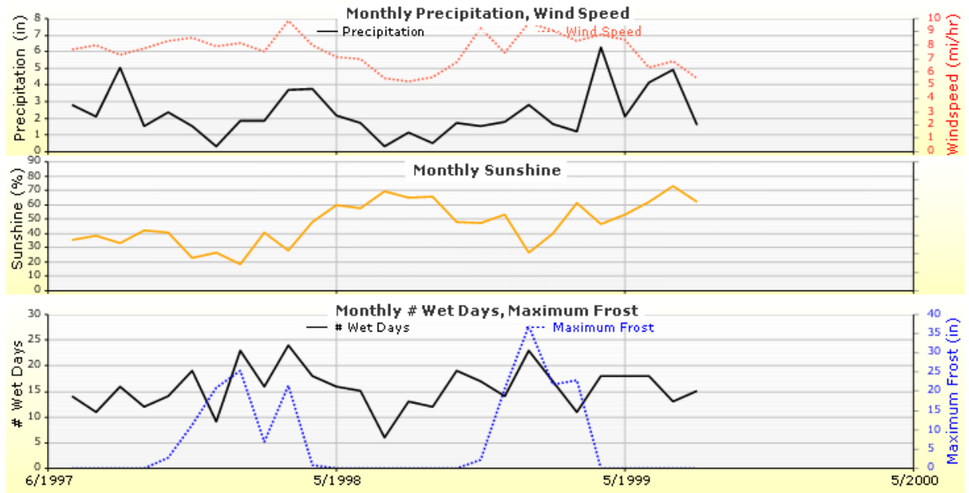
Mean annual air temperature (ºF)	54.23
Mean annual precipitation (in.)	27.49
Freezing index (ºF - days)	453.96
Average annual number of freeze/thaw cycles:	66.35



Water table depth (ft)	4.00

Monthly Climate Summary:



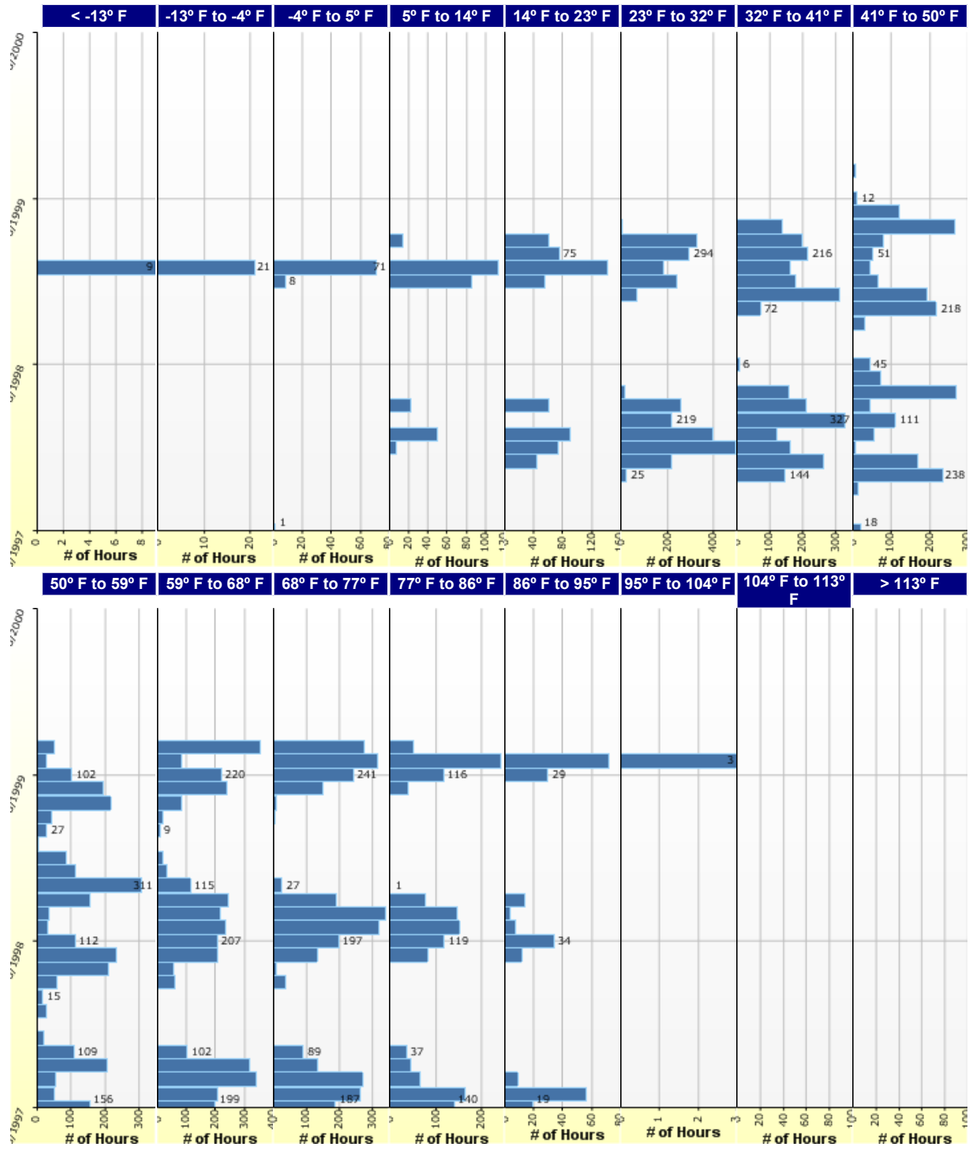


Pavement Design Report Appendix C

US 231 OS Shldrs-Proposed Condition (LowTrucks)

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Hourly Air Temperature Distribution by Month:



US 231 OS Shldrs-Proposed Condition (LowTrucks)

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Design Properties

HMA Design Properties

Use Multilayer Rutting Model	False
Using G* based model (not nationally calibrated)	False
Is NCHRP 1-37A HMA Rutting Model Coefficients	True
Endurance Limit	-
Use Reflective Cracking	True

Layer Name	**Layer Type**	**Interface Friction**
Layer 1 Flexible : PG76-22 9.5mm Surface	Flexible (1)	1.00
Layer 2 Flexible : HMA(existing)	Flexible (1)	1.00
Layer 3 Subgrade : A-6	Subgrade (5)	1.00
Layer 4 Subgrade : A-6	Subgrade (5)	-

Structure - ICM Properties	
AC surface shortwave absorptivity	0.85

HMA Rehabilitation (Input Level: 3)

Milled thickness (in.)	-
Fatigue cracking (%)	-
Pavement rating	Fair
Total rut depth (in.)	0.00

Pavement Design Report Appendix C

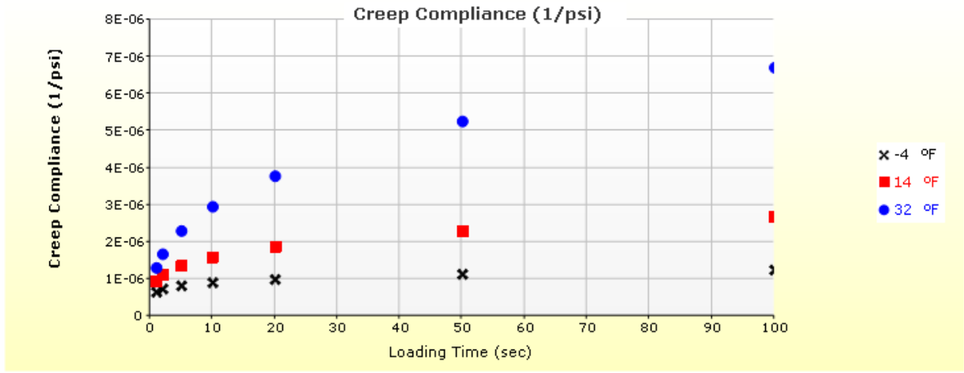
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Thermal Cracking (Input Level: 3)

Indirect tensile strength at 14 °F (psi)	467.26
Thermal Contraction	
Is thermal contraction calculated?	True
Mix coefficient of thermal contraction (in./in./°F)	-
Aggregate coefficient of thermal contraction (in./in./°F)	6.1e-006
Voids in Mineral Aggregate (%)	19.6

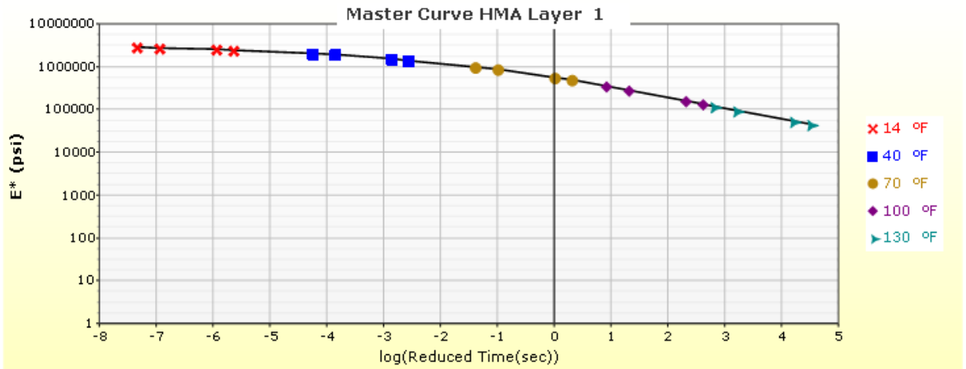
	Creep Compliance (1/psi)		
Loading time (sec)	**-4 °F**	**14 °F**	**32 °F**
1	6.73e-007	9.61e-007	1.32e-006
2	7.41e-007	1.12e-006	1.69e-006
5	8.40e-007	1.38e-006	2.33e-006
10	9.25e-007	1.61e-006	2.98e-006
20	1.02e-006	1.88e-006	3.81e-006
50	1.15e-006	2.31e-006	5.27e-006
100	1.27e-006	2.70e-006	6.74e-006

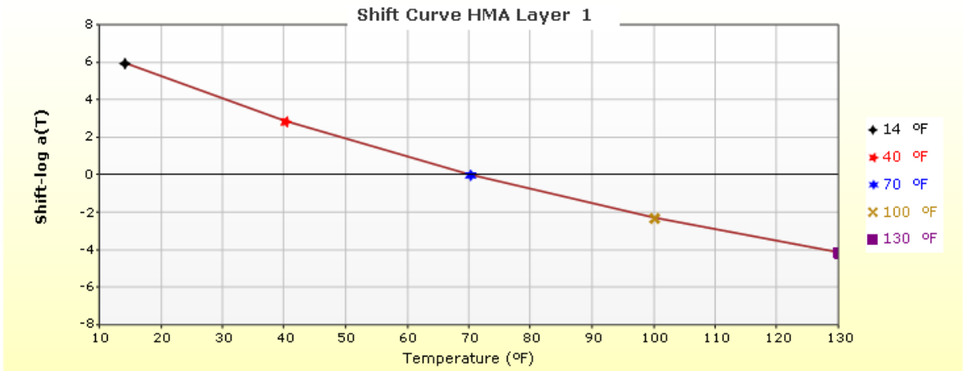


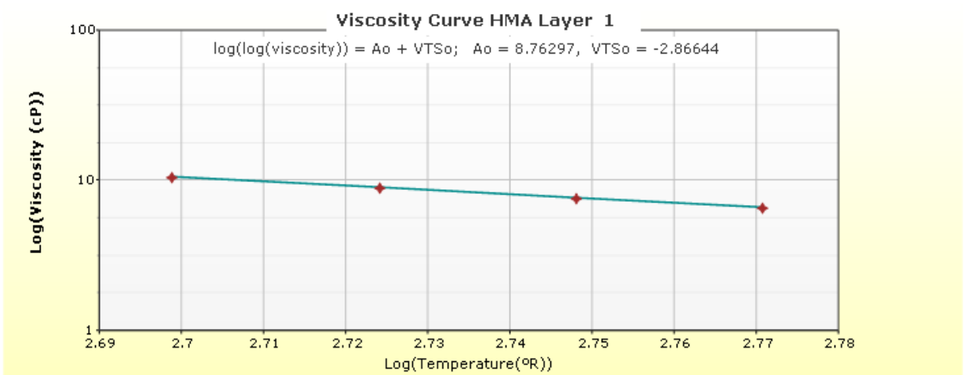
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HMA Layer 1: Layer 1 Flexible : PG76-22 9.5mm Surface



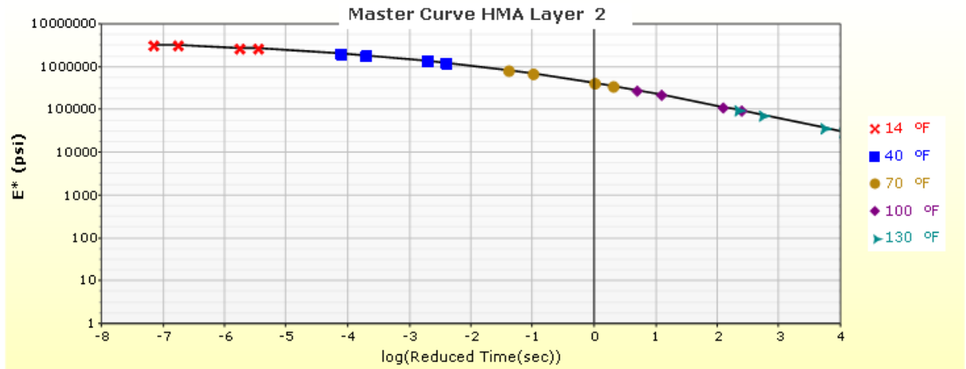


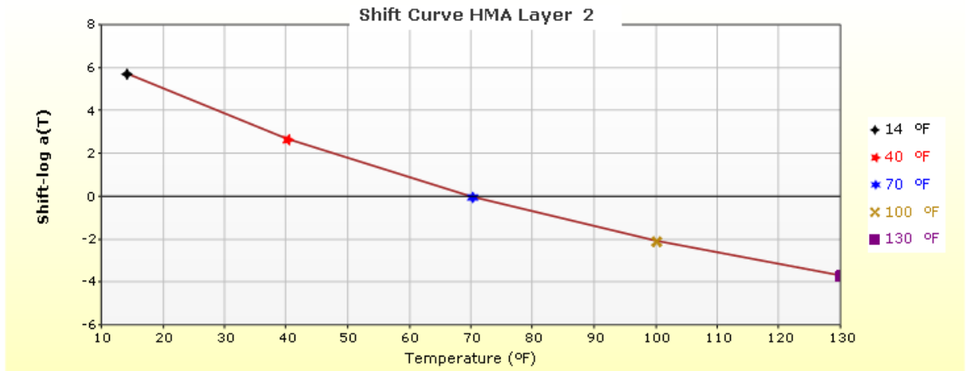


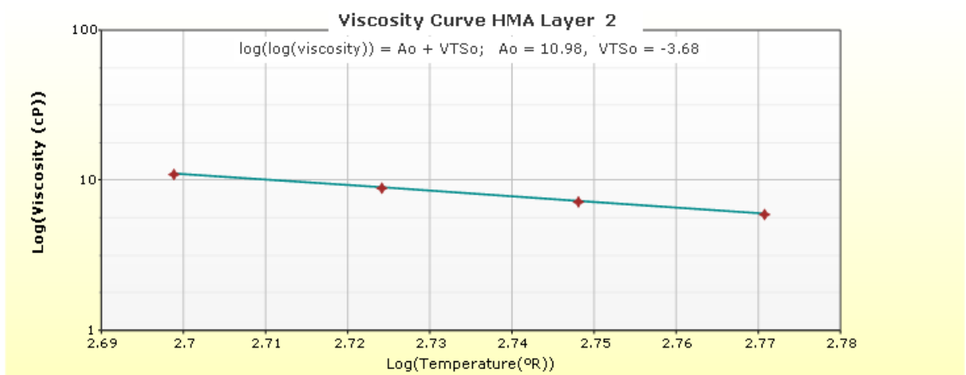
US 231 OS Shldrs-Proposed Condition (LowTrucks)

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HMA Layer 2: Layer 2 Flexible : HMA(existing)



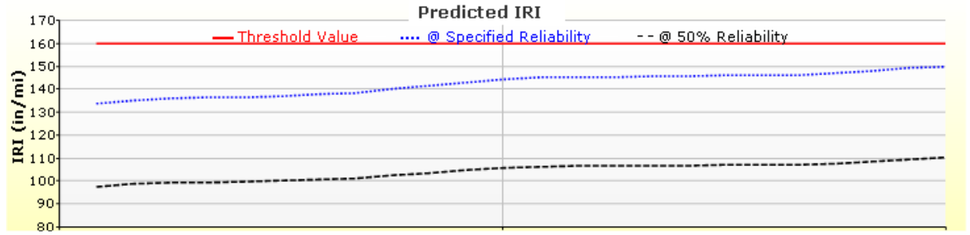


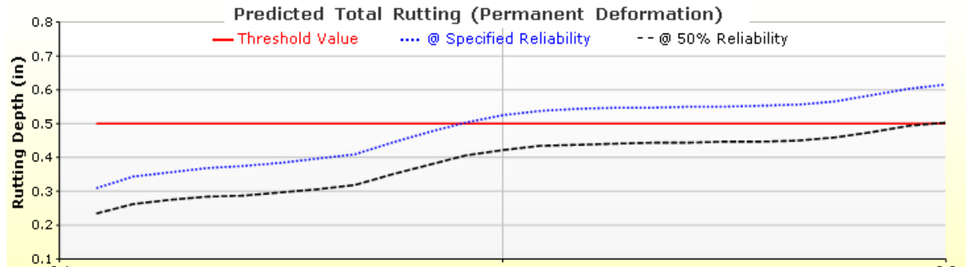


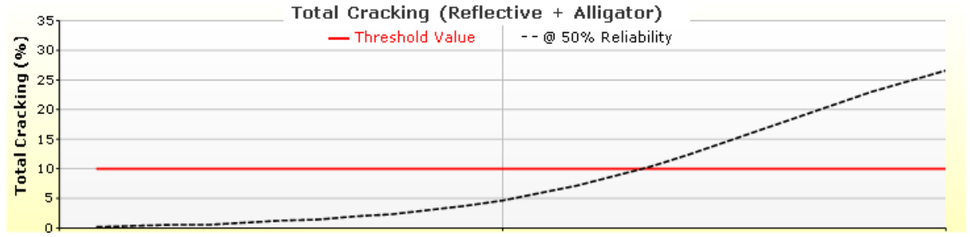
US 231 OS Shldrs-Proposed Condition (LowTrucks)

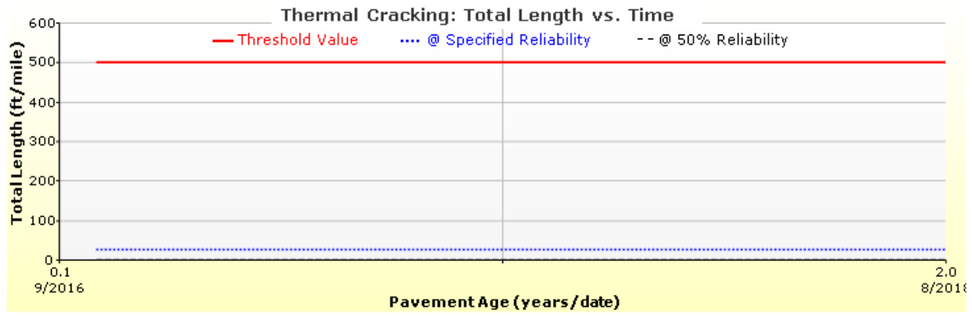
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Analysis Output Charts



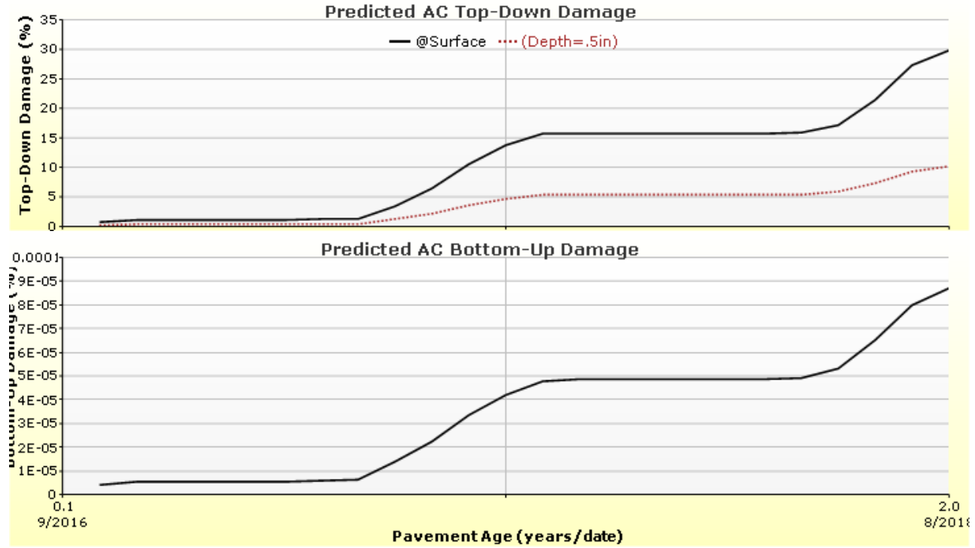


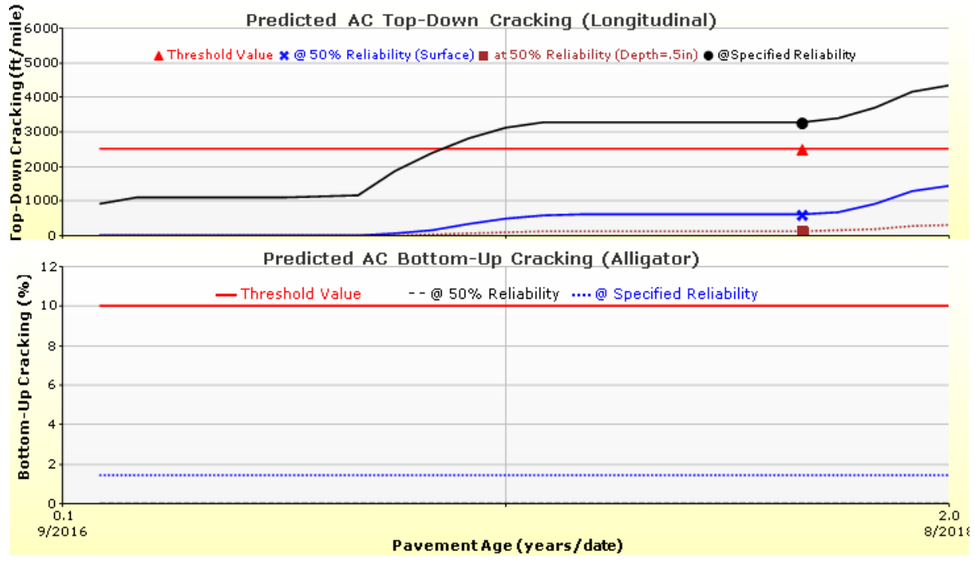




US 231 OS Shldrs-Proposed Condition (LowTrucks)

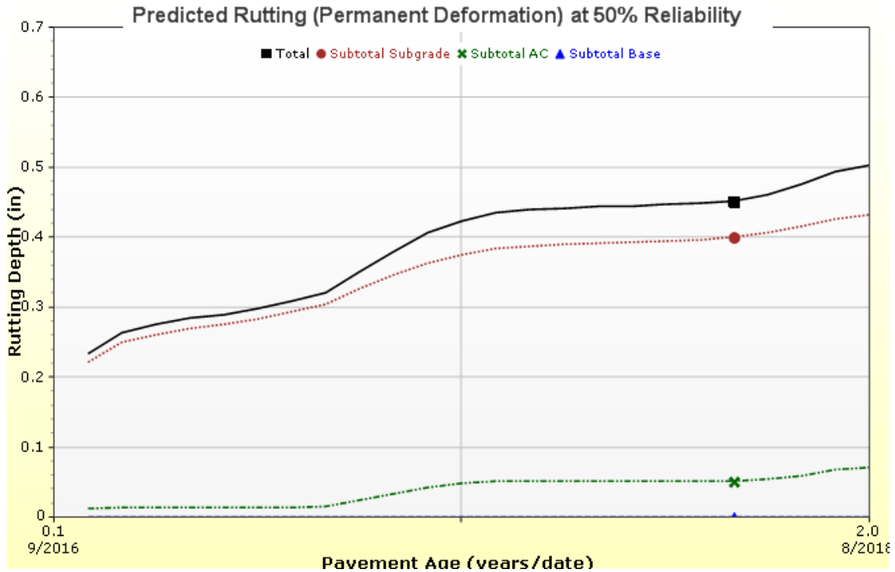
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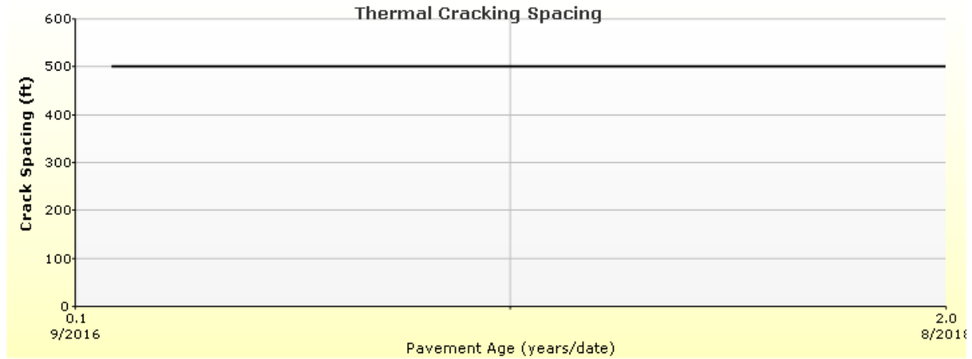
US 231 OS Shldrs-Proposed Condition (LowTrucks)

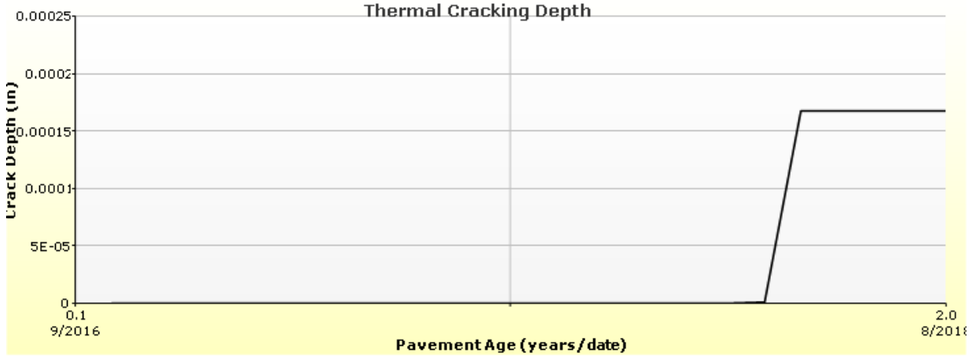
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US 231 OS Shldrs-Proposed Condition (LowTrucks)

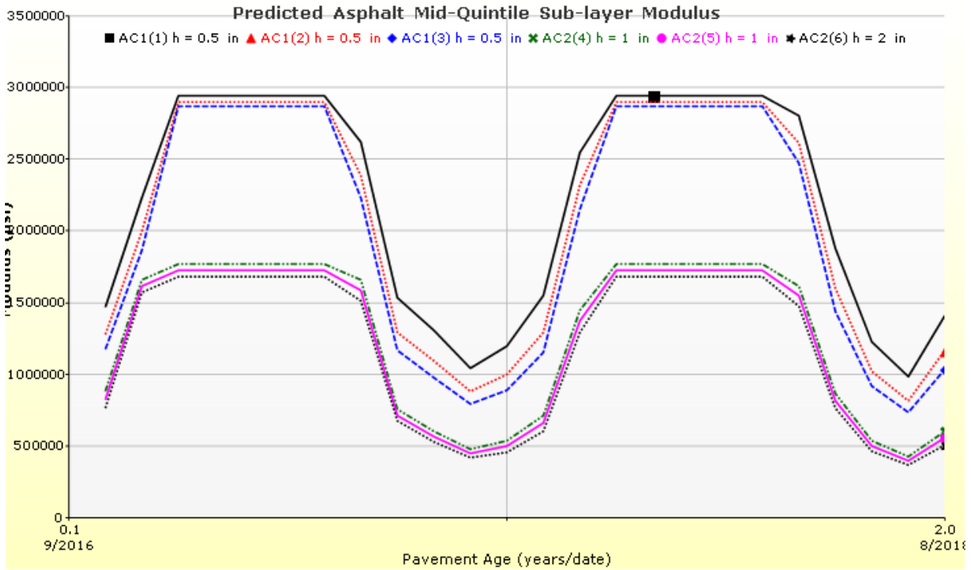
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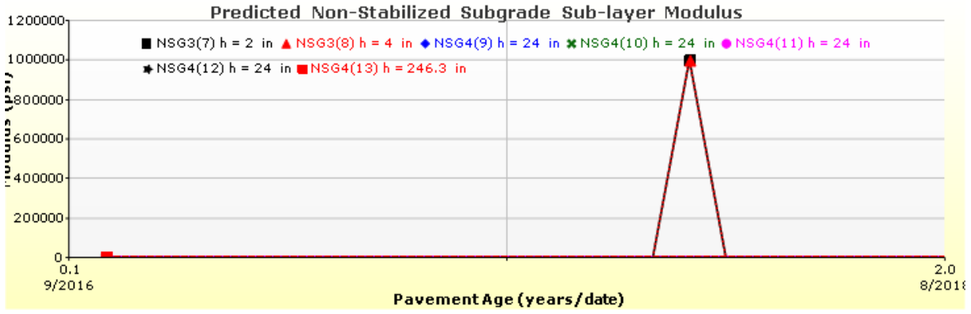




US 231 OS Shldrs-Proposed Condition (LowTrucks)

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\MOT Shoulders - Revised\US 231 OS Shldrs-Proposed Condition (LowTrucks).dgpx





Pavement Design Report Appendix C

US 231 OS Shldrs-Proposed Condition (LowTrucks)

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\MOT Shoulders - Revised\US 231 OS Shldrs-Proposed Condition (LowTrucks).dgpx

Layer Information

Layer 1 Flexible : PG76-22 9.5mm Surface

Asphalt		
Thickness (in.)	1.5	
Unit weight (pcf)	142.6	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 1)

T (°F)	0.1 Hz	1 Hz	10 Hz	25 Hz
10	1922414	2359663	2741196	3289403
40	1696544	1724379	1802622	1998998
70	360428	552631	742187	871404
100	75322	151689	267916	339650
130	30281	56848	109847	144957

Asphalt Binder

Temperature (°F)	Binder Gstar (Pa)	Phase angle (deg)
40	19627632.35	32.71
55	9199787.41	42.43
70	3072091.94	50.32
85	926086.84	56.76
100	278615.81	62.04
115	87586.86	66.4
130	29373.15	70.01

General Info

Name	Value
Reference temperature (°F)	70
Effective binder content (%)	11.61
Air voids (%)	8
Thermal conductivity (BTU/hr-ft-°F)	0.63
Heat capacity (BTU/lb-°F)	0.31

Identifiers

Field	Value
Display name/identifier	PG76-22 9.5mm Surface
Description of object	
Author	
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

US 231 OS Shldrs-Proposed Condition (LowTrucks)

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\MOT Shoulders - Revised\US 231 OS Shldrs-Proposed Condition (LowTrucks).dgpx

Layer 2 Flexible : HMA(existing)

Asphalt		
Thickness (in.)	4.0	
Unit weight (pcf)	143.8	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 3)

Gradation	Percent Passing
3/4-inch sieve	97
3/8-inch sieve	69
No.4 sieve	43
No.200 sieve	2

Asphalt Binder

Parameter	Value
Grade	Superpave Performance Grade
Binder Type	64-22
A	10.98
VTS	-3.68

General Info

Name	Value
Reference temperature (ºF)	70
Effective binder content (%)	10
Air voids (%)	6
Thermal conductivity (BTU/hr-ft-ºF)	0.63
Heat capacity (BTU/lb-ºF)	0.31

Identifiers

Field	Value
Display name/identifier	HMA
Description of object	
Author	
Date Created	10/30/2010 1:00:00 AM
Approver	
Date approved	10/30/2010 1:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

US 231 OS Shldrs-Proposed Condition (LowTrucks)
File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\MOT Shoulders - Revised\US 231 OS Shldrs-Proposed Condition (LowTrucks).dgpx

Layer 3 Subgrade : A-6

Unbound	
Layer thickness (in.)	6.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Modify input values by temperature/moisture
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
4000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	33.0
Plasticity Index	16.0
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	107.9
Saturated hydraulic conductivity (ft/hr)	False	1.95e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	17.1

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	108.4091
bf	0.6801
cf	0.2161
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	63.2
#100	
#80	73.5
#60	
#50	
#40	82.4
#30	
#20	
#16	
#10	90.2
#8	
#4	93.5
3/8-in.	96.4
1/2-in.	97.4
3/4-in.	98.4
1-in.	99.0
1 1/2-in.	99.5
2-in.	99.8
2 1/2-in.	
3-in.	
3 1/2-in.	100.0

US 231 OS Shldrs-Proposed Condition (LowTrucks)

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\MOT Shoulders - Revised\US 231 OS Shldrs-Proposed Condition (LowTrucks).dgpx

Layer 4 Subgrade : A-6

Unbound	
Layer thickness (in.)	Semi-infinite
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
4000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	33.0
Plasticity Index	16.0
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	107.9
Saturated hydraulic conductivity (ft/hr)	False	1.95e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	17.1

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	108.4091
bf	0.6801
cf	0.2161
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	63.2
#100	
#80	73.5
#60	
#50	
#40	82.4
#30	
#20	
#16	
#10	90.2
#8	
#4	93.5
3/8-in.	96.4
1/2-in.	97.4
3/4-in.	98.4
1-in.	99.0
1 1/2-in.	99.5
2-in.	99.8
2 1/2-in.	
3-in.	
3 1/2-in.	100.0

US 231 OS Shldrs-Proposed Condition (LowTrucks)
File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\MOT Shoulders - Revised\US 231 OS Shldrs-Proposed Condition (LowTrucks).dgpx

Calibration Coefficients

AC Fatigue	
$N_f = 0.00432 * C * \beta_{f1} k_1 \left(\frac{1}{\varepsilon_1}\right)^{k_2\beta_{f2}} \left(\frac{1}{E}\right)^{k_3\beta_{f3}}$	k1: 0.007566
	k2: 3.9492
	k3: 1.281
$C = 10^M$	Bf1: 1
$M = 4.84\left(\frac{V_b}{V_a + V_b} - 0.69\right)$	Bf2: 1
	Bf3: 1

AC Rutting

$$\frac{\varepsilon_p}{\varepsilon_r} = k_z \beta_{r1} 10^{k_1} T^{k_2\beta_{r2}} N^{k_3\beta_{r3}}$$

$$k_z = (C_1 + C_2 * depth) * 0.328196^{depth}$$

$$C_1 = -0.1039 * H_a^2 + 2.4868 * H_a - 17.342$$

$$C_2 = 0.0172 * H_a^2 - 1.7331 * H_a + 27.428$$

Where:

$H_{ac} = total\ AC\ thickness(in)$

$\varepsilon_p = plastic\ strain\left(^{in}/_{in}\right)$
$\varepsilon_r = resilient\ strain\left(^{in}/_{in}\right)$
$T = layer\ temperature(^{\circ}F)$
$N = number\ of\ load\ repetitions$

AC Rutting Standard Deviation	0.24*Pow(RUT,0.8026)+0.001	
AC Layer	K1:-3.35412 K2:1.5606 K3:0.4791	Br1:1 Br2:1 Br3:1

Thermal Fracture

$$C_f = 400 * N\left(\frac{\log C / h_{ac}}{\sigma}\right)$$

$$\Delta C = (k * \beta t)^{n+1} * A * \Delta K^n$$

$$A = 10^{(4.389 - 2.52 * \log(E * \sigma_m * n))}$$

$C_f = observed\ amount\ of\ thermal\ cracking(ft/500ft)$
$k = refression\ coefficient\ determined\ through\ field\ calibration$
$N() = standard\ normal\ distribution\ evaluated\ at()$
$\sigma = standard\ deviation\ of\ the \log\ of\ the\ depth\ of\ cracks\ in\ the\ pavments$
$C = crack\ depth(in)$
$h_{ac} = thickness\ of\ asphalt\ layer(in)$
$\Delta C = Change\ in\ the\ crack\ depth\ due\ to\ a\ cooling\ cycle$
$\Delta K = Change\ in\ the\ stress\ intensity\ factor\ due\ to\ a\ cooling\ cycle$
$A, n = Fracture\ parameters\ for\ the\ asphalt\ mixture$
$E = mixture\ stiffness$
$\sigma_M = Undamaged\ mixture\ tensile\ strength$
$\beta_t = Calibration\ parameter$

Level 1 K: 1.5	Level 1 Standard Deviation: 0.1468 * THERMAL + 65.027
Level 2 K: 0.5	Level 2 Standard Deviation: 0.2841 *THERMAL + 55.462
Level 3 K: 1.5	Level 3 Standard Deviation: 0.3972 * THERMAL + 20.422

CSM Fatigue

$$N_f = 10^{\left(\frac{k_1 \beta_{c1} \left(\frac{\sigma_s}{M_r}\right)}{k_2 \beta_{c2}}\right)}$$

$N_f = number\ of\ repetitions\ to\ fatigue\ cracking$
$\sigma_s = Tensile\ stress(psi)$
$M_r = modulus\ of\ rupture(psi)$

k1: 1	k2: 1	Bc1: 1	Bc2:1

US 231 OS Shldrs-Proposed Condition (LowTrucks)

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\MOT Shoulders - Revised\US 231 OS Shldrs-Proposed Condition (LowTrucks).dgpx

Subgrade Rutting

$$\delta_a(N) = \beta_{s_1} k_1 \varepsilon_v h \left(\frac{\varepsilon_0}{\varepsilon_r}\right) \left| e^{-\left(\frac{\rho}{N}\right)^{\beta}} \right|$$

δ_a = permanent deformation for the layer
N = number of repetitions
ε_v = average veritcal strain(in/in)
$\varepsilon_0, \beta, \rho$ = material properties
ε_r = resilient strain(in/in)

Granular		Fine	
k1: 2.03	Bs1: 1	k1: 1.35	Bs1: 1
Standard Deviation (BASERUT) 0.1477*Pow(BASERUT,0.6711)+0.001		Standard Deviation (BASERUT) 0.1235*Pow(SUBRUT,0.5012)+0.001	

AC Cracking

AC Top Down Cracking

$$FC_{top} = \left(\frac{C_4}{1 + e^{(C_1 - C_2 * log_{10}(Damage))}}\right) * 10.56$$

c1: 7	c2: 3.5	c3: 0	c4: 1000

AC Cracking Top Standard Deviation

200 + 2300/(1+exp(1.072-2.1654*LOG10 (TOP+0.0001)))

AC Bottom Up Cracking

$$FC = \left(\frac{6000}{1 + e^{(C_1 * C_1' + C_2 * C_2' * log_{10}(D * 100))}}\right) * \left(\frac{1}{60}\right)$$

$$C_2' = -2.40874 - 39.748 * (1 + h_{ac})^{-2.856}$$

$$C_1' = -2 * C_2'$$

c1: 1	c2: 1	c3: 6000

AC Cracking Bottom Standard Deviation

1.13+13/(1+exp(7.57-15.5*LOG10 (BOTTOM+0.0001)))

CSM Cracking

$$FC_{ctb} = C_1 + \frac{C_2}{1 + e^{C_3 - C_4 (Damage)}}$$

C1: 1	C2: 1	C3: 0	C4: 1000

CSM Standard Deviation

CTB*11

IRI Flexible Pavements

C1 - Rutting
C2 - Fatigue Crack
C3 - Transverse Crack
C4 - Site Factors

C1: 40	C2: 0.4	C3: 0.008	C4: 0.015

Reflective Cracking

$$RC = \frac{100}{1 + e^{c.a + d.b.t}}$$

RC = Percent of cracks reflected, %
t = Time, years
h_{ac} = Overlay thickness(in)
a = 3.5 + 0.75(Heff)
b = -0.688584 – 3.37302(Heff)$^{-0.91545}$
c = 1
d = Calibration parameter (user input)

	AC over AC	AC over Rigid, Good Load Transfer	AC over Rigid, Poor Load Transfer
Heff	h_{ac}	$h_{ac} - 1$	$h_{ac} - 3$

Heff	Recommended Calibration Parameter - d	
	Delay Cracking by 2 years	Accelerate Cracking by 2 years
< 4"	0.6	3
4 – 6"	0.7	1.7
> 6"	0.8	1.4

C: 1	D: 1

Report generated on: 6/22/2016 7:40 AM
Created by: on: 5/9/2016 10:08 AM
Approved by: on: 5/9/2016 10:08 AM

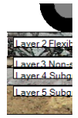
I-65 C2 Crossover Pavement - 7

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Crossover\I-65 C2 Crossover Pavement - 7.dgpx

Design Inputs

Design Life: 2 years
Design Type: Flexible Pavement
Base construction: May, 2016
Pavement construction: June, 2016
Traffic opening: September, 2016
Climate Data Sources (Lat/Lon): 41.453, -87.006; 41.786, -87.752; 41.986, -87.914

Design Structure



Layer type	Material Type	Thickness (in.):
Flexible	PG76-22 HMA Surface 9.5mm	1.5
Flexible	PG76-22 HMA Intermediate 19.0mm	7.0
NonStabilized	Crushed stone	4.0
Subgrade	A-6	6.0
Subgrade	A-6	Semi-infinite

Volumetric at Construction:

Effective binder content (%)	11.6
Air voids (%)	8.0

Traffic

Age (year)	Heavy Trucks (cumulative)
2016 (initial)	20,107
2017 (1 years)	3,767,510
2018 (2 years)	7,572,700

Design Outputs

Distress Prediction Summary

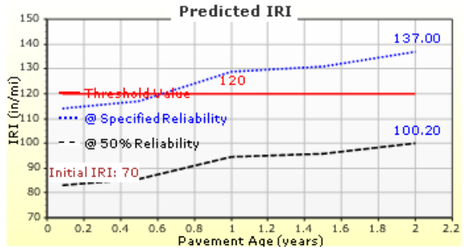
Distress Type	Distress @ Specified Reliability		Reliability (%)		Criterion Satisfied?
	Target	Predicted	Target	Achieved	
Terminal IRI (in./mile)	120.00	137.01	90.00	75.46	Fail
Permanent deformation - total pavement (in.)	0.50	0.82	90.00	4.73	Fail
AC bottom-up fatigue cracking (percent)	10.00	22.83	90.00	64.30	Fail
AC thermal cracking (ft/mile)	500.00	27.17	90.00	100.00	Pass
AC top-down fatigue cracking (ft/mile)	2500.00	994.15	90.00	99.94	Pass
Permanent deformation - AC only (in.)	0.25	0.28	90.00	78.79	Fail

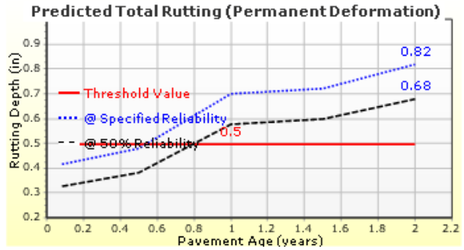
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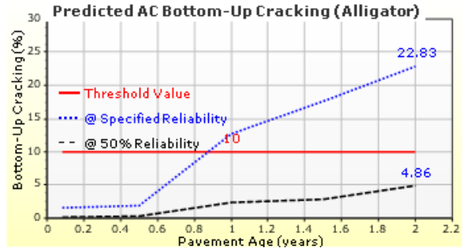
I-65 C2 Crossover Pavement - 7

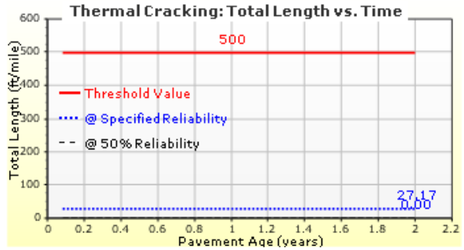
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Distress Charts









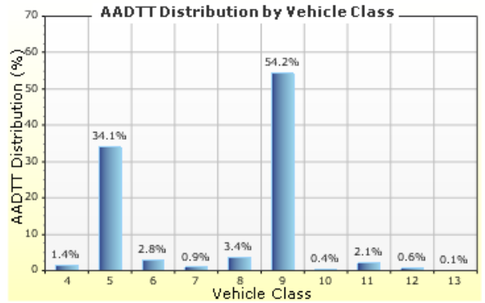
I-65 C2 Crossover Pavement - 7

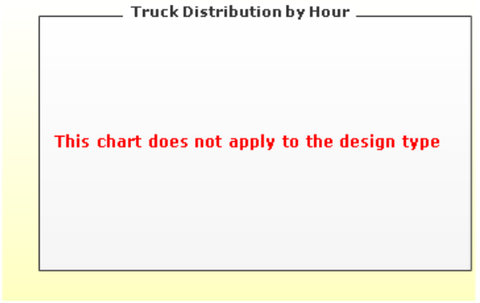
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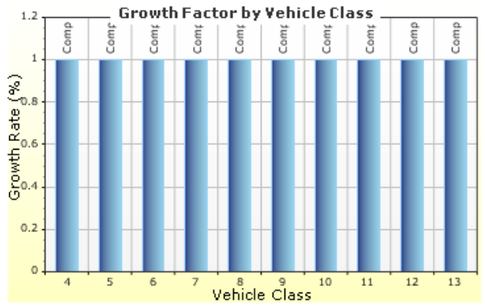
Traffic Inputs

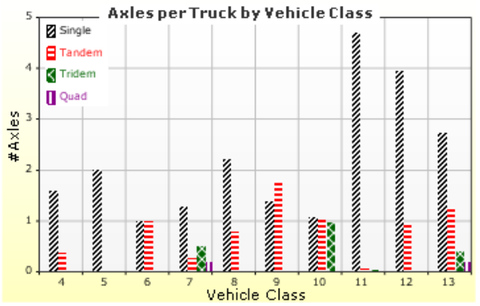
Graphical Representation of Traffic Inputs

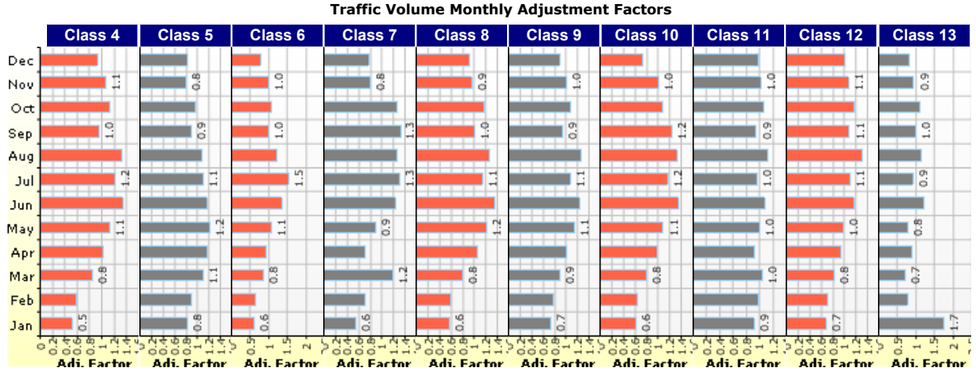
Initial two-way AADTT:	20,107	Percent of trucks in design direction (%):	57.0
Number of lanes in design direction:	2	Percent of trucks in design lane (%):	90.0
		Operational speed (mph)	55.0











I-65 C2 Crossover Pavement - 7

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Tabular Representation of Traffic Inputs

Volume Monthly Adjustment Factors

Level 3: Default MAF

Month	Vehicle Class									
	4	5	6	7	8	9	10	11	12	13
January	0.5	0.8	0.6	0.6	0.6	0.7	0.6	0.9	0.7	1.7
February	0.6	0.9	0.6	0.7	0.6	0.8	0.6	1.0	0.7	0.8
March	0.8	1.1	0.8	1.2	0.8	0.9	0.8	1.0	0.8	0.7
April	1.0	1.2	0.9	0.7	1.1	1.0	1.0	0.9	0.9	0.9
May	1.1	1.2	1.1	0.9	1.2	1.1	1.1	1.0	1.0	0.8
June	1.4	1.2	1.3	1.2	1.4	1.2	1.3	1.1	1.2	1.2
July	1.2	1.1	1.5	1.3	1.1	1.1	1.2	1.0	1.1	0.9
August	1.3	1.1	1.3	1.3	1.3	1.3	1.3	1.1	1.3	1.2
September	1.0	0.9	1.0	1.3	1.0	0.9	1.2	0.9	1.1	1.0
October	1.1	0.9	1.1	1.3	1.2	1.1	1.1	1.1	1.2	1.1
November	1.1	0.8	1.0	0.8	0.9	1.0	1.0	1.0	1.1	0.9
December	0.9	0.8	0.8	0.8	0.9	0.9	0.7	1.0	1.0	0.8

Distributions by Vehicle Class

Truck Distribution by Hour does not apply

Vehicle Class	AADTT Distribution (%) (Level 3)	Growth Factor	
		Rate (%)	Function
Class 4	1.4%	1%	Compound
Class 5	34.1%	1%	Compound
Class 6	2.8%	1%	Compound
Class 7	0.9%	1%	Compound
Class 8	3.4%	1%	Compound
Class 9	54.2%	1%	Compound
Class 10	0.4%	1%	Compound
Class 11	2.1%	1%	Compound
Class 12	0.6%	1%	Compound
Class 13	0.1%	1%	Compound

Axle Configuration

Traffic Wander	
Mean wheel location (in.)	18
Traffic wander standard deviation (in.)	10
Design lane width (ft)	12

Axle Configuration	
Average axle width (ft)	8.5
Dual tire spacing (in.)	12
Tire pressure (psi)	120

Average Axle Spacing	
Tandem axle spacing (in.)	51.6
Tridem axle spacing (in.)	49.2
Quad axle spacing (in.)	49.2

Wheelbase does not apply

Number of Axles per Truck

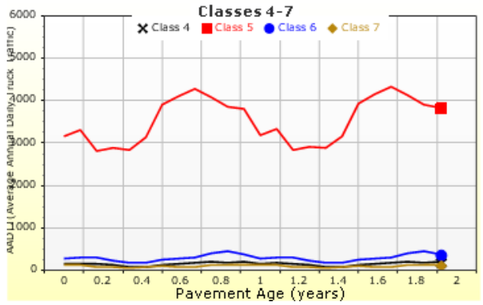
Vehicle Class	Single Axle	Tandem Axle	Tridem Axle	Quad Axle
Class 4	1.6	0.39	0	0
Class 5	2	0	0	0
Class 6	1	1	0	0
Class 7	1.29	0.29	0.5	0.19
Class 8	2.19	0.8	0	0
Class 9	1.37	1.8	0	0
Class 10	1.05	1.02	0.96	0.01
Class 11	4.71	0.08	0.03	0
Class 12	3.94	0.99	0.01	0
Class 13	2.73	1.25	0.41	0.2

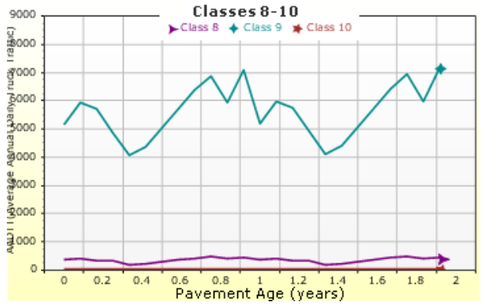
I-65 C2 Crossover Pavement - 7

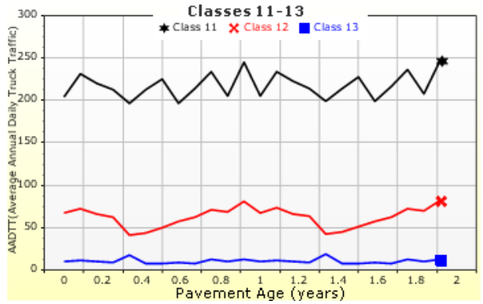
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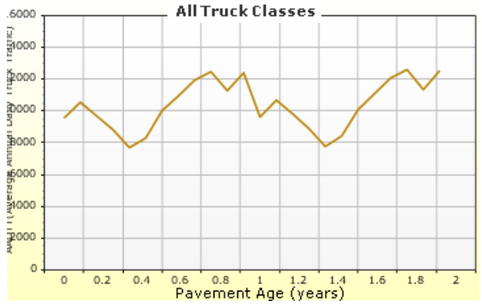
AADTT (Average Annual Daily Truck Traffic) Growth

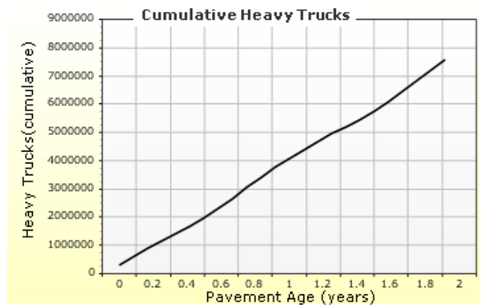
*** Traffic cap is not enforced**











I-65 C2 Crossover Pavement - 7

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Crossover\I-65 C2 Crossover Pavement - 7.dgpx

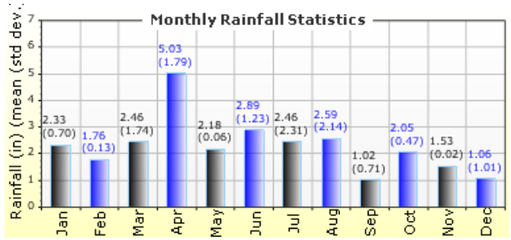
Climate Inputs

Climate Data Sources:

Climate Station Cities:	Location (lat lon elevation(ft))
VALPARAISO, IN	41.45300 -87.00600 770
CHICAGO, IL	41.78600 -87.75200 612
CHICAGO, IL	41.98600 -87.91400 662

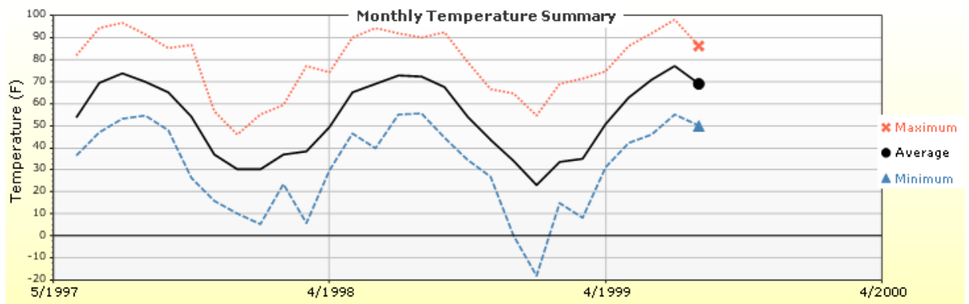
Annual Statistics:

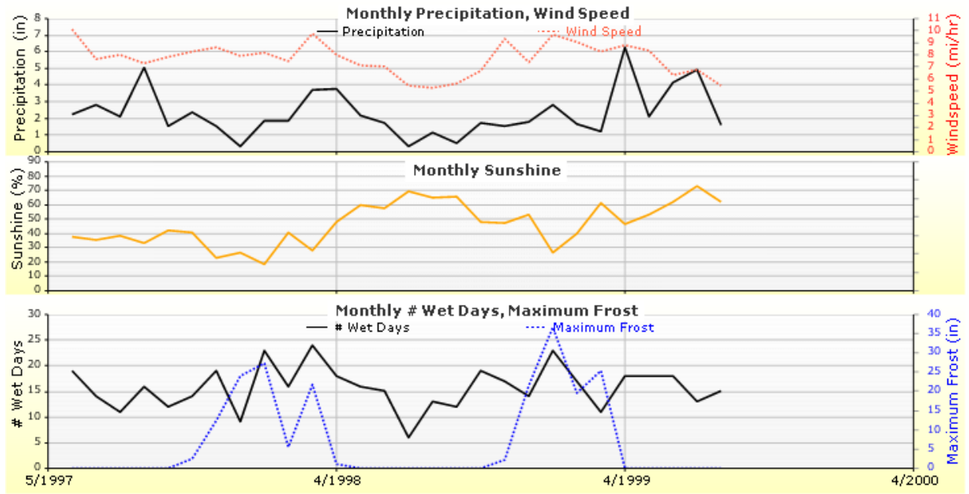
Mean annual air temperature (ºF)	54.21
Mean annual precipitation (in.)	27.46
Freezing index (ºF - days)	438.02
Average annual number of freeze/thaw cycles:	66.35



Water table depth (ft)	4.00

Monthly Climate Summary:



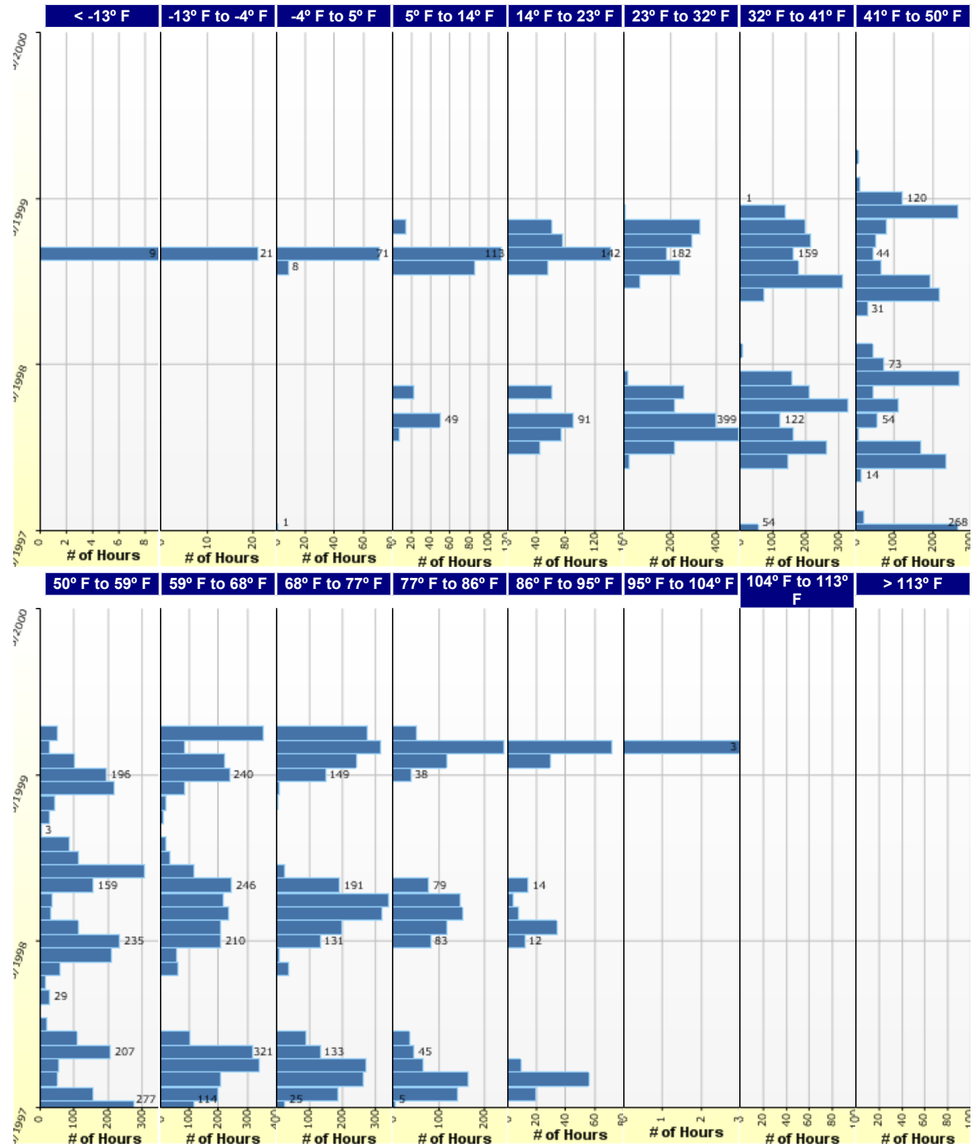


Pavement Design Report Appendix C

I-65 C2 Crossover Pavement - 7

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Hourly Air Temperature Distribution by Month:



I-65 C2 Crossover Pavement - 7

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Design Properties

HMA Design Properties

Use Multilayer Rutting Model	False
Using G* based model (not nationally calibrated)	False
Is NCHRP 1-37A HMA Rutting Model Coefficients	True
Endurance Limit	-
Use Reflective Cracking	True

Structure - ICM Properties	
AC surface shortwave absorptivity	0.85

Layer Name	Layer Type	Interface Friction
Layer 1 Flexible : PG76-22 HMA Surface 9.5mm	Flexible (1)	1.00
Layer 2 Flexible : PG76-22 HMA Intermediate 19.0mm	Flexible (1)	1.00
Layer 3 Non-stabilized Base : Crushed stone	Non-stabilized Base (4)	1.00
Layer 4 Subgrade : A-6	Subgrade (5)	1.00
Layer 5 Subgrade : A-6	Subgrade (5)	-

Pavement Design Report Appendix C

I-65 C2 Crossover Pavement - 7

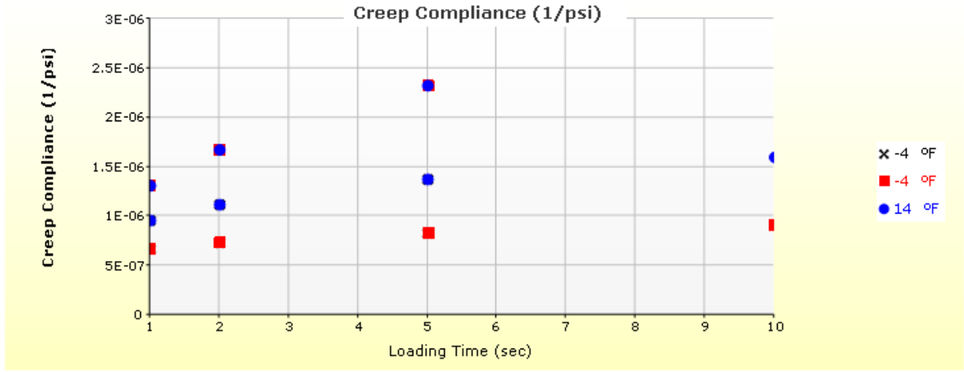
File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Crossover\I-65 C2 Crossover Pavement - 7.dgpx

Thermal Cracking (Input Level: 3)

Indirect tensile strength at 14 °F (psi)	467.26

Thermal Contraction	
Is thermal contraction calculated?	True
Mix coefficient of thermal contraction (in./in./°F)	-
Aggregate coefficient of thermal contraction (in./in./°F)	6.1e-006
Voids in Mineral Aggregate (%)	19.6

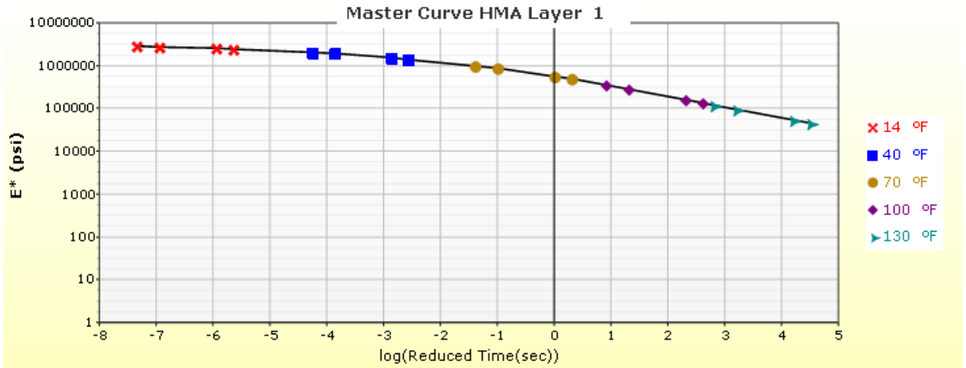
	Creep Compliance (1/psi)		
Loading time (sec)	**-4 °F**	**-4 °F**	**14 °F**
1	6.73e-007	6.73e-007	9.61e-007
1	9.61e-007	1.32e-006	1.32e-006
2	7.41e-007	7.41e-007	1.12e-006
2	1.12e-006	1.69e-006	1.69e-006
5	8.40e-007	8.40e-007	1.38e-006
5	1.38e-006	2.33e-006	2.33e-006
10	9.25e-007	9.25e-007	1.61e-006

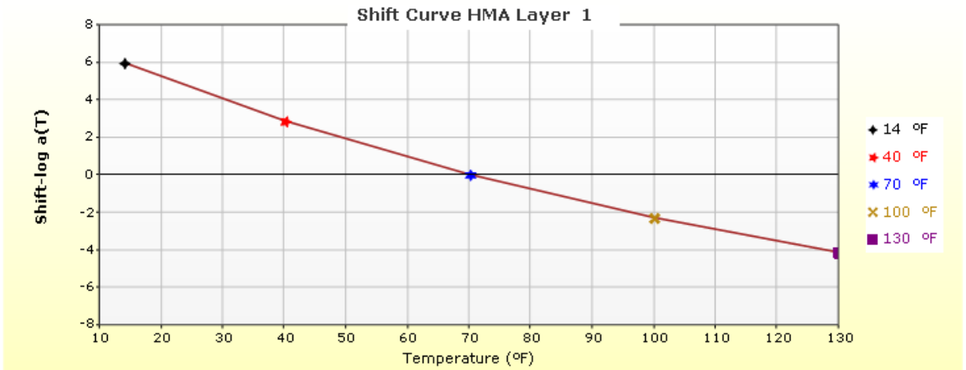


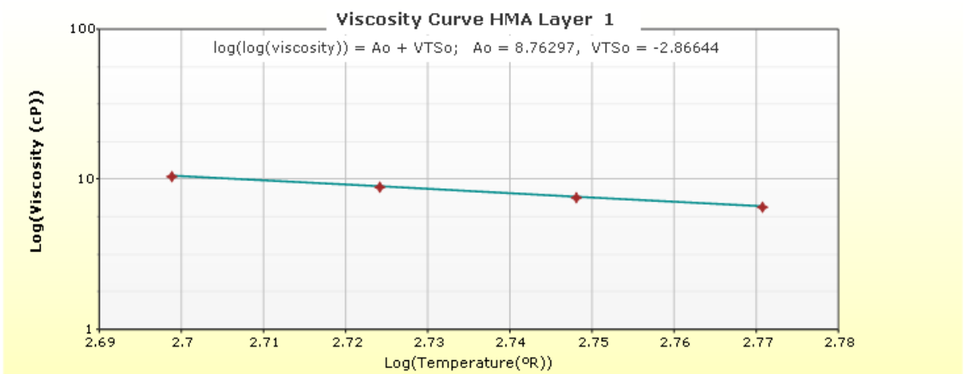
I-65 C2 Crossover Pavement - 7

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Crossover\I-65 C2 Crossover Pavement - 7.dgpx

HMA Layer 1: Layer 1 Flexible : PG76-22 HMA Surface 9.5mm







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Created by: on: 5/9/2016 10:08 AM

Approved by: on: 5/9/2016 10:08 AM

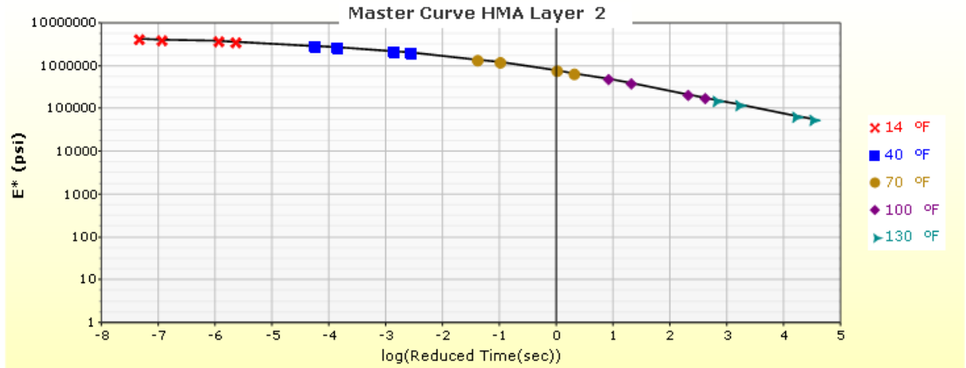
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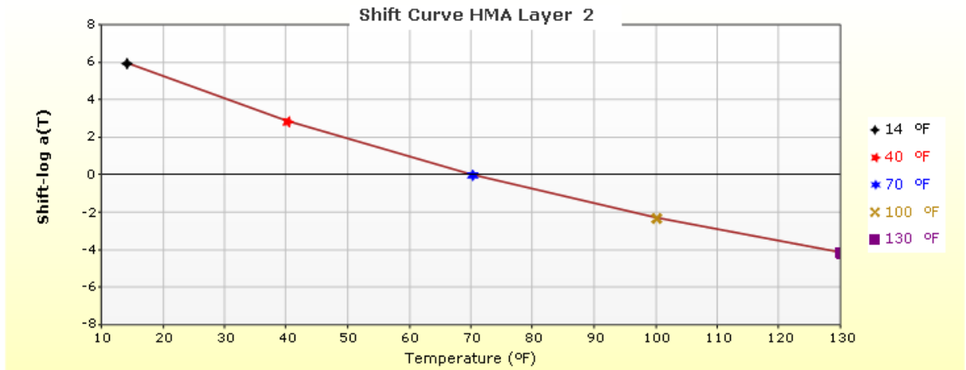
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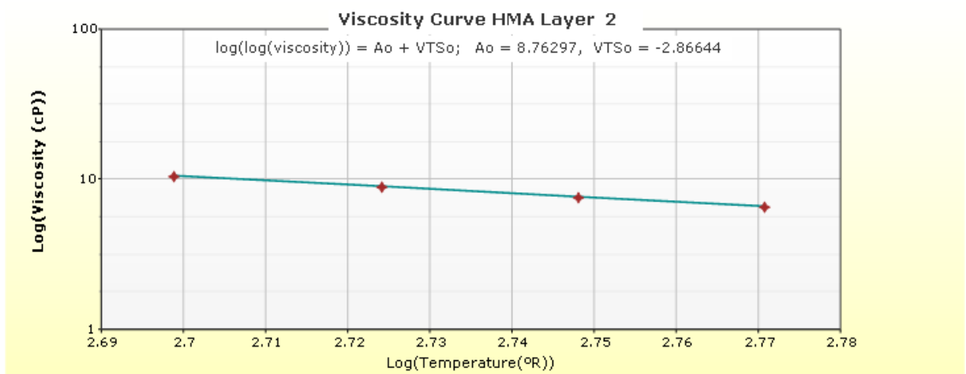
I-65 C2 Crossover Pavement - 7

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HMA Layer 2: Layer 2 Flexible : PG76-22 HMA Intermediate 19.0mm







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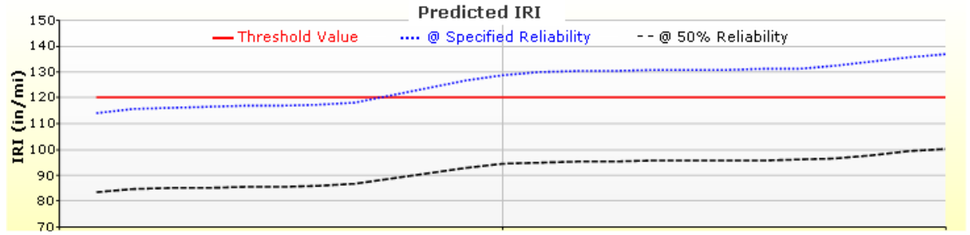
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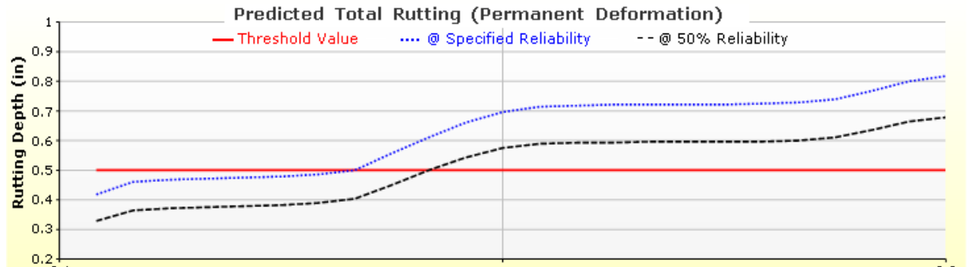
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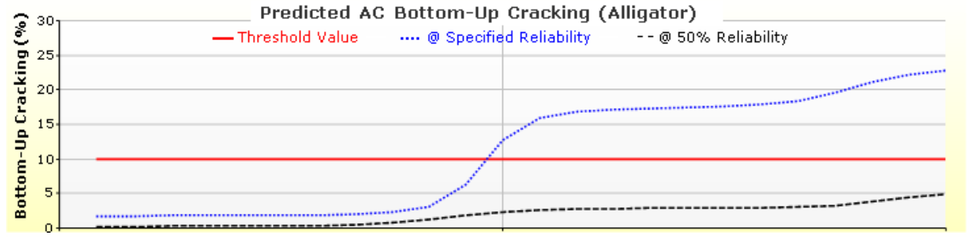
I-65 C2 Crossover Pavement - 7

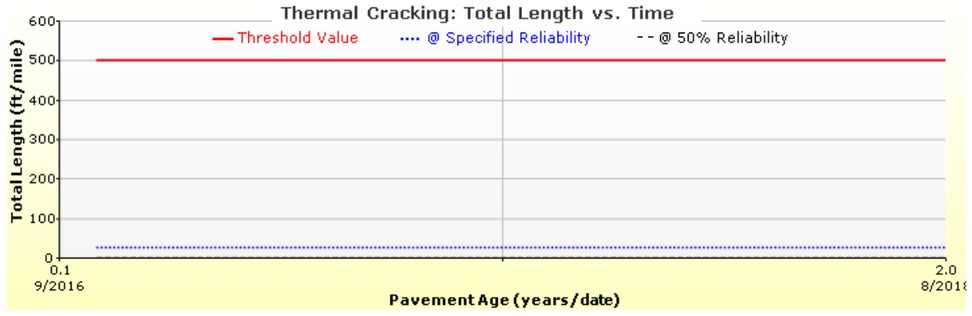
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Analysis Output Charts





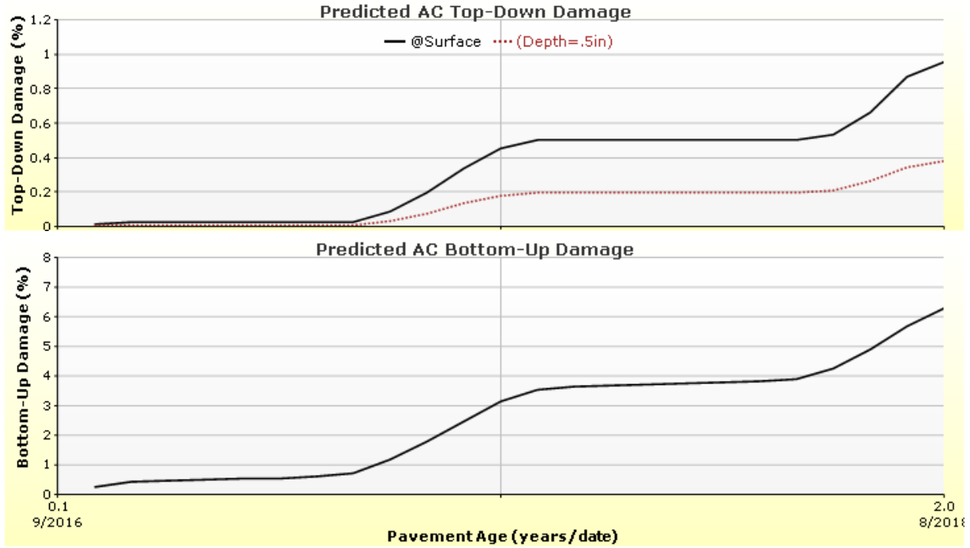


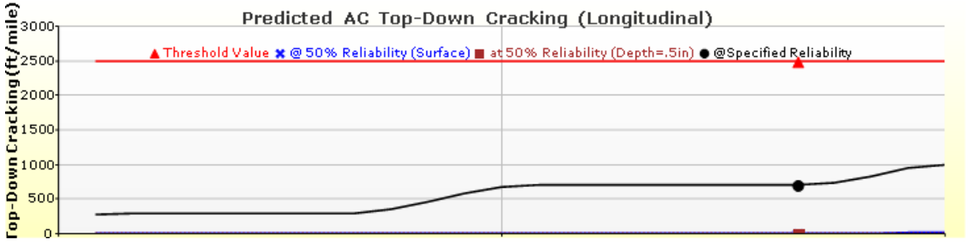


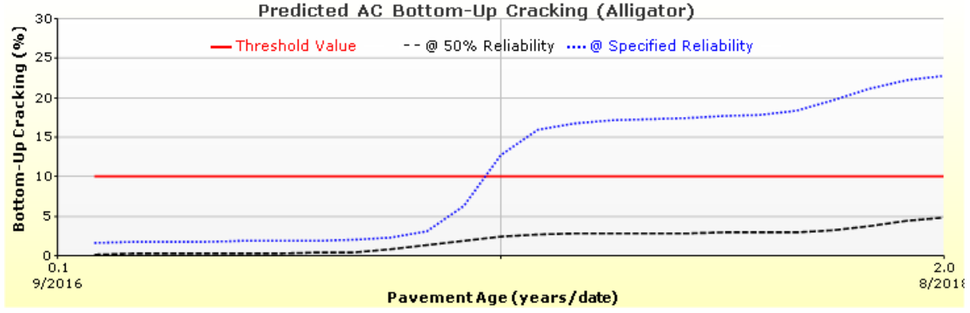
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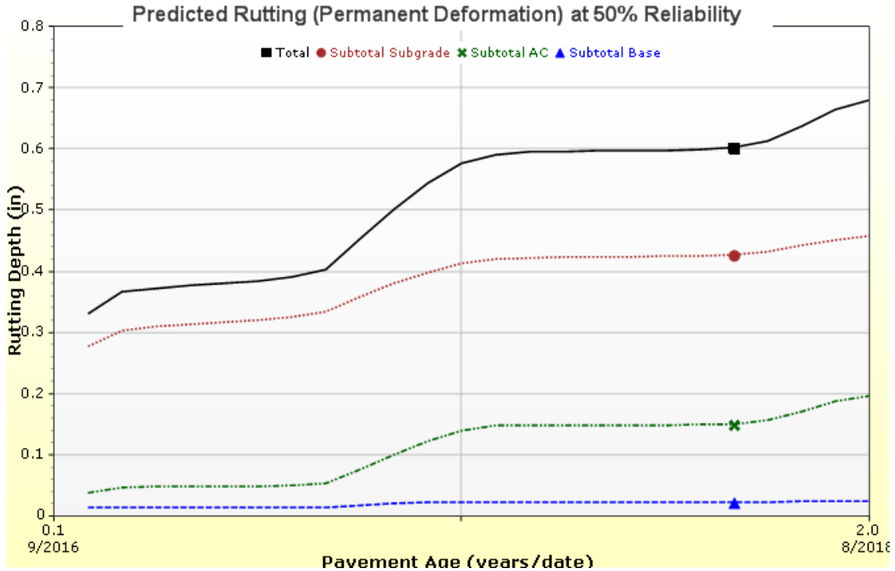






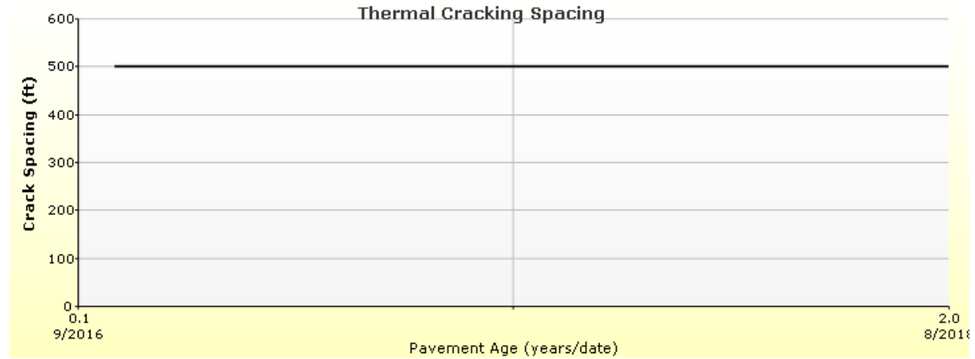
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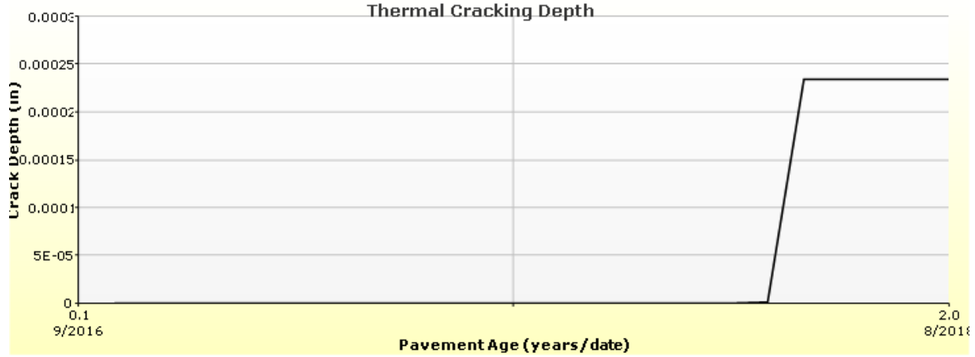
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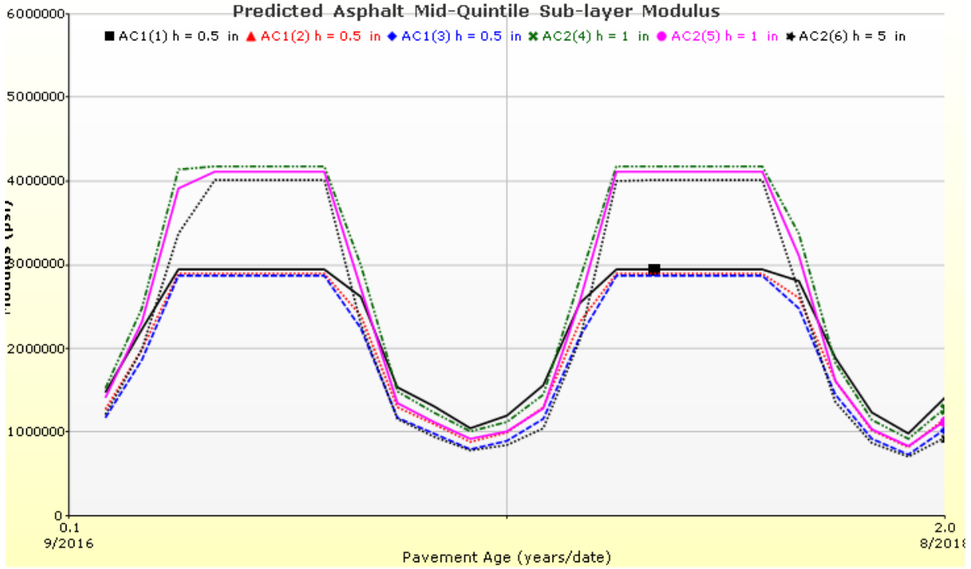
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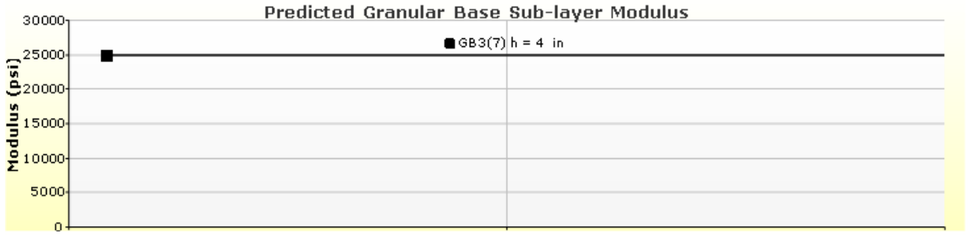


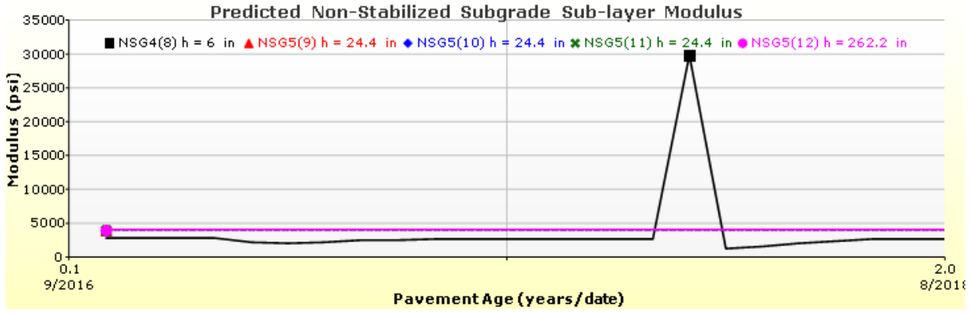


I-65 C2 Crossover Pavement - 7

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Pavement Design Report Appendix C

I-65 C2 Crossover Pavement - 7

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Crossover\I-65 C2 Crossover Pavement - 7.dgpx

Layer Information

Layer 1 Flexible : PG76-22 HMA Surface 9.5mm

Asphalt		
Thickness (in.)	1.5	
Unit weight (pcf)	142.6	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 1)

T (°F)	0.1 Hz	1 Hz	10 Hz	25 Hz
10	1922414	2359663	2741196	3289403
40	1696544	1724379	1802622	1998998
70	360428	552631	742187	871404
100	75322	151689	267916	339650
130	30281	56848	109847	144957

Asphalt Binder

Temperature (°F)	Binder Gstar (Pa)	Phase angle (deg)
40	19627632.35	32.71
55	9199787.41	42.43
70	3072091.94	50.32
85	926086.84	56.76
100	278615.81	62.04
115	87586.86	66.4
130	29373.15	70.01

General Info

Name	Value
Reference temperature (°F)	70
Effective binder content (%)	11.61
Air voids (%)	8
Thermal conductivity (BTU/hr-ft-°F)	0.63
Heat capacity (BTU/lb-°F)	0.31

Identifiers

Field	Value
Display name/identifier	PG76-22 HMA Surface 9.5mm
Description of object	
Author	
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

I-65 C2 Crossover Pavement - 7

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Crossover\I-65 C2 Crossover Pavement - 7.dgpx

Layer 2 Flexible : PG76-22 HMA Intermediate 19.0mm

Asphalt		
Thickness (in.)	7.0	
Unit weight (pcf)	143.8	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 1)

T (°F)	0.1 Hz	1 Hz	10 Hz	25 Hz
10	2785639	3444764	3998971	4863576
40	2446711	2488049	2605196	2900603
70	490152	763705	1037088	1225069
100	96515	199613	360215	460768
130	37445	72052	142777	190406

Asphalt Binder

Temperature (°F)	Binder Gstar (Pa)	Phase angle (deg)
40	19627632.35	32.71
55	9199787.41	42.43
70	3072091.94	50.32
85	926086.84	56.76
100	278615.81	62.04
115	87586.86	66.4
130	29373.15	70.01

General Info

Name	Value
Reference temperature (°F)	70
Effective binder content (%)	9.53
Air voids (%)	8
Thermal conductivity (BTU/hr-ft-°F)	0.63
Heat capacity (BTU/lb-°F)	0.31

Identifiers

Field	Value
Display name/identifier	PG76-22 HMA Intermediate
Description of object	
Author	
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

I-65 C2 Crossover Pavement - 7

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Layer 3 Non-stabilized Base : Crushed stone

Unbound	
Layer thickness (in.)	4.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
25000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	Crushed stone
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.2
Saturated hydraulic conductivity (ft/hr)	False	5.054e-02
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	7.4

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	7.2555
bf	1.3328
cf	0.8242
hr	117.4000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	8.7
#100	
#80	12.9
#60	
#50	
#40	20.0
#30	
#20	
#16	
#10	33.8
#8	
#4	44.7
3/8-in.	57.2
1/2-in.	63.1
3/4-in.	72.7
1-in.	78.8
1 1/2-in.	85.8
2-in.	91.6
2 1/2-in.	
3-in.	
3 1/2-in.	97.6

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Layer 4 Subgrade : A-6

Unbound	
Layer thickness (in.)	6.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Modify input values by temperature/moisture
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
4000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	31.1
Plasticity Index	11.5
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	True	106
Saturated hydraulic conductivity (ft/hr)	False	2.224e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	True	18.2

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	94.5761
bf	0.7777
cf	0.3069
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	20.4
0.020mm	
#200	57.7
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	92.2
#8	
#4	
3/8-in.	
1/2-in.	
3/4-in.	
1-in.	100.0
1 1/2-in.	
2-in.	
2 1/2-in.	
3-in.	
3 1/2-in.	

I-65 C2 Crossover Pavement - 7

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Layer 5 Subgrade : A-6

Unbound	
Layer thickness (in.)	Semi-infinite
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
4000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	31.1
Plasticity Index	11.5
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	True	106
Saturated hydraulic conductivity (ft/hr)	False	2.224e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	True	18.2

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	94.5761
bf	0.7777
cf	0.3069
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	20.4
0.020mm	
#200	57.7
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	92.2
#8	
#4	
3/8-in.	
1/2-in.	
3/4-in.	
1-in.	100.0
1 1/2-in.	
2-in.	
2 1/2-in.	
3-in.	
3 1/2-in.	

I-65 C2 Crossover Pavement - 7

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Calibration Coefficients

AC Fatigue	
$N_f = 0.00432 * C * \beta_{f1} k_1 \left(\frac{1}{\varepsilon_1}\right)^{k_2\beta_{f2}} \left(\frac{1}{E}\right)^{k_3\beta_{f3}}$	k1: 0.007566
$C = 10^M$	k2: 3.9492
$M = 4.84\left(\frac{V_b}{V_a+V_b} - 0.69\right)$	k3: 1.281
	Bf1: 1
	Bf2: 1
	Bf3: 1

AC Rutting

$$\frac{\varepsilon_p}{\varepsilon_r} = k_z \beta_{r1} 10^{k_1} T^{k_2\beta_{r2}} N^{k_3\beta_{r3}}$$

$$k_z = (C_1 + C_2 * depth) * 0.328196^{depth}$$

$$C_1 = -0.1039 * H_a^2 + 2.4868 * H_a - 17.342$$

$$C_2 = 0.0172 * H_a^2 - 1.7331 * H_a + 27.428$$

Where:

$H_{ac} = total\ AC\ thickness(in)$

$\varepsilon_p = plastic\ strain\left(^{in}/_{in}\right)$
$\varepsilon_r = resilient\ strain\left(^{in}/_{in}\right)$
$T = layer\ temperature(^{\circ}F)$
$N = number\ of\ load\ repetitions$

AC Rutting Standard Deviation	0.24*Pow(RUT,0.8026)+0.001	
AC Layer	K1:-3.35412 K2:1.5606 K3:0.4791	Br1:1 Br2:1 Br3:1

Thermal Fracture

$$C_f = 400 * N\left(\frac{\log C / h_{ac}}{\sigma}\right)$$

$$\Delta C = (k * \beta t)^{n+1} * A * \Delta K^n$$

$$A = 10^{(4.389 - 2.52 * \log(E * \sigma_m * n))}$$

C_f = observed amount of thermal cracking($ft/500ft$)
k = refression coefficient determined through field calibration
$N()$ = standard normal distribution evaluated at()
σ = standard deviation of the log of the depth of cracks in the pavments
C = crack depth(in)
h_{ac} = thickness of asphalt layer(in)
ΔC = Change in the crack depth due to a cooling cycle
ΔK = Change in the stress intensity factor due to a cooling cycle
A, n = Fracture parameters for the asphalt mixture
E = mixture stiffness
σ_M = Undamaged mixture tensile strength
β_t = Calibration parameter

Level 1 K: 1.5	Level 1 Standard Deviation: 0.1468 * THERMAL + 65.027
Level 2 K: 0.5	Level 2 Standard Deviation: 0.2841 *THERMAL + 55.462
Level 3 K: 1.5	Level 3 Standard Deviation: 0.3972 * THERMAL + 20.422

CSM Fatigue

$$N_f = 10^{\left(\frac{k_1 \beta_{c1}\left(\frac{\sigma_s}{M_r}\right)}{k_2 \beta_{c2}}\right)}$$

$N_f = number\ of\ repetitions\ to\ fatigue\ cracking$
$\sigma_s = Tensile\ stress(psi)$
$M_r = modulus\ of\ rupture(psi)$

k1: 1	k2: 1	Bc1: 1	Bc2:1

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Subgrade Rutting

$$\delta_a(N) = \beta_{s_1} k_1 \varepsilon_v h \left(\frac{\varepsilon_0}{\varepsilon_r}\right) \left| e^{-\left(\frac{\rho}{N}\right)^{\beta}} \right|$$

$\delta_a = permanent\ deformation\ for\ the\ layer$
$N = number\ of\ repetitions$
$\varepsilon_v = average\ veritcal\ strain(in/in)$
$\varepsilon_0, \beta, \rho = material\ properties$
$\varepsilon_r = resilient\ strain(in/in)$

Granular		Fine	
k1: 2.03	Bs1: 1	k1: 1.35	Bs1: 1
Standard Deviation (BASERUT) 0.1477*Pow(BASERUT,0.6711)+0.001		Standard Deviation (BASERUT) 0.1235*Pow(SUBRUT,0.5012)+0.001	

AC Cracking

AC Top Down Cracking				AC Bottom Up Cracking		
$FC_{top} = \left(\frac{C_4}{1 + e^{(C_1 - C_2 * \log_{10}(Damage))}}\right) * 10.56$				$FC = \left(\frac{6000}{1 + e^{(C_1 * C_1' + C_2 * C_2' * \log_{10}(D * 100))}}\right) * \left(\frac{1}{60}\right)$ $C_2' = -2.40874 - 39.748 * (1 + h_{ac})^{-2.856}$ $C_1' = -2 * C_2'$		
c1: 7	c2: 3.5	c3: 0	c4: 1000	c1: 1	c2: 1	c3: 6000
AC Cracking Top Standard Deviation				AC Cracking Bottom Standard Deviation		
200 + 2300/(1+exp(1.072-2.1654*LOG10 (TOP+0.0001)))				1.13+13/(1+exp(7.57-15.5*LOG10 (BOTTOM+0.0001)))		

CSM Cracking				IRI Flexible Pavements			
$FC_{ctb} = C_1 + \frac{C_2}{1 + e^{C_3 - C_4(Damage)}}$				C1 - Rutting C2 - Fatigue Crack		C3 - Transverse Crack C4 - Site Factors	
C1: 1	C2: 1	C3: 0	C4: 1000	C1: 40	C2: 0.4	C3: 0.008	C4: 0.015
CSM Standard Deviation							
CTB*1							

I-65 C PCCP Overlay Alternative 1

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Design Inputs

Design Life: 50 years
Design Type: AC over JPCP

Existing construction: May, 2000
Pavement construction: July, 2016
Traffic opening: September, 2016

Climate Data Sources (Lat/Lon): 41.453, -87.006; 41.786, -87.752; 41.986, -87.914; 41.707, -86.333; 42.121, -87.905; 41.914, -88.246

Design Structure



Layer type	Material Type	Thickness (in.):
Flexible	PG76-22 Surface SMA	1.5
PCC	Existing PCCP	13.5
NonStabilized	Crushed stone	3.0
NonStabilized	Crushed stone	6.0
Subgrade	A-6	24.0
Subgrade	A-6	Semi-infinite

Volumetric at Construction:	
Effective binder content (%)	13.4
Air voids (%)	7.0

Traffic

Age (year)	Heavy Trucks (cumulative)
2016 (initial)	20,107
2041 (25 years)	70,937,800
2066 (50 years)	161,911,000

Design Outputs

Distress Prediction Summary

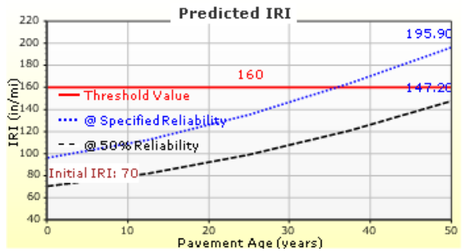
Distress Type	Distress @ Specified Reliability		Reliability (%)		Criterion Satisfied?
	Target	Predicted	Target	Achieved	
Terminal IRI (in./mile)	160.00	195.85	90.00	63.22	Fail
Permanent deformation - total pavement (in.)	0.75	0.20	90.00	100.00	Pass
Total Cracking (Reflective + Alligator) (percent)	50	6.67	-	-	Pass
AC thermal cracking (ft/mile)	500.00	217.41	90.00	100.00	Pass
JPCP transverse cracking (percent slabs)	10.00	3.83	90.00	99.96	Pass
AC bottom-up fatigue cracking (percent)	10.00	1.45	90.00	100.00	Pass
AC top-down fatigue cracking (ft/mile)	2500.00	256.52	90.00	100.00	Pass
Permanent deformation - AC only (in.)	0.40	0.20	90.00	100.00	Pass

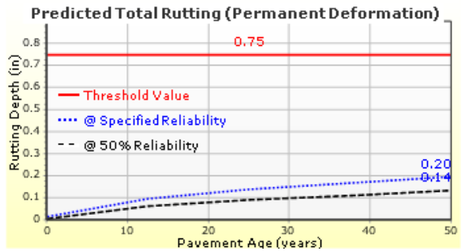
Pavement Design Report Appendix C

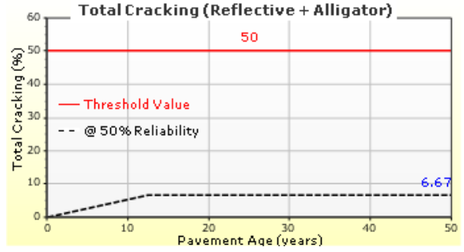
I-65 C PCCP Overlay Alternative 1

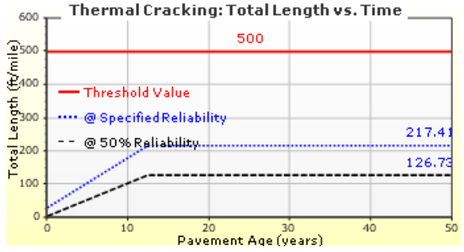
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Distress Charts









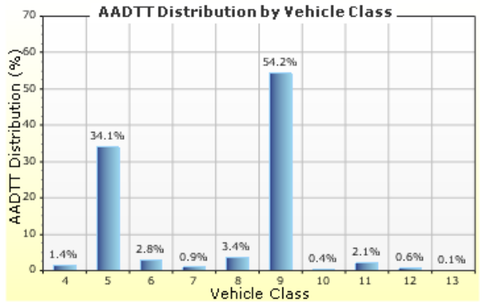
I-65 C PCCP Overlay Alternative 1

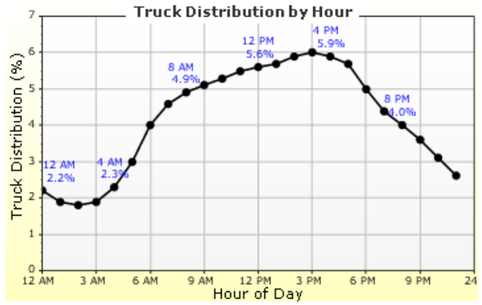
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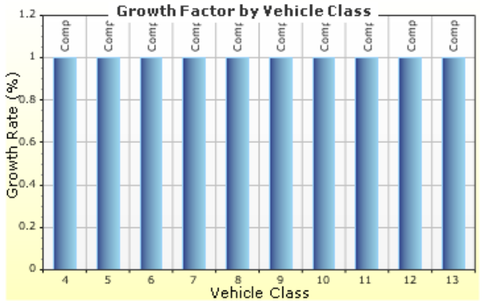
Traffic Inputs

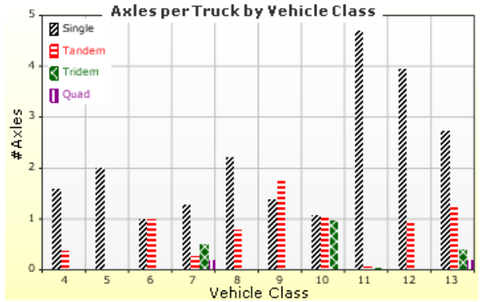
Graphical Representation of Traffic Inputs

Initial two-way AADTT:	20,107	Percent of trucks in design direction (%):	57.0
Number of lanes in design direction:	3	Percent of trucks in design lane (%):	60.0
		Operational speed (mph)	65.0

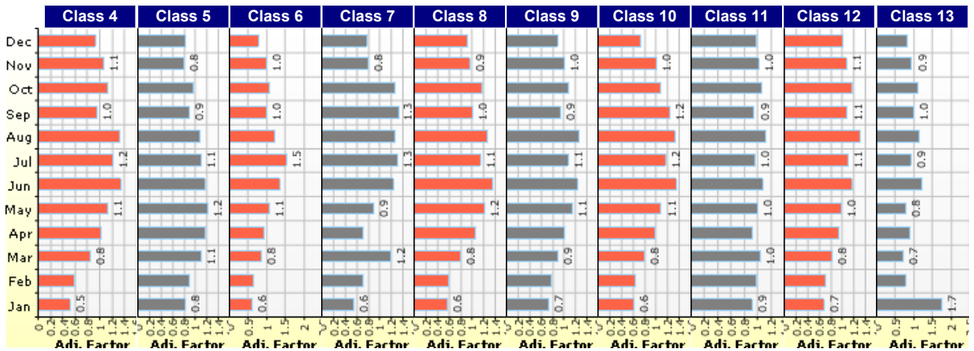








Traffic Volume Monthly Adjustment Factors



I-65 C PCCP Overlay Alternative 1

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Tabular Representation of Traffic Inputs

Volume Monthly Adjustment Factors

Level 3: Default MAF

Month	Vehicle Class									
	4	5	6	7	8	9	10	11	12	13
January	0.5	0.8	0.6	0.6	0.6	0.7	0.6	0.9	0.7	1.7
February	0.6	0.9	0.6	0.7	0.6	0.8	0.6	1.0	0.7	0.8
March	0.8	1.1	0.8	1.2	0.8	0.9	0.8	1.0	0.8	0.7
April	1.0	1.2	0.9	0.7	1.1	1.0	1.0	0.9	0.9	0.9
May	1.1	1.2	1.1	0.9	1.2	1.1	1.1	1.0	1.0	0.8
June	1.4	1.2	1.3	1.2	1.4	1.2	1.3	1.1	1.2	1.2
July	1.2	1.1	1.5	1.3	1.1	1.1	1.2	1.0	1.1	0.9
August	1.3	1.1	1.3	1.3	1.3	1.3	1.3	1.1	1.3	1.2
September	1.0	0.9	1.0	1.3	1.0	0.9	1.2	0.9	1.1	1.0
October	1.1	0.9	1.1	1.3	1.2	1.1	1.1	1.1	1.2	1.1
November	1.1	0.8	1.0	0.8	0.9	1.0	1.0	1.0	1.1	0.9
December	0.9	0.8	0.8	0.8	0.9	0.9	0.7	1.0	1.0	0.8

Distributions by Vehicle Class

Vehicle Class	AADTT Distribution (%) (Level 3)	Growth Factor	
		Rate (%)	Function
Class 4	1.4%	1%	Compound
Class 5	34.1%	1%	Compound
Class 6	2.8%	1%	Compound
Class 7	0.9%	1%	Compound
Class 8	3.4%	1%	Compound
Class 9	54.2%	1%	Compound
Class 10	0.4%	1%	Compound
Class 11	2.1%	1%	Compound
Class 12	0.6%	1%	Compound
Class 13	0.1%	1%	Compound

Truck Distribution by Hour

Hour	Distribution (%)	Hour	Distribution (%)
12 AM	2.2%	12 PM	5.6%
1 AM	1.9%	1 PM	5.7%
2 AM	1.8%	2 PM	5.9%
3 AM	1.9%	3 PM	6%
4 AM	2.3%	4 PM	5.9%
5 AM	3%	5 PM	5.7%
6 AM	4%	6 PM	5%
7 AM	4.6%	7 PM	4.4%
8 AM	4.9%	8 PM	4%
9 AM	5.1%	9 PM	3.6%
10 AM	5.3%	10 PM	3.1%
11 AM	5.5%	11 PM	2.6%
		Total	100%

Axle Configuration

Traffic Wander	
Mean wheel location (in.)	18
Traffic wander standard deviation (in.)	10
Design lane width (ft)	12

Axle Configuration	
Average axle width (ft)	8.5
Dual tire spacing (in.)	12
Tire pressure (psi)	120

Average Axle Spacing	
Tandem axle spacing (in.)	51.6
Tridem axle spacing (in.)	49.2
Quad axle spacing (in.)	49.2

Wheelbase			
Value Type	Axle Type	Short	Medium	Long
Average spacing of axles (ft)		12	15	18
Percent of Trucks (%)		33	33	34

Number of Axles per Truck

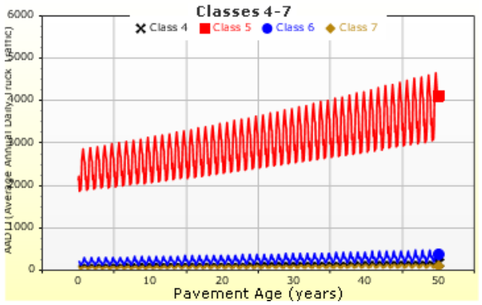
Vehicle Class	Single Axle	Tandem Axle	Tridem Axle	Quad Axle
Class 4	1.6	0.39	0	0
Class 5	2	0	0	0
Class 6	1	1	0	0
Class 7	1.29	0.29	0.5	0.19
Class 8	2.19	0.8	0	0
Class 9	1.37	1.8	0	0
Class 10	1.05	1.02	0.96	0.01
Class 11	4.71	0.08	0.03	0
Class 12	3.94	0.99	0.01	0
Class 13	2.73	1.25	0.41	0.2

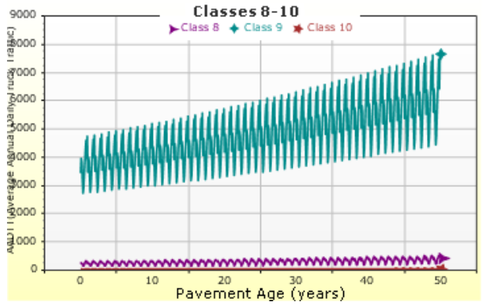
I-65 C PCCP Overlay Alternative 1

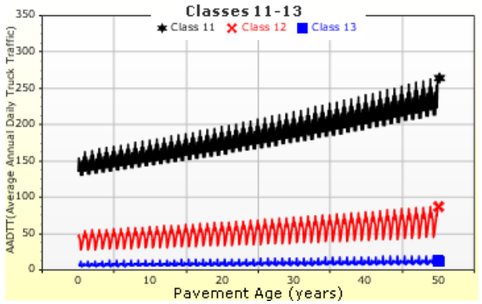
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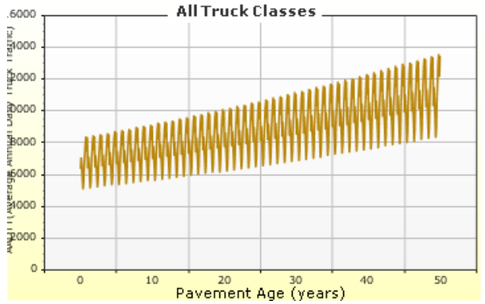
AADTT (Average Annual Daily Truck Traffic) Growth

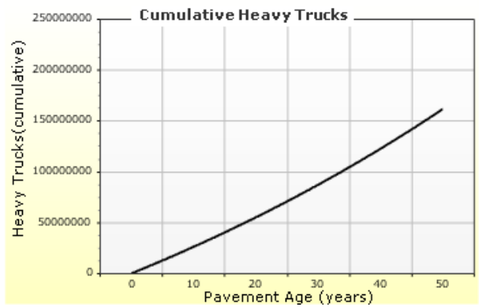
*** Traffic cap is not enforced**











Report generated on: 7/19/2016 10:06 AM

Created by: on: 4/22/2016 9:41 AM

Approved by: on: 4/22/2016 9:41 AM

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File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Overlay Of PCCP\I-65 C PCCP Overlay Alternative 1.dgpx

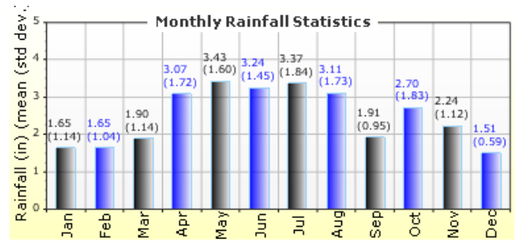
Climate Inputs

Climate Data Sources:

Climate Station Cities:	Location (lat lon elevation(ft))
VALPARAISO, IN	41.45300 -87.00600 770
CHICAGO, IL	41.78600 -87.75200 612
CHICAGO, IL	41.98600 -87.91400 662

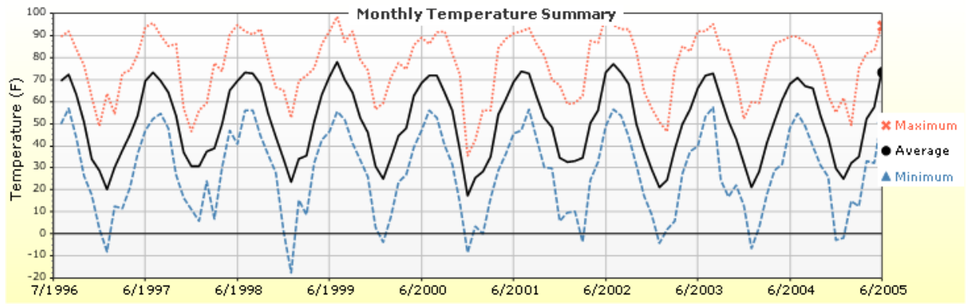
Annual Statistics:

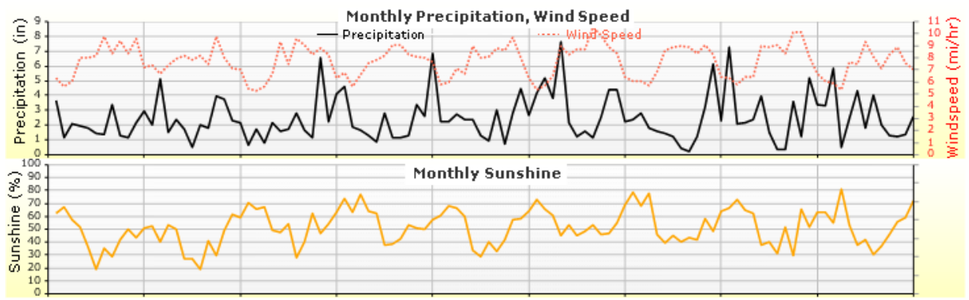
Mean annual air temperature (°F)	50.55
Mean annual precipitation (in.)	29.78
Freezing index (°F - days)	677.11
Average annual number of freeze/thaw cycles:	62.54



Water table depth (ft)	10.00

Monthly Climate Summary:





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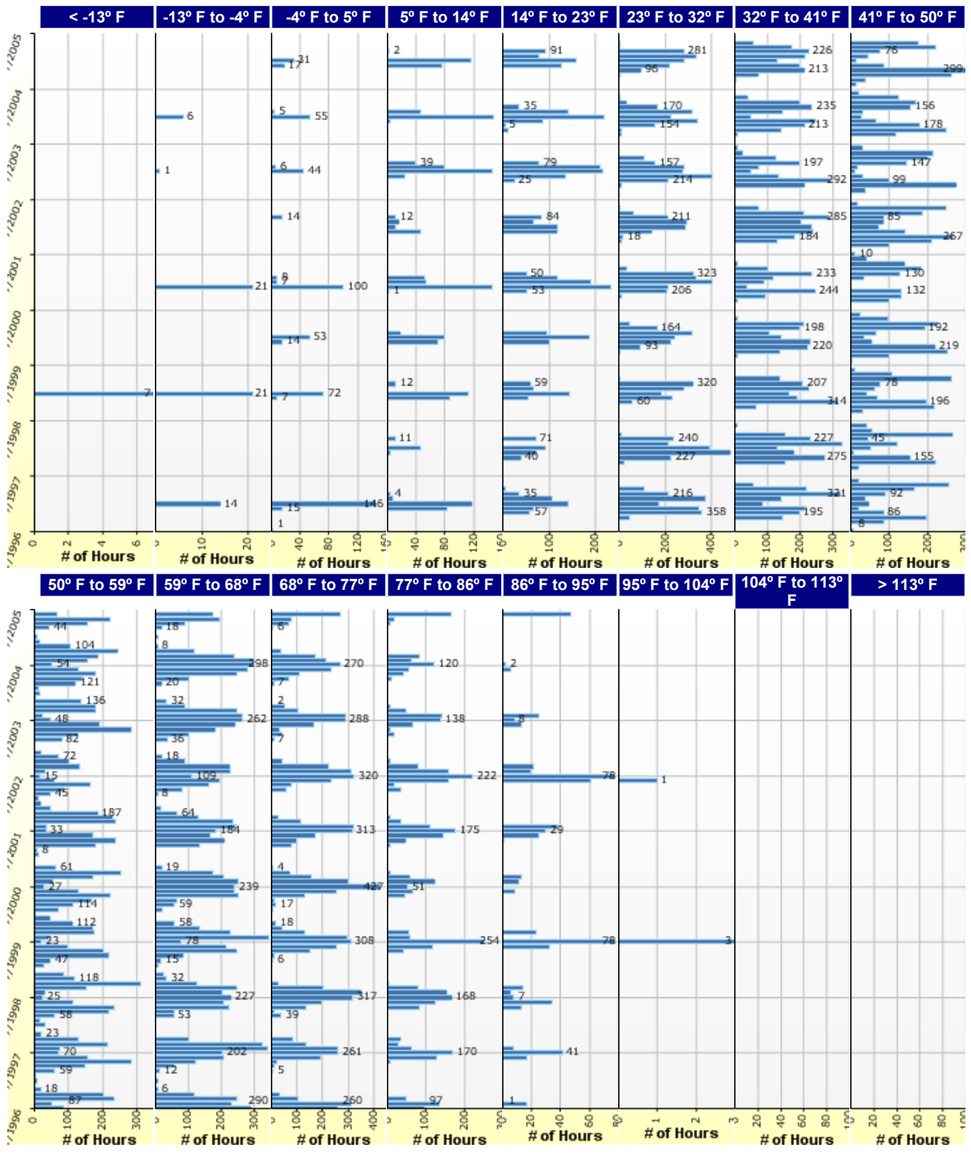
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Hourly Air Temperature Distribution by Month:



Pavement Design Report Appendix C

I-65 C PCCP Overlay Alternative 1

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Overlay Of PCCP\I-65 C PCCP Overlay Alternative 1.dgpx

Design Properties

HMA Design Properties

Use Multilayer Rutting Model	False
Using G* based model (not nationally calibrated)	False
Is NCHRP 1-37A HMA Rutting Model Coefficients	True
Endurance Limit	-
Use Reflective Cracking	True

Layer Name	Layer Type	Interface Friction
Layer 1 Flexible : PG76-22 Surface SMA	Flexible (1)	1.00
Layer 2 PCC : Existing PCCP	PCC (0)	1.00
Layer 3 Non-stabilized Base : Crushed stone	Non-stabilized Base (4)	1.00
Layer 4 Non-stabilized Base : Crushed stone	Non-stabilized Base (4)	1.00
Layer 5 Subgrade : A-6	Subgrade (5)	1.00
Layer 6 Subgrade : A-6	Subgrade (5)	-

JPCP Design Properties

Structure - ICM Properties	
PCC surface shortwave absorptivity	0.85

Doweled Joints	
Is joint doweled ?	True
Dowel diameter (in.)	1.25
Dowel spacing (in.)	12.00

Tied Shoulders	
Tied shoulders	True
Load transfer efficiency (%)	60.00

PCC joint spacing (ft)	
Is joint spacing random ?	False
Joint spacing (ft)	15.00

Widened Slab	
Is slab widened ?	False
Slab width (ft)	12.00

PCC-Base Contact Friction	
PCC-Base full friction contact	True
Months until friction loss	600.00

Sealant type	Other(Including No Sealant... Liquid... Silicone)

Erodibility index	2

Permanent curl/warp effective temperature difference (ºF)	-10.00

JPCP Rehabilitation Properties

Slabs distressed/replaced before restoration (%)	0.00
Slabs repaired/replaced after restoration (%)	0.00

Modulus Subgrade Reaction	
Is modulus of subgrade reaction measured?	False
Month modulus of subgrade reaction measured	-
Dynamic modulus of subgrade reaction (psi/in.)	-

I-65 C PCCP Overlay Alternative 1

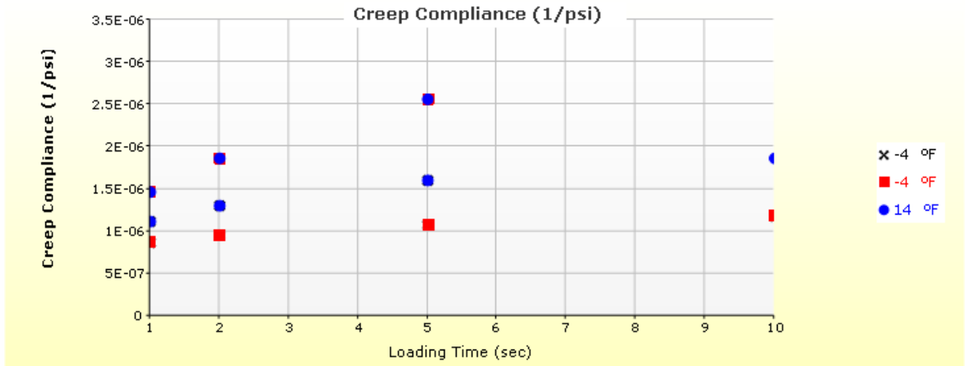
File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Overlay Of PCCP\I-65 C PCCP Overlay Alternative 1.dgpx

Thermal Cracking (Input Level: 3)

Indirect tensile strength at 14 °F (psi)	404.62

Thermal Contraction	
Is thermal contraction calculated?	True
Mix coefficient of thermal contraction (in./in./°F)	-
Aggregate coefficient of thermal contraction (in./in./°F)	6.1e-006
Voids in Mineral Aggregate (%)	20.4

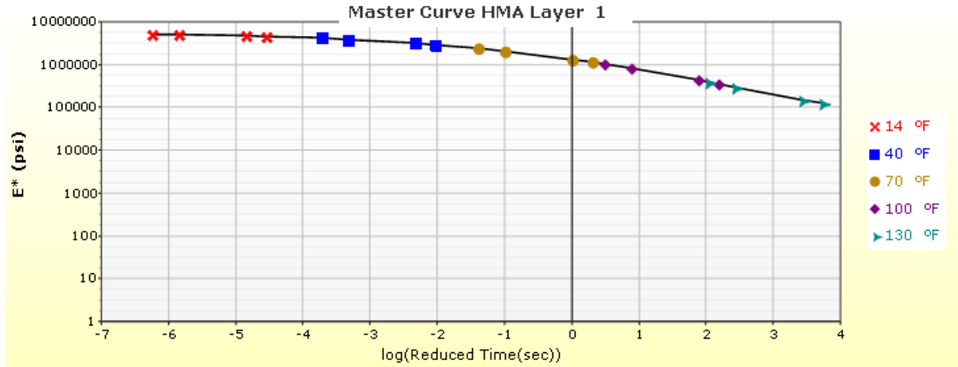
	Creep Compliance (1/psi)		
Loading time (sec)	-4 °F	-4 °F	14 °F
1	8.77e-007	8.77e-007	1.13e-006
1	1.13e-006	1.47e-006	1.47e-006
2	9.61e-007	9.61e-007	1.31e-006
2	1.31e-006	1.87e-006	1.87e-006
5	1.09e-006	1.09e-006	1.61e-006
5	1.61e-006	2.58e-006	2.58e-006
10	1.19e-006	1.19e-006	1.87e-006

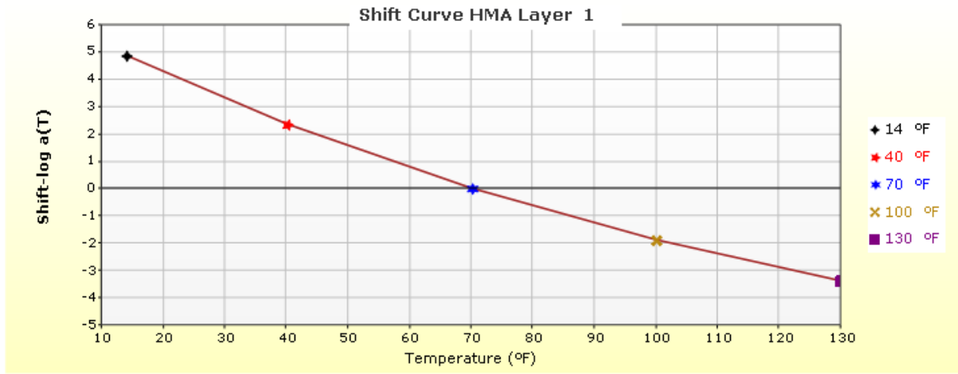


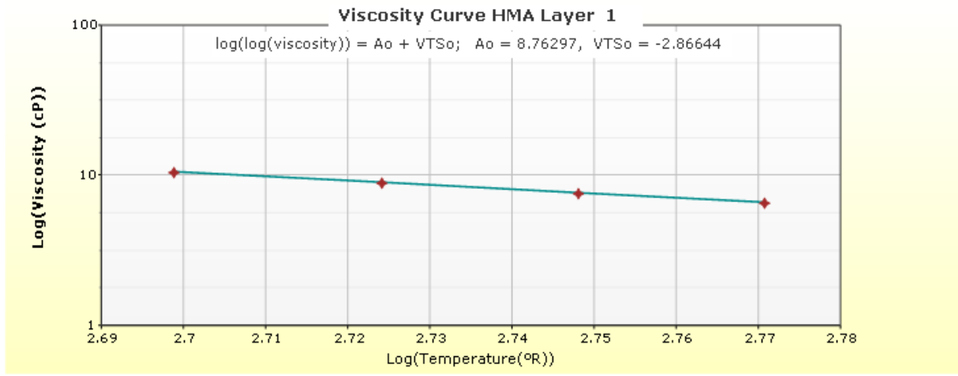
I-65 C PCCP Overlay Alternative 1

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HMA Layer 1: Layer 1 Flexible : PG76-22 Surface SMA



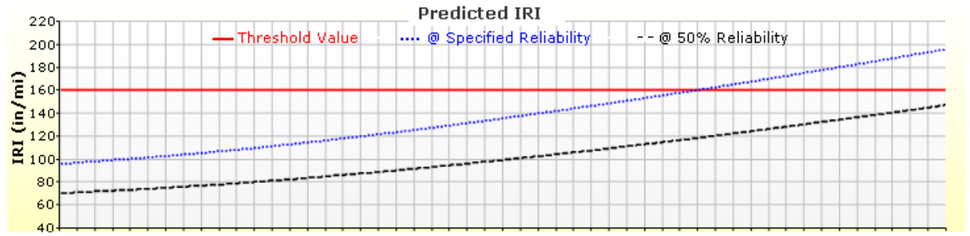


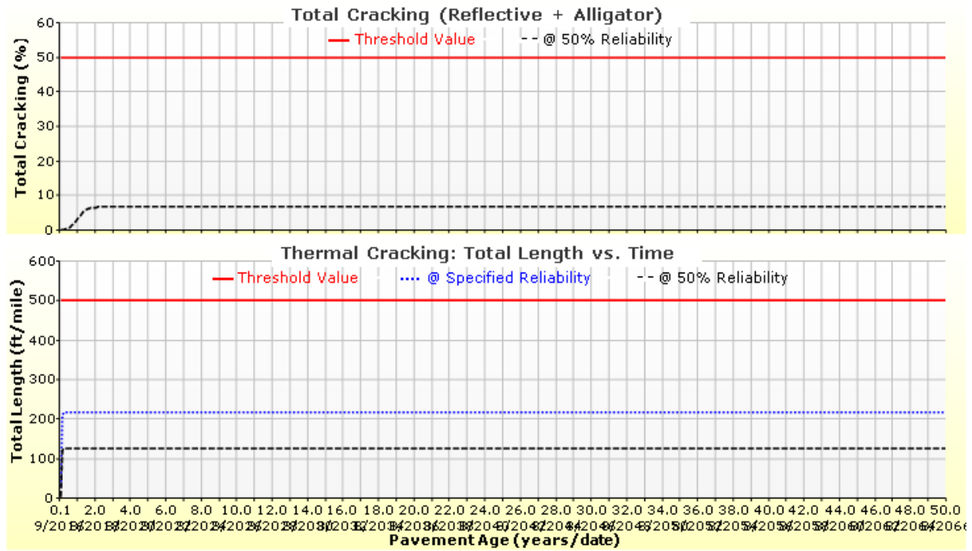


I-65 C PCCP Overlay Alternative 1

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Analysis Output Charts

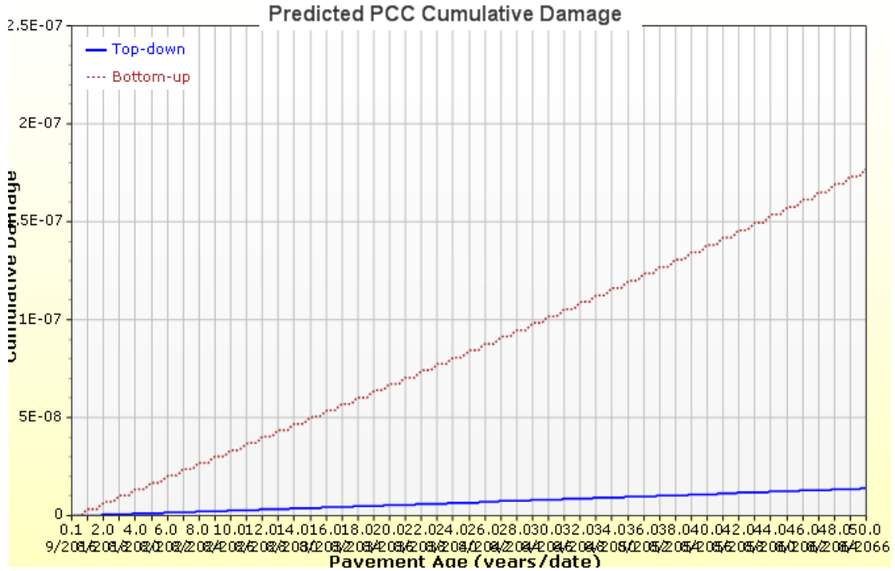


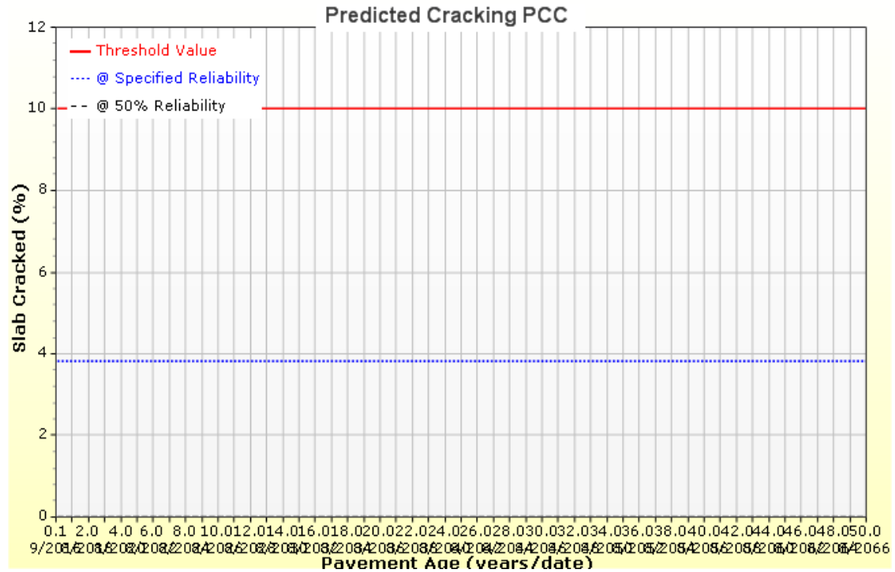


Pavement Design Report Appendix C

I-65 C PCCP Overlay Alternative 1

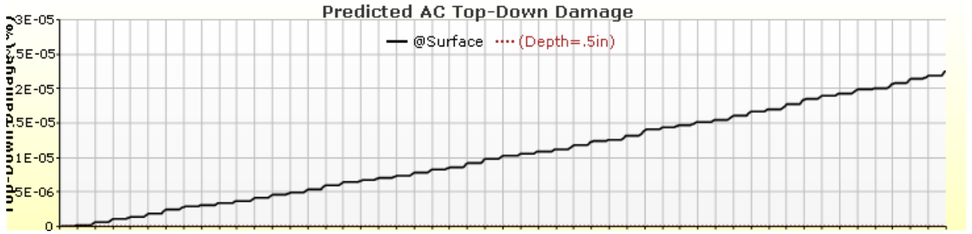
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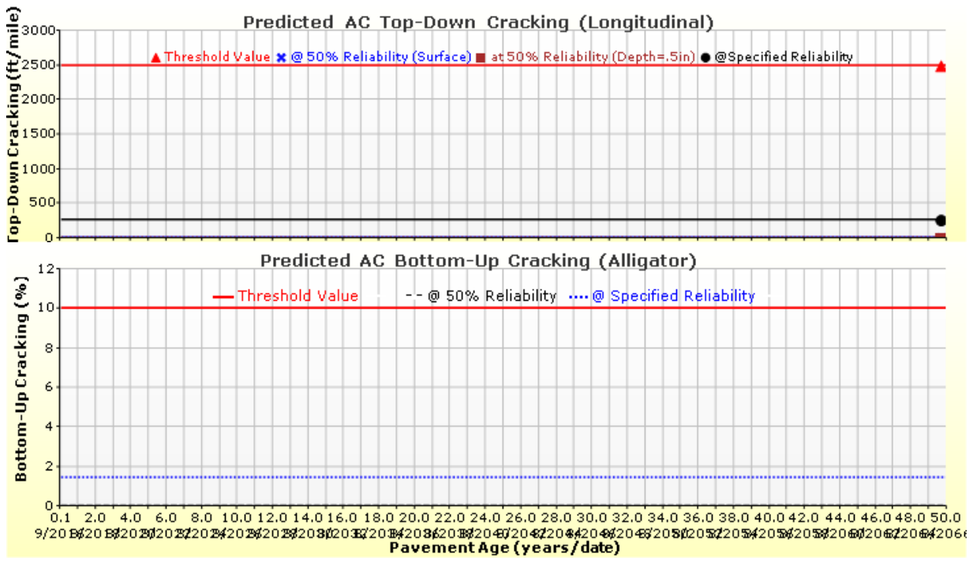




I-65 C PCCP Overlay Alternative 1

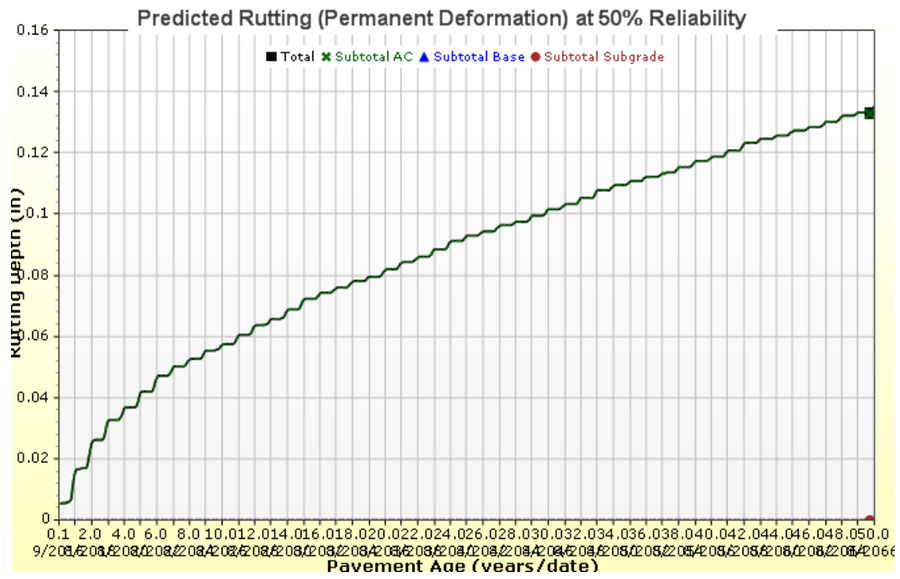
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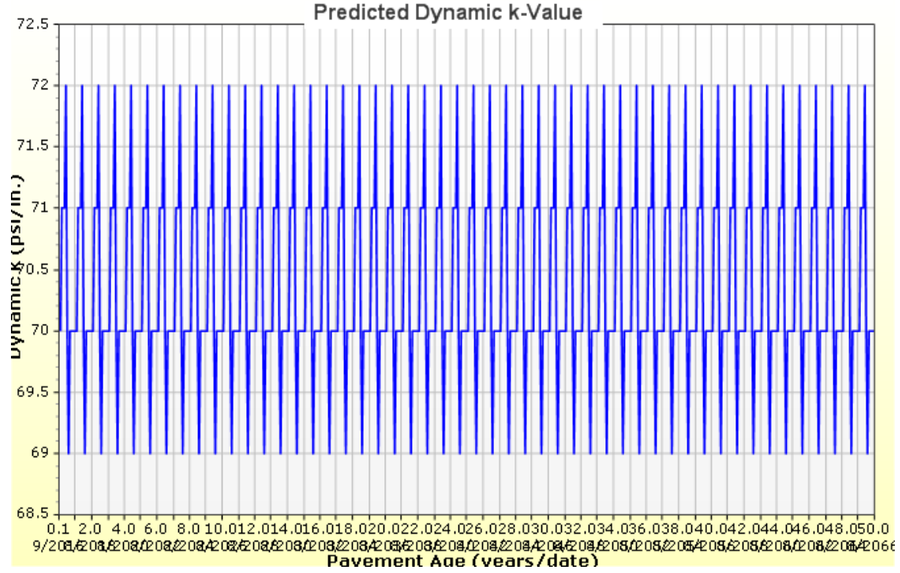




I-65 C PCCP Overlay Alternative 1

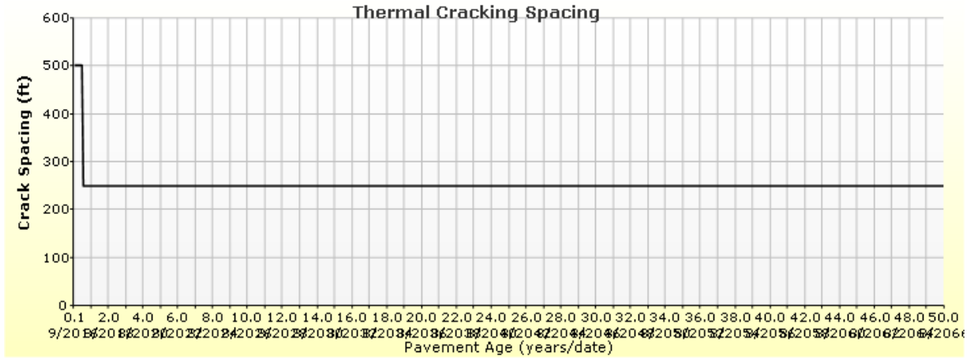
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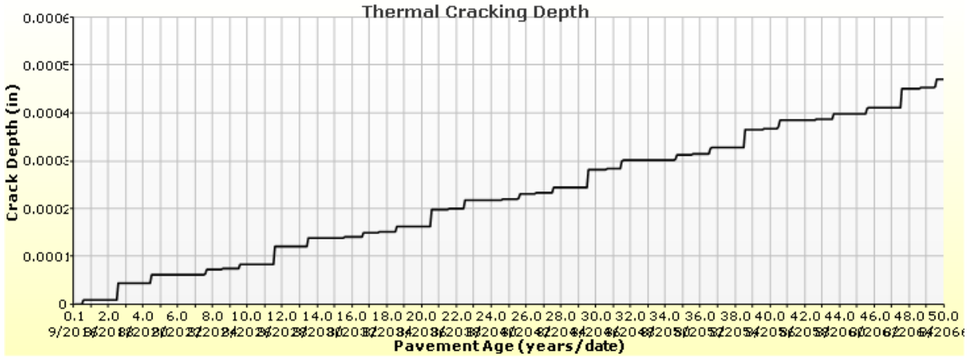




I-65 C PCCP Overlay Alternative 1

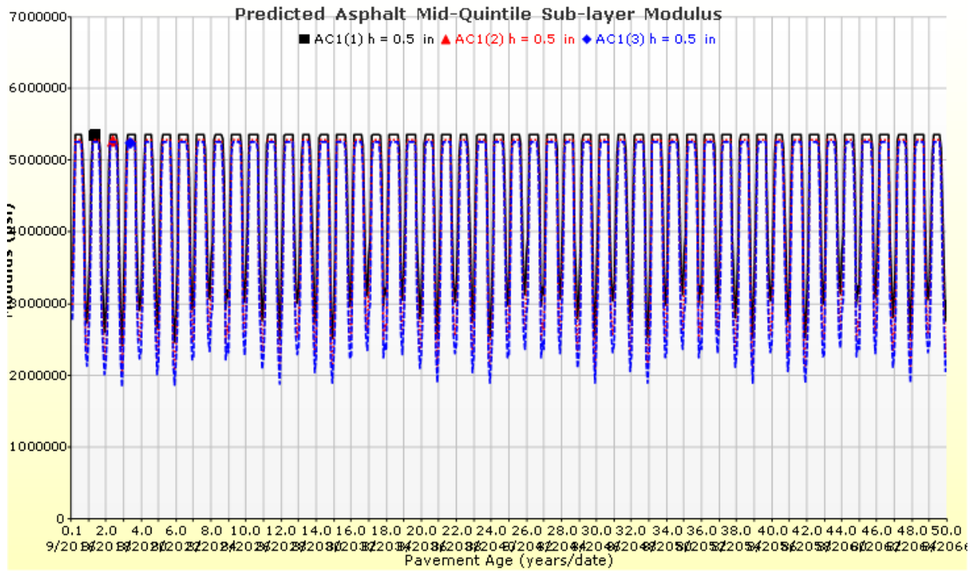
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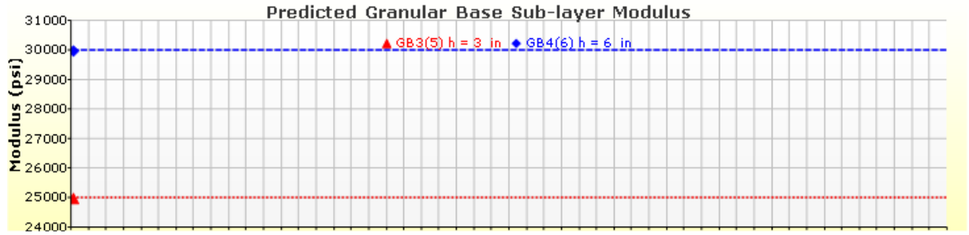


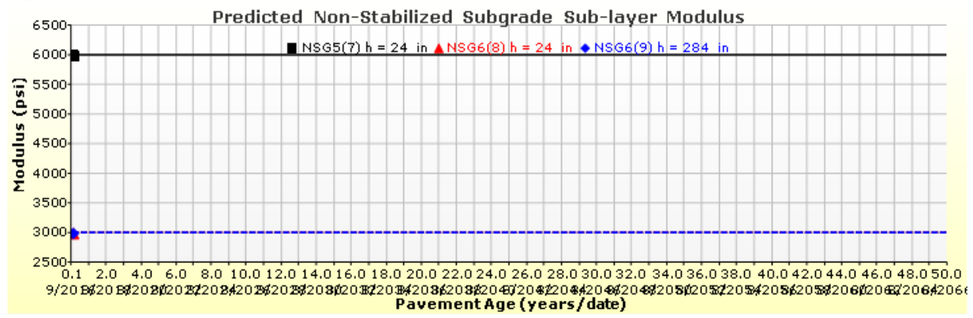


I-65 C PCCP Overlay Alternative 1

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I-65 C PCCP Overlay Alternative 1

File Name: C:\Users\p009729B\Documents\My ME Design\Projects\I-65 Northwest\Overlay Of PCCP\I-65 C PCCP Overlay Alternative 1.dgpx

Layer Information

Layer 1 Flexible : PG76-22 Surface SMA

Asphalt		
Thickness (in.)	1.5	
Unit weight (pcf)	160.0	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 1)

T (ºF)	0.1 Hz	1 Hz	10 Hz	25 Hz
10	3647648	4669504	5000000	5000000
40	2415742	3373281	4392981	4797248
70	763973	1296571	2030073	2372323
100	228891	438683	796159	989704
130	80754	159253	310900	401763

Asphalt Binder

Temperature (ºF)	Binder Gstar (Pa)	Phase angle (deg)
40	19627632.35	32.71
55	9199787.41	42.43
70	3072091.94	50.32
85	926086.84	56.76
100	278615.81	62.04
115	87586.86	66.4
130	29373.15	70.01

General Info

Name	Value
Reference temperature (ºF)	70
Effective binder content (%)	13.4
Air voids (%)	7
Thermal conductivity (BTU/hr-ft-ºF)	0.63
Heat capacity (BTU/lb-ºF)	0.31

Identifiers

Field	Value
Display name/identifier	PG76-22 Surface SMA
Description of object	
Author	
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

I-65 C PCCP Overlay Alternative 1

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Layer 2 PCC : Existing PCCP

PCC		
Thickness (in.)		13.5
Unit weight (pcf)		145.0
Poisson's ratio		0.2

Thermal		
PCC coefficient of thermal expansion (in./in./ºF x 10^-6)		5.4
PCC thermal conductivity (BTU/hr-ft-ºF)		1.25
PCC heat capacity (BTU/lb-ºF)		0.28

Mix		
Cement type		Type I (1)
Cementitious material content (lb/yd^3)		510
Water to cement ratio		0.42
Aggregate type		Limestone (1)
PCC zero-stress temperature (ºF)	Calculated Internally?	True
	User Value	-
	Calculated Value	101.3
Ultimate shrinkage (microstrain)	Calculated Internally?	True
	User Value	-
	Calculated Value	543.2
Reversible shrinkage (%)		50
Time to develop 50% of ultimate shrinkage (days)		35
Curing method		Curing Compound

PCC strength and modulus (Input Level: 3)

28-Day PCC modulus of rupture (psi)	700.0
28-Day PCC elastic modulus (psi)	-

Identifiers

Field	Value
Display name/identifier	Existing PCCP
Description of object	
Author	
Date Created	7/18/2016 12:06:59 PM
Approver	
Date approved	7/18/2016 12:06:59 PM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

I-65 C PCCP Overlay Alternative 1

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Layer 3 Non-stabilized Base : Crushed stone

Unbound	
Layer thickness (in.)	3.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 2)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
25000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	Crushed stone
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.2
Saturated hydraulic conductivity (ft/hr)	False	5.054e-02
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	7.4

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	7.2555
bf	1.3328
cf	0.8242
hr	117.4000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	8.7
#100	
#80	12.9
#60	
#50	
#40	20.0
#30	
#20	
#16	
#10	33.8
#8	
#4	44.7
3/8-in.	57.2
1/2-in.	63.1
3/4-in.	72.7
1-in.	78.8
1 1/2-in.	85.8
2-in.	91.6
2 1/2-in.	
3-in.	
3 1/2-in.	97.6

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Layer 4 Non-stabilized Base : Crushed stone

Unbound	
Layer thickness (in.)	6.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 2)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
30000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	Crushed stone
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted?	True

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.7
Saturated hydraulic conductivity (ft/hr)	False	5.054e-02
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	7.4

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	7.2555
bf	1.3328
cf	0.8242
hr	117.4000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	8.7
#100	
#80	12.9
#60	
#50	
#40	20.0
#30	
#20	
#16	
#10	33.8
#8	
#4	44.7
3/8-in.	57.2
1/2-in.	63.1
3/4-in.	72.7
1-in.	78.8
1 1/2-in.	85.8
2-in.	91.6
2 1/2-in.	
3-in.	
3 1/2-in.	97.6

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Layer 5 Subgrade : A-6

Unbound	
Layer thickness (in.)	24.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 2)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
6000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	31.1
Plasticity Index	11.5
Is layer compacted?	True

	Is User Defined?	Value
Maximum dry unit weight (pcf)	True	106
Saturated hydraulic conductivity (ft/hr)	False	2.224e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	True	18.2

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	94.5761
bf	0.7777
cf	0.3069
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	20.4
0.020mm	
#200	57.7
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	92.2
#8	
#4	
3/8-in.	
1/2-in.	
3/4-in.	
1-in.	100.0
1 1/2-in.	
2-in.	
2 1/2-in.	
3-in.	
3 1/2-in.	

I-65 C PCCP Overlay Alternative 1

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Layer 6 Subgrade : A-6

Unbound	
Layer thickness (in.)	Semi-infinite
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 2)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
3000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

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0.001mm	
0.002mm	20.4
0.020mm	
#200	57.7
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	92.2
#8	
#4	
3/8-in.	
1/2-in.	
3/4-in.	
1-in.	100.0
1 1/2-in.	
2-in.	
2 1/2-in.	
3-in.	
3 1/2-in.	

I-65 C PCCP Overlay Alternative 1

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Calibration Coefficients

AC Fatigue	
$N_f = 0.00432 * C * \beta_{f1} k_1 \left(\frac{1}{\varepsilon_1}\right)^{k_2\beta_{f2}} \left(\frac{1}{E}\right)^{k_3\beta_{f3}}$	k1: 0.007566
$C = 10^M$	k2: 3.9492
$M = 4.84\left(\frac{V_b}{V_a+V_b} - 0.69\right)$	k3: 1.281
	Bf1: 1
	Bf2: 1
	Bf3: 1

AC Rutting

$$\frac{\varepsilon_p}{\varepsilon_r} = k_z \beta_{r1} 10^{k_1} T^{k_2\beta_{r2}} N^{k_3\beta_{r3}}$$

$$k_z = (C_1 + C_2 * depth) * 0.328196^{depth}$$

$$C_1 = -0.1039 * H_a^2 + 2.4868 * H_a - 17.342$$

$$C_2 = 0.0172 * H_a^2 - 1.7331 * H_a + 27.428$$

Where:

$H_{ac} = total\ AC\ thickness(in)$

$\varepsilon_p = plastic\ strain\left(^{in}/_{in}\right)$
$\varepsilon_r = resilient\ strain\left(^{in}/_{in}\right)$
$T = layer\ temperature(^{\circ}F)$
$N = number\ of\ load\ repetitions$

AC Rutting Standard Deviation	0.24*Pow(RUT,0.8026)+0.001	
AC Layer	K1:-3.35412 K2:1.5606 K3:0.4791	Br1:1 Br2:1 Br3:1

Thermal Fracture

$$C_f = 400 * N\left(\frac{\log C / h_{ac}}{\sigma}\right)$$

$$\Delta C = (k * \beta t)^{n+1} * A * \Delta K^n$$

$$A = 10^{(4.389 - 2.52 * \log(E * \sigma_m * n))}$$

C_f = observed amount of thermal cracking($ft/500ft$)
k = refression coefficient determined through field calibration
$N()$ = standard normal distribution evaluated at( )
σ = standard deviation of the log of the depth of cracks in the pavments
C = crack depth(in)
h_{ac} = thickness of asphalt layer(in)
ΔC = Change in the crack depth due to a cooling cycle
ΔK = Change in the stress intensity factor due to a cooling cycle
A, n = Fracture parameters for the asphalt mixture
E = mixture stiffness
σ_M = Undamaged mixture tensile strength
β_t = Calibration parameter

Level 1 K: 1.5	Level 1 Standard Deviation: 0.1468 * THERMAL + 65.027
Level 2 K: 0.5	Level 2 Standard Deviation: 0.2841 *THERMAL + 55.462
Level 3 K: 1.5	Level 3 Standard Deviation: 0.3972 * THERMAL + 20.422

CSM Fatigue

$$N_f = 10^{\left(\frac{k_1 \beta_{c1}\left(\frac{\sigma_s}{M_r}\right)}{k_2 \beta_{c2}}\right)}$$

$N_f = number\ of\ repetitions\ to\ fatigue\ cracking$
$\sigma_s = Tensile\ stress(psi)$
$M_r = modulus\ of\ rupture(psi)$

k1: 1	k2: 1	Bc1: 1	Bc2:1

I-65 C PCCP Overlay Alternative 1

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Subgrade Rutting

$$\delta_a(N) = \beta_{s_1} k_1 \varepsilon_v h \left(\frac{\varepsilon_0}{\varepsilon_r}\right) \left| e^{-\left(\frac{\rho}{N}\right)^{\beta}} \right|$$

$\delta_a = permanent\ deformation\ for\ the\ layer$
$N = number\ of\ repetitions$
$\varepsilon_v = average\ veritcal\ strain(in/in)$
$\varepsilon_0, \beta, \rho = material\ properties$
$\varepsilon_r = resilient\ strain(in/in)$

Granular		Fine	
k1: 2.03	Bs1: 1	k1: 1.35	Bs1: 1
Standard Deviation (BASERUT) 0.1477*Pow(BASERUT,0.6711)+0.001		Standard Deviation (BASERUT) 0.1235*Pow(SUBRUT,0.5012)+0.001	

AC Cracking

AC Top Down Cracking

$$FC_{top} = \left(\frac{C_4}{1 + e^{(C_1 - C_2 * log_{10}(Damage))}}\right) * 10.56$$

c1: 7	c2: 3.5	c3: 0	c4: 1000

AC Bottom Up Cracking

$$FC = \left(\frac{6000}{1 + e^{(C_1 * C_1' + C_2 * C_2' log_{10}(D * 100))}}\right) * \left(\frac{1}{60}\right)$$

$$C_2' = -2.40874 - 39.748 * (1 + h_{ac})^{-2.856}$$

$$C_1' = -2 * C_2'$$

c1: 1	c2: 1	c3: 6000

AC Cracking Top Standard Deviation	AC Cracking Bottom Standard Deviation
200 + 2300/(1+exp(1.072-2.1654*LOG10 (TOP+0.0001)))	1.13+13/(1+exp(7.57-15.5*LOG10 (BOTTOM+0.0001)))

CSM Cracking

$$FC_{ctb} = C_1 + \frac{C_2}{1 + e^{C_3 - C_4(Damage)}}$$

C1: 1	C2: 1	C3: 0	C4: 1000

CSM Standard Deviation
CTB*11

IRI Flexible over PCC

C1 - Rutting
C2 - Fatigue Crack
C3 - Transverse Crack
C4 - Site Factors

C1: 40.8	C2: 0.575	C3: 0.0014	C4: 0.00825

PCC Cracking

$$\log(N) = C1 \cdot \left(\frac{MR}{\sigma}\right)^{C2}$$

$$CRK = \frac{100}{1 + C4\ FD^{C5}}$$

Fatigue Coefficients		Cracking Coefficients	
C1: 2	C2: 1.22	C4: 1	C5: -1.98

PCC Reliability Cracking Standard Deviation
Pow(5.3116*CRACK,0.3903) + 2.99

I-65 C PCCP Overlay Alternative 1

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Reflective Cracking

$$RC = \frac{100}{1 + e^{c.a + d.b.t}}$$

RC = Percent of cracks reflected, %
t = Time, years
h_{ac} = Overlay thickness(in)
a = 3.5 + 0.75(Heff)
b = -0.688584 – 3.37302(Heff)$^{-0.915459}$
c = 1
d = Calibration parameter (user input)

	AC over AC	AC over Rigid, Good Load Transfer	AC over Rigid, Poor Load Transfer
Heff	h_{ac}	$h_{ac} - 1$	$h_{ac} - 3$

Heff	Recommended Calibration Parameter - d	
	Delay Cracking by 2 years	Accelerate Cracking by 2 years
< 4"	0.6	3
4 – 6"	0.7	1.7
> 6"	0.8	1.4

C: 1	D: 1

I-65 C PCCP Overlay Alternative 2

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Design Inputs

Design Life: 50 years
Design Type: AC over JPCP

Existing construction: May, 2000
Pavement construction: July, 2016
Traffic opening: September, 2016

Climate Data Sources (Lat/Lon): 41.453, -87.006; 41.786, -87.752; 41.986, -87.914; 41.707, -86.333; 42.121, -87.905; 41.914, -88.246

Design Structure



Layer type	Material Type	Thickness (in.):
Flexible	PG76-22 Surface SMA	1.5
PCC	Existing PCCP	9.5
NonStabilized	Crushed stone	6.0
Subgrade	A-6	Semi-infinite

Volumetric at Construction:	
Effective binder content (%)	13.4
Air voids (%)	7.0

Traffic

Age (year)	Heavy Trucks (cumulative)
2016 (initial)	20,107
2041 (25 years)	70,937,800
2066 (50 years)	161,911,000

Design Outputs

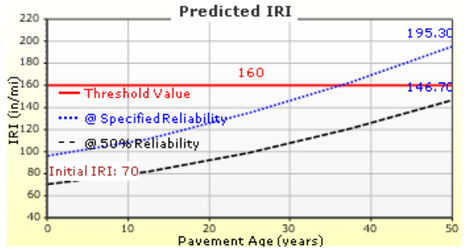
Distress Prediction Summary

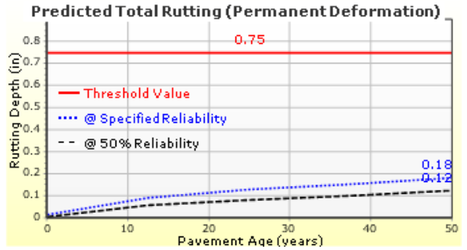
Distress Type	Distress @ Specified Reliability		Reliability (%)		Criterion Satisfied?
	Target	Predicted	Target	Achieved	
Terminal IRI (in./mile)	160.00	195.33	90.00	63.67	Fail
Permanent deformation - total pavement (in.)	0.75	0.18	90.00	100.00	Pass
Total Cracking (Reflective + Alligator) (percent)	50	6.67	-	-	Pass
AC thermal cracking (ft/mile)	500.00	217.41	90.00	100.00	Pass
JPCP transverse cracking (percent slabs)	10.00	3.83	90.00	99.96	Pass
AC bottom-up fatigue cracking (percent)	10.00	1.45	90.00	100.00	Pass
AC top-down fatigue cracking (ft/mile)	2500.00	256.48	90.00	100.00	Pass
Permanent deformation - AC only (in.)	0.40	0.18	90.00	100.00	Pass

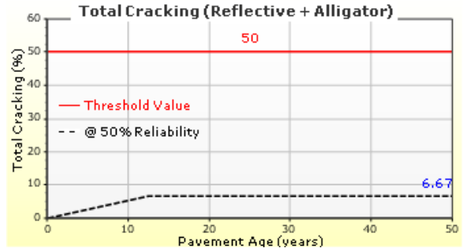
I-65 C PCCP Overlay Alternative 2

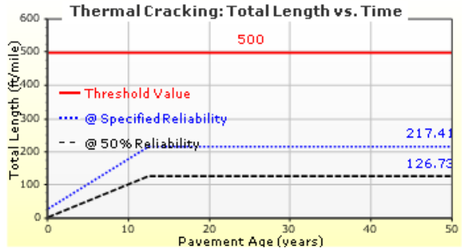
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Distress Charts









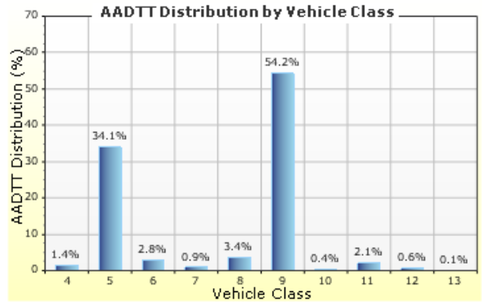
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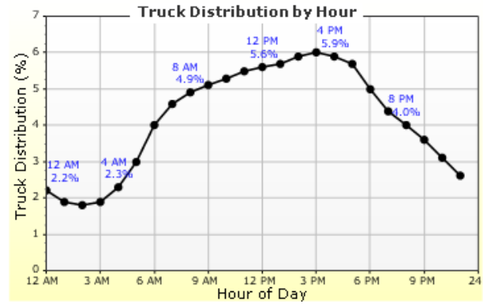
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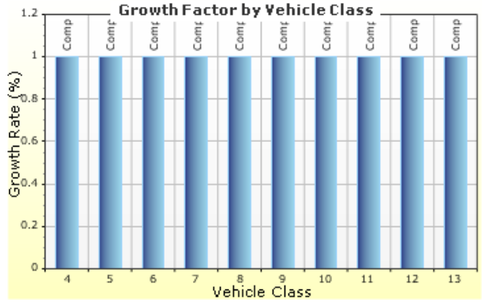
Traffic Inputs

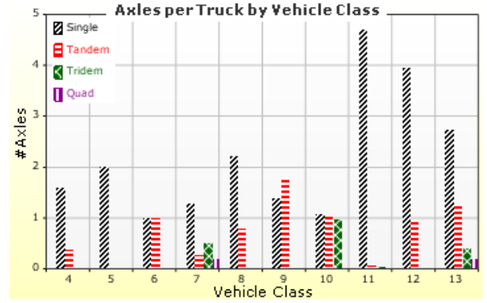
Graphical Representation of Traffic Inputs

Initial two-way AADTT:	20,107	Percent of trucks in design direction (%):	57.0
Number of lanes in design direction:	3	Percent of trucks in design lane (%):	60.0
		Operational speed (mph)	65.0

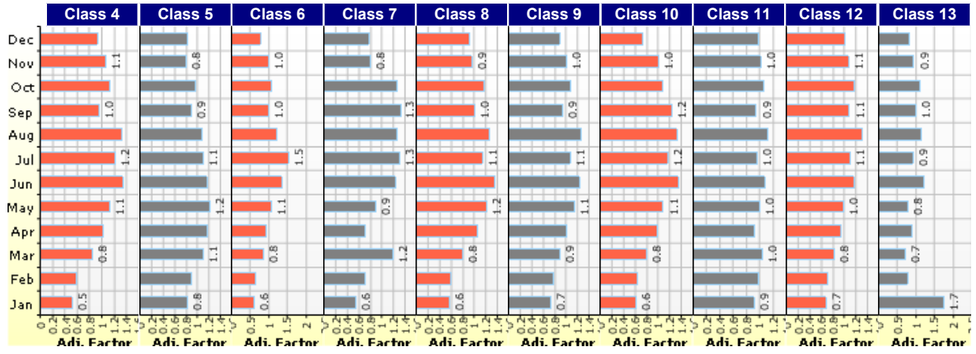








Traffic Volume Monthly Adjustment Factors



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Tabular Representation of Traffic Inputs

Volume Monthly Adjustment Factors

Level 3: Default MAF

Month	Vehicle Class									
	4	5	6	7	8	9	10	11	12	13
January	0.5	0.8	0.6	0.6	0.6	0.7	0.6	0.9	0.7	1.7
February	0.6	0.9	0.6	0.7	0.6	0.8	0.6	1.0	0.7	0.8
March	0.8	1.1	0.8	1.2	0.8	0.9	0.8	1.0	0.8	0.7
April	1.0	1.2	0.9	0.7	1.1	1.0	1.0	0.9	0.9	0.9
May	1.1	1.2	1.1	0.9	1.2	1.1	1.1	1.0	1.0	0.8
June	1.4	1.2	1.3	1.2	1.4	1.2	1.3	1.1	1.2	1.2
July	1.2	1.1	1.5	1.3	1.1	1.1	1.2	1.0	1.1	0.9
August	1.3	1.1	1.3	1.3	1.3	1.3	1.3	1.1	1.3	1.2
September	1.0	0.9	1.0	1.3	1.0	0.9	1.2	0.9	1.1	1.0
October	1.1	0.9	1.1	1.3	1.2	1.1	1.1	1.1	1.2	1.1
November	1.1	0.8	1.0	0.8	0.9	1.0	1.0	1.0	1.1	0.9
December	0.9	0.8	0.8	0.8	0.9	0.9	0.7	1.0	1.0	0.8

Distributions by Vehicle Class

Vehicle Class	AADTT Distribution (%) (Level 3)	Growth Factor	
		Rate (%)	Function
Class 4	1.4%	1%	Compound
Class 5	34.1%	1%	Compound
Class 6	2.8%	1%	Compound
Class 7	0.9%	1%	Compound
Class 8	3.4%	1%	Compound
Class 9	54.2%	1%	Compound
Class 10	0.4%	1%	Compound
Class 11	2.1%	1%	Compound
Class 12	0.6%	1%	Compound
Class 13	0.1%	1%	Compound

Truck Distribution by Hour

Hour	Distribution (%)	Hour	Distribution (%)
12 AM	2.2%	12 PM	5.6%
1 AM	1.9%	1 PM	5.7%
2 AM	1.8%	2 PM	5.9%
3 AM	1.9%	3 PM	6%
4 AM	2.3%	4 PM	5.9%
5 AM	3%	5 PM	5.7%
6 AM	4%	6 PM	5%
7 AM	4.6%	7 PM	4.4%
8 AM	4.9%	8 PM	4%
9 AM	5.1%	9 PM	3.6%
10 AM	5.3%	10 PM	3.1%
11 AM	5.5%	11 PM	2.6%
		Total	100%

Axle Configuration

Traffic Wander	
Mean wheel location (in.)	18
Traffic wander standard deviation (in.)	10
Design lane width (ft)	12

Axle Configuration	
Average axle width (ft)	8.5
Dual tire spacing (in.)	12
Tire pressure (psi)	120

Average Axle Spacing	
Tandem axle spacing (in.)	51.6
Tridem axle spacing (in.)	49.2
Quad axle spacing (in.)	49.2

Wheelbase			
Value Type / Axle Type	Short	Medium	Long
Average spacing of axles (ft)	12	15	18
Percent of Trucks (%)	33	33	34

Number of Axles per Truck

Vehicle Class	Single Axle	Tandem Axle	Tridem Axle	Quad Axle
Class 4	1.6	0.39	0	0
Class 5	2	0	0	0
Class 6	1	1	0	0
Class 7	1.29	0.29	0.5	0.19
Class 8	2.19	0.8	0	0
Class 9	1.37	1.8	0	0
Class 10	1.05	1.02	0.96	0.01
Class 11	4.71	0.08	0.03	0
Class 12	3.94	0.99	0.01	0
Class 13	2.73	1.25	0.41	0.2

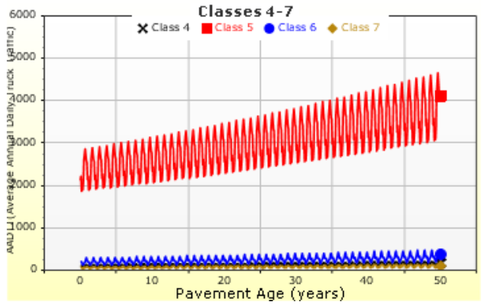
Pavement Design Report Appendix C

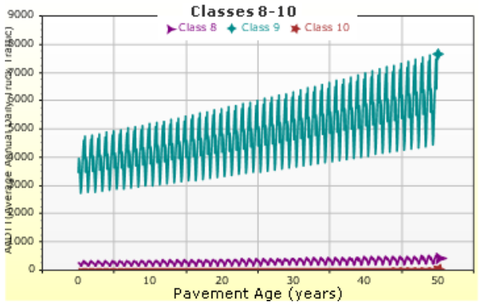
I-65 C PCCP Overlay Alternative 2

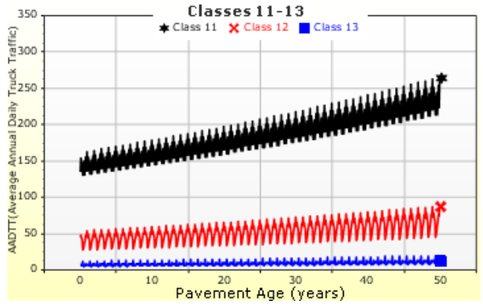
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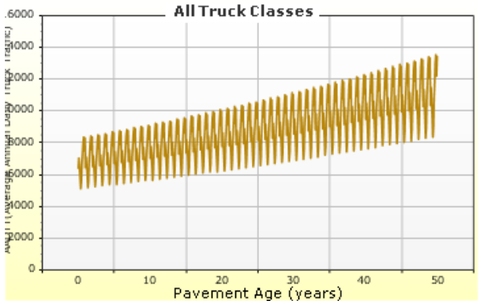
AADTT (Average Annual Daily Truck Traffic) Growth

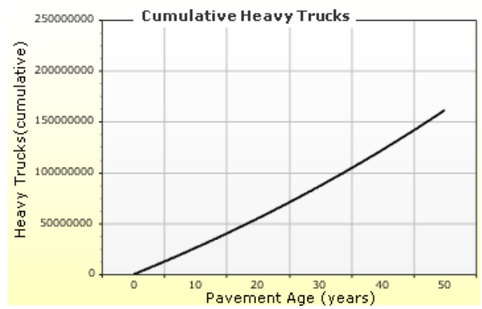
*** Traffic cap is not enforced**











I-65 C PCCP Overlay Alternative 2

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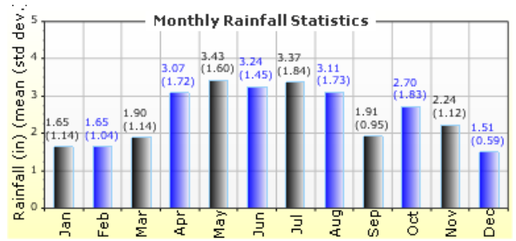
Climate Inputs

Climate Data Sources:

Climate Station Cities:	Location (lat lon elevation(ft))
VALPARAISO, IN	41.45300 -87.00600 770
CHICAGO, IL	41.78600 -87.75200 612
CHICAGO, IL	41.98600 -87.91400 662

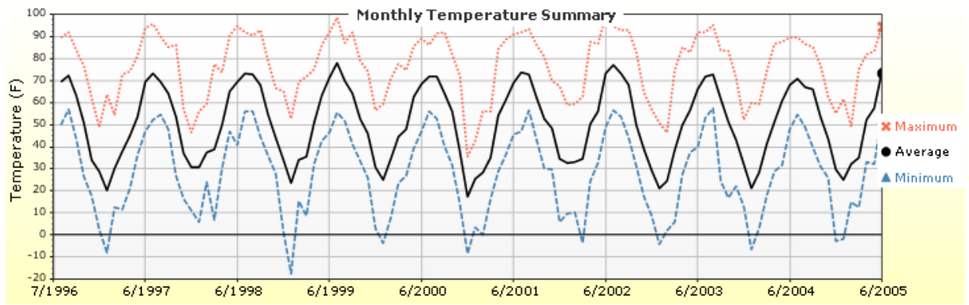
Annual Statistics:

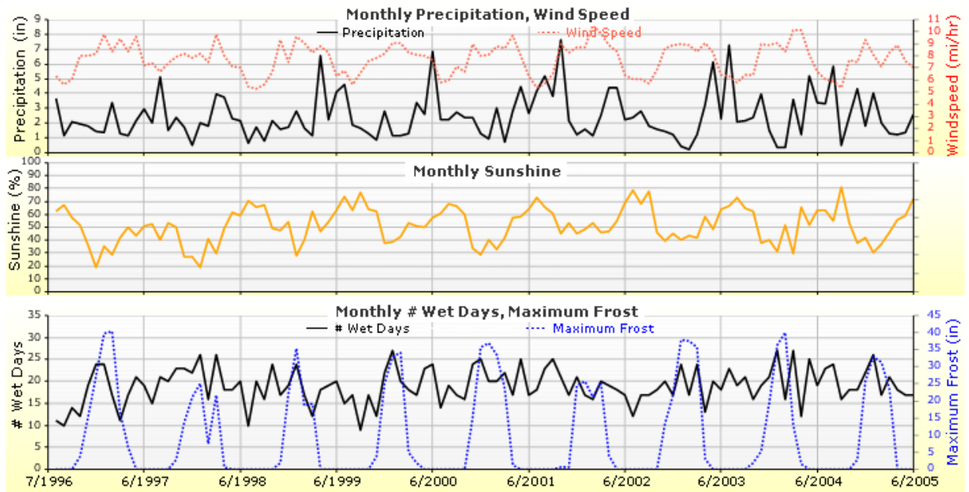
Mean annual air temperature (ºF)	50.55
Mean annual precipitation (in.)	29.78
Freezing index (ºF - days)	677.11
Average annual number of freeze/thaw cycles:	62.54



Water table depth (ft) 10.00

Monthly Climate Summary:



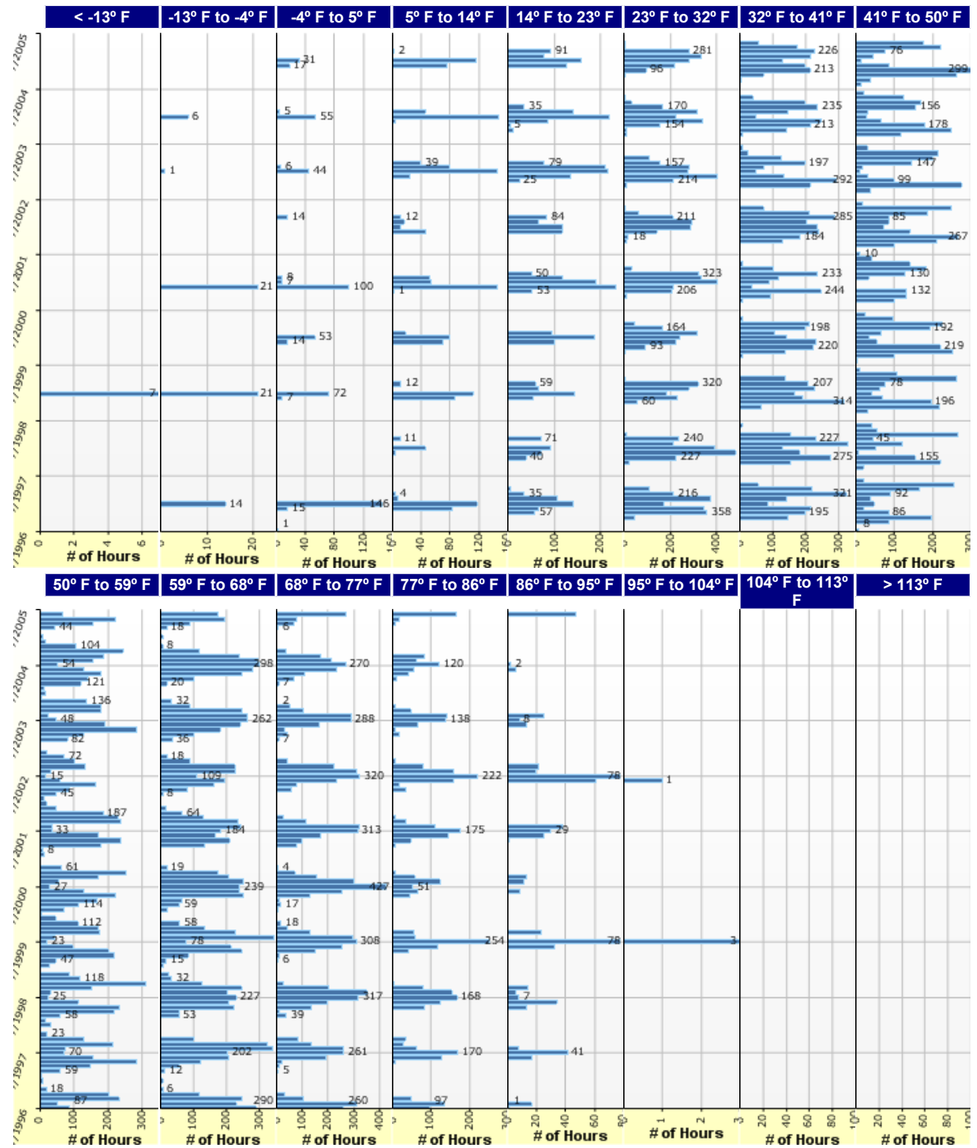


Pavement Design Report Appendix C

I-65 C PCCP Overlay Alternative 2

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Hourly Air Temperature Distribution by Month:



I-65 C PCCP Overlay Alternative 2

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Design Properties

HMA Design Properties

Use Multilayer Rutting Model	False
Using G* based model (not nationally calibrated)	False
Is NCHRP 1-37A HMA Rutting Model Coefficients	True
Endurance Limit	-
Use Reflective Cracking	True

Layer Name	Layer Type	Interface Friction
Layer 1 Flexible : PG76-22 Surface SMA	Flexible (1)	1.00
Layer 2 PCC : Existing PCCP	PCC (0)	1.00
Layer 3 Non-stabilized Base : Crushed stone	Non-stabilized Base (4)	1.00
Layer 4 Subgrade : A-6	Subgrade (5)	-

JPCP Design Properties

Structure - ICM Properties	
PCC surface shortwave absorptivity	0.85

PCC joint spacing (ft)	
Is joint spacing random ?	False
Joint spacing (ft)	15.00

Doweled Joints	
Is joint doweled ?	True
Dowel diameter (in.)	1.25
Dowel spacing (in.)	12.00

Widened Slab	
Is slab widened ?	False
Slab width (ft)	12.00

Sealant type	Other(Including No Sealant... Liquid... Silicone)

Tied Shoulders	
Tied shoulders	False
Load transfer efficiency (%)	-

PCC-Base Contact Friction	
PCC-Base full friction contact	True
Months until friction loss	600.00

Erodibility index	2

Permanent curl/warp effective temperature difference (ºF)	-10.00

JPCP Rehabilitation Properties

Slabs distressed/replaced before restoration (%)	0.00
Slabs repaired/replaced after restoration (%)	0.00

Modulus Subgrade Reaction	
Is modulus of subgrade reaction measured?	False
Month modulus of subgrade reaction measured	-
Dynamic modulus of subgrade reaction (psi/in.)	-

I-65 C PCCP Overlay Alternative 2

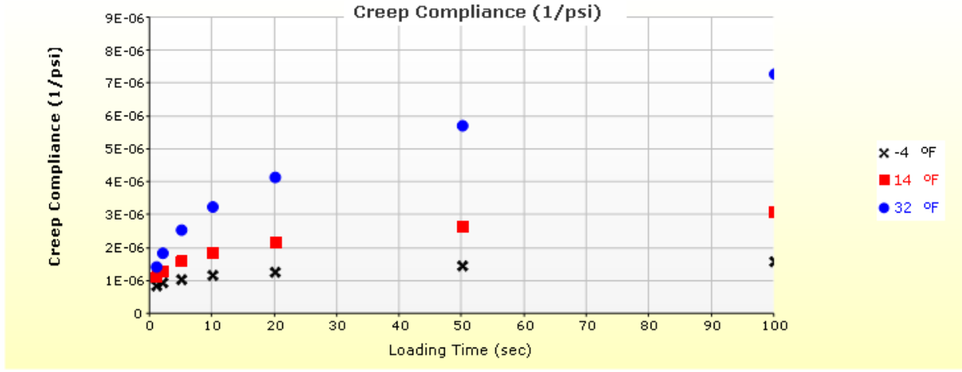
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Thermal Cracking (Input Level: 3)

Indirect tensile strength at 14 ºF (psi)	404.62

Thermal Contraction	
Is thermal contraction calculated?	True
Mix coefficient of thermal contraction (in./in./ºF)	-
Aggregate coefficient of thermal contraction (in./in./ºF)	6.1e-006
Voids in Mineral Aggregate (%)	20.4

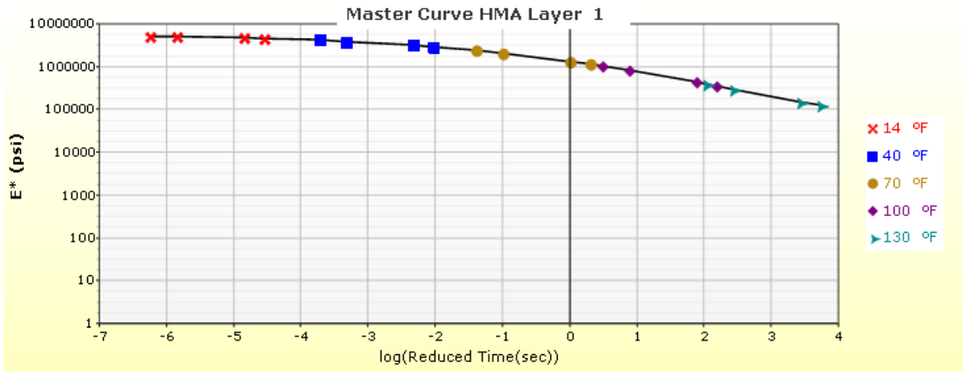
	Creep Compliance (1/psi)		
Loading time (sec)	**-4 ºF**	**14 ºF**	**32 ºF**
1	8.77e-007	1.13e-006	1.47e-006
2	9.61e-007	1.31e-006	1.87e-006
5	1.09e-006	1.61e-006	2.58e-006
10	1.19e-006	1.87e-006	3.28e-006
20	1.31e-006	2.18e-006	4.18e-006
50	1.47e-006	2.67e-006	5.75e-006
100	1.62e-006	3.11e-006	7.32e-006

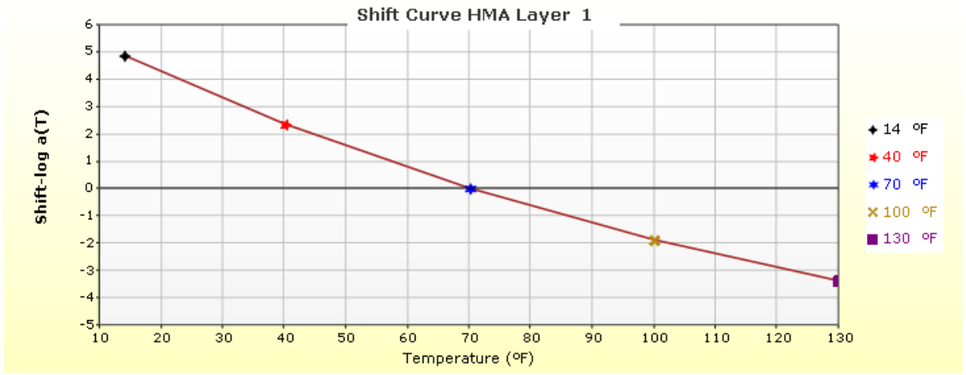


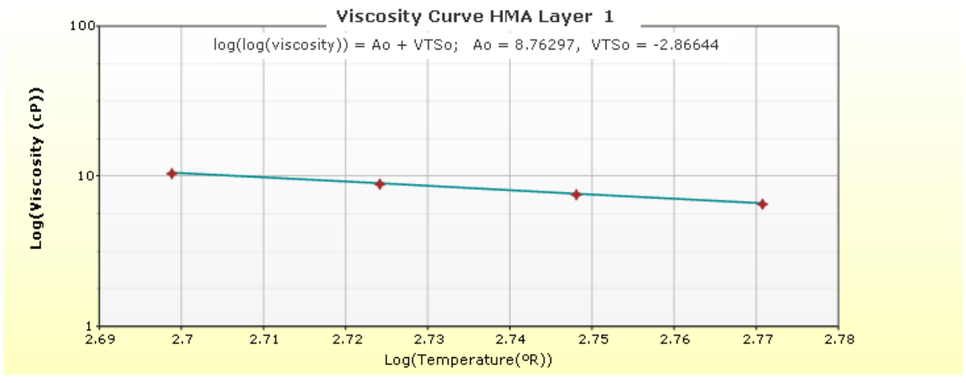
I-65 C PCCP Overlay Alternative 2

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HMA Layer 1: Layer 1 Flexible : PG76-22 Surface SMA



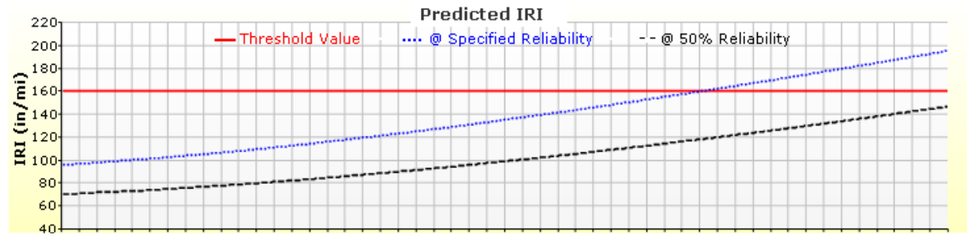


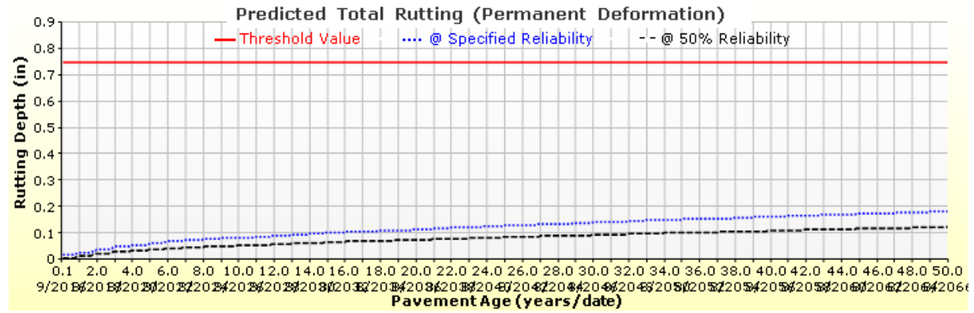


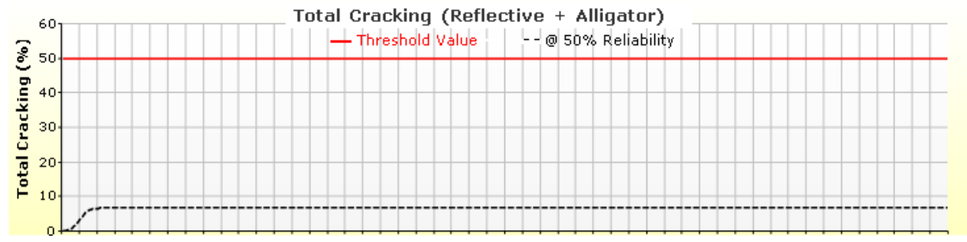
I-65 C PCCP Overlay Alternative 2

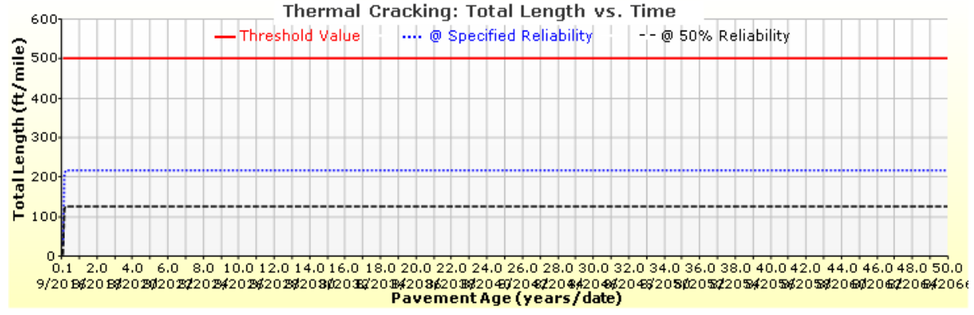
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Analysis Output Charts



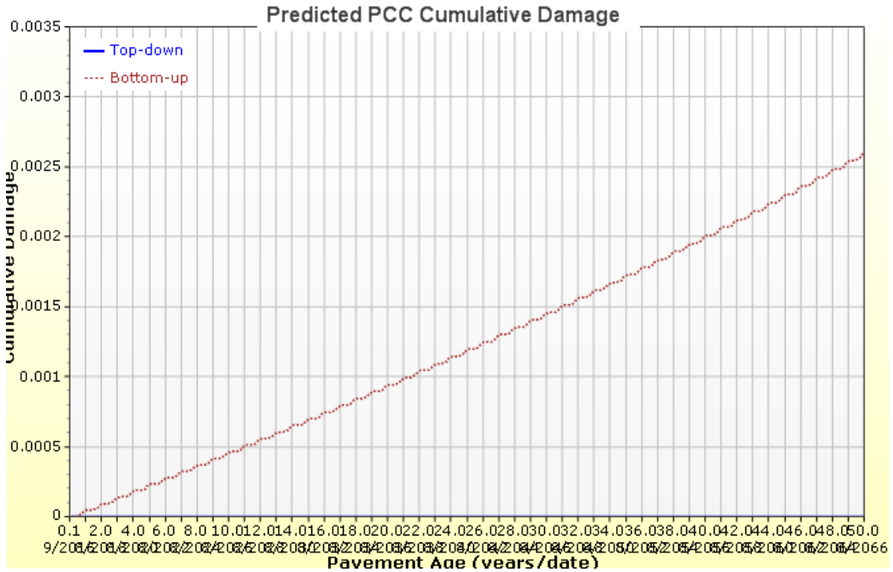


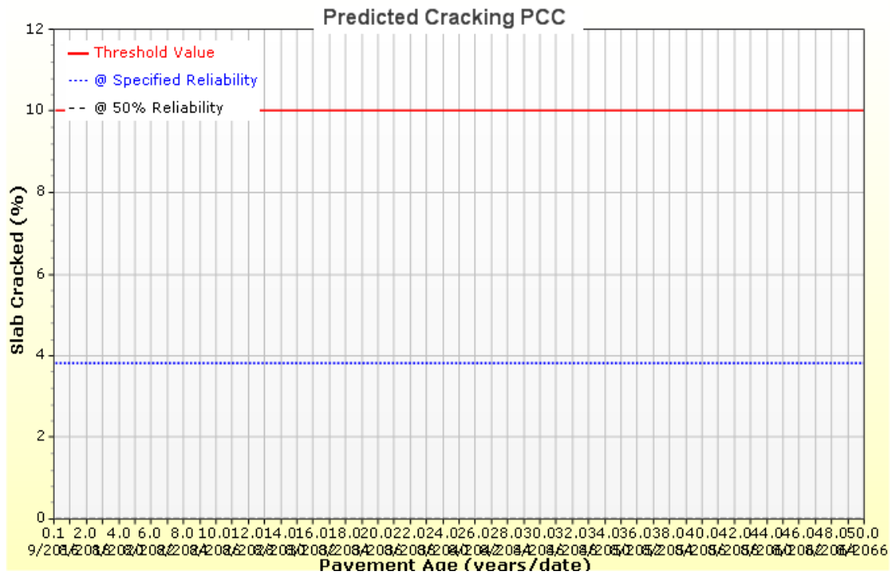




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Created by: on: 4/22/2016 9:41 AM

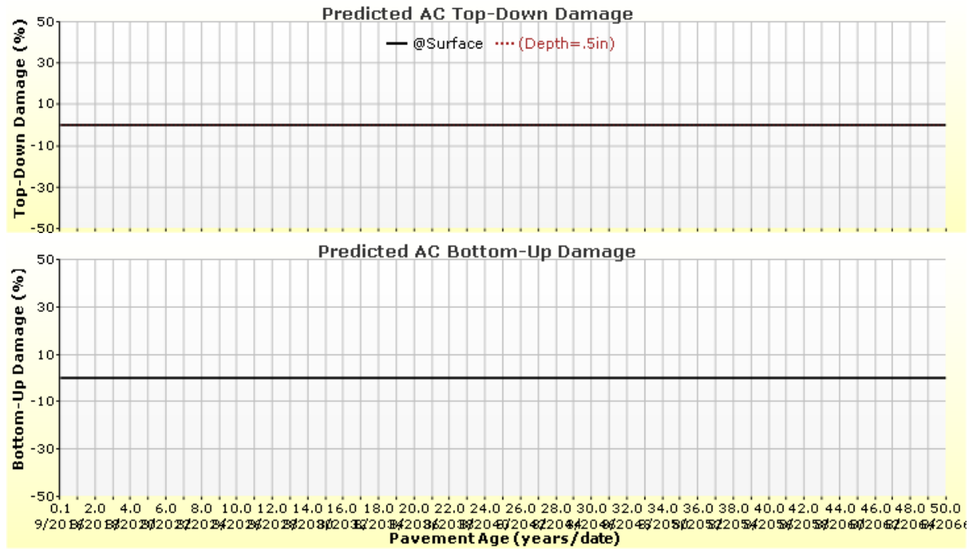
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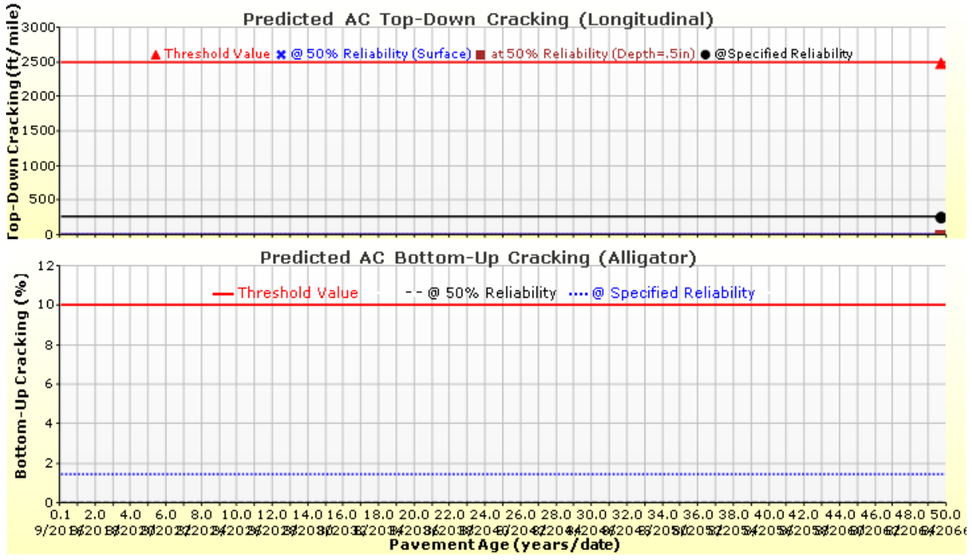
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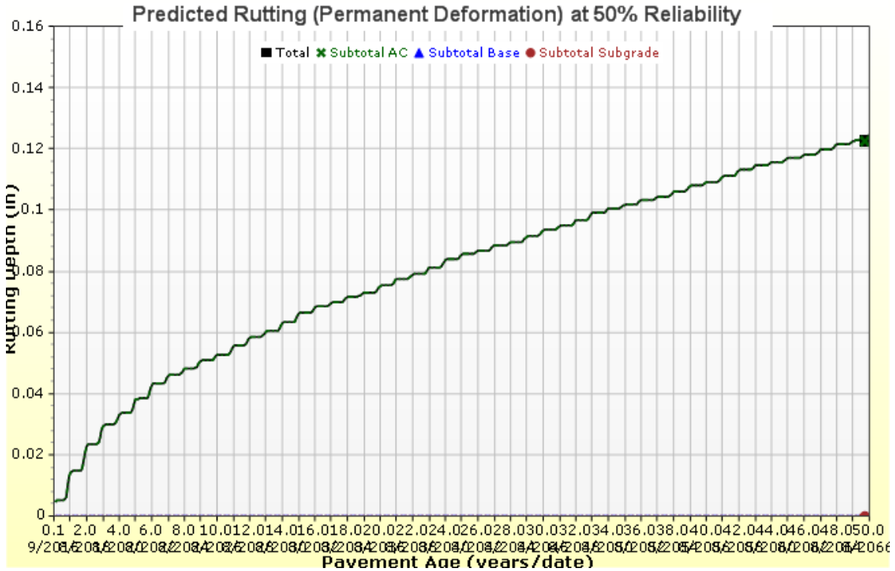
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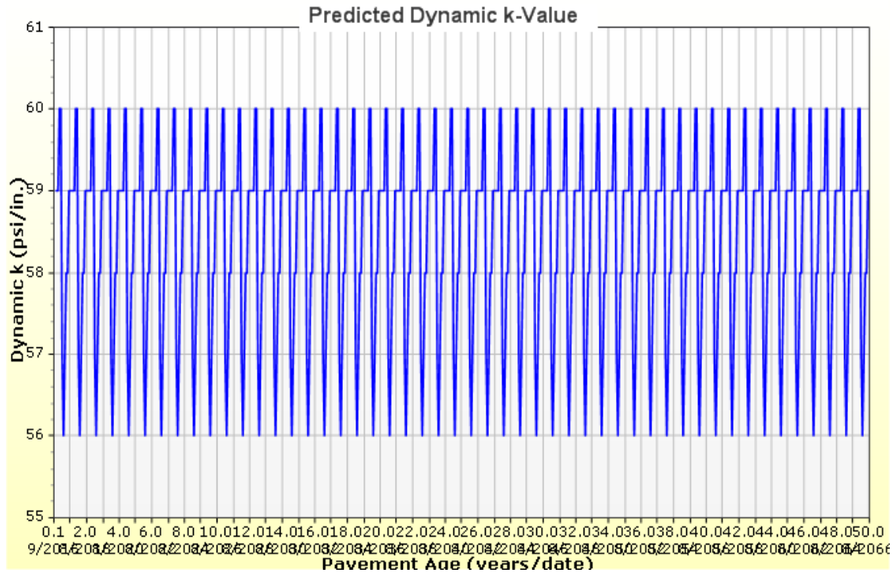
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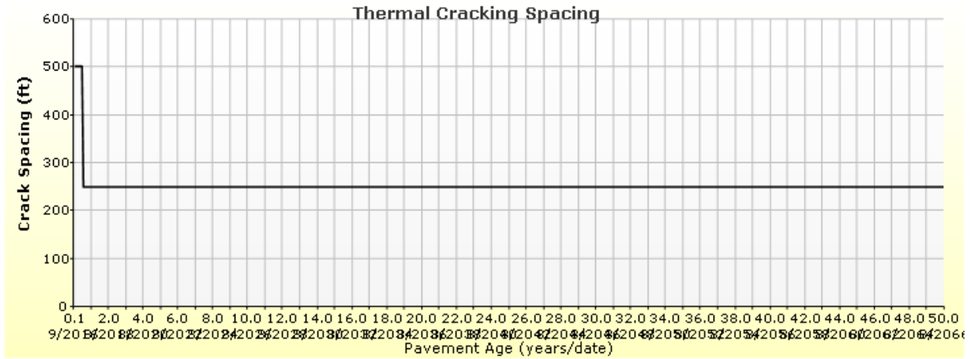
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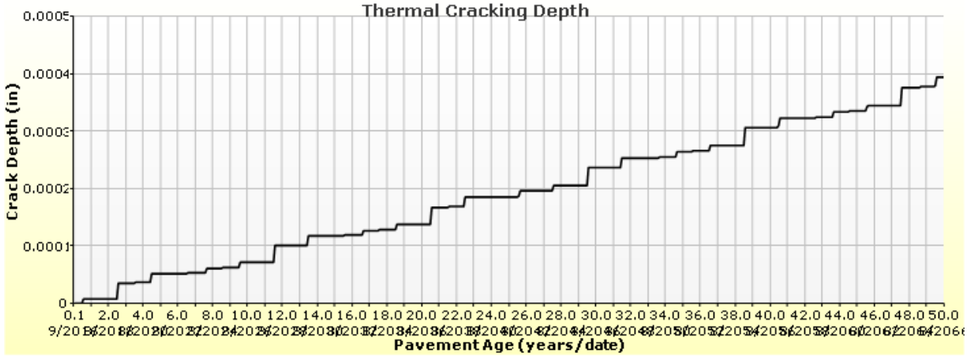




I-65 C PCCP Overlay Alternative 2

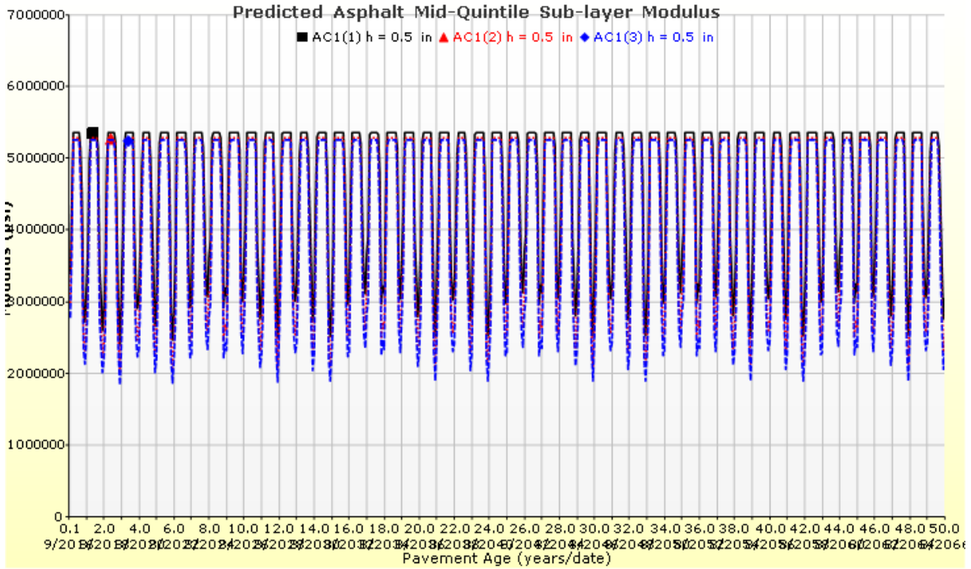
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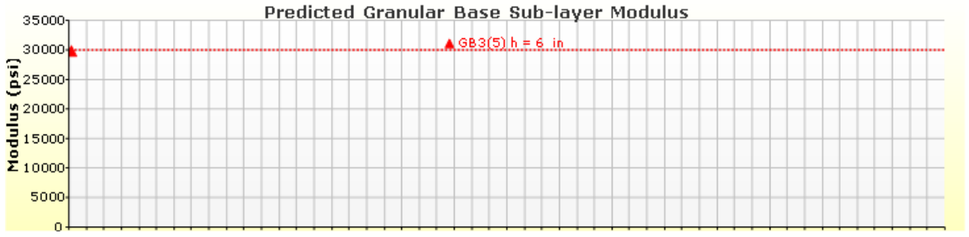


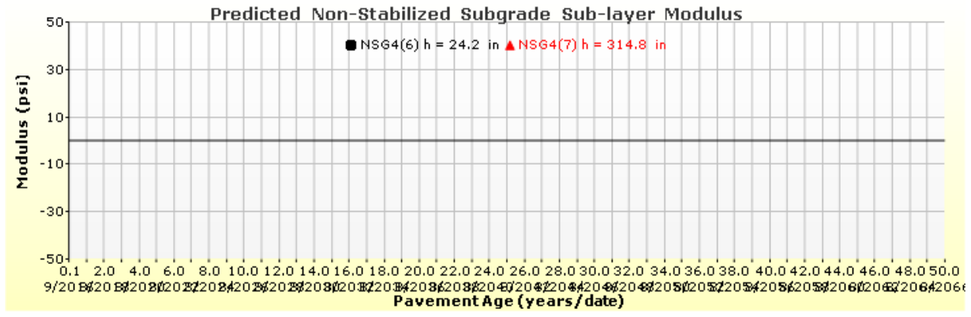


I-65 C PCCP Overlay Alternative 2

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Pavement Design Report Appendix C

I-65 C PCCP Overlay Alternative 2

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Layer Information

Layer 1 Flexible : PG76-22 Surface SMA

Asphalt		
Thickness (in.)	1.5	
Unit weight (pcf)	160.0	
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 1)

T (°F)	0.1 Hz	1 Hz	10 Hz	25 Hz
10	3647648	4669504	5000000	5000000
40	2415742	3373281	4392981	4797248
70	763973	1296571	2030073	2372323
100	228891	438683	796159	989704
130	80754	159253	310900	401763

Asphalt Binder

Temperature (°F)	Binder Gstar (Pa)	Phase angle (deg)
40	19627632.35	32.71
55	9199787.41	42.43
70	3072091.94	50.32
85	926086.84	56.76
100	278615.81	62.04
115	87586.86	66.4
130	29373.15	70.01

General Info

Name	Value
Reference temperature (°F)	70
Effective binder content (%)	13.4
Air voids (%)	7
Thermal conductivity (BTU/hr-ft-°F)	0.63
Heat capacity (BTU/lb-°F)	0.31

Identifiers

Field	Value
Display name/identifier	PG76-22 Surface SMA
Description of object	
Author	
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

I-65 C PCCP Overlay Alternative 2

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Layer 2 PCC : Existing PCCP

PCC		
Thickness (in.)		9.5
Unit weight (pcf)		145.0
Poisson's ratio		0.2

Thermal	
PCC coefficient of thermal expansion (in./in./°F x 10^-6)	5.4
PCC thermal conductivity (BTU/hr-ft-°F)	1.25
PCC heat capacity (BTU/lb-°F)	0.28

Mix		
Cement type		Type I (1)
Cementitious material content (lb/yd^3)		510
Water to cement ratio		0.42
Aggregate type		Limestone (1)
PCC zero-stress temperature (°F)	Calculated Internally?	True
	User Value	-
	Calculated Value	101.3
Ultimate shrinkage (microstrain)	Calculated Internally?	True
	User Value	-
	Calculated Value	541.4
Reversible shrinkage (%)		50
Time to develop 50% of ultimate shrinkage (days)		35
Curing method		Curing Compound

PCC strength and modulus (Input Level: 3)

28-Day PCC modulus of rupture (psi)	700.0
28-Day PCC elastic modulus (psi)	-

Identifiers

Field	Value
Display name/identifier	Existing PCCP
Description of object	
Author	
Date Created	7/18/2016 12:06:59 PM
Approver	
Date approved	7/18/2016 12:06:59 PM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

I-65 C PCCP Overlay Alternative 2

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Layer 3 Non-stabilized Base : Crushed stone

Unbound	
Layer thickness (in.)	6.0
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 2)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
30000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	Crushed stone
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted?	True

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.7
Saturated hydraulic conductivity (ft/hr)	False	5.054e-02
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	False	7.4

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	7.2555
bf	1.3328
cf	0.8242
hr	117.4000

Sieve Size	% Passing
0.001mm	
0.002mm	
0.020mm	
#200	8.7
#100	
#80	12.9
#60	
#50	
#40	20.0
#30	
#20	
#16	
#10	33.8
#8	
#4	44.7
3/8-in.	57.2
1/2-in.	63.1
3/4-in.	72.7
1-in.	78.8
1 1/2-in.	85.8
2-in.	91.6
2 1/2-in.	
3-in.	
3 1/2-in.	97.6

I-65 C PCCP Overlay Alternative 2

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Layer 4 Subgrade : A-6

Unbound	
Layer thickness (in.)	Semi-infinite
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 2)

Analysis Type:	Annual representative values
Method:	Resilient Modulus (psi)

Resilient Modulus (psi)
3000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor:	-

Identifiers

Field	Value
Display name/identifier	A-6
Description of object	Default material
Author	AASHTO
Date Created	1/1/2011 12:00:00 AM
Approver	
Date approved	1/1/2011 12:00:00 AM
State	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	31.1
Plasticity Index	11.5
Is layer compacted?	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	True	106
Saturated hydraulic conductivity (ft/hr)	False	2.224e-05
Specific gravity of solids	False	2.7
Optimum gravimetric water content (%)	True	18.2

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	94.5761
bf	0.7777
cf	0.3069
hr	500.0000

Sieve Size	% Passing
0.001mm	
0.002mm	20.4
0.020mm	
#200	57.7
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	92.2
#8	
#4	
3/8-in.	
1/2-in.	
3/4-in.	
1-in.	100.0
1 1/2-in.	
2-in.	
2 1/2-in.	
3-in.	
3 1/2-in.	

I-65 C PCCP Overlay Alternative 2

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Calibration Coefficients

AC Fatigue	
$N_f = 0.00432 * C * \beta_{f1} k_1 \left(\frac{1}{\varepsilon_1}\right)^{k_2\beta_{f2}} \left(\frac{1}{E}\right)^{k_3\beta_{f3}}$	k1: 0.007566
	k2: 3.9492
	k3: 1.281
$C = 10^M$	Bf1: 1
$M = 4.84\left(\frac{V_b}{V_a + V_b} - 0.69\right)$	Bf2: 1
	Bf3: 1

AC Rutting

$$\frac{\varepsilon_p}{\varepsilon_r} = k_z \beta_{r1} 10^{k_1} T^{k_2\beta_{r2}} N^{k_3\beta_{r3}}$$

$$k_z = (C_1 + C_2 * depth) * 0.328196^{depth}$$

$$C_1 = -0.1039 * H_a^2 + 2.4868 * H_a - 17.342$$

$$C_2 = 0.0172 * H_a^2 - 1.7331 * H_a + 27.428$$

Where:

$H_{ac} = total\ AC\ thickness(in)$

$\varepsilon_p = plastic\ strain\left(^{in}/_{in}\right)$

$\varepsilon_r = resilient\ strain\left(^{in}/_{in}\right)$

$T = layer\ temperature(^{\circ}F)$

$N = number\ of\ load\ repetitions$

AC Rutting Standard Deviation	0.24*Pow(RUT,0.8026)+0.001	
AC Layer	K1:-3.35412 K2:1.5606 K3:0.4791	Br1:1 Br2:1 Br3:1

Thermal Fracture

$$C_f = 400 * N\left(\frac{\log C / h_{ac}}{\sigma}\right)$$

$$\Delta C = (k * \beta t)^{n+1} * A * \Delta K^n$$

$$A = 10^{(4.389 - 2.52 * \log(E * \sigma_m * n))}$$

$C_f = observed\ amount\ of\ thermal\ cracking(ft/500ft)$
$k = refression\ coefficient\ determined\ through\ field\ calibration$
$N() = standard\ normal\ distribution\ evaluated\ at()$
$\sigma = standard\ deviation\ of\ the \log\ of\ the\ depth\ of\ cracks\ in\ the\ pavments$
$C = crack\ depth(in)$
$h_{ac} = thickness\ of\ asphalt\ layer(in)$
$\Delta C = Change\ in\ the\ crack\ depth\ due\ to\ a\ cooling\ cycle$
$\Delta K = Change\ in\ the\ stress\ intensity\ factor\ due\ to\ a\ cooling\ cycle$
$A, n = Fracture\ parameters\ for\ the\ asphalt\ mixture$
$E = mixture\ stiffness$
$\sigma_M = Undamaged\ mixture\ tensile\ strength$
$\beta_t = Calibration\ parameter$

Level 1 K: 1.5	Level 1 Standard Deviation: 0.1468 * THERMAL + 65.027
Level 2 K: 0.5	Level 2 Standard Deviation: 0.2841 *THERMAL + 55.462
Level 3 K: 1.5	Level 3 Standard Deviation: 0.3972 * THERMAL + 20.422

CSM Fatigue

$$N_f = 10^{\left(\frac{k_1 \beta_{c1} \left(\frac{\sigma_s}{M_r}\right)}{k_2 \beta_{c2}}\right)}$$

$N_f = number\ of\ repetitions\ to\ fatigue\ cracking$
$\sigma_s = Tensile\ stress(psi)$
$M_r = modulus\ of\ rupture(psi)$

k1: 1	k2: 1	Bc1: 1	Bc2:1

I-65 C PCCP Overlay Alternative 2

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Subgrade Rutting

$$\delta_a(N) = \beta_{s_1} k_1 \varepsilon_v h \left(\frac{\varepsilon_0}{\varepsilon_r}\right) \left| e^{-\left(\frac{\rho}{N}\right)^{\beta}} \right|$$

δ_a = permanent deformation for the layer
N = number of repetitions
ε_v = average veritcal strain(in/in)
$\varepsilon_0, \beta, \rho$ = material properties
ε_r = resilient strain(in/in)

Granular		Fine	
k1: 2.03	Bs1: 1	k1: 1.35	Bs1: 1
Standard Deviation (BASERUT) 0.1477*Pow(BASERUT,0.6711)+0.001		Standard Deviation (BASERUT) 0.1235*Pow(SUBRUT,0.5012)+0.001	

AC Cracking

AC Top Down Cracking

$$FC_{top} = \left(\frac{C_4}{1 + e^{(C_1 - C_2 * log_{10}(Damage))}}\right) * 10.56$$

c1: 7	c2: 3.5	c3: 0	c4: 1000

AC Cracking Top Standard Deviation

200 + 2300/(1+exp(1.072-2.1654*LOG10 (TOP+0.0001)))

AC Bottom Up Cracking

$$FC = \left(\frac{6000}{1 + e^{(C_1 * C_1' + C_2 * C_2' log_{10}(D * 100))}}\right) * \left(\frac{1}{60}\right)$$

$$C_2' = -2.40874 - 39.748 * (1 + h_{ac})^{-2.856}$$

$$C_1' = -2 * C_2'$$

c1: 1	c2: 1	c3: 6000

AC Cracking Bottom Standard Deviation

1.13+13/(1+exp(7.57-15.5*LOG10 (BOTTOM+0.0001)))

CSM Cracking

$$FC_{ctb} = C_1 + \frac{C_2}{1 + e^{C_3 - C_4 (Damage)}}$$

C1: 1	C2: 1	C3: 0	C4: 1000

CSM Standard Deviation

CTB*11

IRI Flexible over PCC

C1 - Rutting
C2 - Fatigue Crack
C3 - Transverse Crack
C4 - Site Factors

C1: 40.8	C2: 0.575	C3: 0.0014	C4: 0.00825

PCC Cracking

$$\log(N) = C1 \cdot \left(\frac{MR}{\sigma}\right)^{C2}$$

$$CRK = \frac{100}{1 + C4\ FD^{C5}}$$

Fatigue Coefficients		Cracking Coefficients	
C1: 2	C2: 1.22	C4: 1	C5: -1.98

PCC Reliability Cracking Standard Deviation

Pow(5.3116*CRACK,0.3903) + 2.99

I-65 C PCCP Overlay Alternative 2

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Reflective Cracking

$$RC = \frac{100}{1 + e^{c.a + d.b.t}}$$

RC = Percent of cracks reflected, %
t = Time, years
h_{ac} = Overlay thickness(in)
a = 3.5 + 0.75(Heff)
b = -0.688584 – 3.37302(Heff)$^{-0.915459}$
c = 1
d = Calibration parameter (user input)

	AC over AC	AC over Rigid, Good Load Transfer	AC over Rigid, Poor Load Transfer
Heff	h_{ac}	$h_{ac} - 1$	$h_{ac} - 3$

Heff	Recommended Calibration Parameter - d	
	Delay Cracking by 2 years	Accelerate Cracking by 2 years
< 4"	0.6	3
4 – 6"	0.7	1.7
> 6"	0.8	1.4

C: 1	D: 1

IMPROVING MOBILITY
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