Land and Water Conservation Fund (LWCF) County Property List for Indiana (Last Updated March 2022)

ProjectNumber	SubProjectCode	County	Property
1800048	1800048	Marion	Eagle Creek Park, Nature Preserve, and Peace Learning Center
1800072	1800072	Marion	Martin Luther King Park
1800088	1800088	Marion	Eagle Creek Park, Nature Preserve, and Peace Learning Center
1800114	1800114	Marion	Eagle Creek Golf Course
1800148	1800148	Johnson	Tot Park, New Whiteland Park
1800167	1800167	Marion	Eagle Creek Park, Nature Preserve, and Peace Learning Center
1800185	1800185	Marion	German Church & 30th St Park
1800222	1800222	Marion	Southwestway Park
1800245	1800245	Marion	Lawrence Community Park
1800245.1	1800245.1	Marion	Richard T Park
1800247	1800247	Marion	Ft. Harrison S.P. Dog Park (old--Fall Creek Park)
1800307	1800307	Marion	Washington Park
1800307.1	1800307.1	Marion	16th and Franklin Park (Greene Park)
1800330	1800330	Marion	Riverside Park
1800369	1800369B.10	Johnson	Independence Park
1800369	1800369B	Johnson	Johnson Co. Park/Hoosier Horse Park
1800369	1800369M	Marion	Ft. Harrison S.P. Dog Park (old--Fall Creek Park)
1800384	1800384	Marion	Sarah T. Bolton Park
1800401	1800401B	Marion	Eagles Crest
1800401.2	1800401.2A	Marion	Starling Nature Sanctuary at Eagle Creek
1800401.2	1800401.2B	Marion	Wish Park
1800401.3	1800401.3	Marion	Cancer Park
1800401.4	1800401.4	Marion	Krannert Park
1800404	1800404	Marion	Major Taylor Velodrome & Lake Sullivan
1800459	1800459	Marion	Fall Creek Parkway, Fall Creek Corridor Ph.III
1800467	1800467	Marion	Hartman Park/Beech Grove Little League
1800478	1800478	Marion	Oaklandon Play Park
1800505	1800505	Marion	Fall Creek Parkway, Fall Creek Corridor Ph.III
1800541	1800541	Marion	Southwestway Park
1800600	1800600	Marion	Southport Park
1800617	1800617	Marion	Fort Benjamin Harrison Civic Plaza
1800635	1800635	Marion	Leonard Park

*Park names may have changed. If acquisition of publically owned land or impacts to publically owned land is anticipated, coordination with IDNR, Division of Outdoor Recreation, should occur.

From:	Bales, Ronald
To:	Christine Meador; Miller, Brandon; Hinkle, Meghan; Darrah, Taylor N
Cc:	Wallace, Jonathan N; ericka.miller@indy.gov; Chris Schultz; Adin McCann; Susan Harrington
Subject:	RE: Des. No. 2002553 - DPW Project ST-45-067 - County Line Road – Request for Determination of CSRS
Date:	Friday, July 9, 2021 8:17:05 AM
Attachments:	image001.png image002.png image003.png image004.png image005.gif

INDOT concurs that based on the information provided, a CSRS is not required for this project. Thank you.

Ron Bales
INDOT-Environmental Services Division
Office: (317) 515-7908
Email: rbales@indot.in.gov

From: Christine Meador <CMeador@HNTB.com>
Sent: Wednesday, June 30, 2021 12:48 PM
To: Bales, Ronald <rbales@indot.IN.gov>; Miller, Brandon <BraMiller1@indot.IN.gov>; Hinkle, Meghan <MHinkle@indot.IN.gov>; Darrah, Taylor N <TDarrah@indot.IN.gov>
Cc: Wallace, Jonathan N <JWallace2@indot.IN.gov>; ericka.miller@indy.gov; Chris Schultz <cjschultz@HNTB.com>; Adin McCann <amccann@hntb.com>; Susan Harrington <sharrington@HNTB.com>
Subject: Des. No. 2002553 - DPW Project ST-45-067 - County Line Road – Request for Determination of CSRS

All –

As we have progressed with the design of County Line Road between I-69 (SR 37) and SR 135 (Des. No. 2002553 - DPW Project ST-45-067) Marion & Johnson Counties, Indiana, we have determined that avoidance of residential relocations is not possible. At this time we are expecting 12 residential relocations; however, that number may change as we continue into design. Per the INDOT CE Manual, projects with more than 10 relocations should consider if a Conceptual Stage Relocation Study (CSRS) is necessary.

At this time, we are requesting your concurrence that a CSRS is not required. The project is located at the edge of Marion and Johnson counties within a highly developed residential area and abundant replacement housing is available. Property acquisition will be completed by the Department of Public Works for the City of Indianapolis in accordance with all state and federal requirements.

Thank you for your assistance with this project and have a great day.

Existing Structures

Stucture Number	Station		Offset from Centerline (feet)	Pipe Diameter (inches)	Pipe Length (feet)	Material	Intended Action
P-EX206	A 225+86.66	Storm Sewer	-39.37	24	237	RCP	Reconnect to New Storm Sewer
P-EX210	A 213+35.62	Storm Sewer	50.88	24	85	CMP	Remove / Replace with Storm Sewer
P-EX213	A 224+84.81	Storm Sewer	62.41	12	19	RCP	Do Not Disturb
P-EX215	A 225+85.68	Storm Sewer	38.85	18	129	RCP	Do Not Disturb
P-EX10000	56+52.34	Under Morris Rd	-17.82	12	51	RCP	Remove / Replace with Storm Sewer
P-EX10001	57+64.30	Under Drive	-15.12	12	17	RCP	Remove / Replace with Storm Sewer
P-EX10002	A 112+69.58	Under Drive	-16.87	12	19	RCP	Remove / Replace with Storm Sewer
P-EX10003	A 113+97.06	Under Drive	-14.81	12	17	RCP	Remove / Replace with Storm Sewer
P-EX10004	A 115+79.27	Under Drive	-13.88	12	19	CMP	Remove / Replace with Storm Sewer
P-EX10005	A 125+58.45	Under Drive	43.55	12	28	RCP	Remove
P-EX10007	A 127+80.18	Under Drive	33.66	12	50	PVC	Remove
P-EX10008	A 132+84.34	Under Drive	-37.72	24	28	CMP	Remove / Replace with Storm Sewer
P-EX10009	A 133+67.15	Under Drive	28.47	12	24	CMP	Remove / Replace with Storm Sewer
P-EX10010	A 134+51.32	Under Drive	24.23	12	26	CMP	Remove / Replace with Storm Sewer
P-EX10011	A 134+64.09	Under Drive	-29.63	12	24	CMP	Remove / Replace with Storm Sewer
P-EX10012	A 135+23.00	Under Drive	21.91	8	19	PVC	Remove / Replace with Storm Sewer
P-EX10013	A 136+26.46	Under Drive	-28.98	12	24	CMP	Remove / Replace with Storm Sewer
P-EX10014	A 137+02.93	Under Drive	-27.19	12	20	CMP	Remove / Replace with Storm Sewer
P-EX10016	A 143+62.99	Under County Line Road	15.65	12	39	CMP	Remove / Replace with Storm Sewer
P-EX10017	A 144+34.93	Under Ridge Hill Drive	-25.97	30	57	RCP	Remove / Replace with Storm Sewer
P-EX10018	A 146+12.31	Storm Sewer	-118.88	15	88	RCP	Reconnect to New Storm Sewer
P-EX10019	A 158+61.17	Storm Sewer	-21.4	12	57	RCP	Remove / Replace with Storm Sewer
P-EX10020	A 159+68.26	Under Drive	-57.07	15	15	CMP	Do Not Disturb
P-EX10021	A 169+15.91	Under County Line Road	0	24	48	CMP	Remove / Replace with Storm Sewer
P-EX10022	A 171+07.85	Under Depot Drive	-44.48	12	80	CMP	Remove / Replace with Storm Sewer
P-EX10023	A 175+70.74	Under Drive	-32.26	12	20	CMP	Remove / Replace with Storm Sewer
P-EX10024	A 176+67.98	Under Drive	-32.61	15	24	CMP	Remove / Replace with Storm Sewer
P-EX10025	A 177+08.73	Storm Sewer	-172.61	18	129	RCP	Reconnect to New Storm Sewer
P-EX10026	A 177+74.11	Under County Line Road	-21.5	19	40	RCP	Remove / Replace with Storm Sewer
P-EX10027	A 178+03.33	Under County Line Road	-18.17	18	43	RCP	Remove / Replace with Storm Sewer
P-EX10028	A 178+61.20	Storm Sewer	-190.23	15	70	RCP	Remove / Replace with Storm Sewer
P-EX10029	A 179+38.97	Under County Line Road	-18.27	15	49	RCP	Remove / Replace with Storm Sewer
P-EX10030	A 180+42.94	Storm Sewer	-46.95	12	34	RCP	Remove / Replace with Storm Sewer
P-EX10031	A 181+67.10	Under Drive	-60.34	12	76	RCP	Remove / Replace with Storm Sewer
P-EX10032	A 185+77.52	Under Drive	-22.64	12	23	CMP	Remove / Replace with Storm Sewer
P-EX10033	A 185+96.89	Under County Line Road	0	24	39	CMP	Remove / Replace with Storm Sewer
P-EX10034	A 194+80.27	Storm Sewer	-20.47	15	220	CMP	Remove / Replace with Storm Sewer
P-EX10036	A 196+73.58	Under Clubhouse Court	39.78	15	79	CMP	Remove / Replace with Storm Sewer
P-EX10039	A 199+11.16	Under County Line Road	35.56	30	70	CMP	Remove / Replace with Storm Sewer
P-EX10042	A 214+33.77	Storm Sewer	42.14	24	97	CMP	Remove / Replace with Storm Sewer
P-EX10043	A 214+08.16	Culvert Under Grass Drive	-36.97	18	59	CMP	Remove / Replace with Open Ditch
P-EX10044	A 218+37.35	Under Drive	40.6	42	39	RCP	Remove / Replace with Storm Sewer
P-EX10045	A 220+61.02	Under Drive	38.57	24	49	RCP	Remove / Replace with Storm Sewer
P-EX10047	A 227+15.78	Under Drive	-87.78	12	20	RCP	Do Not Disturb
P-EX110228	A 125+97.35	Storm Sewer	-12.28	18	21	RCP	Remove / Replace with Storm Sewer
P-EX110687	A 125+09.28	Storm Sewer	-53.94	12	43	RCP	Remove / Replace with Storm Sewer

P-EX201747	A 205+09.84	Storm Sewer	41.64	24	92	RCP	Remove / Replace with Storm Sewer
P-EX220181	A 174+17.45	Storm Sewer	-43.22	12	23	RCP	Remove / Replace with Storm Sewer
P-EX221694	A 178+72.78	Storm Sewer	-43	18	66	RCP	Remove / Replace with Storm Sewer
P-EX222385	A 180+19.57	Storm Sewer	-20.63	12	66	RCP	Remove / Replace with Storm Sewer
P-EX240329	A 170+48.14	Storm Sewer	-69.99	12	32	RCP	Remove / Replace with Storm Sewer
P-EX272110	A 141+59.50	Storm Sewer	-29.61	15	33	RCP	Remove / Replace with Storm Sewer
P-EX301597	A 218+04.41	Storm Sewer	76.93	12	35	PVC	Do Not Disturb
P-EX10034B	A 198+90.08	Storm Sewer	-19.3	15	29	CMP	Remove / Replace with Storm Sewer
CV-EX10006	A 126+05	Under County Line Road	0	64x43	113	CMP	Remove / Replace with Storm Sewer

Proposed Structures

Stucture Number	Station	Offset from Centerline (feet)	Pipe Diameter (inches)	Pipe Length (feet)	Material	Intended Action
P-98	A 56+65	-60	36 x 24	68	RCP	Replaces Open Culvert
P-1200	A 118+27	-65	12	38	RCP	Storm Sewer Outfall
P-1301	A 121+23	165	12	99	RCP	Storm Sewer Outfall
P-137	A 126+00	-62	60	30	RCP	Replaces Open Culvert
P-138	A 125+90	0	60	114	RCP	Replaces Open Culvert
P-200	A 131+75	-50	48	130	RCP	Storm Sewer Outfall
P-381	A 133+70	50	15	290	RCP	Storm Sewer Outfall
P-387	A 140+07	55	54	21	RCP	Storm Sewer Outfall
P-399	A 139+25	475	36	85	RCP	Storm Sewer Outfall
P-378B	A 177+66	84	48 x 36	32	RCP	Culvert Outlet
P-377	A 177+64	-70	48 x 36	66	RCP	Multi-Section Culvert Inlet
P-11311	A 178+10	1060	36	60	RCP	Storm Sewer Outfall
P-663	A 223+85.29	-59.54	12	84	RCP	Storm Sewer Outfall
P-529	A 200+50.00	37.08	15	63	RCP	Storm Sewer Outfall
P-531	A 201+25.00	-51.89	24	118	RCP	Storm Sewer Outfall
P-533	A 201+25.00	29.75	12	13	RCP	Storm Sewer Outfall
P-539	A 204+15.93	48.47	24	11	RCP	Storm Sewer Outfall
P-548	A 206+04.14	-37.08	24	48	RCP	Storm Sewer Outfall
P-610	A 212+75.00	-37.08	36	37	RCP	Storm Sewer Outfall
P-621	A 215+75.00	29.75	12	25	RCP	Storm Sewer Outfall
P-626	A 217+25.00	37.08	30	53	RCP	Storm Sewer Outfall
P-657A	A 223+08.64	-42.69	30	13	RCP	Storm Sewer Outfall
49-4503 B	PR-A 130+95.95	0	84'-2" (Bridge Width)	141'-7 1/8" (Bridge Length)	Rolled Steel Beam Bridge	Replace Existing Bridge
49-4510 B	PR-A 202+31.00	1	84'-2" (Bridge Width)	110'-2 5/8" (Bridge Length)	Reinforced Concrete Slab Bridge	Replace Existing Bridge

TO:	Ericka Miller, P.E., P.T.O.E., PMP Chief Engineer Department of Public Works – City of Indianapolis
FROM:	Benjamin Stenger, P.E. Senior Staff Engineer
SUBJECT:	Geometric Alternatives Analysis Memo
PROJECT NO:	ST-45-067
DES. NO.:	2002553
RE:	County Line Road

INTRODUCTION AND PROJECT INFORMATION

The purpose of this memorandum is to discuss and document the alternative horizontal and vertical alignment decisions made in the development of the County Line Road corridor between SR 37 and SR 135. Decisions presented in this memo will direct the design development of the Abbreviated Engineer's Report and Stage 1 plans as well as future submittals.

County Line Road is being widened from two lanes to five (two lanes in eastbound and westbound directions, and a two way left turn lane (TWLTL) in the center) between SR 37 / future I-69 and SR 135. This project is being constructed in anticipation of the conversion of SR 37 to a new interstate and the additional traffic that will result from it. A roadway will be constructed on a new horizontal and vertical alignment that will add capacity to County Line Road as well as improves deficiencies in the existing geometric configuration. Bridges over Pleasant Run Creek and Buffalo Creek are being replaced due to deficiencies in hydraulics and providing new structures to reset the design lives to coordinate with the new roadway design life.

County Line Road is classified as an urban major arterial roadway at the junction of Marion and Johnson Counties, south of Indianapolis. The Des. No. assigned by INDOT to this project is 2002553.

ALTERNATIVES ANALYSIS: VERTICAL PROFILE WEST OF MORGANTOWN ROAD

The intent of this analysis is to assess the vertical crest curve to the west of the intersection of County Line Road and Morgantown Road. The existing vertical geometry does not meet design standards for vertical grade for the existing design speed of 40 miles per hour. Indianapolis DPW has also expressed concerns about stopping distances for eastbound traffic approaching the west leg of this intersection in inclement weather.

Option 1.1: Retaining Walls with Vertical Curve Maximum Reduction

Option 1.1 analyzes the potential to flatten the vertical curve down to acceptable design parameters while maintaining the same design speed and utilizing retaining walls to reduce the quantity of parcel acquisition required. The intersection of County Line Road with Morgantown Road acts as a profile tie-in point due to an existing bridge over Pleasant Run located 200 feet north along Morgantown Road. This bridge structure was reconstructed in 2019 as part of a project unrelated to this contract. Raising the intersection in question would require reconfiguration of this bridge.

In lowering the grade of this hill, the intersections of Morris Road and Mount Pleasant East Street will be altered. Because the cut of the hill also extends into these two roads, access to them will no longer be feasible. Cul-de-sacs are proposed on these two roadways in order to provide safe termini. Providing cul-de-sacs at the backside of retaining walls also anticipates a reduction in property acquisitions. For properties in wall areas that will not need to be removed, driveways will be reconfigured in order to maintain access and proper safety measures such as fencing will be added at

the top of the retaining wall. This is anticipated for one parcel along with the aforementioned cul-de-sacs.

After construction is completed, access to County Line Road will be closed to the eastern intersection of Morris Road. All access to properties in this area will come from the western intersection of Morris Road, which is approximately 0.20 miles east of SR 37 and 0.27 miles west of Morgantown Road. Access to County Line Road will also be removed at Mount Pleasant East Street, which removes this intersection 0.07 miles west of Morgantown Road. Access to this neighborhood will be from Mount Pleasant Center Street on Morgantown Road and Mount Pleasant West Street, near SR 37. Future coordination will be required if intersection modifications are performed in this location.

This option requires ten full property acquisitions. Because the profile is being lowered by up to 30 feet in this section and because a majority of the parcels being acquired have drive access only off of County Line Road, it is not feasible to maintain these parcels.

A matrix of anticipated quantities and costs for retaining wall and common excavation is below. Unit prices are derived from recommendations in the Scoping Report and similar project applications. Items analyzed are isolated to earthwork, retaining walls, and right-of-way purchasing as it is assumed all other items are similar across both options. A 10% contingency was applied to wall and common excavation quantities for this analysis. Attachment 1.1 provides a visual of this option.

Item	Quantity	Unit Price	Estimate
Retaining Walls Westbound	20,343 sft	$75/sft	$1,525,725
Retaining Walls Eastbound	23,247 sft	$75/sft	$1,743,525
Common Excavation	95,423 cyd	$11.44/cyd	$1,091,639
Full Parcel Acquisition	10 parcels	$150,000/parcel	$1,500,000
Total			**$5,860,889**

Option 1.1 is not recommended for this alternative based on the initial cost of construction of retaining walls in comparison to other options analyzed.

Option 1.2: Open Side Slopes with Vertical Curve Reduction

Option 1.2 analyzes the same vertical profile design in Option 1.1, but with open cutting of earthwork in place of utilizing retaining walls. This option requires optimization of the vertical profile to account for the cut required in the hill to the west of the Morgantown Road intersection, where the crest of the hill is 40 feet above the intersection. Because the intersection grade cannot be raised or lowered without affecting the Morgantown Road bridge reconstructed in 2019, vertical profile adjustments must be made based on this intersection's current configuration.

This option requires more full property acquisitions due to the open side slope earthwork condition, including removal of houses. While the costs of walls are not warranted in this option, the quantity of common excavation is greatly increased due to the side slope requirements in comparison to Option 1.1. This option includes the same 10% contingency as identified in Option 1.1. This option rebuilds the Morris Road and Mt. Pleasant East Street intersections at grade in lieu of installing cul-de-sacs as performed in Option 1.1. Maintaining all access points into the neighborhood is considered an advantage for this option. Option 1.2 anticipates 22 full parcel acquisitions along County Line Road, Morris Road, and Mt. Pleasant East Street.

A matrix of anticipated costs for this option is below. Attachment 1.2 provides a visual of this option.

Item	Quantity	Unit Price	Estimate
Common Excavation	310,140 cyd	$11.44/cyd	$3,548,000
Full Parcel Acquisition	22 parcels	$150,000/parcel	$3,300,000
Total			**$6,848,000**

Option 1.2 is not recommended for this alternative due to the higher quantity of property acquisition and a substantially higher common excavation quantity.

Option 1.3: Open Cut Side Slopes with Minimal Wall Application

Combining the concepts explored in Options 1.1 and 1.2, Option 1.3 proposes a minimal application of retaining walls and open cutting of side slopes in areas where parcel acquisition is unavoidable. This option only requires retaining walls in the areas with the largest amount of cut, again up to 30 feet in certain locations. Grading would then occur elsewhere, along parcels less impacted by major grading operations.

In this option, cul-de-sacs will replace existing connections with County Line Road at both Morris Road and Mount Pleasant East Street. Between the cul-de-sacs and walls would be similar grading in order to drain storm events towards ditches constructed on the high sides of walls. Along with a reduced wall quantity, the number of parcels requiring full acquisition are reduced in this option compared to Option 1.2 due to the reduction in open cut in the most adverse conditions by adding the retaining walls. 15 parcels are anticipated to require full acquisition due to earthwork requirements.

A matrix of anticipated costs for this option is below. Attachment 1.3 provides a visual of this option.

Item	Quantity	Unit Price	Estimate
Common Excavation	136,000 cyd	$11.44/cyd	$1,555,840
Retaining Walls	6,270 sft	$75/sft	$470,250
Full Parcel Acquisition	15 parcels	$150,000/parcel	$2,250,000
Total			**$4,276,090**

Option 1.3 is recommended for this alternative based on the lowest cost to implement, including common excavation, retaining walls, and parcel acquisition.

Option 1.4: Reduce Design Speed to 30 mph

Option 1.4 explores the concept of reducing the design speed and subsequently the speed limit of this portion of the corridor to 30 mph from the 40 mph speed limit in other options. The corridor is posted at 30 mph in the existing condition (signed at County Line Road and West Mount Pleasant Street). The rest of this corridor is being designed for 40 mph. A vertical profile developed for this alternate shows approximately three less feet of vertical cut required in the typical tangent scenario and a maximum of about five feet in the area of the crest curve. The intersections of Morris Road and Mount Pleasant East Street will still require geometric reconfiguration.

Option 1.4 is not recommended for this project. Varying speed limits between 30 mph and 40 mph in the new corridor may confuse drivers and one speed limit is recommended through the entire corridor. The major concern about implementing a reduced design speed in this location is that driver speeds will not match the design speeds and design sight distances. This would result in potentially unsafe conditions at the intersections of Morris Road and Mount Pleasant East Street, especially when consideration is given to widening the geometry from two lanes to five.

ALTERNATIVES ANALYSIS: HORIZONTAL PROFILE EAST OF MORGANTOWN ROAD

The intent of this set of alternatives is to explore different horizontal configurations for County Line Road between the Morgantown Road intersection and the eastern extent of the project at SR 135. The intersection of Morgantown Road and to the west is not being analyzed for various horizontal options due to the density of housing, the close proximity of the proposed interchange with SR 37 / I-69 to the west of this project limit, the newly constructed bridge along Morgantown Road north of County Line Road, and the anticipated amount of cut required into the hill to the west of the Morgantown Road

intersection. Because of these reasons, the horizontal alignment of County Line Road shall be approximately matching the existing configuration in this western location. To the east of the bridge over Pleasant Run Creek, the alignment could be reconfigured from the existing layout.

For all options discussed, the typical section is five lanes (four 11-foot travel lanes and one 13-foot TWLTL), curb and gutter, a ten-foot multi-use path on the north side, and a six-foot sidewalk on the south side.

Option 2.1: Match Existing Alignment Configuration and Centerline

Option 2.1 analyzes a match of the existing alignment in the proposed condition. The corridor would follow the existing County Line Road while implementing horizontal curves where current low-angle deflections occur in the geometry. This alignment configuration requires temporary pavement to be constructed in a pre-phase in some locations, in order to provide two lanes of traffic throughout early stages of construction. Existing shoulder pavement will need to be evaluated for maintenance of traffic in areas where it currently exists and could be utilized.

Matching the centerline minimizes the quantity of parcels that will require full acquisition because of impacts to residential structures. Right-of-way acquisition will be required on both sides of County Line Road throughout the corridor. Full property acquisitions are expected to be minimal throughout and only will occur in areas where large cut or fill volumes are required. Additional retaining wall behind the sidewalk or multi-use path may be utilized to further reduce full parcel acquisitions.

Implementing Option 2.1 to the corridor anticipates six full parcel acquisitions due to impacts from widening and earthwork. A preliminary analysis of this alternative also indicates that approximately 22 other parcels may be impacted substantively. It is anticipated that the vertical profile will require iterations and optimizations to reduce the number of parcels that are significantly impacted.

A preliminary assessment of earthwork for this option shows a common excavation quantity of approximately 34,800 cyd and a fill of approximately 26,000 cyd. A 10% variance on these numbers is anticipated as the profile is optimized. Attachment 2.1 provides a visual for this option.

Option 2.1 is preferred for the horizontal configuration of County Line Road.

Option 2.2: New Centerline at North Edge of Pavement

Option 2.2 analyzes the adjustment of the centerline to be at the current northern edge of pavement. This shift, approximately 11 feet to the north, applies the theory to place horizontal curves at two locations in the corridor between Morgantown Road and SR 135 that would place the centerline of the new County Line Road along this existing pavement edge. A benefit to this option is minimizing the amount of temporary pavement required, as the first phase of maintenance of traffic would construct lanes to the north of the existing lanes, as traffic would continue in its existing orientation until the new lanes were built, at which point traffic would then be switched onto new lanes to construct the remainder of the corridor.

Shifting the centerline of County Line Road 11 feet to the north means that, given the typical sections this corridor is utilizing, the new westbound edge of pavement will be approximately 17 to 18 feet farther to the north. This combined with the multi-use path proposed on the north side of County Line Road would have impacts on properties along the north side of County Line Road, as the proposed geometric requirements would have improvements being constructed approximately 48 feet farther to the north than what the existing edge of pavement indicates. This anticipates full parcel acquisitions of approximately 26 additional houses on the north side of County Line Road including impacts to the Classic View community.

Applying Option 2.2 to the corridor on a selective approach would minimize the quantity of parcel acquisitions throughout, but doing so would introduce multiple horizontal curves into the corridor,

changing the makeup of the east-west movements of traffic from the existing straight-line configuration.

Option 2.2 is not recommended for implementation in the corridor.

Option 2.3: New Centerline at South Edge of Pavement

Option 2.3 follows the same general concept of Option 2.2 in that the centerline of County Line Road is being moved in order to reduce temporary pavement for maintenance of traffic and to utilize existing travel lanes for the first phase of construction. In this option, the new centerline of County Line Road would align with the approximate edge of pavement in the eastbound direction, or a general southbound shift of the alignment. Similar offsetting of the new edges of pavement, locations of sidewalk / multi-use path, and construction limits apply, but in the southern direction instead of the northern direction.

Because land along the south side of County Line Road is tentatively planned to be used for surface detention to meet hydraulic requirements, this southern shift of the horizontal alignment would require additional right-of-way purchasing on the south side of the corridor. Approximately 13 additional full parcel acquisitions are anticipated with a complete southern shift of the alignment.

Similar to Option 2.2, this option could be applied on a selective approach instead of a complete approach. Doing so would minimize the quantity of parcel acquisitions but would similarly introduce multiple horizontal curves into the corridor, which would change the makeup of east-west movements of traffic from the existing straight-line configuration.

Option 2.3 is not recommended for implementation in the corridor.

ALTERNATIVES ANALYSIS: PLEASANT RUN CREEK FREEBOARD

The vertical profile in the area of Pleasant Run Creek is being analyzed due to initial hydraulic discoveries of the area in the location of this bridge structure having negative freeboard in some areas, causing the potential for flooding in heavy rain events.

Option 3.1: Two Feet of Freeboard

Option 3.1 implements the desired structural freeboard scenario as detailed by the IDM for this segment of County Line Road between Morgantown Road and Rocky Ridge Road. This two-foot serviceability requirement anticipates an additional 17,820 cyd of fill material and seven full parcel acquisitions within Stations 132+00 to 145+00. Parcels are anticipated to not need full acquisition if driveway slopes can be maintained within acceptable design standards. At a cost of $150,000 per parcel as identified above and $6.20 per cyd of borrow, this option anticipates costing approximately $1,160,484 within this quarter mile segment. Borrow quantity is assumed to be hauled from west of the Morgantown Road intersection, utilizing earthwork generated from work being performed in this part of the corridor. Attachment 3.1 provides a visual for this option.

Item	Quantity	Unit Price	Estimate
Borrow	17,820 cyd	$6.20/cyd	$110,484
Full Parcel Acquisition	7 parcels	$150,000/parcel	$1,050,000
Total			**$1,160,484**

Option 3.1 is not recommended due to the higher quantity of parcel acquisitions required.

Option 3.2: One Foot of Freeboard

Option 3.2 implements one foot of freeboard within this segment of County Line Road. Though providing less than two feet of freeboard as prescribed in the IDM, this option notably improves motorist safety by providing one foot of freeboard instead of allowing floodwater to encroach on the

roadway as in the existing condition. This option anticipates 11,750 cyd of fill material and three full parcel acquisitions within Stations 132+00 to 145+00. Parcels are anticipated to not need full acquisition if driveway slopes can be maintained within acceptable design standards. Similar to Option 3.1, earthwork will be generated to the west and is assumed to be reusable. At the unit prices previously noted, this option anticipates a total relative cost of $522,850. Attachment 3.2 provides a visual for this option.

Item	Quantity	Unit Price	Estimate
Borrow	11,750 cyd	$6.20/cyd	$72,850
Full Parcel Acquisition	3 parcels	$150,000/parcel	$450,000
Total			**$522,850**

Option 3.2 is recommended for this analysis due to minimizing both the fill material required and full parcel acquisitions required.

Option 3.3: Zero Feet of Freeboard

Option 3.3 addresses the profile most similar to its existing condition. A zero-foot freeboard option has minimal improvement over the existing conditions, as it currently has negative freeboard (water encroaches into the roadway but does not "overtop"). Within Stations 132+00 to 145+00 this option expects 7,550 cyd of fill material and two parcel acquisitions, for an overall anticipated cost of $346,810. Parcels are anticipated to not need full acquisition if driveway slopes can be maintained within acceptable design standards. Attachment 3.3 provides a visual for this option.

Item	Quantity	Unit Price	Estimate
Borrow	7,550 cyd	$6.20/cyd	$46,810
Full Parcel Acquisition	2 parcels	$150,000/parcel	$300,000
Total			**$346,810**

While this option is the least expensive of the three presented, it has been determined to not be feasible to construct due to hydraulic requirements. Option 3.3 is not recommended.

In all of the above options, it should be known that the freeboard profile grade adjustments in the regions of Pleasant Run Creek Bridge and Buffalo Creek Bridge will affect the construction and cost of the bridges. Alternatives for the bridges are being developed in a different analysis performed by the bridge design team and coordination is actively occurring between the two disciplines.

ALTERNATIVES ANALYSIS: VERTICAL PROFILE EAST OF MORGANTOWN ROAD

Similar to the horizontal alignment analysis, the vertical profile of County Line Road east of Morgantown Road and the Pleasant Run Creek Bridge is being analyzed. With the widening of the corridor from two lanes to five, geometric challenges may occur that can be mitigated with the assessment of different options.

Directly to the east of the Pleasant Run Creek Bridge, the vertical profile is required to undergo adjustments in order to meet minimum freeboard requirements. This portion of the corridor is exempt from the below discussions, as the proposed profile requires being raised.

Option 4.1: Match Existing Vertical Profile

Option 4.1 assesses the vertical profile in its current configuration. This profile would maintain the vertical curvature throughout and would effectively be a widening alternative of the existing pavement section out to the proposed edge of lane, before implementing the pedestrian facilities on either side of the corridor.

This option simplifies the construction process as major grade changes within the pavement envelope will not be required. Earthwork will be required to fill embankments along the outsides of the existing pavement area in several locations, which may be able to be balanced by the significant amount of cut performed in the western portion of the project. Generally across the corridor, the existing topography is higher to the north (typical cut section) The new corridor will have an established grade based off of the centerline for either 43 feet or 47 feet based on sidewalk or multi-use path presence, instead of the 11-foot width (up to approximately 22 feet in shoulder areas) in the current configuration.

Matching the existing centerline may result in large right-of-way purchasing needs from select parcels in the event that fill earthwork is required in order to tie slopes down to existing ground. In the event that slopes are found to be impacting, retaining walls could be explored as a right-of-way or residential relocation mitigation measure.

A high-level analysis of the corridor includes applying a template to determine full parcel acquisitions and house removals. This option of matching the existing vertical profile anticipates about six full acquisitions due to earthwork requirements, including cut/fill and proximity to new geometric features with the potential to affect approximately 22 additional properties in terms of fill slope encroachments, impacts to existing features including fences, and hydraulic needs. Minor adjustments to mitigate these impacts will be made in developing this option further in plan development as the project proceeds into Stage 1 design.

Option 4.1 is recommended for development of the County Line Road vertical profile.

Option 4.2: Minimize Number of Vertical Curves

Option 4.2 proposes a reconfiguration of the existing vertical profile to reduce the number of curves. In the existing condition, the eastern portion of the corridor has several crest and sag curves of varying sizes. This option is being considered to reduce the overall number of vertical curves throughout, in order to provide a more streamlined corridor between Ridge Hill Drive and SR 135.

Construction of this option is anticipated to be more difficult due to the varying height of the proposed profile. In areas where major cuts (beneath the anticipated pavement section) are desired, retention of the existing pavement structure may be required. Similarly in areas where major fill is desired, the road may require additional horizontal stabilization during early phase work. Private drive access is anticipated to be difficult to maintain through portions of the corridor, as existing drive slopes are expected to undergo changes due to the edge of travel lane extending approximately 17 to 18 feet farther out than in the existing condition. This, combined with the addition of a sidewalk or multi-use path, extends the northern and southern limit of the corridor that will affect how driveways tie into County Line Road.

Option 4.2 does not anticipate purchasing of right-of-way outside of the standard expectation for the corridor, as a reconfiguration of the profile would allow for an optimization of the section regarding tie-ins at this proposed right-of-way line. Impacts to the connecting S-lines are feasible based on the new intersection locations but could also be mitigated where feasible. Accommodating all tie-ins as closely as possible would negate the attempt of minimizing vertical curves, so additional right-of-way purchasing may end up being necessary in select parcels.

Option 4.2 is not recommended for complete implementation throughout the corridor, however application of the theory of this option will be applied to the selected option. Minimizing the number of vertical curves may also have a negative effect on speeds throughout the corridor, especially given the lack of deviation in the horizontal alignment.

Option 4.3: Lower Profile to Reduce Earthwork Cut/Fill and Minimize Tie-In Slopes

Option 4.3 proposes a general lowering of the vertical profile throughout the corridor. This option is being considered due to the overall widening of the project corridor, and a portion of the existing corridor being built on an embankment originally. The corridor has identified locations where a large

amount of fill will be required to widen the roadway, and this option suggests lowering the profile to reduce the amount of fill required.

Construction of this option would require temporary barrier wall to be installed throughout the length of the corridor, as cuts of multiple feet would be required in some areas in order to attempt to minimize the overall earthwork of the corridor. These cuts would also be warranted in areas where multiple residences currently exist, as a layout similar to Option 4.1 may change the vertical tie-in point of these driveways by multiple feet in some locations. This option also can utilize the practices outlined in Option 4.2 above, minimizing the number of vertical curves throughout the corridor instead of attempting to match the existing alignment.

Lowering of the profile will generate more common excavation than the other two options. As demonstrated in the Alternatives Analysis in the cut section of the profile, nearly 100,000 cubic yards of cut is anticipated. Lowering of the profile reduces the quantity of borrow required, which will increase the amount of earthwork that will need to be hauled offsite. The general lowering of the profile also may present challenges with outletting of stormwater within pipe networks. Even in areas where the profile is proposed to be lowered overall, there may be locations where this is not feasible, like intersections with S-lines.

Option 4.3 is not recommended for consideration in this corridor.

In all of the options noted above, modular block walls can be implemented to avoid total parcel acquisitions in select areas. Locations are identified where, due to grading requirements, ditches for drainage, and other various geometric and construction requirements, a full parcel may need to be acquired which would displace a homeowner and cost an estimated $150,000. At an approximate cost of $60 per square foot for a modular block wall, the breakeven point is 2,500 square feet of new wall to offset a full parcel acquisition. Utilizing modular block walls could be addressed on a parcel-by-parcel basis with the intention of minimizing construction impacts towards homes and having steep grading slopes on the backside of the multi-use path and sidewalk being constructed throughout the corridor. While these locations were not identified in this alternatives analysis, they will be assessed as project development proceeds.

Decision Matrix Summary

Option	Parcel Acquisitions	Common Exc	Retaining Walls	Total
1.1: Retaining Walls	10 $1,500,000	95,423 cyd $1,091,639	43,590 sft $3,269,250	$5,860,889
1.2: Open Cut	22 $3,300,000	310,140 cyd $3,548,000	0 sft $0	$6,848,000
1.3: Earthwork and Minimal Wall	15 $2,250,000	136,000 cyd $1,555,840	6,270 sft $470,250	$4,276,090

Table 1: Vertical Profile West of Morgantown Summary

Option	Parcel Acquisitions
2.1: Match Existing Config	6 (+22 partial impacts) $900,000
2.2: Shift North	32 (includes 6 from above) $4,800,000
2.3: Shift South	19 (includes 6 from above) $2,850,000

Table 2: Horizontal Profile East of Morgantown Summary

Option	Parcel Acquisitions	Borrow	Design Criteria	Total
3.1: 2' Freeboard	7 $1,050,000	17,820 cyd $110,484	Desired	$1,160,484
3.2: 1' Freeboard	3 $450,000	11,750 cyd $72,850	Minimum Allowed	$522,850
3.3: 0' Freeboard	2 $300,000	7,550 cyd $46,810	Not Approved	$346,810

Table 3: Pleasant Run Creek Freeboard Summary

Option	Parcel Acquisitions
4.1: Match Existing Vertical	22 $3,300,000
4.2: Minimize Curves	30+ $4,500,000
4.3: Lower Roadway	40+ $6,000,000

Table 4: Vertical Profile East of Morgantown Summary

ATTACHMENTS

Attachment 1.1: Vertical Profile Adjustments West of Morgantown Road *Proposed Retaining Wall Alternative*

Attachment 1.2: Vertical Profile Adjustments West of Morgantown Road *Proposed Cut Alternative*

Attachment 2.1: Proposed Line "A" Matches Existing Centerline -> Vertical Profile Matches Existing Ground

Attachment 3.1: Vertical Profile Adjustments East of Morgantown Road *2-foot of roadway freeboard for Pleasant Run Creek*

Attachment 3.2: Vertical Profile Adjustments East of Morgantown Road 1-*foot of roadway freeboard for Pleasant Run Creek*

Attachment 3.3: Vertical Profile Adjustments East of Morgantown Road 0-*foot of roadway freeboard for Pleasant Run Creek*

COUNTY LINE ROAD - ATTACHMENT 1.1

Vertical Profile Adjustments West of Morgantown Road

Proposed Retaining Wall Alternative

Morris Road

Pleasant Run Creek

Morgantown Road

Cul-de-sac existing
Morris Road

A

105'A"

110'A"

115'A"

120'A"

125'A"

County Line Road

A

Cul-de-sac existing
Mt. Pleasant E. Street

Mt. Pleasant E. St.

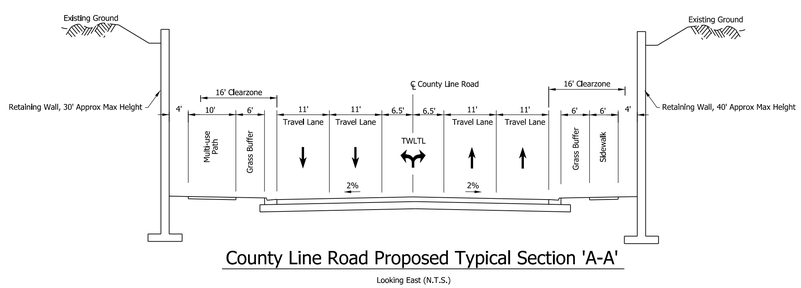
Co. Rd. 500 W

Mt. Pleasant N. St.

LEGEND

- EXISTING PARCEL BOUNDARY
- PROPOSED IMPROVEMENTS (as noted)
- PROPOSED RETAINING WALL
- PROPERTY ACQUISITION
- REMOVING ACCESS

0' 50' 100'



County Line Road Proposed Typical Section 'A-A'

Looking East (N.T.S.)

COUNTY LINE ROAD - ATTACHMENT 1.2

Vertical Profile Adjustments West of Morgantown Road

Proposed Cut Alternative

Morris Road

Pleasant Run Creek

Morgantown Road

Lower existing Morris Road

105'A"

110'A"

115'A"

120'A"

125'A"

County Line Road

A

A

Lower existing Mt. Pleasant E. Street

Mt. Pleasant E. St.

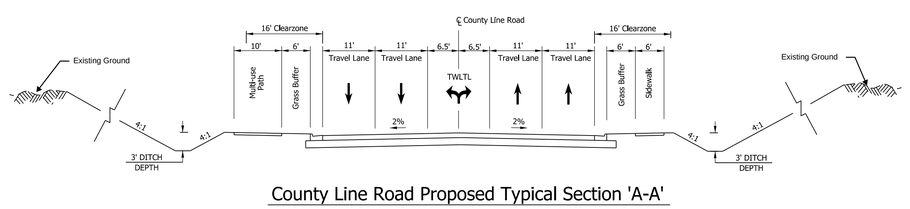
Mt. Pleasant N. St.

Co. Rd. 500 W

LEGEND

- EXISTING PARCEL BOUNDARY
- PROPOSED IMPROVEMENTS (as noted)
- PROPOSED CONSTRUCTION LIMITS
- PROPERTY ACQUISITION
- REMOVING ACCESS

0' 50' 100'



County Line Road Proposed Typical Section 'A-A'

Looking East (N.T.S.)

COUNTY LINE ROAD - ATTACHMENT 1.3

Vertical Profile Adjustments West of Morgantown Road

Proposed Hybrid Cut and Wall Alternative

Morris Road

Pleasant Run Creek

Morgantown Road

Cul-de-sac existing
Morris Road

105'A"

110'A"

115'A"

120'A"

125'A"

County Line Road

A

A

Cul-de-sac existing
Mt. Pleasant E. Street

Mt. Pleasant N. St.

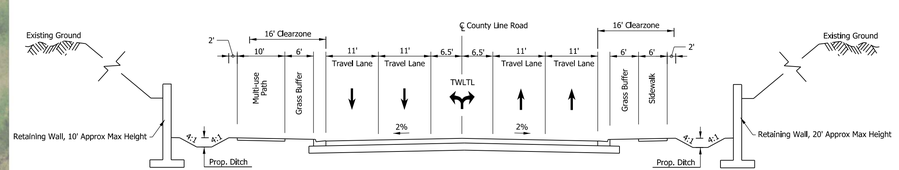
Mt. Pleasant E. St.

Co. Rd. 500 W

LEGEND

- EXISTING PARCEL BOUNDARY
- PROPOSED IMPROVEMENTS (as noted)
- PROPOSED CONSTRUCTION LIMITS
- PROPERTY ACQUISITION
- REMOVING ACCESS

0' 50' 100'



County Line Road Proposed Typical Section 'A-A'

Looking East (N.T.S.)

Attachment 2.1 : Proposed Line “A” Matches Existing Centerline → Vertical Profile Matches Existing Ground

COUNTY LINE ROAD - Attachment 3.1

Vertical Profile Adjustments East of Morgantown Road

2-foot of roadway freeboard for Pleasant Run Creek

Pleasant Run Creek

>15% Driveway Slope

>15% Driveway Slope

10% Driveway Slope

>15% Driveway Slope

8% Driveway Slope

Assumes full parcel acquisition with the impacts to the pool

>15% Driveway Slope

>15% Driveway Slope

120"A" 125"A" 130"A" 135"A" 140"A"

132+00 "A" to 145+00 "A"

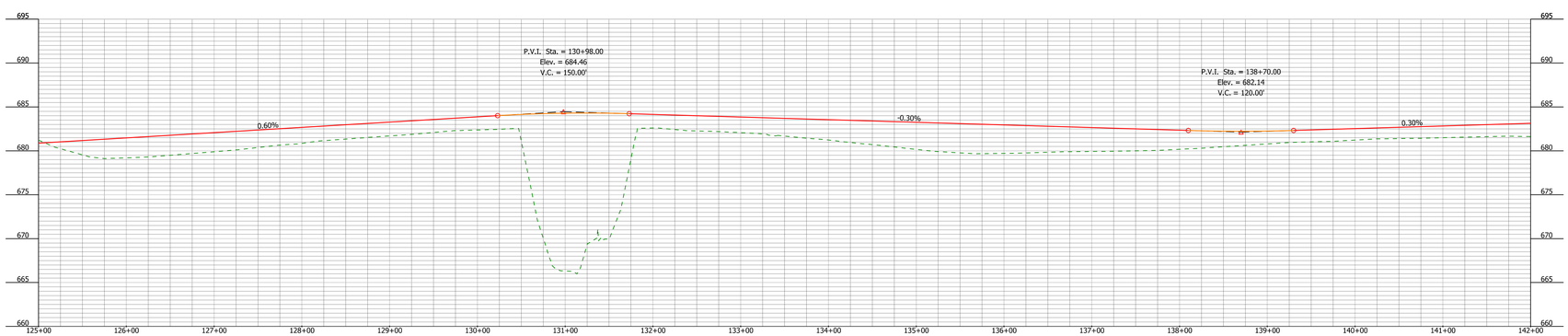
Common Exc : 0.00 Cu.Yd.

Fill Material : 17,820 Cu. Yd.

Legend

- Parcel Acquisition
- Ditch Path
- Drainage Culvert
- Construction Limits

0' 50' 100'



COUNTY LINE ROAD - Attachment 3.2

Vertical Profile Adjustments East of Morgantown Road

1-foot of roadway freeboard for Pleasant Run Creek

Pleasant Run Creek

12% Driveway Slope

10% Driveway Slope

7% Driveway Slope

6% Driveway Slope

<5% Driveway Slope

>15% Driveway Slope

>15% Driveway Slope

120"A"

125"A"

130"A"

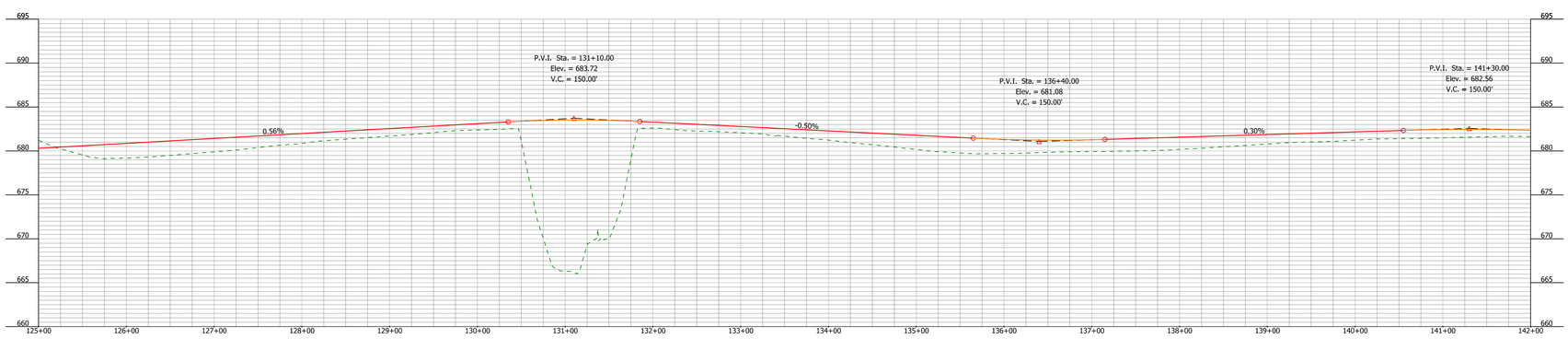
135"A"

140"A"

132+00 "A" to 145+00 "A"

Common Exc : 0.00 Cu.Yd.

Fill Material : 11,750 Cu. Yd.



Legend

- Parcel Acquisition
- Ditch Path
- Drainage Culvert
- Construction Limits

0' 50' 100'

COUNTY LINE ROAD - Attachment 3.3

Vertical Profile Adjustments East of Morgantown Road

0-foot of roadway freeboard for Pleasant Run Creek

Pleasant Run Creek

10% Driveway Slope

6% Driveway Slope

6% Driveway Slope

<5% Driveway Slope

<5% Driveway Slope

>15% Driveway Slope

12% Driveway Slope

Ditch backslope within 5-feet of house

120"A" 125"A" 130"A" 135"A" 140"A"

132+00 "A" to 145+00 "A"

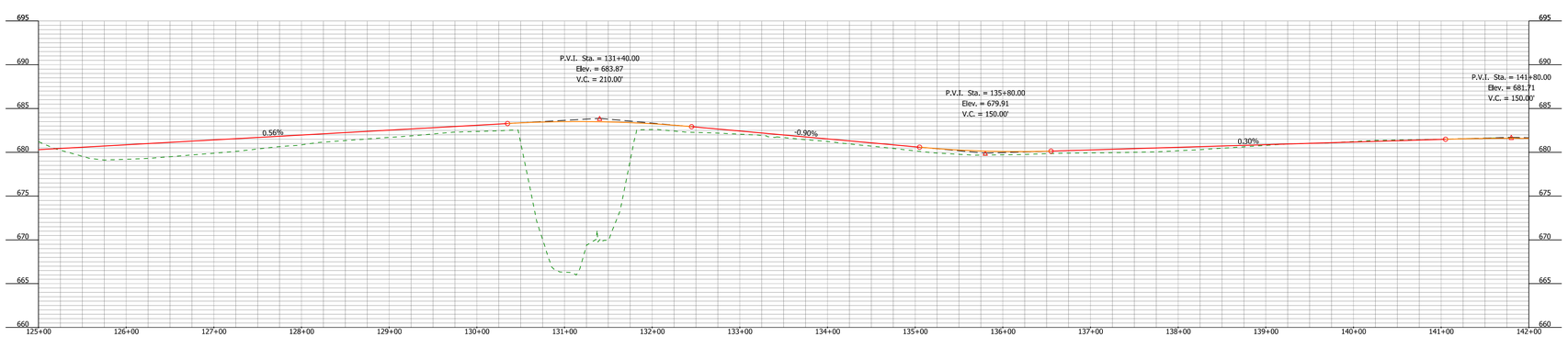
Common Exc : 405 Cu.Yd.

Fill Material : 7,550 Cu. Yd.

Legend

- Parcel Acquisition
- Ditch Path
- Drainage Culvert
- Construction Limits

0' 50' 100'



Report Excerpt - Attachments have been removed for brevity.

ABBREVIATED ENGINEERING REPORT

Developed for City of Indianapolis Department of Public Works

Bridge Replacement on County Line Road over Pleasant Run Creek

DES 2002553
DPW Project No. ST-45-067
Existing Str. No. 49-4503F
Proposed Str. No. TBD
NBI No. 4900420

Prepared By
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Reviewed by:
Chief Engineer Review

Approved by Ericak MIller, Long Nguyen, and Bill Chappell via Email on 11/16/2020

_____ Date: _____
Name: Ericka Miller
Title: Chief Engineer

This document was prepared by:

Edward L Spahr III

Name: Ed Spahr, PE
Title: HNTB Project Manager

Date: 11/13/2020

TABLE OF CONTENTS

ATTACHMENTS

Attachment A – Project Location Map

Attachment B – Photographs

Attachment C – Bridge Inspection Report

Attachment D – Superstructure Type Selection

1.0 DESIGN INFORMATION

The structure is located approximately 0.10 miles east of Morgantown Road dividing Marion County and Johnson County within INDOT's Greenfield District. For a map of the structure location see Attachment A.

The scope of the project is a bridge replacement and is scheduled for a December 2023 letting. This project is part of DPW Project No. ST-45-067, which includes a bridge replacement on County Line Road over Buffalo Creek and reconstruction of County Line Road from the new interchange at I-69/SR 37 to SR 135/Meridian St. Justification for the scope of this project is covered in detail in the Discussion of Alternatives.

2.0 DISCUSSION OF DESIGN FACTORS

This project is classified as an urban principal arterial roadway. Table 2-1 below provides the existing roadway geometry and proposed design criteria.

2.1 Roadway Geometry and Design Criteria

Table 2-1: Roadway Information

Roadway Information			
Geometric Criteria			
Proposed Design Criteria	3R (Non Freeway)	Rural / Urban	Urban
Proposed Design Speed	40 mph	Functional Class	Principal Arterial
Terrain	Level	Access Control	None
Typical Cross Section			
IDM Figure Reference	IDM 53-6	Design Year	2043
Travel Lane Count	Existing: 2 Lanes	Travel Lane Width	2 @ 12'-0" (existing)
	Proposed: 5 Lanes		4 @ 11'-0", 1 @ 13'-0" (Proposed)
Usable Shoulder Width	2'-0" (existing - bridge) 2'-0" (proposed – bridge)	Paved Shoulder Width	2'-0" (existing - bridge) 2'-0" (proposed – bridge)
Mainline & Shoulder Pavement	Existing: HMA Proposed: TBD	Landscape Buffer Width	Existing: N/A Proposed - Bridge: 2 @ 2'-0"
Bicycle Path	Existing: N/A Proposed: 1 @ 10'-0"	Sidewalk	Existing: N/A Proposed: 1 @ 6'-0"

2.2 Existing Bridge

The existing structure (Structure No. 49-4503F) is a concrete box beam, continuous 3-span bridge with spans of 41'-3", 49'-6", and 41'-3". The existing superstructure is supported by end bents with spill slopes on piles and hammerhead piers on spread footings. The existing bridge was built in 1973, on a 30°00'00" skew left. No rehabilitations are on record. The out-to-out bridge deck length is 134'-10 1/2. The out-to-out coping width is 31'-6" with a clear roadway width of 28'-0". The existing bridge uses type 5 aluminum railing.

The most recent inspection report detailed that the existing deck, wearing surface and superstructure are in satisfactory condition and the existing substructure is in good condition. The most recent load rating of the bridge in 2020 determined an inventory rating of 33 tons and an operating rating of 59 tons. See Attachment C for the most recent bridge inspection report.

The existing bridge does not provide adequate hydraulic opening. Further discussion on the continued use of the existing structure can be found in the Discussion of Alternatives.

The project team visited the site on August 13, 2020. See Attachment B for photographs of the site.

2.3 Existing Drainage

Existing drainage primarily consists of sheet flow to ditches along the roadway. The existing bridge has deck drains that outlet directly into Pleasant Run.

2.4 Geotechnical Considerations

Geotechnical investigation will be completed during Phase 2 Design Services. There are no known geotechnical restrictions for this project at this time. The existing bridge is supported by driven piles, which is the anticipated foundation type for the replacement bridge.

2.5 Existing Utilities and Other Topographical Elements

There are approximately 17 utility companies to coordinate with within the project limits. Overhead utility lines run along County Line Road to the north of the structure.

Utility coordination will begin after the Stage 1 plan submission when construction impacts are defined.

2.6 Right of Way Constraints

Existing permanent right of way varies from 45′ to 50′ from the centerline of County Line Road. Given the planned expansion in roadway width, right of way acquisition is anticipated. Right of Way Engineering will begin after the Stage 1 plan submission when construction impacts are defined.

2.7 Environmental Restrictions

This project will require a NEPA Environmental Document (Categorical Exclusion Level 4) due to the added travel lanes, acquisition of property, and potential use of federal funding.

This bridge is not eligible for listing in the National Register of Historic Places according to the Indiana Historic Bridge Inventory.

USACE 401/404 and CIF permits are anticipated to be required. Commitments for migratory birds and bats may be required.

A Traffic Technical Memorandum and Noise Analysis Report are anticipated to be required.

2.8 Maintenance of Traffic

The proposed maintenance of traffic consists of two phases. In Phase I, it is proposed that traffic to County Line Road will be maintained using temporary pavement while half of the bridge is constructed. Once half of the bridge deck is constructed, Phase II will begin, and traffic will be routed along the completed side while construction of the other half is underway.

2.9 Traffic Data

Traffic requests have been submitted and will be analyzed during Stage 1 development.

2.10 Crash Data and Analysis

Crash Data has been requested and will be analyzed during Stage 1 development.

2.11 Corridor Consistency & Aesthetics

County Line Road is being expanded to a curbed road with 2 travel lanes in each direction and a 13′ center turn lane, 6′ grass buffers on either side, with a 6′ sidewalk on the south side and a 10′ multipurpose trail on the north side. The proposed bridge

structure will be wide enough to continue this proposed roadway with the only modification being that the buffers will reduce to a 2′ buffer per side within the bridge structure limits.

3.0 DISCUSSION OF ALTERNATIVES

As described in the Existing Bridge Section, the existing structure is in satisfactory to good condition; however, the existing bridge has several aspects that make it undesirable for continued use. First, the bridge is undersized for the hydraulic demand. According to hydraulic analysis, the replacement bridge requires a minimum structure length of 135 feet and a low structure elevation raise of at least 0.31 feet to provide the required 2 foot of freeboard.

The proposed cross section on the bridge is 85′-2″ compared with the existing cross section of 31′-6″. The proposed cross section is centered on the existing cross section which therefore requires 26′-10″ of widening on either side of the bridge. When the additional drop in deck elevation due to the cross slope is considered in the structure depth, the waterway area is further reduced which only exacerbates the hydraulic capacity issues.

Additionally, reusing the existing bridge eliminates the opportunity to make desirable adjustments to the profile grade. The adjustments result in improved stopping sight distance, rider comfort and balancing earthwork within the project limits which helps minimize project costs. Finally, DPW expressed concerns about maintaining a bridge with elements of the existing bridge incorporated into the middle of the proposed structure. The existing bridge is 47 years old and has not received any maintenance. Incorporating the existing bridge into the proposed structure would require removing 3 to 4 feet of both copings, adding semi-integral diaphragms to the end bents and repairing the deck with full and partial depth patching as well as applying a rigid overlay to address deterioration of the superstructure and connect the existing structure to the proposed bridge. The existing components would continue to deteriorate at a more rapid rate than the widened elements.

The application of a rigid overlay means that the bridge is one or more (if polymeric overlays are considered) maintenance cycles further into its useful design life. Since the proposed bridge width will be nearly double the existing bridge width, the cost savings to incorporate the existing bridge into the new bridge is minimal compared with the total cost of construction. Due to the numerous detrimental factors of rehabilitation compared with the cost savings, full replacement of the existing structure is recommended.

The hydraulic capacity of the structure was analyzed to determine the required bridge size. The analysis found a minimum skewed structure length of 139′ is required. Given the length of the proposed structure, the hydraulic analysis evaluated a three span bridge with 2:1 spill slopes in the end spans. The spans for each of these alternatives were chosen to optimize superstructure efficiency and adjusted so the proposed piers

are constructed outside of the existing piers to avoid complete removal of the existing piers. As a result, each alternative was designed with the following spans: 40', 60', and 40'. This span arrangement provides a balanced span arrangement and adequate hydraulic opening.

Structure types for the proposed replacement were examined using comprehensive evaluation criteria. There are a number of superstructure types applicable to this bridge geometry, per the Indiana Design Manual. Using past experience with these structure types and preliminary cost estimates based on bridge size, all but the following three structure types were eliminated. A table showing the structure type selection process is included in the attachments. All alternatives considered to carry County Line Road over Pleasant Run are three-span configurations each consisting of 9 beam lines supported by wall piers and integral end bents. The alternatives are: a rolled weathering steel beam bridge, a 27"x48" prestressed concrete box beam bridge, and a precast prestressed concrete 36"x49" bulb tee beam bridge. See Attachment D for detailed superstructure type analysis.

3.1 Bridge Typical Section

The typical section of the proposed alternates is identical and consists of a 2" coping offset, a 1'-4" barrier, a 10' multi-use trail, a 2' landscape buffer, a 2'-7" combined curb and gutter, two 11' lanes, a 13' median turn lane, two 11' lanes, a 2'-7" combined curb and gutter, a 2'-0" landscape buffer, a 6' sidewalk, a 1'-4" barrier and a 2" coping offset. Each alternative has an out-to-out coping of 85'-2". The design of each alternative assumes an 8" concrete deck and a normal crown with a 2% cross slope. The profile grade and roadway crown are located in the center of the median turn lane. See Attachment D for a dimensioned typical section.

Level One Checklists and all necessary design exceptions, if applicable, will be completed in Stage 1.

3.2 Horizontal Alignment

County Line Road has an existing tangent horizontal alignment with a bearing of N 90° 00' 00" E. The proposed bridge will be constructed with a skew of 30° 00' 00" left to match the existing condition.

3.3 Vertical Alignment

The vertical alignment will be designed for Stage 1 Plans. Consideration will be given to minimizing approach roadway work while providing the minimum low structure elevation. The vertical alignment was developed to provide adequate waterway opening per the hydraulic analysis.

There are no vertical clearance requirements for this project.

3.4 Description Of Alternatives

Structure types were examined using comprehensive evaluation criteria. The objective of all alternates is to replace the existing bridge and fulfill the needs of the proposed County Line Road roadway.

Three superstructure alternates were considered:

Alternative	Description	Grade Raise	Span Lengths	Depth of Beam/Girder Used
Alternative 1	Weathering Rolled Steel Beams	10.22"	40'-60'-40'	25"
Alternative 2	27"x48" Prestressed Concrete Box Beams	12.46"	40'-60'-40'	27"
Alternative 3	Precast Prestressed Concrete 36"x49" Bulb Tee Beam Bridge	21.59"	40'-60'-40'	36"

4.0 ECONOMIC ANALYSIS AND PROBABLE CONSTRUCTION COST

To select the appropriate superstructure type, an economic analysis was performed comparing the alternatives described above. Comparative cost estimates were developed for each alternative, based on quantity estimates and probable construction cost estimates. The total comparative cost for each alternative is summarized in the table below. Approach roadway pay items have not been included because they have been included in the roadway estimate.

4.1 Structure Recommendations

Alternative 3 carries the highest cost and is 12% more than Alternative 1. Alternative 2 carries the second highest cost and is 5% more than Alternative 1. Alternative 2 also requires higher long-term maintenance costs than the others due to the cost associated with rehabilitating concrete box beam sections. Alternatives 1 and 3 carry similar low long-term maintenance costs, with good expected performance of both weathering steel and precast, prestressed concrete.

Based on results of the comparative cost analysis and consideration of long-term costs, Alternative 1 is the recommended alternative.

In addition to being the lowest cost option, Alternative 1 also requires the lowest profile grade raise. This will limit the number of impacted residential drives and the amount of grade raise required on the nearby cross street (Morgantown Road).

See Attachment D for comparative cost estimates shown in Table 4-1.

Table 4-1: Summary of Comparative Costs

Alternative and Description	Construction Cost	Percent Higher Than Lowest Alternate
Alternative 1- Weathering Steel Rolled Beams	**$3,218,000**	-
Alternative 2 – 27"x48" Prestressed Concrete Box Beams	$3,360,000	5%
Alternative 3 - Precast Prestressed Concrete 36"x49" Bulb Tee Beam Bridge	$3,583,000	12%

Bridge Inspection Report

49-4503F
COUNTY LINE RD S
over
PLEASANT RUN

Inspection Date: 12/28/2022

Inspected By: Tyler Wolf

Inspection Type(s): Routine

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CURRENT DECK RATING: SATISFACTORYCURRENT SUPERSTRUCTURE RATING: SATISFACTORYCURRENT SUBSTRUCTURE RATING: GOODCURRENT CULVERT RATING: NOT APPLICABLETHIS BRIDGE WAS ASSESSED AS: "NOT SCOUR CRITICAL"
PLEASE SEE THE STRUCTURE INVENTORY AND APPRAISAL REPORT FOR MORE DETAILED INFORMATION.

IDENTIFICATION

(1) STATE CODE:	**185 - Indiana**
(8) STRUCTURE:	**4900420**
(5 A-B-C-D-E) INV. ROUTE:	**1 - 5 - 1 - 00000 - 0**
(2) HIGHWAY AGENCY DISTRICT:	**03 - Greenfield**
(3) COUNTY CODE:	**049 - MARION**
(4) PLACE CODE:	**36000 - INDIANAPOLIS**
(6) FEATURES INTERSECTED:	**PLEASANT RUN**
(7) FACILITY CARRIED:	**COUNTY LINE RD S**
(9) LOCATION:	**00.10 E OF MORGANTOWN RD**
(11) MILEPOINT:	**0000.000**
(12) BASE HIGHWAY NETWORK:	**0**
(13A) INVENTORY ROUTE:	
(13B) SUBROUTE NUMBER:	
(16) LATITUDE:	**39.63443**
(17) LONGITUDE:	**-86.19426**
(98) BORDER	
A) STATE NAME:	
B) PERCENT	**%**
(99) BORDER BRIDGE STRUCT. NO:	

STRUCTURE TYPE AND MATERIAL

(43) STRUCTURE TYPE, MAIN:	
A) KIND OF MATERIAL/DESIGN:	**6 - Prestressed concrete continuous**
B) TYPE OF DESIGN/CONSTR:	**06 - Box Beam or Girders - Single or Spread**
(44) STRUCTURE TYPE, APPROACH SPANS:	
A) KIND OF MATERIAL/DESIGN:	**0 - Other**
B) TYPE OF DESIGN/CONSTR:	**00 - Other**
(45) NUMBER OF SPANS IN MAIN UNIT:	**003**
(46) NUMBER OF APPROACH SPANS:	**0000**
(107) DECK STRUCTURE TYPE:	**1 - Concrete Cast-in-Place**
(108) WEARING SURFACE/PROT SYS:	
A) WEARING SURFACE:	**1 - Monolithic Concrete (concurrently placed with structural deck)**
B) DECK MEMBRANE:	**0 - None**
C) DECK PROTECTION:	**0 - None**

AGE OF SERVICE

(27) YEAR BUILT:	**1973**
(106) YEAR RECONSTRUCTED:	**0000**
(42) TYPE OF SERVICE:	
A) ON BRIDGE:	**1 - Highway**
B) UNDER BRIDGE:	**5 - Waterway**
(28) LANES:	
A) ON BRIDGE:	**02**
B) UNDER BRIDGE:	**00**
(29) AVERAGE DAILY TRAFFIC:	**018373**
(30) YEAR OF AVERAGE DAILY TRAFFIC:	**2019**
(109) AVERAGE DAILY TRUCK TRAFFIC:	**05 %**
(19) BYPASS DETOUR LENGTH:	**004 MI**

GEOMETRIC DATA

(48) LENGTH OF MAX SPAN:	**0049.5 FT**
(49) STRUCTURE LENGTH:	**00134.6 FT**
(50) CURB/SIDEWALK WIDTHS:	
A) LEFT	**00.5 FT**
B) RIGHT:	**00.5 FT**
(51) BRDG RDWY WIDTH CURB-TO-CURB:	**028.0 FT**
(52) DECK WIDTH, OUT-TO-OUT:	**031.5 FT**
(32) APPROACH ROADWAY	**027.0 FT**
(33) BRIDGE MEDIAN:	**0 - No median**
(34) SKEW:	**31 DEG**
(35) STRUCTURE FLARED:	**0 - No flare**
(10) INV RTE, MIN VERT CLEARANCE:	**99.99 FT**
(47) TOT HORIZ CLEARANCE:	**028.0 FT**
(53) VERT CLEAR OVER BR RDWY:	**99.99 FT**
(54) MIN VERTICAL UNDERCLEARANCE:	
A) REFERENCE FEATURE:	**N**
B) MIN VERT UNDERCLEAR:	**00.00 FT**
(55) LATERAL UNDERCLEARANCE RIGHT:	
A) REFERENCE FEATURE:	**N**
B) MIN LATERAL UNDERCLEAR:	**000.0 FT**
(56) MIN LATERAL UNDERCLEAR ON LEFT:	**000.0 FT**

INSPECTIONS

(90) INSPECTION DATE:	**12/28/2022**
(92) CRITICAL FEATURE INSPECTION:	
A) FRACTURE CRITICAL REQUIRED/FREQUENCY:	**N**
B) UNDERWATER INSPECTION REQUIRED/FREQUENCY:	**N**
C) OTHER SPECIAL INSPECTION REQUIRED/FREQUENCY:	**N**
(91) DESIGNATED INSPECTION FREQUENCY:	**24 MONTHS**
(93) CRITICAL FEATURE INSPECTION DATE:	
A) FRACTURE CRITICAL DATE:	
B) UNDERWATER INSP DATE:	
C) OTHER SPECIAL INSP DATE:	

CONDITION

(58) DECK:	**6 - Satisfactory Condition (minor deterioration)**
(58.01) WEARING SURFACE:	**5 - Fair Condition**
(59) SUPERSTRUCTURE:	**6 - Satisfactory Condition (minor deterioration)**
(60) SUBSTRUCTURE:	**7 - Good Condition (some minor problems)**
(61) CHANNEL/CHANNEL PROTECTION:	**6 - Bank slump. widespread minor damage**
(62) CULVERTS:	**N - Not Applicable**

CONDITION COMMENTS

(58) DECK: **6 - Satisfactory Condition (minor deterioration)**

Comments:
SATISFACTORY - EXPOSED REBAR CHAIRS IN COPING. MINOR SPALLS WITH EXPOSED STEEL IN DECK COPING.
Material:
CONCRETE

(58.01) WEARING SURFACE: **5 - Fair Condition**

Comments:
FAIR- TINING WORN OFF WITH MINOR SPALLS AND POPOUTS IN WEARING SURFACE. SEVERAL POTHOLES IN WEST END OF DECK HAVE BEEN PATCHED.
Material:
CONCRETE

(59) SUPERSTRUCTURE: **6 - Satisfactory Condition (minor deterioration)**

Comments:
SATISFACTORY - SPALLS AND RUST AT STRAPS ON BEAMS. SPALL AT END OF BEAM 3 AT BENT 4. MINOR CRACKS IN PIER 2 DIAPHRAGM.
Material:
PRESTRESSED CONCRETE

(60) SUBSTRUCTURE: **7 - Good Condition (some minor problems)**

Comments:
GOOD - LEAKING ON END BENTS.
Material:
CONCRETE

(61) CHANNEL/CHANNEL PROTECTION **6 - Bank slump. widespread minor damage**

Comments:
SATISFACTORY - SAND AND GRAVEL FLOWLINE. BANK EROSION ON UPSTREAM AND DOWNSTREAM BANKS.
Material:
RIPRAP

(62) CULVERTS: **N - Not Applicable**

Comments:
N/A
Material:
N/A

LOAD RATING AND POSTING

(31) DESIGN LOAD:	**5 - HS 20**	(66) INVENTORY RATING:	**33.84**
(70) BRIDGE POSTING	**5 - Equal to or above legal loads**	(65) INVENTORY RATING METHOD:	**1 - Load Factor (LF)**
		(66B) INVENTORY RATING (H):	
(41) STRUCTURE OPEN/POSTED/CLOSED:	**A - Open**	(66C) TONS POSTED :	
		(66D) DATE POSTED/CLOSED:	
(64) OPERATING RATING:	**59.04**		
(63) OPERATING RATING METHOD:	**1 - Load Factor (LF)**		

APPRAISAL

SUFFICIENCY RATING:	**70.6**	(36) TRAFFIC SAFETY FEATURE:	
STATUS:	**2**	36A) BRIDGE RAILINGS:	**0**
(67) STRUCTURAL EVALUATION:	**6**	36B) TRANSITIONS:	**0**
(68) DECK GEOMETRY:	**2**	36C) APPROACH GUARDRAIL:	**0**
(69) UNDERCLEARANCES, VERTICAL & HORIZONTAL:	**N**	36D) APPROACH GUARDRAIL ENDS:	**0**

(71) WATERWAY ADEQUACY: **8 - Bridge Above Approaches**

Comments:
APPEARS ADEQUATE

(72) APPROACH ROADWAY ALIGNMENT: **8 - Equal to present desirable criteria**

Comments:
Material:
BITUMINOUS
72: STRAIGHT, IN CREST CURVE, DRIVE NORTHEAST

(113) SCOUR CRITICAL BRIDGES: **5 - Scour within limits of footing or piles**

Comments:
SCOUR HOLE 1-2 FT. DEEP AT SOUTH END OF PIER 2.

CLASSIFICATION

(20) TOLL:	**3 - On Free Road**	(21) MAINT. RESPONSIBILITY:	**04 - City or Municipal Highway Agency**
(22) OWNER:	**04 - City or Municipal Highway Agency**	(26) FUNCTIONAL CLASS OF INVENTORY RTE:	**06 - Rural - Minor Arterial**
(37) HISTORICAL SIGNIFICANCE:	**5 - Not eligible**	(100) STRAHNET HIGHWAY:	**Not a STRAHNET route**
(101) PARALLEL STRUCTURE:	**N - No parallel structure**	(102) DIRECTION OF TRAFFIC:	**2-way traffic**
(103) TEMPORARY STRUCTURE:		(104) HIGHWAY SYSTEM OF INVENTORY ROUTE:	**0 - Structure/Route is NOT on NHS**
(105) FEDERAL LANDS HIGHWAYS:	**0-Not Applicable**	(110) DESIGNATED NATIONAL NETWORK:	**Inventory route not on network**
(112) NBIS BRIDGE LENGTH:	**Yes**		

NAVIGATION DATA

(38) NAVIGATION CONTROL:	**0 - No navigation control on waterway (bridge permit not required)**	(39) NAVIGATION VERTICAL CLEAR:	**000.0 FT**
		(116) MINIMUM NAVIGATION VERT. CLEARANCE, VERT. LIFT BRIDGE:	**FT**
(111) PIER OR ABUTMENT PROTECTION:		(40) NAV HORIZONTAL CLEARANCE:	**0000.0 FT**

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK:	**35 - Rehabilitation - Deterioration**	(95) ROADWAY IMPROVEMENT COST:	**$ 000135**
(75B) WORK DONE BY:	**1 - Work to be done by contract**	(96) TOTAL PROJECT COST:	**$ 000435**
(76) LENGTH OF IMPROVEMENT:	**000134. FT 6**	(97) YR OF IMPROVEMENT COST EST:	**2023**
		(114) FUTURE AVG DAILY TRAFFIC:	**027301**
(94) BRIDGE IMPROVEMENT COST:	**$ 000300**	(115) YR OF FUTURE ADT:	**2039**

Approach Slabs: ** Indicate if present & condition rating.*

Comments:

Paint: ** Indicate if paint present , year painted & condition rating.*

N

Comments:

N/A
Material:
N/A

Endangered Species: ** If yes, add one photo to the dropdown field*

Bats: seen or heard under structure? * N

Birds/swallows/nests seen? Empty nests present? * N

BRIDGE Culvert Geometry:

Barrel Length:

Height:

Width:

Inspector:	Wolf,Tyler	**Structure Number:**	4900420
Inspection Date:	12/28/2022	**Facility Carried:**	COUNTY LINE RD S

Bridge Inspection Report

NBI Data come from National Inventory

NBI 113: Scour Critical Bridges 5

NBI 113a Scour Critical Bridges Comments

SCOUR HOLE 1-2 FT. DEEP AT SOUTH END OF PIER 2.

To Be Completed by Hydraulics

Scour Analysis Status

Scour Analysis Date

Scour Analysis Determination

Hydraulics Comments

To Be Completed by Bridge Inspection

Scour Critical Safety Status

Date of Counter Measure Placed or Field Verified

Bridge Inspectoin Comments

Scour Delineators installed

LOAD RATING - BRADIN

Load Rating Date: 14-MAR-19

National Bridge Inventory (NBI):

(65) INVENTORY RATING METHOD: 1

(66) INVENTORY RATING: 33.84

(63) OPERATING RATING METHOD: 1

(64) OPERATING RATING: 59.04

(31) DESIGN LOAD: 5

(70) BRIDGE POSTING: 5

(41) STRUCTURE OPEN/POSTED/CLOSED: A

(66C) TONS POSTED:

(66D) DATE POSTED/CLOSED:

Posting Configurations:

Emergency Vehicles:

EV2: LEGAL RF: 2.65

EV3: LEGAL RF: 1.7

2-Axles:

H20-44: LEGAL RF: 2.24

ALTERNATE MILITARY: LEGAL RF: 2.04

3-Axles:

HS20: LEGAL RF: 1.64

AASHTO TYPE 3: LEGAL RF: 2.18

4-Axles:

SU4: LEGAL RF: 1.99

TOLL ROAD LOADING NO. 2: ROUTINE PERMIT RF:

Other Configurations:

H20-44: DESIGN RF: 1.34

NRL: LEGAL RF: 1.66

5-Axles:

AASHTO TYPE 3S2: LEGAL RF: 2.25

SU5: LEGAL RF: 1.83

TOLL ROAD LOADING NO. 1: ROUTINE PERMIT RF:

6+-Axles:

AASHTO TYPE 3-3: LEGAL RF: 2.42

LANE TYPE: LEGAL RF:

SU6: LEGAL RF: 1.74

SPECIAL TOLL ROAD TRUCK: ROUTINE PERMIT RF:

SU7: LEGAL RF: 1.68

MICHIGAN TRAIN TRUCK NO. 5: ROUTINE PERMIT RF:

MICHIGAN TRAIN TRUCK NO. 8: ROUTINE PERMIT RF:

SUPERLOAD-11 AXLES: SPECIAL PERMIT RF:

SUPERLOAD-13 AXLES: SPECIAL PERMIT RF:

SUPERLOAD-14 AXLES: SPECIAL PERMIT RF:

SUPERLOAD-19 AXLES (152.5T): SPECIAL PERMIT RF:

SUPERLOAD-19 AXLES (240.045T): SPECIAL PERMIT RF:

Inspector: Tyler Wolf

Inspection Date: 12/28/2022

Asset Name: 49-4503F

Facility Carried: COUNTY LINE RD S

Bridge Inspection Report

Date Reported: 07/09/2014

Priority:

Work Code:

Deficiency Description:

Work Description:

DUE TO OVERALL DETERIORATION, RECOMMEND REHABILITATION. PLACE NEW CONCRETE OVERLAY AND INSTALL CURRENT STANDARD CONCRETE BRIDGE RAIL.

Date Repairs Completed:

Maintenance Comments:

UNTIL REHABILITATION, INSTALL CURRENT STANDARD BRIDGE AND APPROACH RAIL WITH END TREATMENTS, RIPRAP SOUTHWEST CHANNEL BANK, CLEAR VEGETATION AT BRIDGE, CLEAN DEBRIS FROM CHANNEL, CLEAN DECK. PLACE RIPRAP AT SOUTH END OF PIER 2.

Inspector:	Wolf,Tyler	**Structure Number:**	4900420
Inspection Date:	12/28/2022	**Facility Carried:**	COUNTY LINE RD S

Bridge Inspection Report

Channel Measurement

Date of Channel Measurements:

Distance Measured From:

Depth Measured From:

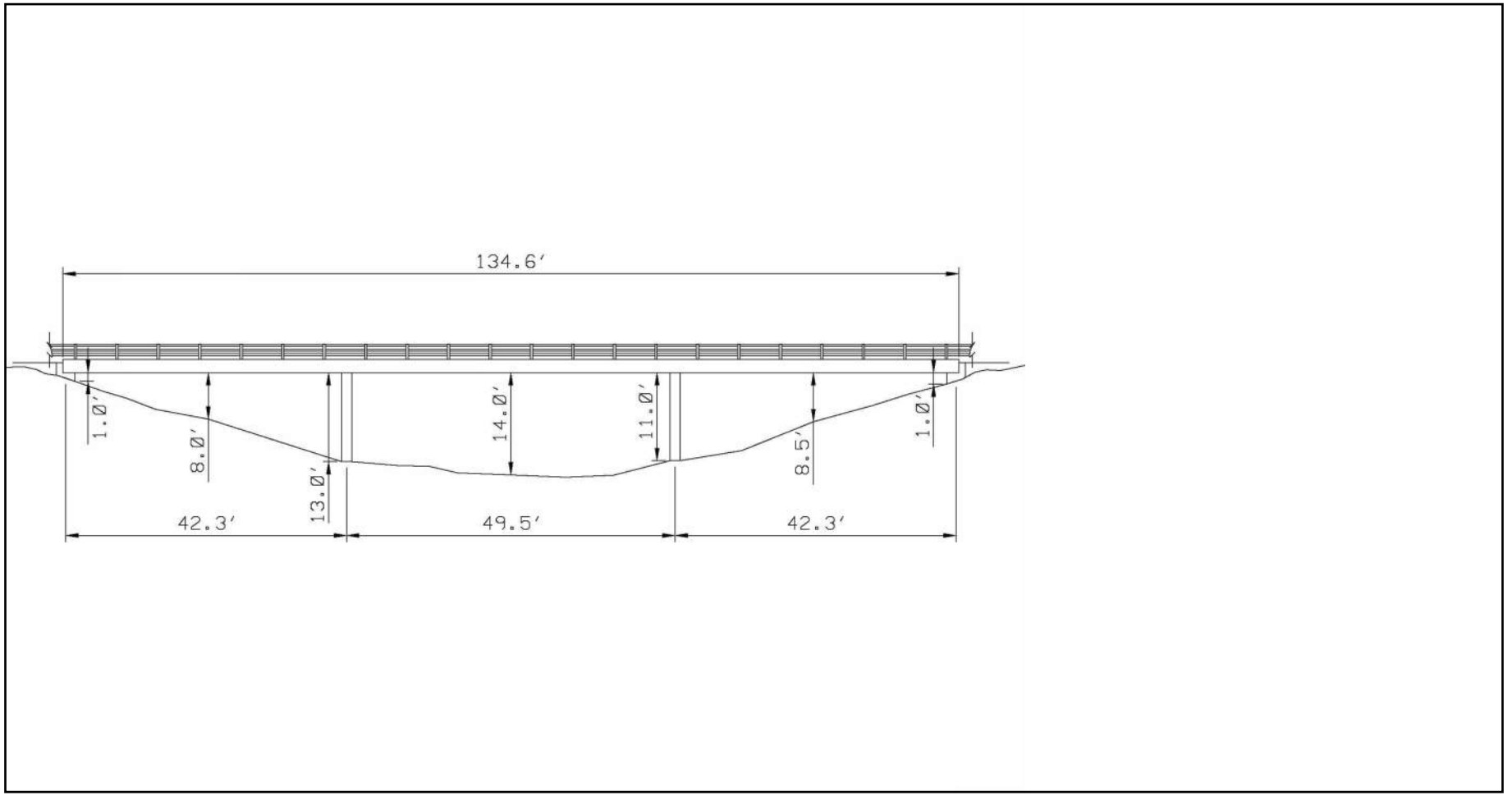
Number of Measurement Points Taken:

Number of Fixed Objects in Channel:

Water Level:

High Water Mark:

Measurement Type:



Report Excerpt - Attachments have been removed for brevity.

ABBREVIATED ENGINEERING REPORT

Developed for City of Indianapolis Department of Public Works

Bridge Replacement on County Line Road over Buffalo Creek

DES 2002553
DPW Project No. ST-45-067
Existing Str. No. 49-4510 F
Proposed Str. No. TBD
NBI No. 4900427

Prepared By
HNTB Corporation
111 Monument Circle, Suite 1200
Indianapolis, IN 46204
Phone (317) 636-4682

Reviewed by:
Chief Engineer Review

_____ Date: _____
Name: Ericka Miller
Title: Chief Engineer

This document was prepared by:

Edward L Spahr III

Date: 11/13/2020

Name: Ed Spahr, PE
Title: HNTB Project Manager

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ATTACHMENTS

Attachment A – Project Location Map

Attachment B – Photographs

Attachment C – Bridge Inspection Report

Attachment D – Superstructure Type Selection

Attachment E – Preferred Alternate Total Life Cycle Cost Estimate

1.0 DESIGN INFORMATION

The project is located approximately 0.55 miles west of Meridian Street dividing Marion County and Johnson County within INDOT's Greenfield District. For a map of the structure location see Attachment A.

The scope of the project is a bridge replacement and is scheduled for a December 2023 letting. The project is part of DPW Project No. ST-45-067, which includes a bridge replacement on County Line Road over Pleasant Run Creek and reconstruction of County Line Road from the future interchange at I-69/SR 37 to SR 135/Meridian St. Justification for the scope of this project is covered in detail in the Discussion of Alternatives.

2.0 DISCUSSION OF DESIGN FACTORS

This project is classified as an urban principal arterial roadway. Table 2-1 below provides the existing roadway geometry and proposed design criteria.

2.1 Roadway Geometry and Design Criteria

Table 2-1: Roadway Information

Roadway Information			
Geometric Criteria			
Proposed Design Criteria	3R (Non Freeway)	Rural / Urban	Urban
Proposed Design Speed	40 mph	Functional Class	Principal Arterial
Terrain	Level	Access Control	None
Typical Cross Section			
IDM Figure Reference	IDM 53-6	Design Year	2043
Travel Lane Count	Existing: 2 Lanes	Travel Lane Width	2 @ 12'-0" (existing)
	Proposed: 5 Lanes		4 @ 11'-0", 1 @ 13'-0" (Proposed)
Usable Shoulder Width	10'-0" (existing - bridge) 2'-0" (proposed – bridge)	Paved Shoulder Width	10'-0" (existing - bridge) 2'-0" (proposed – bridge)
Mainline & Shoulder Pavement	Existing: HMA Proposed: TB**D**	Landscape Buffer Width	Existing: N/A Proposed - Bridge: 2 @ 2'-0"
Bicycle Path	Existing: N/A Proposed: 1 @ 10'-0"	Sidewalk	Existing: N/A Proposed: 1 @ 6'-0"

2.2 Existing Bridge

The existing structure (Structure No. 49-4510 F) is a reinforced concrete slab, continuous 3-span bridge with spans of 24'-10", 29'-10", and 24'-10". The existing superstructure is supported by end bents with spill slopes and wall piers on two rows of piles. The existing bridge was built in 1987, on a 35°00'00" right skew. The out-to-out bridge deck length is 81'-4". The out-to-out coping width is 47'-0" with a clear roadway width of 44'-0". The existing bridge uses 1'-6" concrete railing.

The existing wearing surface and substructure are in good condition. The latest inspection report rated the substructure a 7 and only noted concerns with the underpin in the northwest corner. The existing superstructure and bridge deck are in satisfactory condition, with minor deterioration especially at the drains, and cracking in the coping and underside of the slab. The most recent load rating of the bridge in 2019 determined an inventory rating of 36 tons and an operating rating of 71 tons. See Attachment C for the most recent Bridge Inspection Report.

The existing bridge does not provide adequate hydraulic opening. Further discussion on the continued use of the existing structure can be found in the Discussion of Alternatives.

The project team visited the site on August 13, 2020. See Attachment B for photographs of the site.

2.3 Existing Drainage

Existing drainage primarily consists of sheet flow to ditches along the roadway. The existing bridge has PVC deck drains that outlet directly into Buffalo Creek.

2.4 Geotechnical Considerations

Geotechnical investigation will be completed during Phase 2 Design Services. There are no known geotechnical restrictions for this project at this time. The existing bridge is supported by driven piles, which is the anticipated foundation type for the replacement bridge.

2.5 Existing Utilities and Other Topographical Elements

There are approximately 17 utility companies to coordinate with within the project limits. Overhead utility lines run along County Line Road to the north of the structure.

Utility coordination will begin after the Stage 1 plan submission when construction impacts are defined.

2.6 Right of Way Constraints

Existing right of way varies from 50' to 90' from the centerline of County Line Road to the south and is 50' from the centerline of County Line Road to the north. An existing drainage easement varies from 50' to 170' from the centerline of County Line Road to the north of the structure. 15' and 10' utility easements run perpendicular to the roadway to the north of the structure. Given the planned expansion in roadway width, right of way acquisition is anticipated. Right of Way Engineering will begin after the Stage 1 plan submission when construction impacts are defined.

2.7 Environmental Restrictions

This project will require a NEPA Environmental Document (Categorical Exclusion Level 4) due to the added travel lanes, acquisition of property, and potential use of federal funding.

This bridge is not eligible for listing in the National Register of Historic Places according to the Indiana Historic Bridge Inventory.

USACE 401/404 and CIF permits are anticipated to be required. Commitments for migratory birds and bats are anticipated to be required.

A Traffic Technical Memorandum and Noise Analysis Report are anticipated to be required.

2.8 Maintenance of Traffic

The proposed maintenance of traffic consists of two phases. In Phase I, it is proposed that traffic to County Line Road will be maintained using temporary pavement while half of the bridge is constructed. Once half of the bridge deck is constructed, Phase II will begin, and traffic will be routed along the completed side while construction of the other half is underway.

2.9 Traffic Data

Traffic requests have been submitted and their collection is underway.

2.10 Crash Data and Analysis

Crash Data has been requested and will be analyzed during Stage 1 development.

2.11 Corridor Consistency & Aesthetics

County Line Road is being expanded to a curbed road with 2 travel lanes in each direction and a 13' center turn lane, 6' grass buffers on either side, with a 6' sidewalk on the south side and a 10' multipurpose trail on the north side. The proposed bridge structure will be wide enough to continue this proposed roadway with the only modification being that the buffers will reduce to a 2' buffer per side within the bridge structure limits.

3.0 DISCUSSION OF ALTERNATIVES

As described in the Existing Bridge Section, the existing structure is in satisfactory to good condition; however, the existing bridge has several aspects that make it undesirable for continued use. First, the bridge is undersized for the hydraulic demand. According to hydraulic analysis, the replacement bridge requires a minimum structure length of 105 feet compared with the existing structure length of 81'-4". This is an increase of 23'-8" or nearly 30%.

The proposed cross section on the bridge is 85'-2" compared with the existing cross section of 47'-0". The proposed cross section is centered on the existing cross section which therefore requires 19'-1" of widening on either side of the bridge. When the additional drop in deck elevation due to the cross slope is considered in the structure depth, the waterway area is further reduced which only exacerbates the hydraulic capacity issues.

Additionally, reusing the existing bridge eliminates the opportunity to make desirable adjustments to the profile grade. The adjustments result in improved stopping sight distance, rider comfort and balancing earthwork within the project limits which helps minimize project costs. Finally, DPW expressed concerns about maintaining a bridge with elements of the existing bridge incorporated into the middle of the proposed structure. The existing bridge is 33 years old and has not received any maintenance. Incorporating the existing bridge into the proposed structure would require removing 3 to 4 feet of both copings as well as applying a rigid overlay to address deterioration of the superstructure and connect the existing structure to the proposed bridge. The existing components would continue to deteriorate at a more rapid rate than the widened elements.

The application of a rigid overlay means that the bridge is one or more (if polymeric overlays are considered) maintenance cycles further into its useful design life. Since the proposed bridge width will be nearly double the existing bridge width, the cost savings to incorporate the existing bridge into the new bridge is minimal compared with the total cost of construction. Due to the numerous detrimental factors of rehabilitation compared with the cost savings, full replacement of the existing structure is recommended.

The hydraulic capacity of the structure was analyzed to determine the required bridge size. The analysis found a minimum skewed structure length of 109' is required. Given the length of the proposed structure, the hydraulic analysis evaluated a three span bridge with 2:1 spill slopes in the end spans. The spans for each of these alternatives were chosen to optimize superstructure efficiency and adjusted so the proposed piers are constructed outside of the existing piers to avoid complete removal of the existing piers. As a result, each alternative was designed with the following spans: 34', 41', and 34'. This span arrangement provides a balanced span arrangement and adequate hydraulic opening.

Structure types for the proposed replacement were examined using comprehensive evaluation criteria. There are a number of superstructure types applicable to this bridge geometry, per the Indiana Design Manual. Using past experience with these structure types and preliminary cost estimates based on bridge size, all but the following three structure types were eliminated. A table showing the structure type selection process is included in the attachments. All alternatives considered to carry County Line Road over Buffalo Creek are three-span configurations supported by wall piers and integral end bents. The alternatives are: a rolled weathering steel beam bridge, a 21"x36" prestressed concrete box beam bridge, and a reinforced concrete slab bridge. Both beam alternatives use 9 beam lines. See Attachment D for detailed superstructure type analysis.

3.1 Bridge Typical Section

The typical section of the proposed alternates is identical and consists of a 2" coping offset, a 1'-4" barrier, a 10' multi-use trail, a 2' landscape buffer, a 2'-7" combined curb and gutter, two 11' lanes, a 13' median turn lane, two 11' lanes, a 2'-7" combined curb and gutter, a 2'-0" landscape buffer, a 6' sidewalk, a 1'-4" barrier and a 2" coping offset. Each alternative has an out-to-out coping of 85'-2". The design of each alternative assumes an 8" concrete deck and a normal crown with a 2% cross slope. The profile grade and roadway crown are located in the center of the median turn lane. See Attachment D for a dimensioned typical section.

Level One Checklists and all necessary design exceptions, if applicable, will be completed in Stage 1.

3.2 Horizontal Alignment

County Line Road has a tangent horizontal alignment with a bearing of N 88° 56' 02" E. The proposed bridge will be constructed with a skew of 35° 00' 00" right to match the existing condition.

3.3 Vertical Alignment

The vertical alignment will be designed for Stage 1 Plans. Consideration will be given to minimizing approach roadway work while providing the minimum low structure elevation. The vertical alignment was developed to provide adequate waterway opening per the hydraulic analysis.

There are no vertical clearance requirements for this project.

3.4 Description Of Alternatives

Structure types were examined using comprehensive evaluation criteria. The objective of all alternates is to replace the existing bridge and fulfill the needs of the proposed County Line Road roadway.

Three superstructure alternatives were considered:

Alternative	Description	Grade Raise	Span Lengths	Depth of Beam/Girder Used
Alternative 1	Rolled Steel Beams	20.37"	34'-41'-34'	21.5"
Alternative 2	21"x36" Prestressed Concrete Box Beams	20.11"	34'-41'-34'	21"
Alternative 3	Reinforced Concrete Slab	8.77"	34'-41'-34'	21"

4.0 ECONOMIC ANALYSIS AND PROBABLE CONSTRUCTION COST

To select the appropriate superstructure type, an economic analysis was performed comparing the alternatives described above. Comparative cost estimates were developed for each alternative, based on quantity estimates and probable construction cost estimates. The total comparative cost for each alternative is summarized in the table below. Approach roadway quantities have not been included because they have been included in the roadway estimate. The only quantities that are included reflect the additional work required on Leisure Lane for the grade raise at the bridge.

4.1 Structure Recommendations

Alternative 1 carries the highest cost and is 16% more than Alternative 3. Alternative 2 carries the second highest cost and is 15% more than Alternative 3. Alternative 2 also requires higher long-term maintenance costs than the others due to the cost associated with rehabilitating concrete box beam sections. Alternatives 1 and 3 carry similar low long-term maintenance costs, with good expected performance of both weathering steel and cast-in-place concrete.

Based on results of the comparative cost analysis and consideration of long-term costs, Alternative 3 is the recommended alternative.

In addition to carrying the lowest cost, Alternative 3 also requires the lowest profile grade raise. This will limit the number of impacted residential drives and the amount of grade raise required on the nearby cross street (Leisure Lane).

See Attachment D for comparative cost estimates shown in Table 4-1. See Attachment E for the total cost estimate of the preferred alternative shown in Table 4-2.

Table 4-1: Summary of Construction Costs

Alternative and Description	Construction Cost	Percent Higher Than Lowest Alternate
Alternative 1- Weathering Rolled Steel Beams	$1,105,828	16%
Alternative 2 – 21"x36" Prestressed Concrete Box Beams	$1,096,165	15%
Alternative 3 – Reinforced Concrete Slab	**$955,760**	-

Table 4-2: Summary of Total Costs

Alternative and Description	Total Cost (Construction)
Alternative 3 – Reinforced Concrete Slab	$**2**,**783**,000

Bridge Inspection Report

49-4510F
COUNTY LINE RD S
over
BUFFALO CREEK

Inspection Date: 12/21/2022

Inspected By: Alfred V. Wessling

Inspection Type(s): Routine

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CURRENT DECK RATING: SATISFACTORYCURRENT SUPERSTRUCTURE RATING: SATISFACTORYCURRENT SUBSTRUCTURE RATING: GOODCURRENT CULVERT RATING: NOT APPLICABLETHIS BRIDGE WAS ASSESSED AS: "NOT SCOUR CRITICAL"
PLEASE SEE THE STRUCTURE INVENTORY AND APPRAISAL REPORT FOR MORE DETAILED INFORMATION.

Bridge Inspection Report

IDENTIFICATION

(1) STATE CODE:	185 - Indiana
(8) STRUCTURE:	4900427
(5 A-B-C-D-E) INV. ROUTE:	1 - 5 - 1 - 00000 - 0
(2) HIGHWAY AGENCY DISTRICT:	03 - Greenfield
(3) COUNTY CODE:	049 - MARION
(4) PLACE CODE:	36000 - INDIANAPOLIS
(6) FEATURES INTERSECTED:	BUFFALO CREEK
(7) FACILITY CARRIED:	COUNTY LINE RD S
(9) LOCATION:	00.55 W OF MERIDIAN ST
(11) MILEPOINT:	0000.000

(12) BASE HIGHWAY NETWORK:	0
(13A) INVENTORY ROUTE:	
(13B) SUBROUTE NUMBER:	
(16) LATITUDE:	39.63488
(17) LONGITUDE:	-86.168945
(98) BORDER	
A) STATE NAME:	
B) PERCENT	%
(99) BORDER BRIDGE STRUCT. NO:	

STRUCTURE TYPE AND MATERIAL

(43) STRUCTURE TYPE, MAIN:	
A) KIND OF MATERIAL/DESIGN:	2 - Concrete continuous
B) TYPE OF DESIGN/CONSTR:	01 - Slab
(44) STRUCTURE TYPE, APPROACH SPANS:	
A) KIND OF MATERIAL/DESIGN:	0 - Other
B) TYPE OF DESIGN/CONSTR:	00 - Other

(45) NUMBER OF SPANS IN MAIN UNIT:	003
(46) NUMBER OF APPROACH SPANS:	0000
(107) DECK STRUCTURE TYPE:	1 - Concrete Cast-in-Place
(108) WEARING SURFACE/PROT SYS:	
A) WEARING SURFACE:	1 - Monolithic Concrete (concurrently placed with structural deck)
B) DECK MEMBRANE:	0 - None
C) DECK PROTECTION:	0 - None

AGE OF SERVICE

(27) YEAR BUILT:	1987
(106) YEAR RECONSTRUCTED:	0000
(42) TYPE OF SERVICE:	
A) ON BRIDGE:	1 - Highway
B) UNDER BRIDGE:	5 - Waterway

(28) LANES:		
A) ON BRIDGE:	02	
B) UNDER BRIDGE:	00	
(29) AVERAGE DAILY TRAFFIC:	014669	
(30) YEAR OF AVERAGE DAILY TRAFFIC:	2014	
(109) AVERAGE DAILY TRUCK TRAFFIC:	05	%
(19) BYPASS DETOUR LENGTH:	004	MI

Bridge Inspection Report

GEOMETRIC DATA

(48) LENGTH OF MAX SPAN:	0029.8	FT	(35) STRUCTURE FLARED:	0 - No flare	
(49) STRUCTURE LENGTH:	00081.3	FT	(10) INV RTE, MIN VERT CLEARANCE:	99.99	FT
(50) CURB/SIDEWALK WIDTHS:			(47) TOT HORIZ CLEARANCE:	044.0	FT
A) LEFT	00.0	FT	(53) VERT CLEAR OVER BR RDWY:	99.99	FT
B) RIGHT:	00.0	FT	(54) MIN VERTICAL UNDERCLEARANCE:		
(51) BRDG RDWY WIDTH CURB-TO-CURB:	044.0	FT	A) REFERENCE FEATURE:	N	
(52) DECK WIDTH, OUT-TO-OUT:	047.0	FT	B) MIN VERT UNDERCLEAR:	00.00	FT
(32) APPROACH ROADWAY	044.0	FT	(55) LATERAL UNDERCLEARANCE RIGHT:		
(33) BRIDGE MEDIAN:	0 - No median		A) REFERENCE FEATURE:	N	
			B) MIN LATERAL UNDERCLEAR:	000.0	FT
(34) SKEW:	35	DEG	(56) MIN LATERAL UNDERCLEAR ON LEFT:	000.0	FT

INSPECTIONS

(90) INSPECTION DATE:	12/21/2022	(91) DESIGNATED INSPECTION FREQUENCY:	48 MONTHS
(92) CRITICAL FEATURE INSPECTION:		(93) CRITICAL FEATURE INSPECTION DATE:	
A) FRACTURE CRITICAL REQUIRED/FREQUENCY:	N	A) FRACTURE CRITICAL DATE:	
B) UNDERWATER INSPECTION REQUIRED/FREQUENCY:	N	B) UNDERWATER INSP DATE:	
C) OTHER SPECIAL INSPECTION REQUIRED/FREQUENCY:	N	C) OTHER SPECIAL INSP DATE:	

CONDITION

(58) DECK:	6 - Satisfactory Condition (minor deterioration)	(60) SUBSTRUCTURE:	7 - Good Condition (some minor problems)
(58.01) WEARING SURFACE:	7 - Good Condition	(61) CHANNEL/CHANNEL PROTECTION:	6 - Bank slump. widespread minor damage
(59) SUPERSTRUCTURE:	6 - Satisfactory Condition (minor deterioration)	(62) CULVERTS:	N - Not Applicable

CONDITION COMMENTS

(58) DECK: 6 - Satisfactory Condition (minor deterioration)

Comments:
SATISFACTORY - DEBRIS ON BRIDGE SHOULDERS. SPALLS ALONG EAST JOINT. SEE SUPERSTRUCTURE COMMENTS.
Material:
REINFORCED CONCRETE SLAB

(58.01) WEARING SURFACE: 7 - Good Condition

Comments:
GOOD - HAIRLINE CRACKS IN WEARING SURFACE.
Material:
CONCRETE

(59) SUPERSTRUCTURE: 6 - Satisfactory Condition (minor deterioration)

Comments:
SATISFACTORY - SPALLS WITH DELAMINATION AND EXPOSED STEEL AROUND SOUTH COPING DRAINS ON UNDERSIDE OF SLAB. BROKEN DRAIN PIPES ALONG SOUTH COPING. LONGITUDINAL CRACK ALONG SOUTH COPING AT SOUTHEAST CORNER.
Material:
REINFORCED CONCRETE SLAB

(60) SUBSTRUCTURE: 7 - Good Condition (some minor problems)

Comments:
GOOD - CONSTRUCTION SLAB AT NORTHWEST CORNER BROKEN AND SETTLED. LEAKING ON END BENTS. MINOR CRACKING WITH RUST STAINING ON SOUTHEAST END BENT.
Material:
CONCRETE

(61) CHANNEL/CHANNEL PROTECTION: 6 - Bank slump. widespread minor damage

Comments:
SATISFACTORY - SAND AND GRAVEL FLOWLINE. RIPRAP WASHED INTO DOWNSTREAM CHANNEL. MINOR EROSION AT NORTH END OF PIER 2 AT STORM SEWER OUTLET.
Material:
RIPRAP

(62) CULVERTS: N - Not Applicable

Comments:
N/A
Material:
N/A

LOAD RATING AND POSTING

(31) DESIGN LOAD:	5 - HS 20	(66) INVENTORY RATING:	36.72
(70) BRIDGE POSTING	5 - Equal to or above legal loads	(65) INVENTORY RATING METHOD:	1 - Load Factor (LF)
		(66B) INVENTORY RATING (H):	
(41) STRUCTURE OPEN/POSTED/CLOSED:	A - Open	(66C) TONS POSTED :	
		(66D) DATE POSTED/CLOSED:	
(64) OPERATING RATING:	71.28		
(63) OPERATING RATING METHOD:	1 - Load Factor (LF)		

APPRAISAL

SUFFICIENCY RATING:	95.9	(36) TRAFFIC SAFETY FEATURE:	
STATUS:	0	36A) BRIDGE RAILINGS:	1
(67) STRUCTURAL EVALUATION:	6	36B) TRANSITIONS:	1
(68) DECK GEOMETRY:	6	36C) APPROACH GUARDRAIL:	1
(69) UNDERCLEARANCES, VERTICAL & HORIZONTAL:	N	36D) APPROACH GUARDRAIL ENDS:	1

(71) WATERWAY ADEQUACY: 8 - Bridge Above Approaches
Comments:
APPEARS ADEQUATE

(72) APPROACH ROADWAY ALIGNMENT: 8 - Equal to present desirable criteria
Comments:
EROSION AT NORTHWEST AND SOUTHEAST BRIDGE CORNERS. MINOR CRACKS AND SPALLS IN EAST APPROACH SLAB. PAVEMENT CRACKING AT ENDS OF APPROACH SLABS.
Material:
BITUMINOUS
72: STRAIGHT, ON GRADE

(113) SCOUR CRITICAL BRIDGES: 8 - Stable for scour conditions
Comments:
NO MAJOR SCOUR VISIBLE.

CLASSIFICATION

(20) TOLL:	3 - On Free Road	(21) MAINT. RESPONSIBILITY:	04 - City or Municipal Highway Agency
(22) OWNER:	04 - City or Municipal Highway Agency	(26) FUNCTIONAL CLASS OF INVENTORY RTE:	06 - Rural - Minor Arterial
(37) HISTORICAL SIGNIFICANCE:	5 - Not eligible	(100) STRAHNET HIGHWAY:	Not a STRAHNET route
(101) PARALLEL STRUCTURE:	N - No parallel structure	(102) DIRECTION OF TRAFFIC:	2-way traffic
(103) TEMPORARY STRUCTURE:		(104) HIGHWAY SYSTEM OF INVENTORY ROUTE:	0 - Structure/Route is NOT on NHS
(105) FEDERAL LANDS HIGHWAYS:	0-Not Applicable	(110) DESIGNATED NATIONAL NETWORK:	Inventory route not on network
(112) NBIS BRIDGE LENGTH:	Yes		

NAVIGATION DATA

(38) NAVIGATION CONTROL:	0 - No navigation control on waterway (bridge permit not required)	(39) NAVIGATION VERTICAL CLEAR:	000.0 FT
(111) PIER OR ABUTMENT PROTECTION:		(116) MINIMUM NAVIGATION VERT. CLEARANCE, VERT. LIFT BRIDGE:	FT
		(40) NAV HORIZONTAL CLEARANCE:	0000.0 FT

PROPOSED IMPROVEMENTS

(75A) TYPE OF WORK:		(95) ROADWAY IMPROVEMENT COST:	$ 000000
(75B) WORK DONE BY:		(96) TOTAL PROJECT COST:	$ 000000
(76) LENGTH OF IMPROVEMENT:	00000.0 FT	(97) YR OF IMPROVEMENT COST EST:	
(94) BRIDGE IMPROVEMENT COST:	$ 000000	(114) FUTURE AVG DAILY TRAFFIC:	021798
		(115) YR OF FUTURE ADT:	2034

Miscellaneous Asset Data

4900427

Asset Management

Load Rating 2:

Has the dead load or the structural condition of the primary load carrying members changed since the last inspection?

Extended Frequency: Submittal Date: 01/23/2020

Inspector: This bridge is being submitted for Extended Frequency.

INDOT Reviewer:

This bridge has been accepted into the Extended Frequency Program. Approval Date:

Joints: ** Indicate location, type, and rating of lowest rated joint.*

Comments:

Terminal Joints: **Rating of lowest rated terminal joint.*

Comments:

Concrete Slopewall: **Rating of lowest rated slopewall.*

Comments:

Bearings: ** Indicate type, and rating of lowest rated bearing.*

Comments:

Approach Slabs: ** Indicate if present & condition rating.*

Comments:

Paint: ** Indicate if paint present , year painted & condition rating.*

N

Comments:

N/A
Material:
N/A

Endangered Species: ** If yes, add one photo to the dropdown field*

Bats: seen or heard under structure? * N

Birds/swallows/nests seen? Empty nests present? * N

BRIDGE Culvert Geometry:

Barrel Length:

Height:

Width:

Inspector:	Wessling,Alfred V.	**Structure Number:**	4900427
Inspection Date:	12/21/2022	**Facility Carried:**	COUNTY LINE RD S

Bridge Inspection Report

NBI Data come from National Inventory

NBI 113: Scour Critical Bridges 8

NBI 113a Scour Critical Bridges Comments

NO MAJOR SCOUR VISIBLE.

To Be Completed by Hydraulics

Scour Analysis Status

Scour Analysis Date

Scour Analysis Determination

Hydraulics Comments

To Be Completed by Bridge Inspection

Scour Critical Safety Status

Date of Counter Measure Placed or Field Verified

Bridge Inspectoin Comments

Scour Delineators installed

LOAD RATING - BRADIN

Load Rating Date: 20-MAR-19

National Bridge Inventory (NBI):

(65) INVENTORY RATING METHOD: 1

(66) INVENTORY RATING: 36.72

(63) OPERATING RATING METHOD: 1

(64) OPERATING RATING: 71.28

(31) DESIGN LOAD: 5

(70) BRIDGE POSTING: 5

(41) STRUCTURE OPEN/POSTED/CLOSED: A

(66C) TONS POSTED:

(66D) DATE POSTED/CLOSED:

Posting Configurations:

Emergency Vehicles:

EV2: LEGAL RF: 1.97

EV3: LEGAL RF: 1.23

2-Axles:

H20-44: LEGAL RF: 2.06

ALTERNATE MILITARY: LEGAL RF: 1.68

3-Axles:

HS20: LEGAL RF: 1.98

AASHTO TYPE 3: LEGAL RF: 2.38

4-Axles:

SU4: LEGAL RF: 1.98

TOLL ROAD LOADING NO. 2: ROUTINE PERMIT RF:

5-Axles:

AASHTO TYPE 3S2: LEGAL RF: 2.45

SU5: LEGAL RF: 1.91

TOLL ROAD LOADING NO. 1: ROUTINE PERMIT RF:

6+-Axles:

AASHTO TYPE 3-3: LEGAL RF: 3.01

LANE TYPE: LEGAL RF:

SU6: LEGAL RF: 1.76

SPECIAL TOLL ROAD TRUCK: ROUTINE PERMIT RF:

SU7: LEGAL RF: 1.72

MICHIGAN TRAIN TRUCK NO. 5: ROUTINE PERMIT RF:

MICHIGAN TRAIN TRUCK NO. 8: ROUTINE PERMIT RF:

Other Configurations:

H20-44: DESIGN RF: 1.23

NRL: LEGAL RF: 1.64

SUPERLOAD-11 AXLES: SPECIAL PERMIT RF:

SUPERLOAD-13 AXLES: SPECIAL PERMIT RF:

SUPERLOAD-14 AXLES: SPECIAL PERMIT RF:

SUPERLOAD-19 AXLES (152.5T): SPECIAL PERMIT RF:

SUPERLOAD-19 AXLES (240.045T): SPECIAL PERMIT RF:

Inspector: Alfred V. Wessling

Inspection Date: 12/21/2022

Asset Name: 49-4510F

Facility Carried: COUNTY LINE RD S

Bridge Inspection Report

Date Reported: 07/09/2014

Priority:

Work Code:

Deficiency Description:

Work Description:
NO MAJOR WORK NEEDED.

Date Repairs Completed:

Maintenance Comments:
CLEAN DECK. CLEAR VEGETATION AT BRIDGE. REPAIR JOINTS. REPAIR DECK DRAINS, REPAIR EROSION AT NORTHWEST AND SOUTHEAST CORNERS. PATCH SPALLS AT DRAINS. GRADE APPROACH SHOULDERS TO DRAIN.

Inspector:	Wessling,Alfred V.	**Structure Number:**	4900427
Inspection Date:	12/21/2022	**Facility Carried:**	COUNTY LINE RD S

Bridge Inspection Report

Channel Measurement

Date of Channel Measurements:

Distance Measured From:

Depth Measured From:

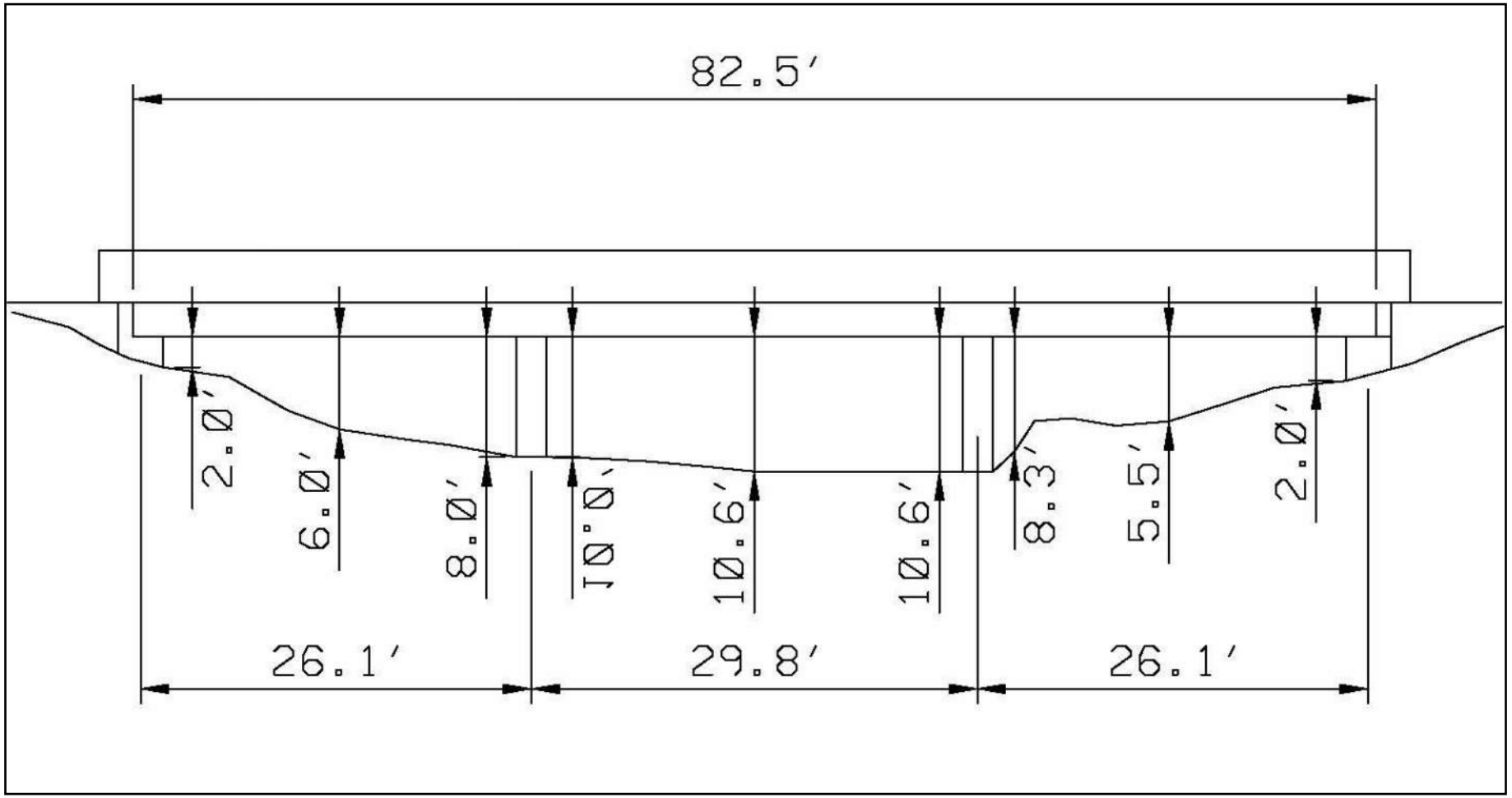
Number of Measurement Points Taken:

Number of Fixed Objects in Channel:

Water Level:

High Water Mark:

Measurement Type:



HNTB

TO: Ericka Miller, PE, PTOE, PMP
Chief Engineer
Department of Public Works – City of Indianapolis

FROM: Matthew Miller, PE, PTOE
Senior Engineer

DATE: January 15, 2021
SUBJECT: Traffic Forecast and Analysis Memo
PROJECT NO: ST-45-067
DES. NO.: 2002553
RE: County Line Road Added Travel Lanes, I-69 to SR 135

Purpose

The purpose of this memorandum is to document the traffic forecasting and traffic analysis leading to the recommended configuration of County Line Road between the future I-69 and SR 135. This segment of County Line Road is being widened from its existing two-lane configuration to provide four travel lanes (two eastbound and two westbound) plus a center two way left turn lane (TWLTL). County Line Road is located on the border between Marion County and Johnson County and is classified as an urban major arterial roadway.

Existing Traffic Volumes

Recent traffic count data was obtained from the Indiana Department of Transportation (INDOT) to support the traffic forecasting and analysis. The locations and dates of counts used in this analysis are identified in **Table 1**. Segment counts were obtained from the INDOT Traffic Count Database System,[1] while traffic counts were provided by INDOT through its online intersection count portal.[2]

Additional traffic counts were planned at several intersections on County Line Road for this project, but these counts were postponed due to COVID-19 impacts on travel volumes. If traffic conditions return to "normal" prior to project construction, additional counts would be useful to confirm the proposed turn lane lengths are sufficient at minor intersections.

[1] Indiana Department of Transportation Traffic Count Database System. https://indot.ms2soft.com/tcds/
[2] Miovision DataLink. https://datalink.miovision.com/

Table 1. Traffic Count Data Obtained from the Indiana Department of Transportation

Road	Location	Count Type	Date
County Line Rd	Between SR 37 and Morgantown Rd	48-hour segment count	September 2014
County Line Rd	West of SR 135	24-hour segment count	January 2019
Railroad Rd	Between County Line Rd and Stop 11 Rd	48-hour segment count	August 2019
Morgantown Rd	Between Fairview Rd and County Line Rd	48-hour segment count	September 2019
Morgantown Rd	Between County Line Rd and Bluff Rd	48-hour segment count	January 2019
County Line Rd	At Morgantown Rd	4-hour turning movement	September 2019
County Line Rd	At Railroad Rd	24-hour turning movement	December 2019
County Line Rd	At State Rd 135	24-hour turning movement	April 2016

Traffic Forecast

Daily Volumes

Forecast information was provided in September 2020 by the Indianapolis Metropolitan Planning Organization (IMPO). This information was obtained from their Indianapolis Regional Travel Demand Model. This data provided the basis for traffic forecasts developed for the County Line Road added travel lanes project. MPO travel demand output for the following model scenarios was evaluated for this scoping report:

- 2020 Existing plus Committed Scenario. This reflects 2020 traffic demand on the existing road network, including any new projects expected to be completed by 2020.
- 2025 No Build Scenario. This reflects 2025 traffic demand on the existing network, plus committed projects that are expected to be complete by 2025. This includes the conversion of SR 37 to I-69 from Martinsville to I-465, with an interchange at County Line Road. The extension of Ameriplex Parkway from SR 67 to the White River, which is currently under development by the City of Indianapolis, is also included in this scenario.
- 2025 Build Scenario. This modifies the 2025 No Build Scenario by widening County Line Road to provide four travel lanes from I-69 to SR 135.
- 2045 No Build Scenario. This reflects 2045 traffic demand on the existing network, plus committed projects that are expected to complete by 2045.
- 2045 Build Scenario. This modifies the 2045 No Build Scenario by widening County Line Road to provide four travel lanes from I-69 to SR 135

Table 2 provides a comparison of average daily traffic volume forecasts on the road segments included in this study for the various scenarios. Historic count data available from the INDOT Traffic Count Database System[3] is also included in the table. 2045 volume forecasts for the I-69 Section 6 Refined Preferred

[3] https://indot.ms2soft.com/tcds

Alternative, as provided in the I-69 Section 6 Environmental Impact Statement (EIS)[4] are also provided for comparison. The I-69 Section 6 EIS forecast reflects widening of County Line Road from I-69 to Morgantown Road. Peterman Road/Railroad Road is not included in the travel demand model network provided by the Indianapolis MPO, so forecasts are not available. Traffic demand growth rates on Peterman Road/Railroad Road were assumed to be similar to those on Morgantown Road.

Table 2 shows that volumes on County Line Road are significantly higher in the Build condition than the No Build condition in both 2025 and 2045. This is because the added capacity on County Line Road in the Build condition would make it a more attractive travel route for drivers who would otherwise use parallel routes in the vicinity. The addition of capacity on County Line Road relieves a constraint on east-west road capacity on the south side of Indianapolis. Despite the higher volumes on County Line Road, analysis of travel demand modeling provided by the IMPO shows that the widening of County Line Road is expected to improve travel times and safety at a regional level. Many drivers who currently use other parallel travel routes will instead use the improved County Line Road to reduce their travel times. This will, in turn, reduce traffic demand and congestion on the other parallel routes. The improved County Line Road, with turn lanes and standard urban arterial design features, is also expected to be safer than the two-lane routes that drivers are currently using.

Table 2. Average Daily Travel Volume Counts and Travel Demand Model Forecasts

	County Line Road			Morgantown Road		Peterman Road	Railroad Road
	SR 37 to Morgantown	Morgantown to Railroad	Railroad to SR 135	County Line to Fairview	County Line to Bluff	County Line to Fairview	County Line to Stop 11
Historic Count (Year)	5,580 (2014)	11,110 (2019)	13,130 (2019)	8,280 (2019)	5,380 (2019)	4,600 (2019)	4,910 (2019)
2020 E+C Model	15,700	8,700	11,200	23,000	11,000	NA	NA
2025 No Build Model	17,000	11,400	12,800	19,000	12,900	NA	NA
2025 Build Model	21,200	19,700	22,700	18,400	12,100	NA	NA
2045 No Build Model	16,300	13,100	14,100	23,000	19,400	NA	NA
2045 Build Model	28,300	24,800	27,600	26,600	18,100	NA	NA
2045 I-69 EIS Model*	22,300	14,900	NA	14,200	NA	NA	NA

*The I-69 Section 6 EIS included widening County Line Rd to 4 travel lanes from I-69 to Morgantown Rd.

[4] Final Environmental Impact Statement, I-69 Section 6, Martinsville to Indianapolis, Federal Highway Administration and Indiana Department of Transportation, February 2018. Available at: https://www.in.gov/indot/projects/i69/2515.htm

Peak Hour Volumes

Peak hour turning movements forecasts were developed for the 2025 Build, 2045 No Build, and 2045 Build scenarios based on 2019 peak period turning movement counts and peak period travel demand growth identified from the IMPO travel demand model runs. Travel demand model outputs for the future scenarios were compared to the output for the 2020 Existing plus Committed scenario to determine volume growth by road segment and direction. These growth estimates were then applied to the recent turning movement counts, and adjustments were made to assure reasonable balance along County Line Road. As stated above, traffic demand growth rates on Railroad Road/Peterman Road were assumed to be similar to those on Morgantown Road, since this road was not included in the MPO travel demand model. Existing and forecast peak hour turning movement volumes are shown for the intersection of County Line Road and Morgantown Road in **Table 3** and for the intersection of County Line Road and Railroad Road/Peterman Road in **Table 4**.

As noted previously with the daily volume forecasts, the peak hour volume forecasts shown in **Table 3** and **Table 4** also reflect higher demand on County Line Road in the Build scenario than the No Build scenario.

Table 3. Existing and Forecast Peak Hour Volumes at County Line Road & Morgantown Road

AM Peak Hour		Morgantown Rd Northbound			Morgantown Rd Southbound			County Line Rd Eastbound			County Line Rd Westbound		
		L	T	R	R	T	L	L	T	R	R	T	L
2019 Count	Total	100	355	89	7	60	28	14	242	28	27	200	40
	Truck	-	-	1	-	-	3	1	7	2	1	10	-
2025 Build	Total	121	355	210	11	82	76	19	662	39	41	349	61
	Truck	-	-	3	-	-	9	2	22	3	2	16	1
2045 No Build	Total	102	449	104	10	87	44	17	279	28	42	260	53
	Truck	-	-	1	-	-	6	2	9	2	2	15	1
2045 Build	Total	157	435	231	14	90	84	26	788	49	57	493	80
	Truck	-	-	3	-	-	11	2	29	4	3	34	3

PM Peak Hour		Morgantown Rd Northbound			Morgantown Rd Southbound			County Line Rd Eastbound			County Line Rd Westbound		
		L	T	R	R	T	L	L	T	R	R	T	L
2019 Count	Total	24	134	69	44	475	50	19	276	80	27	298	90
	Truck	1	1	-	-	1	-	-	1	-	-	1	-
2025 Build	Total	31	139	112	56	475	81	21	468	86	64	782	211
	Truck	1	1	-	-	1	-	-	2	-	-	3	-
2045 No Build	Total	24	217	102	52	581	82	31	406	84	48	343	108
	Truck	1	2	-	-	2	-	-	1	-	-	1	-
2045 Build	Total	43	207	187	83	573	140	34	814	109	62	757	168
	Truck	2	2	-	-	1	-	-	4	-	-	4	-

Table 4. Existing and Forecast Peak Hour Volumes at County Line Road & Railroad Road/Peterman Road

AM Peak Hour		Peterman Rd Northbound			Railroad Rd Southbound			County Line Rd Eastbound			County Line Rd Westbound		
		L	T	R	R	T	L	L	T	R	R	T	L
2019 Count	Total	20	188	214	22	47	87	22	380	14	34	170	39
	Truck	-	-	-	1	-	-	-	5	-	1	5	1
2025 Build	Total	31	228	337	63	89	160	52	1,184	33	60	393	69
	Truck	-	-	-	2	-	-	-	21	-	2	9	-
2045 No Build	Total	26	238	227	57	68	128	31	455	16	47	243	45
	Truck	-	-	-	2	-	-	-	7	-	2	7	-
2045 Build	Total	40	280	352	79	100	171	59	1,289	36	82	544	89
	Truck	-	-	-	3	-	-	-	25	-	3	19	-

PM Peak Hour		Peterman Rd Northbound			Railroad Rd Southbound			County Line Rd Eastbound			County Line Rd Westbound		
		L	T	R	R	T	L	L	T	R	R	T	L
2019 Count	Total	136	78	111	81	198	58	23	352	24	16	349	40
	Truck	1	-	1	-	-	-	2	2	-	-	4	1
2025 Build	Total	209	79	138	125	198	72	46	786	48	36	970	90
	Truck	3	-	2	-	-	-	4	6	-	-	17	5
2045 No Build	Total	178	111	124	134	274	84	40	499	32	24	475	44
	Truck	1	-	1	-	-	-	4	3	-	-	7	2
2045 Build	Total	245	95	170	169	268	105	66	1,121	65	39	1,058	92
	Truck	3	-	3	-	-	-	7	10	-	-	20	5

Crash Analysis

Crash data for County Line Road during the years 2017, 2018, and 2019 were obtained by the City of Indianapolis from the Indiana State Police Automated Reporting Information Exchange System (ARIES). During this three-year period, a total of 151 crashes occurred along County Line Road from east of SR 37 to west of SR 135. The data set includes 29 injury crashes with a total of 40 injuries and zero fatalities, as shown in **Table 5**. This table indicates that the number of injury crashes steadily increased from 2017 to 2019, while the number of property damage only (PDO) crashes remained relatively constant.

Table 5: County Line Road Crashes, East of SR 37 to West of SR 135

	2017	2018	2019	Totals
Property Damage Only (PDO) Crashes	44	42	36	122
Injury Crashes	4	11	14	29
Injuries	6	15	19	40
Fatal Crashes	-	-	-	-
Fatalities	-	-	-	-
Total Crashes	48	53	50	151

Figure 1 shows a breakdown of crashes by type over the three-year period. Rear-end crashes are the most common crash type on this segment of County Line Road, and their frequency remained relatively steady through the analysis period. These crashes are often caused by congestion or poor visibility. Rear end crashes are often less severe than angle or road departure crashes, which explains why PDO crashes remained relatively constant over the analysis period.

Figure 1: County Line Road Crashes by Type and Year

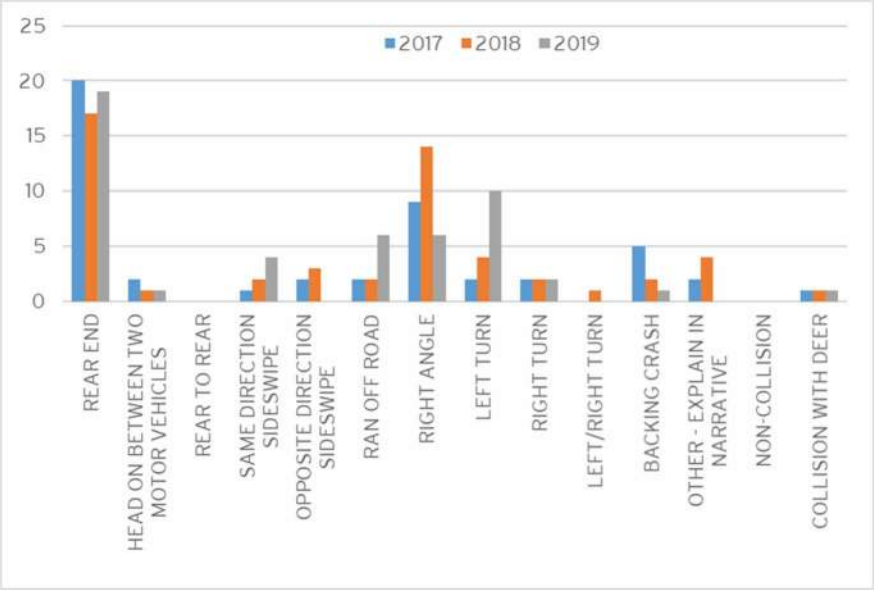


Figure 2 illustrates the number of crashes at intersections along County Line Road. The Morgantown Road and Railroad Road intersections with County Line Road are where a large majority of crashes occurred. Both intersections experienced 22 crashes over the three-year period. Crashes approximately doubled each year from 2017 to 2019 at the Morgantown Road intersection, while crashes at the Railroad Road intersection remained relatively constant over this time period.

Figure 2: Total Crashes per Intersection

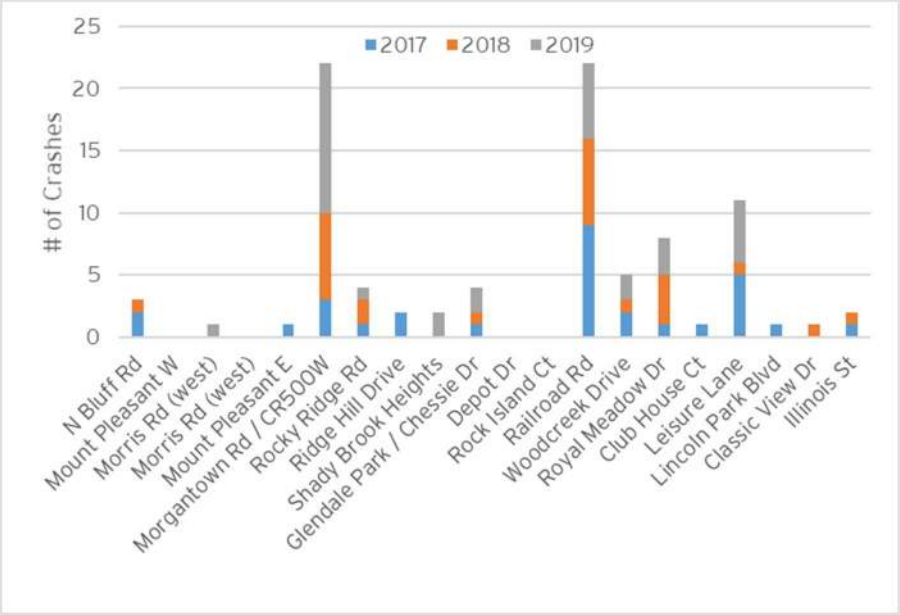


Figure 3 and **Figure 4** provide summaries of the frequency of crashes by type at the County Line Road intersections with Morgantown Road and Railroad Road/Peterman Road, respectively. The two main crash types at the Morgantown Road intersection are rear end crashes and right-angle crashes. These two types of crashes are often associated with congested conditions, visibility problems, or improper traffic signal clearance intervals. There is some evidence that the proximity of the vertical crest curve on County Line Road immediately west of the intersection contributes to some crashes. The crest of the vertical curve is approximately 350 feet west of the eastbound stop bar at the Morgantown Road traffic signal, limiting visibility to eastbound vehicles that may be queued at the intersection. In addition, the downhill grade of approximately 11 percent increases the distance required to stop at the intersection, especially when the road is wet. Three crash narratives mention crashes caused by the inability of eastbound vehicles to stop on wet pavement, while this is not identified for any other approach.

Right angle crashes are the principal crash type at the Railroad Road intersection, as illustrated in **Figure 4**. This all-way stop controlled intersection will be signalized in the upcoming construction season. Per the Crash Modification Clearinghouse, signalization is expected to reduce right-angle crashes by 67%. The second highest crash type at the Railroad Road intersection are rear end crashes, which are indicative of congested conditions.

Figure 3: Crash Types at Morgantown Rd & County Line Rd Intersection

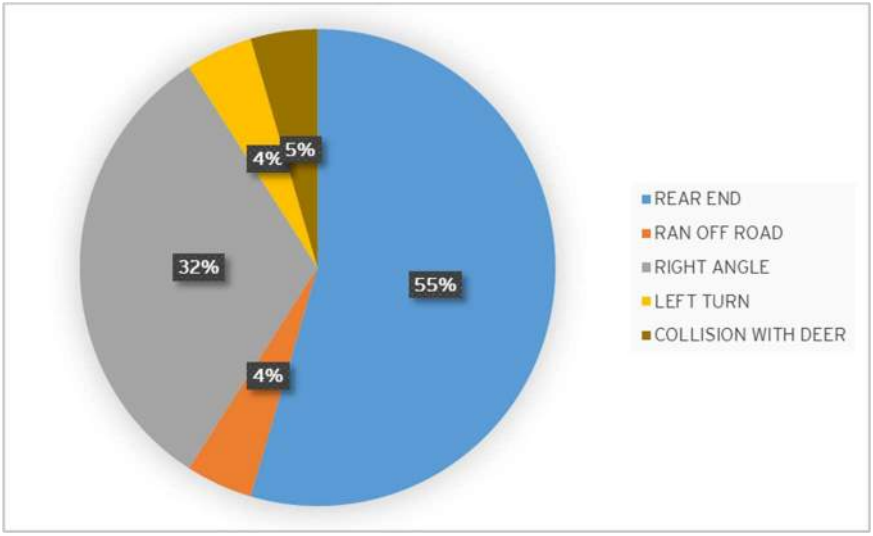
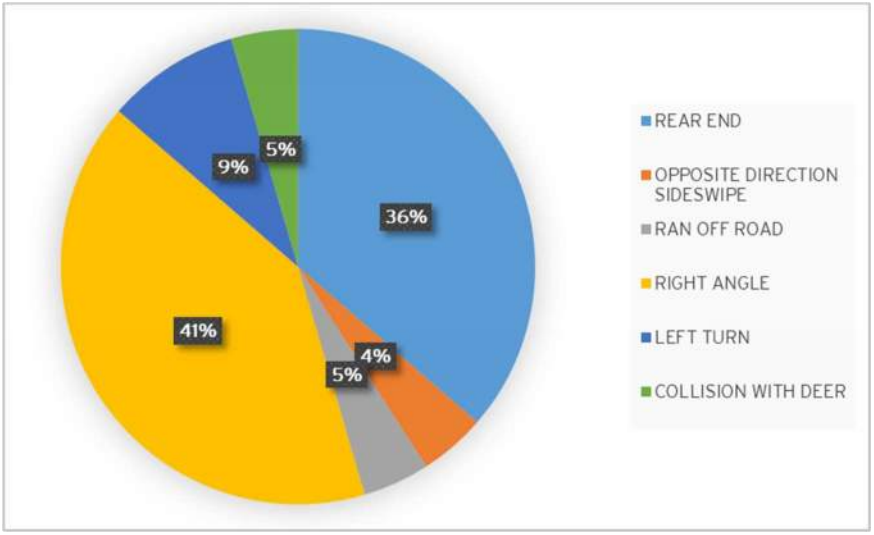


Figure 4: Crash Types at Railroad Rd & County Line Rd Intersection



The intersection of County Line Road and Leisure Lane experienced approximately four crashes per year over the analysis period. Most crashes at this location were rear end or left turn crashes, indicating congested conditions and a lack of space for turning vehicles to move out of traffic lanes while slowing or waiting for gaps to turn. The closely spaced intersections of County Line Road with Royal Meadow Drive and Club House Court experienced an average of three crashes per year. These were primarily rear end crashes, which also indicates a lack of space for turning vehicles to slow and wait for gaps outside of the travel lanes.

Traffic Analysis

Traffic operations analysis was conducted for County Line Road to determine the recommended roadway lane configuration and intersection traffic control to be constructed. Operational analysis was conducted by using the methods of the TRB Highway Capacity Manual[5] to calculate Level of Service. Level of Service (LOS) is a common way of describing the degree of traffic congestion on roadways, using "grades" on a letter scale from LOS A (best) to LOS F (worst). LOS A represents near ideal traffic flow, while LOS F represents a breakdown of the traffic flow. LOS relates to operations, not the physical condition of the roadway. The Indiana Department of Transportation Design Manual[6] recommends that an arterial road in an urban area, such as South County Line Road, operate with LOS D or better. For an intersection, the overall intersection should operate at LOS D or better, while individual intersection approaches should operate no worse than LOS E.

Typical Section Requirements

The through lane requirements for County Line Road were verified by comparing 2045 average daily traffic forecasts to the service volume thresholds for a signalized arterial. The maximum volume that can be served with an acceptable highway capacity LOS D or better on County Line Road in its existing two-lane configuration is estimated to be 12,750 vehicles per day, based on generalized service volume estimates developed by the Florida Department of Transportation and shown in **Attachment A**.[7] The 2045 No Build scenario demand estimated for each segment of County Line Road exceeds 12,750, as shown in **Table 2**, and a two-lane arterial will therefore provide insufficient capacity. An arterial with four travel lanes and turn lanes at intersections has an estimated capacity of 39,8000 per the generalized service volume estimates and will therefore provide enough capacity to serve the 2045 Build scenario volumes. Due to the number of driveway and street intersections along County Line Road, a two-way center left turn lane is recommended for safety and capacity.

It is noted that forecast demand on Morgantown Road and Railroad/Peterman Road also exceed the maximum acceptable two-lane arterial volumes, and these roads may require additional travel lanes in the future.

Intersection Traffic Control

A traffic signal was installed at the intersection of County Line Road and Morgantown Road in 2014. While no formal signal warrant analysis has been conducted as a part of this study, daily traffic forecasts indicate that the volumes at the intersection will likely continue to meet Indiana MUTCD traffic signal warrants

[5] Transportation Research Board, Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis, National Academies of Science.
[6] *Indiana Department of Transportation 2013 Design Manual*, Figures 55-3E and 55-3F. Available at: https://www.in.gov/dot/div/contracts/design/Part%203/Chapter%2055%20-%20Geometric%20Design%20of%20Existing%20Non-Freeway%20(3R).pdf
[7] 2012 Generalized Service Volume Tables, Florida Department of Transportation Systems Planning Office, December 2012. Available at: https://www.fdot.gov/planning

under either the 2025 No Build or 2025 Build scenario.[8] A roundabout was considered for this intersection during project scoping, but the alternative was rejected due to the steep grade on the west approach and the Pleasant Run Creek crossings on the north and east approaches that would increase the cost of widening on these approaches.

The intersection of County Line Road and Railroad Road/Peterman Road is currently controlled by an all-way stop. However, a traffic signal is scheduled to be constructed at this intersection in early 2021, so signal control was assumed for all future No Build and Build scenarios. Examination of existing daily counts and MPO growth forecasts indicate that this intersection currently warrants a traffic signal and is expected to continue to warrant a signal through 2045. A roundabout was considered for this intersection during project scoping, but a traffic signal is preferred due to the adjacent railroad. A roundabout would need to be shifted away from the current center of the intersection in order to accommodate the railroad, and would thus have greater right of way impacts.

Traffic volume information is unavailable at other intersections within the County Line Road study segment, and as mentioned above, new count data was not collected as a part of this effort due to COVID-19 impacts. However, side street volumes at all other intersections are much lower than those at the Morgantown Road and the Railroad Road/Peterman Road intersections. It is expected that other public road intersections will retain existing stop control on the side street approaches.

Intersection Lane Configuration and Level of Service

Intersection capacity analysis was conducted for the intersections of County Line Road with Morgantown Road and with Railroad Road/Peterman Road using Synchro 10 traffic analysis software. This analysis was conducted using the 2045 AM and PM peak hour Build Scenario traffic forecasts and the proposed signal control at both intersections in order to determine the intersection lane configurations that would provide acceptable traffic operation. Intersection turn lane recommendations are based on providing an overall intersection LOS of D or better in 2045 and on the warrants in Section 46-4.0 of the Indiana Design Manual Turn.

Recommended approach lane configurations, turn lane storage lengths, and resulting 2045 AM and PM peak hour Build Scenario LOS for each intersection movement are all shown in **Table 6**. The storage length for each turn lane was set to accommodate the higher of the AM peak or PM peak 95th percentile queue length, which is the length that is expected to be exceeded only five percent of the time under the forecast conditions. A minimum storage length of 100 feet was used. The lengths in the table only include full-width storage requirements and exclude entrance taper lengths. Per the Indiana Design Manual, recommended turn lane lengths exclude deceleration distance due to the developed urban area and speeds of 40 mph or less. Turn lanes would ideally be longer than the 95th percentile queue length in the adjacent through lane so that vehicles could enter turn lanes unimpeded. However, this would require significant additional cost and impact at these intersections.

The 2045 AM peak hour LOS of E that is shown for the northbound right turn on Peterman Road is due to a forecast volume increase from 214 vehicles per hour in 2019 to 352 vehicles per hour in the 2045 Build scenario. Based on the uncertainty of traffic forecasts for any specific turning movement and the cost of

[8] Indiana Manual on Uniform Traffic Control Devices, 2011 Edition. Table 4C-2.

providing additional capacity, no additional investment is recommended at this time to improve the LOS forecast for this movement. A channelized right turn lane or some other improvement could be considered in the future if this movement does experience significant delay.

Table 6. Recommended Intersection Lane Configurations and 2045 AM/PM Peak Hour Traffic Operation

County Line Rd & Morgantown Rd												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lanes	**h**	↑↑	**g**	**h**	↑↑	**g**	**h**	↑	**g**	**h**	↑	**g**
2045 AM/PM Peak Hour LOS	B/C	C/C	B/C	B/C	C/C	B/B	B/C	D/C	C/C	C/B	C/D	C/B
95th % Queue Length (ft)	30	348	34	183	291	4	92	377	80	82	536	16
Turn Lane Storage (ft)	100	-	100	200	-	100	100	-	100	100	-	100
County Line Rd & Railroad Rd/Peterman Rd												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lanes	**h**	↑↑	**g**	**h**	↑↑	**g**	**h**	↑	**g**	**h**	↑	**g**
2045 AM/PM Peak Hour LOS	B/C	D/C	B/B	C/C	C/D	B/B	C/D	D/C	E/C	D/C	C/D	C/D
95th % Queue Length (ft)	45	586	0	60	448	8	200	300	204	158	274	36
Turn Lane Storage (ft)	100	-	100	100	-	100	200	-	270	230	-	100

Traffic analysis was not conducted to identify Intersection LOS and recommended turn lane lengths at other public road intersections along County Line Road because additional traffic counts were postponed. Traffic volumes are still lower than normal due to COVID-19 impacts. Turn lane recommendations for other intersections within the project will be developed by the design team based on Indiana Design Manual guidance and/or field observation of travel patterns. It is also possible that additional traffic counts will be collected in 2021 if typical traffic patterns appear to resume.

Intersection capacity analysis was conducted for the same two intersections of County Line Road with Morgantown Road and with Railroad Road/Peterman Road using the proposed 2045 lane configurations and traffic control but using 2025 Build Scenario peak hour volume forecasts. This analysis was conducted to assure that the proposed lane configurations would provide acceptable traffic operation in the 2025 opening year. Capacity analysis was also conducted with 2019 existing conditions and the forecast 2045 No Build condition for comparison. **Table 7** provides a summary comparison of the LOS for each intersection approach under each forecast scenario. Synchro software analysis output reports for all scenarios are provided in **Attachment B.** The only unacceptable approach LOS values are at the existing all-way stop-controlled intersection of County Line Road and Railroad Road/Peterman Road. LOS at this intersection will improve once the stop control is replaced by a traffic signal.

Table 7. Intersection Approach LOS Comparison by Alternative

Intersection	Scenario	Year	Control	Period	EB LOS	WB LOS	NB LOS	SB LOS	INT LOS
County Line Rd & Morgantown Rd	Existing	2019	Signal	AM	B	B	B	A	B
				PM	B	B	B	B	B
	No Build	2045	Signal	AM	B	B	B	B	B
				PM	C	B	B	C	C
	Build	2025	Signal	AM	B	B	C	B	B
				PM	C	C	B	C	C
	Build	2045	Signal	AM	C	B	C	C	C
				PM	C	C	C	D	C
County Line Rd & Railroad Rd	Existing	2019	All Way Stop	AM	F	C	F	C	E
				PM	F	F	F	F	F
	No Build	2045	Signal*	AM	B	B	C	B	B
				PM	D	D	D	C	D
	Build	2025	Signal	AM	C	C	D	D	C
				PM	B	C	D	C	C
	Build	2045	Signal	AM	D	C	D	D	D
				PM	C	C	D	D	C

*A traffic signal will be constructed at the County Line Road/Railroad Road intersection in 2021.

Lane Reduction Options at the County Line Road & Railroad Road Intersection

Due to right of way constraints at the intersection of County Line Road with Railroad Road, intersection traffic operations impacts were evaluated for two options to the base recommended lane configuration on the southbound Railroad Road approach, as shown in **Table 6**. Option A would provide a southbound exclusive left turn lane and a shared through-right turn lane. Option B would provide a southbound exclusive right turn lane and a shared through-left lane. The lane configuration for all other approaches would be the same as shown in **Table 6**.

A comparison of the resulting 2045 traffic operation by intersection approach is summarized in **Table 8**. Option A is preferred over Option B due to better operation performance, and detailed LOS and queuing results for this option are provided in **Table 9**. Synchro reports for both options are included in **Attachment B**.

The PM peak hour LOS of F on the southbound approach with Option A would not meet INDOT Design Manual requirements, but the configuration could be considered by DPW if the operation is determined to be acceptable in light of the reduced right of way impacts and construction costs. Another consideration for Option A is that southbound traffic would be more likely gridlock during railroad preemption than with

the base approach configuration because no separate storage area would be available for traffic waiting to turn right across the railroad track.

Table 8. LOS Comparison for Southbound Lane Configuration Options at County Line Road/Railroad Road

Intersection	Scenario	Year	Control	Period	EB LOS	WB LOS	NB LOS	SB LOS	INT LOS
County Line Rd & Railroad Rd	Build Base	2045	Signal	AM	D	C	D	D	D
				PM	C	C	D	D	C
	Build Option A	2045	Signal	AM	D	C	D	D	D
				PM	D	D	D	F	D
	Build Option B	2045	Signal	AM	E	C	F	E	E
				PM	D	E	D	F	E

Table 9. County Line Road/Railroad Road Build Option A Lane Configurations and 2045 AM/PM Peak Hour Traffic Operation

County Line Rd & Railroad Rd/Peterman Rd – Build Option A												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lanes	h	↑↑	g	h	↑↑	g	h	↑	g	h	P	
2045 AM/PM Peak Hour LOS	B/D	D/D	B/C	C/D	C/E	C/C	C/E	D/C	D/C	D/C	C/F	-
95th % Queue Length (ft)	70	632	0	123	592	8	292	281	210	180	562	-
Turn Lane Storage (ft)	100	-	100	130	-	100	290	-	280	230	-	-

Attachments

Attachment A: Generalized Level of Service Requirements

Attachment B: Synchro Software Output

TABLE 1

Generalized **Annual Average Daily** Volumes for Florida's **Urbanized Areas**

LOS D threshold for existing County Line Road configuration = 17,700 vpd - 10% - 20% = 12,744 vpd

INTERRUPTED FLOW FACILITIES

STATE SIGNALIZED ARTERIALS

Class I (40 mph or higher posted speed limit)

Lanes	Median	B	C	D	E
2	Undivided	*	16,800	17,700	**
4	Divided	*	37,900	39,800	**
6	Divided	*	58,400	59,900	**
8	Divided	*	78,800	80,100	**

Class II (35 mph or slower posted speed limit)

Lanes	Median	B	C	D	E
2	Undivided	*	7,300	14,800	15,600
4	Divided	*	14,500	32,400	33,800
6	Divided	*	23,300	50,000	50,900
8	Divided	*	32,000	67,300	68,100

Non-State Signalized Roadway Adjustments

(Alter corresponding state volumes by the indicated percent.)

Non-State Signalized Roadways	- 10%

Median & Turn Lane Adjustments

Lanes	Median	Exclusive Left Lanes	Exclusive Right Lanes	Adjustment Factors
2	Divided	Yes	No	+5%
2	Undivided	No	No	-20%
Multi	Undivided	Yes	No	-5%
Multi	Undivided	No	No	-25%
–	–	–	Yes	+ 5%

One-Way Facility Adjustment

Multiply the corresponding two-directional volumes in this table by 0.6

BICYCLE MODE[2]

(Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Paved Shoulder/Bicycle Lane Coverage	B	C	D	E
0-49%	*	2,900	7,600	19,700
50-84%	2,100	6,700	19,700	>19,700
85-100%	9,300	19,700	>19,700	**

PEDESTRIAN MODE[2]

(Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Sidewalk Coverage	B	C	D	E
0-49%	*	*	2,800	9,500
50-84%	*	1,600	8,700	15,800
85-100%	3,800	10,700	17,400	>19,700

BUS MODE (Scheduled Fixed Route)[3]

(Buses in peak hour in peak direction)

Sidewalk Coverage	B	C	D	E
0-84%	> 5	≥ 4	≥ 3	≥ 2
85-100%	> 4	≥ 3	≥ 2	≥ 1

UNINTERRUPTED FLOW FACILITIES

FREEWAYS

Core Urbanized

Lanes	B	C	D	E
4	47,400	64,000	77,900	84,600
6	69,900	95,200	116,600	130,600
8	92,500	126,400	154,300	176,600
10	115,100	159,700	194,500	222,700
12	162,400	216,700	256,600	268,900

Urbanized

Lanes	B	C	D	E
4	45,800	61,500	74,400	79,900
6	68,100	93,000	111,800	123,300
8	91,500	123,500	148,700	166,800
10	114,800	156,000	187,100	210,300

Freeway Adjustments

Auxiliary Lanes Present in Both Directions	Ramp Metering
+ 20,000	+ 5%

UNINTERRUPTED FLOW HIGHWAYS

Lanes	Median	B	C	D	E
2	Undivided	8,600	17,000	24,200	33,300
4	Divided	36,700	51,800	65,600	72,600
6	Divided	55,000	77,700	98,300	108,800

Uninterrupted Flow Highway Adjustments

Lanes	Median	Exclusive left lanes	Adjustment factors
2	Divided	Yes	+5%
Multi	Undivided	Yes	-5%
Multi	Undivided	No	-25%

[1]Values shown are presented as two-way annual average daily volumes for levels of service and are for the automobile/truck modes unless specifically stated. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the Highway Capacity Manual and the Transit Capacity and Quality of Service Manual.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of motorized vehicles, not number of bicyclists or pedestrians using the facility.

[3] Buses per hour shown are only for the peak hour in the single direction of the higher traffic flow.

* Cannot be achieved using table input value defaults.

** Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

Source:
Florida Department of Transportation
Systems Planning Office
www.dot.state.fl.us/planning/systems/sm/los/default.shtm

TABLE 1
(continued)

Generalized **Annual Average Daily** Volumes for Florida's **Urbanized Areas**

12/18/12

INPUT VALUE ASSUMPTIONS	Uninterrupted Flow Facilities				Interrupted Flow Facilities					
					State Arterials				Class I	
	Freeways	Core Freeways	Highways		Class I		Class II		Bicycle	Pedestrian
ROADWAY CHARACTERISTICS										
Area type (u,lu)	lu	lu	u	u	u	u	u	u	u	u
Number of through lanes (both dir.)	4-10	4-12	2	4-6	2	4-8	2	4-8	4	4
Posted speed (mph)	70	65	50	50	45	50	30	30	45	45
Free flow speed (mph)	75	70	55	55	50	55	35	35	50	50
Auxiliary Lanes (n,y)	n	n								
Median (n, nr, r)			n	r	n	r	n	r	r	r
Terrain (l,r)	l	l	l	l	l	l	l	l	l	l
% no passing zone			80							
Exclusive left turn lane impact (n, y)			[n]	y	y	y	y	y	y	y
Exclusive right turn lanes (n, y)					n	n	n	n	n	n
Facility length (mi)	4	4	5	5	2	2	1.9	1.8	2	2
Number of basic segments	4	4								
TRAFFIC CHARACTERISTICS										
Planning analysis hour factor (K)	0.090	0.085	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090
Directional distribution factor (D)	0.547	0.547	0.550	0.550	0.550	0.560	0.565	0.560	0.565	0.565
Peak hour factor (PHF)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Base saturation flow rate (pcphpl)			1,700	2,100	1,950	1,950	1,950	1,950	1,950	1,950
Heavy vehicle percent	4.0	4.0	2.0	2.0	1.0	1.0	1.0	1.0	2.5	2.0
Local adjustment factor	0.91	0.91	0.97	0.98						
% left turns					12	12	12	12	12	12
% right turns					12	12	12	12	12	12
CONTROL CHARACTERISTICS										
Number of signals					4	4	10	10	4	6
Arrival type (1-6)					3	3	4	4	4	4
Signal type (a, c, p)					c	c	c	c	c	c
Cycle length (C)					120	150	120	120	120	120
Effective green ratio (g/C)					0.44	0.45	0.44	0.44	0.44	0.44
MULTIMODAL CHARACTERISTICS										
Paved shoulder/bicycle lane (n, y)									n, 50%, y	n
Outside lane width (n, t, w)									t	t
Pavement condition (d, t, u)									t	
On-street parking (n, y)										
Sidewalk (n, y)										n, 50%, y
Sidewalk/roadway separation(a, t, w)										t
Sidewalk protective barrier (n, y)										n

LEVEL OF SERVICE THRESHOLDS

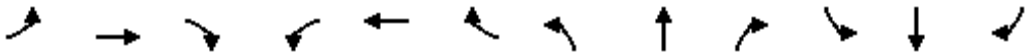
Level of Service	Freeways	Highways		Arterials		Bicycle	Ped	Bus
	Density	Two-Lane %ffs	Multilane Density	Class I ats	Class II ats	Score	Score	Buses/hr.
B	≤ 17	> 83.3	≤ 17	> 31 mph	> 22 mph	≤ 2.75	≤ 2.75	≤ 6
C	≤ 24	> 75.0	≤ 24	> 23 mph	> 17 mph	≤ 3.50	≤ 3.50	≤ 4
D	≤ 31	> 66.7	≤ 31	> 18 mph	> 13 mph	≤ 4.25	≤ 4.25	< 3
E	≤ 39	> 58.3	≤ 35	> 15 mph	> 10 mph	≤ 5.00	≤ 5.00	< 2

% ffs = Percent free flow speed ats = Average travel speed

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	14	242	28	40	200	27	100	355	89	28	60	7
Future Volume (veh/h)	14	242	28	40	200	27	100	355	89	28	60	7
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1781	1856	1856	1870	1826	1826	1870	1870	1870	1722	1900	1900
Adj Flow Rate, veh/h	15	266	31	45	227	31	111	394	99	32	68	8
Peak Hour Factor	0.91	0.91	0.91	0.88	0.88	0.88	0.90	0.90	0.90	0.88	0.88	0.88
Percent Heavy Veh, %	8	3	3	2	5	5	2	2	2	12	0	0
Cap, veh/h	429	515	60	412	496	68	650	513	129	310	593	70
Arrive On Green	0.32	0.32	0.32	0.32	0.32	0.32	0.36	0.36	0.36	0.36	0.36	0.36
Sat Flow, veh/h	1068	1631	190	1082	1572	215	1323	1443	362	832	1668	196
Grp Volume(v), veh/h	15	0	297	45	0	258	111	0	493	32	0	76
Grp Sat Flow(s),veh/h/ln	1068	0	1821	1082	0	1787	1323	0	1805	832	0	1865
Q Serve(g_s), s	0.4	0.0	4.5	1.2	0.0	3.9	2.1	0.0	8.1	1.2	0.0	0.9
Cycle Q Clear(g_c), s	4.2	0.0	4.5	5.6	0.0	3.9	3.0	0.0	8.1	9.3	0.0	0.9
Prop In Lane	1.00		0.10	1.00		0.12	1.00		0.20	1.00		0.11
Lane Grp Cap(c), veh/h	429	0	574	412	0	564	650	0	641	310	0	663
V/C Ratio(X)	0.03	0.00	0.52	0.11	0.00	0.46	0.17	0.00	0.77	0.10	0.00	0.11
Avail Cap(c_a), veh/h	715	0	1063	703	0	1043	952	0	1053	500	0	1088
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.8	0.0	9.4	11.7	0.0	9.2	8.2	0.0	9.6	13.7	0.0	7.2
Incr Delay (d2), s/veh	0.0	0.0	0.7	0.1	0.0	0.6	0.1	0.0	2.0	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	1.2	0.2	0.0	1.0	0.4	0.0	2.3	0.2	0.0	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	10.9	0.0	10.1	11.8	0.0	9.7	8.4	0.0	11.5	13.8	0.0	7.3
LnGrp LOS	B	A	B	B	A	A	A	A	B	B	A	A
Approach Vol, veh/h		312			303			604			108	
Approach Delay, s/veh		10.1			10.0			10.9			9.2	
Approach LOS		B			B			B			A	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		16.0		17.4		16.0		17.4				
Change Period (Y+Rc), s		5.5		5.5		5.5		5.5				
Max Green Setting (Gmax), s		19.5		19.5		19.5		19.5				
Max Q Clear Time (g_c+I1), s		6.5		11.3		7.6		10.1				
Green Ext Time (p_c), s		3.5		0.2		2.9		1.8				

Intersection Summary												
HCM 6th Ctrl Delay			10.4									
HCM 6th LOS			B									



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	276	80	90	298	27	24	134	69	50	475	44
Future Volume (veh/h)	19	276	80	90	298	27	24	134	69	50	475	44
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1841	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	310	90	102	339	31	27	152	78	54	511	47
Peak Hour Factor	0.89	0.89	0.89	0.88	0.88	0.88	0.88	0.88	0.88	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	4	2	2	2	2	2
Cap, veh/h	394	528	153	367	640	58	241	423	217	477	613	56
Arrive On Green	0.38	0.38	0.38	0.38	0.38	0.38	0.36	0.36	0.36	0.36	0.36	0.36
Sat Flow, veh/h	1012	1393	404	985	1688	154	838	1165	598	1151	1687	155
Grp Volume(v), veh/h	21	0	400	102	0	370	27	0	230	54	0	558
Grp Sat Flow(s),veh/h/ln	1012	0	1798	985	0	1843	838	0	1763	1151	0	1842
Q Serve(g_s), s	0.7	0.0	7.6	3.9	0.0	6.7	1.3	0.0	4.1	1.5	0.0	11.8
Cycle Q Clear(g_c), s	7.4	0.0	7.6	11.5	0.0	6.7	13.1	0.0	4.1	5.6	0.0	11.8
Prop In Lane	1.00		0.22	1.00		0.08	1.00		0.34	1.00		0.08
Lane Grp Cap(c), veh/h	394	0	681	367	0	698	241	0	640	477	0	669
V/C Ratio(X)	0.05	0.00	0.59	0.28	0.00	0.53	0.11	0.00	0.36	0.11	0.00	0.83
Avail Cap(c_a), veh/h	474	0	822	444	0	842	320	0	806	585	0	842
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.2	0.0	10.6	15.2	0.0	10.3	18.4	0.0	9.9	12.0	0.0	12.4
Incr Delay (d2), s/veh	0.1	0.0	0.8	0.4	0.0	0.6	0.2	0.0	0.3	0.1	0.0	5.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	2.2	0.7	0.0	2.0	0.2	0.0	1.2	0.3	0.0	4.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	13.2	0.0	11.4	15.6	0.0	10.9	18.6	0.0	10.3	12.1	0.0	18.3
LnGrp LOS	B	A	B	B	A	B	B	A	B	B	A	B
Approach Vol, veh/h		421			472			257			612	
Approach Delay, s/veh		11.5			11.9			11.2			17.8	
Approach LOS		B			B			B			B	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		21.7		21.0		21.7		21.0				
Change Period (Y+Rc), s		5.5		5.5		5.5		5.5				
Max Green Setting (Gmax), s		19.5		19.5		19.5		19.5				
Max Q Clear Time (g_c+I1), s		9.6		13.8		13.5		15.1				
Green Ext Time (p_c), s		4.0		1.4		2.6		0.4				

Intersection Summary												
HCM 6th Ctrl Delay			13.7									
HCM 6th LOS			B									

Intersection	
Intersection Delay, s/veh	45.7
Intersection LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑			↑			↑	
Traffic Vol, veh/h	22	380	14	34	170	39	20	188	214	87	47	22
Future Vol, veh/h	22	380	14	34	170	39	20	188	214	87	47	22
Peak Hour Factor	0.92	0.92	0.92	0.84	0.84	0.84	0.86	0.86	0.86	0.90	0.90	0.90
Heavy Vehicles, %	3	3	0	3	3	3	2	2	2	2	2	3
Mvmt Flow	24	413	15	40	202	46	23	219	249	97	52	24
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	54.9	24.2	59.8	17.6
HCM LOS	F	C	F	C

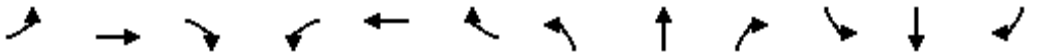
Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	5%	5%	14%	56%
Vol Thru, %	45%	91%	70%	30%
Vol Right, %	51%	3%	16%	14%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	422	416	243	156
LT Vol	20	22	34	87
Through Vol	188	380	170	47
RT Vol	214	14	39	22
Lane Flow Rate	491	452	289	173
Geometry Grp	1	1	1	1
Degree of Util (X)	0.97	0.939	0.639	0.413
Departure Headway (Hd)	7.117	7.476	7.949	8.587
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	510	484	454	418
Service Time	5.175	5.54	6.025	6.675
HCM Lane V/C Ratio	0.963	0.934	0.637	0.414
HCM Control Delay	59.8	54.9	24.2	17.6
HCM Lane LOS	F	F	C	C
HCM 95th-tile Q	12.6	11.3	4.4	2

Intersection	
Intersection Delay, s/veh	98
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑			↑			↑	
Traffic Vol, veh/h	23	352	24	40	349	16	136	78	111	58	198	81
Future Vol, veh/h	23	352	24	40	349	16	136	78	111	58	198	81
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.87	0.87	0.87	0.93	0.93	0.93
Heavy Vehicles, %	10	2	2	3	2	2	2	2	2	2	2	2
Mvmt Flow	25	378	26	43	375	17	156	90	128	62	213	87
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	120	121.2	73.8	69.1
HCM LOS	F	F	F	F

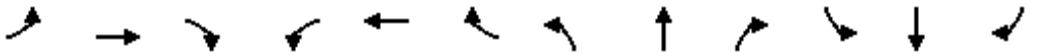
Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	42%	6%	10%	17%
Vol Thru, %	24%	88%	86%	59%
Vol Right, %	34%	6%	4%	24%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	325	399	405	337
LT Vol	136	23	40	58
Through Vol	78	352	349	198
RT Vol	111	24	16	81
Lane Flow Rate	374	429	435	362
Geometry Grp	1	1	1	1
Degree of Util (X)	0.97	1.131	1.136	0.948
Departure Headway (Hd)	10.256	10.073	9.957	10.335
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	355	365	370	355
Service Time	8.256	8.073	7.957	8.335
HCM Lane V/C Ratio	1.054	1.175	1.176	1.02
HCM Control Delay	73.8	120	121.2	69.1
HCM Lane LOS	F	F	F	F
HCM 95th-tile Q	10.7	15.6	15.9	10.1



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	17	279	28	53	260	42	102	449	104	44	87	10
Future Volume (veh/h)	17	279	28	53	260	42	102	449	104	44	87	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1752	1856	1856	1856	1811	1811	1870	1870	1870	1678	1870	1870
Adj Flow Rate, veh/h	19	313	31	60	295	48	116	510	118	47	94	11
Peak Hour Factor	0.89	0.89	0.89	0.88	0.88	0.88	0.88	0.88	0.88	0.93	0.93	0.93
Percent Heavy Veh, %	10	3	3	3	6	6	2	2	2	15	2	2
Cap, veh/h	323	540	54	339	494	80	664	621	144	248	694	81
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.33	0.42	0.42	0.42	0.42	0.42	0.42
Sat Flow, veh/h	972	1661	165	1028	1519	247	1289	1469	340	716	1643	192
Grp Volume(v), veh/h	19	0	344	60	0	343	116	0	628	47	0	105
Grp Sat Flow(s),veh/h/ln	972	0	1826	1028	0	1767	1289	0	1809	716	0	1836
Q Serve(g_s), s	0.7	0.0	6.8	2.2	0.0	7.1	2.6	0.0	13.4	2.7	0.0	1.5
Cycle Q Clear(g_c), s	7.8	0.0	6.8	9.1	0.0	7.1	4.2	0.0	13.4	16.1	0.0	1.5
Prop In Lane	1.00		0.09	1.00		0.14	1.00		0.19	1.00		0.10
Lane Grp Cap(c), veh/h	323	0	594	339	0	575	664	0	764	248	0	775
V/C Ratio(X)	0.06	0.00	0.58	0.18	0.00	0.60	0.17	0.00	0.82	0.19	0.00	0.14
Avail Cap(c_a), veh/h	442	0	817	464	0	790	844	0	1017	348	0	1032
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.6	0.0	12.2	16.0	0.0	12.3	9.0	0.0	11.1	18.3	0.0	7.7
Incr Delay (d2), s/veh	0.1	0.0	0.9	0.2	0.0	1.0	0.1	0.0	4.1	0.4	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	2.2	0.5	0.0	2.2	0.6	0.0	4.6	0.4	0.0	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	15.7	0.0	13.1	16.2	0.0	13.3	9.1	0.0	15.3	18.6	0.0	7.8
LnGrp LOS	B	A	B	B	A	B	A	A	B	B	A	A
Approach Vol, veh/h		363			403			744			152	
Approach Delay, s/veh		13.3			13.7			14.3			11.1	
Approach LOS		B			B			B			B	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		19.7		23.9		19.7		23.9				
Change Period (Y+Rc), s		5.5		5.5		5.5		5.5				
Max Green Setting (Gmax), s		19.5		24.5		19.5		24.5				
Max Q Clear Time (g_c+I1), s		9.8		18.1		11.1		15.4				
Green Ext Time (p_c), s		3.3		0.3		3.1		2.3				

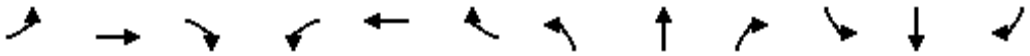
Intersection Summary												
HCM 6th Ctrl Delay			13.7									
HCM 6th LOS			B									



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	31	406	84	108	343	48	24	217	102	82	581	52
Future Volume (veh/h)	31	406	84	108	343	48	24	217	102	82	581	52
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1841	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	35	456	94	123	390	55	27	247	116	88	625	56
Peak Hour Factor	0.89	0.89	0.89	0.88	0.88	0.88	0.88	0.88	0.88	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	4	2	2	2	2	2
Cap, veh/h	316	599	124	239	639	90	176	500	235	391	702	63
Arrive On Green	0.40	0.40	0.40	0.40	0.40	0.40	0.42	0.42	0.42	0.42	0.42	0.42
Sat Flow, veh/h	945	1504	310	858	1604	226	747	1203	565	1019	1692	152
Grp Volume(v), veh/h	35	0	550	123	0	445	27	0	363	88	0	681
Grp Sat Flow(s),veh/h/ln	945	0	1815	858	0	1830	747	0	1769	1019	0	1843
Q Serve(g_s), s	1.8	0.0	15.4	8.1	0.0	11.4	2.1	0.0	8.9	4.1	0.0	20.2
Cycle Q Clear(g_c), s	13.2	0.0	15.4	23.5	0.0	11.4	22.3	0.0	8.9	13.0	0.0	20.2
Prop In Lane	1.00		0.17	1.00		0.12	1.00		0.32	1.00		0.08
Lane Grp Cap(c), veh/h	316	0	723	239	0	729	176	0	734	391	0	765
V/C Ratio(X)	0.11	0.00	0.76	0.51	0.00	0.61	0.15	0.00	0.49	0.22	0.00	0.89
Avail Cap(c_a), veh/h	316	0	723	239	0	729	189	0	764	409	0	797
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	19.4	0.0	15.3	25.7	0.0	14.1	26.3	0.0	12.7	17.5	0.0	16.0
Incr Delay (d2), s/veh	0.2	0.0	4.7	1.9	0.0	1.5	0.4	0.0	0.5	0.3	0.0	11.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	6.1	1.7	0.0	4.1	0.4	0.0	3.1	0.9	0.0	9.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	19.5	0.0	20.1	27.5	0.0	15.6	26.7	0.0	13.2	17.8	0.0	27.8
LnGrp LOS	B	A	C	C	A	B	C	A	B	B	A	C
Approach Vol, veh/h		585			568			390			769	
Approach Delay, s/veh		20.0			18.2			14.1			26.7	
Approach LOS		C			B			B			C	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		29.0		30.0		29.0		30.0				
Change Period (Y+Rc), s		5.5		5.5		5.5		5.5				
Max Green Setting (Gmax), s		23.5		25.5		23.5		25.5				
Max Q Clear Time (g_c+I1), s		17.4		22.2		25.5		24.3				
Green Ext Time (p_c), s		3.6		1.2		0.0		0.2				

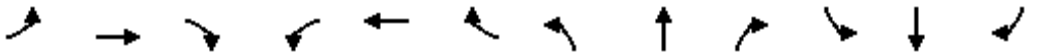
Intersection Summary												
HCM 6th Ctrl Delay			20.8									
HCM 6th LOS			C									



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑			↑			↑	
Traffic Volume (veh/h)	31	455	16	45	243	47	26	238	227	128	68	57
Future Volume (veh/h)	31	455	16	45	243	47	26	238	227	128	68	57
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1856	1856	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	33	489	17	48	261	51	30	274	261	138	73	61
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.87	0.87	0.87	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	3	3	3	2	2	2	2	2	2
Cap, veh/h	88	660	22	122	517	94	83	325	294	231	120	75
Arrive On Green	0.39	0.39	0.39	0.39	0.39	0.39	0.36	0.36	0.36	0.36	0.36	0.36
Sat Flow, veh/h	58	1702	57	133	1332	242	48	893	809	381	329	205
Grp Volume(v), veh/h	539	0	0	360	0	0	565	0	0	272	0	0
Grp Sat Flow(s),veh/h/ln	1817	0	0	1706	0	0	1750	0	0	915	0	0
Q Serve(g_s), s	4.2	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	14.8	0.0	0.0	8.9	0.0	0.0	17.5	0.0	0.0	16.9	0.0	0.0
Prop In Lane	0.06		0.03	0.13		0.14	0.05		0.46	0.51		0.22
Lane Grp Cap(c), veh/h	770	0	0	732	0	0	701	0	0	426	0	0
V/C Ratio(X)	0.70	0.00	0.00	0.49	0.00	0.00	0.81	0.00	0.00	0.64	0.00	0.00
Avail Cap(c_a), veh/h	935	0	0	878	0	0	884	0	0	550	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	15.4	0.0	0.0	13.6	0.0	0.0	17.5	0.0	0.0	16.2	0.0	0.0
Incr Delay (d2), s/veh	1.8	0.0	0.0	0.5	0.0	0.0	4.4	0.0	0.0	1.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.4	0.0	0.0	3.0	0.0	0.0	7.1	0.0	0.0	2.9	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.2	0.0	0.0	14.1	0.0	0.0	21.9	0.0	0.0	17.8	0.0	0.0
LnGrp LOS	B	A	A	B	A	A	C	A	A	B	A	A
Approach Vol, veh/h		539			360			565			272	
Approach Delay, s/veh		17.2			14.1			21.9			17.8	
Approach LOS		B			B			C			B	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		31.6		26.7		31.6		26.7				
Change Period (Y+Rc), s		9.0		5.5		9.0		5.5				
Max Green Setting (Gmax), s		28.0		27.5		28.0		27.5				
Max Q Clear Time (g_c+I1), s		16.8		18.9		10.9		19.5				
Green Ext Time (p_c), s		5.8		0.9		5.2		1.7				

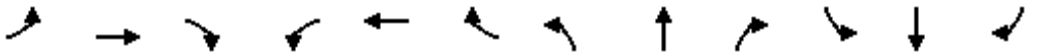
Intersection Summary												
HCM 6th Ctrl Delay			18.2									
HCM 6th LOS			B									



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑			↑			↑	
Traffic Volume (veh/h)	40	499	32	44	475	24	178	111	124	84	274	134
Future Volume (veh/h)	40	499	32	44	475	24	178	111	124	84	274	134
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	43	537	34	47	511	26	205	128	143	90	295	144
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.87	0.87	0.87	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	69	571	35	73	552	27	244	139	140	142	422	193
Arrive On Green	0.39	0.39	0.39	0.39	0.39	0.39	0.45	0.45	0.45	0.45	0.45	0.45
Sat Flow, veh/h	69	1468	90	77	1419	70	414	309	311	211	937	429
Grp Volume(v), veh/h	614	0	0	584	0	0	476	0	0	529	0	0
Grp Sat Flow(s),veh/h/ln	1626	0	0	1566	0	0	1034	0	0	1578	0	0
Q Serve(g_s), s	0.7	0.0	0.0	0.0	0.0	0.0	16.3	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	33.5	0.0	0.0	32.8	0.0	0.0	40.5	0.0	0.0	24.2	0.0	0.0
Prop In Lane	0.07		0.06	0.08		0.04	0.43		0.30	0.17		0.27
Lane Grp Cap(c), veh/h	675	0	0	652	0	0	522	0	0	757	0	0
V/C Ratio(X)	0.91	0.00	0.00	0.90	0.00	0.00	0.91	0.00	0.00	0.70	0.00	0.00
Avail Cap(c_a), veh/h	675	0	0	652	0	0	522	0	0	757	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	26.2	0.0	0.0	25.8	0.0	0.0	26.6	0.0	0.0	19.9	0.0	0.0
Incr Delay (d2), s/veh	16.4	0.0	0.0	15.0	0.0	0.0	20.2	0.0	0.0	2.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.7	0.0	0.0	13.6	0.0	0.0	12.8	0.0	0.0	8.7	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.6	0.0	0.0	40.8	0.0	0.0	46.8	0.0	0.0	22.8	0.0	0.0
LnGrp LOS	D	A	A	D	A	A	D	A	A	C	A	A
Approach Vol, veh/h		614			584			476			529	
Approach Delay, s/veh		42.6			40.8			46.8			22.8	
Approach LOS		D			D			D			C	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		44.0		46.0		44.0		46.0				
Change Period (Y+Rc), s		9.0		5.5		9.0		5.5				
Max Green Setting (Gmax), s		35.0		40.5		35.0		40.5				
Max Q Clear Time (g_c+I1), s		35.5		26.2		34.8		42.5				
Green Ext Time (p_c), s		0.0		2.0		0.1		0.0				

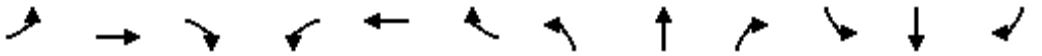
Intersection Summary												
HCM 6th Ctrl Delay			38.3									
HCM 6th LOS			D									



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	662	39	61	349	41	121	355	210	76	82	11
Future Volume (veh/h)	19	662	39	61	349	41	121	355	210	76	82	11
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1767	1856	1781	1870	1826	1841	1870	1870	1870	1693	1870	1870
Adj Flow Rate, veh/h	21	720	42	66	379	45	132	386	228	83	89	12
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	9	3	8	2	5	4	2	2	2	14	2	2
Cap, veh/h	395	1073	460	311	1165	524	521	475	402	268	446	378
Arrive On Green	0.02	0.30	0.30	0.06	0.34	0.34	0.08	0.25	0.25	0.06	0.24	0.24
Sat Flow, veh/h	1682	3526	1510	1781	3469	1560	1781	1870	1585	1612	1870	1585
Grp Volume(v), veh/h	21	720	42	66	379	45	132	386	228	83	89	12
Grp Sat Flow(s),veh/h/ln	1682	1763	1510	1781	1735	1560	1781	1870	1585	1612	1870	1585
Q Serve(g_s), s	0.5	10.5	1.2	1.4	4.8	1.2	3.2	11.4	7.4	2.2	2.2	0.3
Cycle Q Clear(g_c), s	0.5	10.5	1.2	1.4	4.8	1.2	3.2	11.4	7.4	2.2	2.2	0.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	395	1073	460	311	1165	524	521	475	402	268	446	378
V/C Ratio(X)	0.05	0.67	0.09	0.21	0.33	0.09	0.25	0.81	0.57	0.31	0.20	0.03
Avail Cap(c_a), veh/h	496	1227	525	362	1207	543	533	651	552	303	651	552
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.5	17.9	14.7	13.5	14.6	13.4	14.9	20.7	19.2	16.2	17.9	17.2
Incr Delay (d2), s/veh	0.1	1.2	0.1	0.3	0.2	0.1	0.3	5.6	1.3	0.7	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	3.8	0.4	0.5	1.6	0.4	1.2	5.2	2.6	0.8	0.9	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	13.6	19.1	14.7	13.9	14.7	13.4	15.1	26.2	20.4	16.9	18.1	17.2
LnGrp LOS	B	B	B	B	B	B	B	C	C	B	B	B
Approach Vol, veh/h		783			490			746			184	
Approach Delay, s/veh		18.7			14.5			22.5			17.5	
Approach LOS		B			B			C			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.3	23.4	8.6	19.6	5.5	25.3	7.7	20.5
Change Period (Y+Rc), s	4.0	5.5	4.0	5.5	4.0	5.5	4.0	5.5
Max Green Setting (Gmax), s	5.0	20.5	5.0	20.5	5.0	20.5	5.0	20.5
Max Q Clear Time (g_c+I1), s	3.4	12.5	5.2	4.2	2.5	6.8	4.2	13.4
Green Ext Time (p_c), s	0.0	5.4	0.0	0.2	0.0	4.7	0.0	1.5

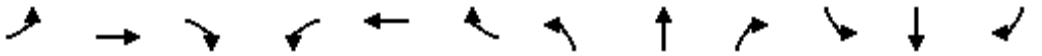
Intersection Summary	
HCM 6th Ctrl Delay	19.0
HCM 6th LOS	B



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	468	86	211	782	64	31	139	112	81	475	56
Future Volume (veh/h)	21	468	86	211	782	64	31	139	112	81	475	56
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1841	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	23	509	93	229	850	70	34	151	122	88	516	61
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	4	2	2	2	2	2
Cap, veh/h	227	895	399	389	1141	509	221	537	455	474	587	498
Arrive On Green	0.03	0.25	0.25	0.10	0.32	0.32	0.04	0.29	0.29	0.06	0.31	0.31
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	1753	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	23	509	93	229	850	70	34	151	122	88	516	61
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1753	1870	1585	1781	1870	1585
Q Serve(g_s), s	0.6	7.8	2.9	5.7	13.4	2.0	0.8	3.9	3.7	2.1	16.4	1.7
Cycle Q Clear(g_c), s	0.6	7.8	2.9	5.7	13.4	2.0	0.8	3.9	3.7	2.1	16.4	1.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	227	895	399	389	1141	509	221	537	455	474	587	498
V/C Ratio(X)	0.10	0.57	0.23	0.59	0.74	0.14	0.15	0.28	0.27	0.19	0.88	0.12
Avail Cap(c_a), veh/h	322	1161	518	389	1218	543	298	731	619	505	731	619
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.2	20.5	18.7	14.9	19.0	15.1	16.5	17.3	17.3	14.1	20.4	15.4
Incr Delay (d2), s/veh	0.2	0.6	0.3	2.3	2.4	0.1	0.3	0.3	0.3	0.2	10.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	2.9	1.0	2.2	5.1	0.7	0.3	1.6	1.3	0.8	8.0	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.4	21.1	18.9	17.3	21.4	15.2	16.8	17.6	17.6	14.3	30.5	15.5
LnGrp LOS	B	C	B	B	C	B	B	B	B	B	C	B
Approach Vol, veh/h		625			1149			307			665	
Approach Delay, s/veh		20.6			20.2			17.5			27.0	
Approach LOS		C			C			B			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.0	21.3	6.2	25.2	5.7	25.6	7.9	23.5
Change Period (Y+Rc), s	4.0	5.5	4.0	5.5	4.0	5.5	4.0	5.5
Max Green Setting (Gmax), s	6.0	20.5	5.0	24.5	5.0	21.5	5.0	24.5
Max Q Clear Time (g_c+I1), s	7.7	9.8	2.8	18.4	2.6	15.4	4.1	5.9
Green Ext Time (p_c), s	0.0	5.3	0.0	1.3	0.0	4.8	0.0	0.9

Intersection Summary	
HCM 6th Ctrl Delay	21.6
HCM 6th LOS	C



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	1184	33	69	393	60	31	228	337	160	89	63
Future Volume (veh/h)	52	1184	33	69	393	60	31	228	337	160	89	63
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1856	1870	1870	1870	1870	1870	1856
Adj Flow Rate, veh/h	57	1287	36	75	427	65	34	248	366	174	97	68
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	3	2	2	2	2	2	3
Cap, veh/h	393	1428	637	191	1246	551	352	389	405	231	425	358
Arrive On Green	0.04	0.40	0.40	0.05	0.35	0.35	0.03	0.21	0.21	0.04	0.23	0.23
Sat Flow, veh/h	1781	3554	1585	1781	3554	1572	1781	1870	1585	1781	1870	1572
Grp Volume(v), veh/h	57	1287	36	75	427	65	34	248	366	174	97	68
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1572	1781	1870	1585	1781	1870	1572
Q Serve(g_s), s	1.8	30.2	1.2	2.4	7.9	2.5	1.3	10.8	18.5	4.0	3.8	3.1
Cycle Q Clear(g_c), s	1.8	30.2	1.2	2.4	7.9	2.5	1.3	10.8	18.5	4.0	3.8	3.1
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	393	1428	637	191	1246	551	352	389	405	231	425	358
V/C Ratio(X)	0.14	0.90	0.06	0.39	0.34	0.12	0.10	0.64	0.90	0.75	0.23	0.19
Avail Cap(c_a), veh/h	418	1438	641	207	1378	610	387	389	405	231	425	358
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.3	25.0	16.3	21.3	21.3	19.6	26.7	32.2	32.1	33.5	28.0	27.8
Incr Delay (d2), s/veh	0.2	8.1	0.0	1.3	0.2	0.1	0.1	3.4	23.2	13.0	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	13.2	0.4	1.0	3.1	0.9	0.6	5.1	10.0	2.6	1.6	1.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.5	33.1	16.3	22.7	21.5	19.7	26.8	35.6	55.3	46.5	28.3	28.0
LnGrp LOS	B	C	B	C	C	B	C	D	E	D	C	C
Approach Vol, veh/h		1380			567			648			339	
Approach Delay, s/veh		32.0			21.4			46.3			37.6	
Approach LOS		C			C			D			D	

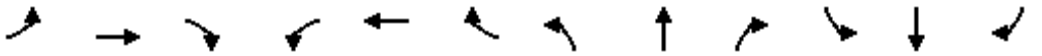
Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.2	45.7	7.3	26.7	13.8	41.2	9.0	25.0
Change Period (Y+Rc), s	5.0	10.0	5.0	6.5	10.0	* 10	5.0	6.5
Max Green Setting (Gmax), s	5.0	36.0	4.0	18.5	5.0	* 35	4.0	18.5
Max Q Clear Time (g_c+I1), s	4.4	32.2	3.3	5.8	3.8	9.9	6.0	20.5
Green Ext Time (p_c), s	0.0	3.5	0.0	0.4	0.0	7.6	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	33.7
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.



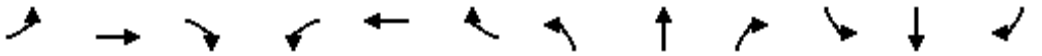
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	46	786	48	90	970	36	209	79	138	72	198	125
Future Volume (veh/h)	46	786	48	90	970	36	209	79	138	72	198	125
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1752	1870	1870	1811	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	50	854	52	98	1054	39	227	86	150	78	215	136
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	10	2	2	6	2	2	2	2	2	2	2	2
Cap, veh/h	207	1411	629	329	1217	543	272	314	266	347	285	242
Arrive On Green	0.04	0.40	0.40	0.06	0.34	0.34	0.07	0.17	0.17	0.06	0.15	0.15
Sat Flow, veh/h	1668	3554	1585	1725	3554	1585	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	50	854	52	98	1054	39	227	86	150	78	215	136
Grp Sat Flow(s),veh/h/ln	1668	1777	1585	1725	1777	1585	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	1.3	13.5	1.4	2.5	19.6	1.2	5.0	2.8	6.1	2.6	7.8	5.6
Cycle Q Clear(g_c), s	1.3	13.5	1.4	2.5	19.6	1.2	5.0	2.8	6.1	2.6	7.8	5.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	207	1411	629	329	1217	543	272	314	266	347	285	242
V/C Ratio(X)	0.24	0.61	0.08	0.30	0.87	0.07	0.83	0.27	0.56	0.22	0.75	0.56
Avail Cap(c_a), veh/h	252	1411	629	347	1234	550	272	570	483	375	570	483
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.7	16.9	13.3	14.1	21.7	15.6	27.6	25.6	27.0	23.2	28.6	27.7
Incr Delay (d2), s/veh	0.6	0.7	0.1	0.5	6.6	0.1	19.5	0.5	1.9	0.3	4.0	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	4.9	0.5	0.9	8.3	0.4	2.8	1.3	2.4	1.0	3.5	2.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.3	17.6	13.3	14.6	28.3	15.7	47.1	26.1	28.8	23.5	32.6	29.8
LnGrp LOS	B	B	B	B	C	B	D	C	C	C	C	C
Approach Vol, veh/h		956			1191			463			429	
Approach Delay, s/veh		17.4			26.8			37.3			30.1	
Approach LOS		B			C			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.3	37.0	9.0	16.3	12.1	33.2	7.9	17.3
Change Period (Y+Rc), s	4.0	9.0	4.0	5.5	9.0	* 9	4.0	5.5
Max Green Setting (Gmax), s	5.0	26.0	5.0	21.5	5.0	* 25	5.0	21.5
Max Q Clear Time (g_c+I1), s	4.5	15.5	7.0	9.8	3.3	21.6	4.6	8.1
Green Ext Time (p_c), s	0.0	7.7	0.0	1.0	0.0	2.6	0.0	0.7

Intersection Summary	
HCM 6th Ctrl Delay	25.9
HCM 6th LOS	C

Notes

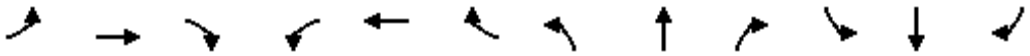
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	26	788	49	80	493	57	157	435	231	84	90	14
Future Volume (veh/h)	26	788	49	80	493	57	157	435	231	84	90	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1752	1841	1752	1841	1796	1811	1870	1870	1870	1663	1870	1870
Adj Flow Rate, veh/h	28	857	53	87	536	62	171	473	251	91	98	15
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	10	4	10	4	7	6	2	2	2	16	2	2
Cap, veh/h	303	1060	450	241	1125	506	532	536	454	219	472	400
Arrive On Green	0.03	0.30	0.30	0.06	0.33	0.33	0.09	0.29	0.29	0.06	0.25	0.25
Sat Flow, veh/h	1668	3497	1485	1753	3413	1535	1781	1870	1585	1584	1870	1585
Grp Volume(v), veh/h	28	857	53	87	536	62	171	473	251	91	98	15
Grp Sat Flow(s),veh/h/ln	1668	1749	1485	1753	1706	1535	1781	1870	1585	1584	1870	1585
Q Serve(g_s), s	0.8	16.8	1.9	2.5	9.3	2.1	5.2	18.0	10.0	3.1	3.1	0.5
Cycle Q Clear(g_c), s	0.8	16.8	1.9	2.5	9.3	2.1	5.2	18.0	10.0	3.1	3.1	0.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	303	1060	450	241	1125	506	532	536	454	219	472	400
V/C Ratio(X)	0.09	0.81	0.12	0.36	0.48	0.12	0.32	0.88	0.55	0.42	0.21	0.04
Avail Cap(c_a), veh/h	366	1105	469	261	1125	506	532	616	522	233	568	482
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.2	23.9	18.7	18.3	19.8	17.4	17.7	25.3	22.5	20.6	21.9	21.0
Incr Delay (d2), s/veh	0.1	4.4	0.1	0.9	0.3	0.1	0.3	12.9	1.1	1.3	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	6.9	0.6	1.0	3.4	0.7	2.0	9.3	3.6	1.1	1.3	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.4	28.3	18.8	19.2	20.1	17.5	18.1	38.2	23.5	21.9	22.2	21.0
LnGrp LOS	B	C	B	B	C	B	B	D	C	C	C	C
Approach Vol, veh/h		938			685			895			204	
Approach Delay, s/veh		27.5			19.8			30.2			21.9	
Approach LOS		C			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.7	28.0	12.4	24.3	7.7	30.0	9.8	26.8
Change Period (Y+Rc), s	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Max Green Setting (Gmax), s	5.0	23.5	6.9	22.6	5.0	23.5	5.0	24.5
Max Q Clear Time (g_c+I1), s	4.5	18.8	7.2	5.1	2.8	11.3	5.1	20.0
Green Ext Time (p_c), s	0.0	3.7	0.0	0.3	0.0	6.1	0.0	1.4

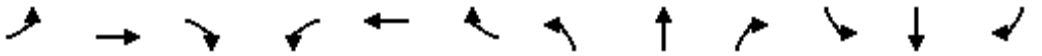
Intersection Summary	
HCM 6th Ctrl Delay	26.0
HCM 6th LOS	C



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	28	857	53	87	536	62	171	473	251	91	98	15
v/c Ratio	0.08	0.77	0.09	0.38	0.43	0.09	0.34	0.83	0.41	0.46	0.18	0.03
Control Delay	14.3	30.4	0.3	19.3	20.5	0.3	16.5	40.0	9.3	22.4	23.0	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.3	30.4	0.3	19.3	20.5	0.3	16.5	40.0	9.3	22.4	23.0	0.1
Queue Length 50th (ft)	8	210	0	25	93	0	51	218	24	26	37	0
Queue Length 95th (ft)	22	#306	0	53	166	0	92	#377	80	54	74	0
Internal Link Dist (ft)		934			5255			707			786	
Turn Bay Length (ft)	100		100	170		100	120		100	170		100
Base Capacity (vph)	336	1210	632	226	1356	722	509	677	692	198	624	653
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.71	0.08	0.38	0.40	0.09	0.34	0.70	0.36	0.46	0.16	0.02

Intersection Summary

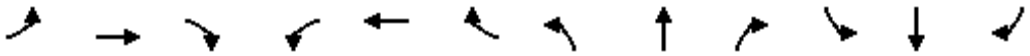
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	34	814	109	168	757	62	43	207	187	140	573	83
Future Volume (veh/h)	34	814	109	168	757	62	43	207	187	140	573	83
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1841	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	37	885	118	183	823	67	47	225	203	152	623	90
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	4	2	2	2	2	2
Cap, veh/h	235	1079	481	253	1210	540	184	614	520	439	673	570
Arrive On Green	0.03	0.30	0.30	0.07	0.34	0.34	0.04	0.33	0.33	0.07	0.36	0.36
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	1753	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	37	885	118	183	823	67	47	225	203	152	623	90
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1753	1870	1585	1781	1870	1585
Q Serve(g_s), s	1.2	19.4	4.7	5.9	16.7	2.5	1.5	7.7	8.3	4.7	26.9	3.2
Cycle Q Clear(g_c), s	1.2	19.4	4.7	5.9	16.7	2.5	1.5	7.7	8.3	4.7	26.9	3.2
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	235	1079	481	253	1210	540	184	614	520	439	673	570
V/C Ratio(X)	0.16	0.82	0.25	0.72	0.68	0.12	0.26	0.37	0.39	0.35	0.93	0.16
Avail Cap(c_a), veh/h	280	1119	499	253	1210	540	219	722	612	439	744	631
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.0	27.2	22.1	21.1	23.8	19.1	21.0	21.6	21.8	16.7	25.9	18.3
Incr Delay (d2), s/veh	0.3	4.8	0.3	9.7	1.6	0.1	0.7	0.4	0.5	0.5	16.6	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	8.4	1.7	2.9	6.7	0.9	0.6	3.3	3.0	1.8	14.2	1.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.3	32.0	22.3	30.8	25.4	19.2	21.7	22.0	22.3	17.1	42.4	18.4
LnGrp LOS	C	C	C	C	C	B	C	C	C	B	D	B
Approach Vol, veh/h		1040			1073			475			865	
Approach Delay, s/veh		30.5			25.9			22.1			35.5	
Approach LOS		C			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.0	31.1	7.3	35.8	6.9	34.2	10.0	33.1
Change Period (Y+Rc), s	4.0	5.5	4.0	5.5	4.0	5.5	4.0	5.5
Max Green Setting (Gmax), s	6.0	26.5	5.0	33.5	5.0	27.5	6.0	32.5
Max Q Clear Time (g_c+I1), s	7.9	21.4	3.5	28.9	3.2	18.7	6.7	10.3
Green Ext Time (p_c), s	0.0	4.1	0.0	1.4	0.0	6.5	0.0	1.6

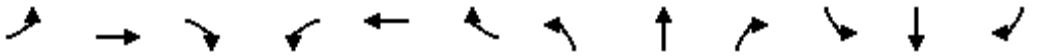
Intersection Summary	
HCM 6th Ctrl Delay	29.2
HCM 6th LOS	C



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	37	885	118	183	823	67	47	225	203	152	623	90
v/c Ratio	0.15	0.80	0.20	0.83	0.62	0.10	0.24	0.40	0.33	0.34	0.91	0.14
Control Delay	16.5	33.8	5.1	51.1	26.2	0.7	15.6	24.2	4.6	15.8	45.0	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.5	33.8	5.1	51.1	26.2	0.7	15.6	24.2	4.6	15.8	45.0	2.1
Queue Length 50th (ft)	12	247	0	65	221	0	13	92	0	46	328	0
Queue Length 95th (ft)	30	#348	34	#183	291	4	31	150	44	82	#536	16
Internal Link Dist (ft)		934			5255			1143			1052	
Turn Bay Length (ft)	100		100	170		100	120		100	170		100
Base Capacity (vph)	254	1149	599	220	1334	675	193	742	752	452	765	724
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.77	0.20	0.83	0.62	0.10	0.24	0.30	0.27	0.34	0.81	0.12

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



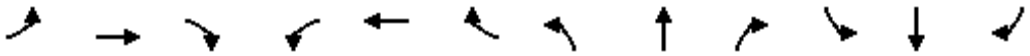
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	59	1289	36	89	544	82	40	280	352	171	100	79
Future Volume (veh/h)	59	1289	36	89	544	82	40	280	352	171	100	79
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1841	1856	1870	1870	1870	1870	1870	1841
Adj Flow Rate, veh/h	64	1401	39	97	591	89	43	304	383	186	109	86
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	4	3	2	2	2	2	2	4
Cap, veh/h	328	1416	632	180	1217	547	368	389	413	237	452	377
Arrive On Green	0.05	0.40	0.40	0.05	0.35	0.35	0.03	0.21	0.21	0.06	0.24	0.24
Sat Flow, veh/h	1781	3554	1585	1781	3497	1572	1781	1870	1585	1781	1870	1560
Grp Volume(v), veh/h	64	1401	39	97	591	89	43	304	383	186	109	86
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1749	1572	1781	1870	1585	1781	1870	1560
Q Serve(g_s), s	2.0	33.9	1.3	3.0	11.5	3.4	1.6	13.3	18.0	5.5	4.1	3.8
Cycle Q Clear(g_c), s	2.0	33.9	1.3	3.0	11.5	3.4	1.6	13.3	18.0	5.5	4.1	3.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	328	1416	632	180	1217	547	368	389	413	237	452	377
V/C Ratio(X)	0.20	0.99	0.06	0.54	0.49	0.16	0.12	0.78	0.93	0.78	0.24	0.23
Avail Cap(c_a), veh/h	350	1416	632	250	1455	654	399	389	413	237	452	377
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.3	25.8	16.0	21.7	22.1	19.5	25.8	32.4	31.2	30.1	26.4	26.3
Incr Delay (d2), s/veh	0.3	21.3	0.0	2.5	0.3	0.1	0.1	9.9	27.0	15.7	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	17.0	0.5	1.3	4.4	1.2	0.7	6.9	10.6	2.2	1.8	1.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.6	47.1	16.1	24.2	22.4	19.6	25.9	42.3	58.2	45.8	26.7	26.6
LnGrp LOS	B	D	B	C	C	B	C	D	E	D	C	C
Approach Vol, veh/h		1504			777			730			381	
Approach Delay, s/veh		45.0			22.3			49.7			36.0	
Approach LOS		D			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.6	43.5	8.1	26.4	12.9	39.1	11.0	23.5
Change Period (Y+Rc), s	4.0	9.0	5.5	5.5	9.0	* 9	5.5	5.5
Max Green Setting (Gmax), s	8.0	34.5	4.1	19.4	5.0	* 36	5.5	18.0
Max Q Clear Time (g_c+I1), s	5.0	35.9	3.6	6.1	4.0	13.5	7.5	20.0
Green Ext Time (p_c), s	0.1	0.0	0.0	0.5	0.0	10.2	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	39.8
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

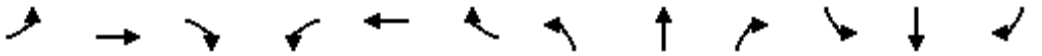


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	64	1401	39	97	591	89	43	304	383	186	109	86
v/c Ratio	0.19	0.98	0.05	0.41	0.40	0.12	0.13	0.84	0.64	0.82	0.23	0.16
Control Delay	12.7	47.9	0.1	15.0	19.5	1.1	22.5	55.4	20.7	55.2	29.6	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.7	47.9	0.1	15.0	19.5	1.1	22.5	55.4	20.7	55.2	29.6	0.6
Queue Length 50th (ft)	17	~451	0	23	124	0	17	166	110	79	52	0
Queue Length 95th (ft)	37	#586	0	46	170	8	40	#300	204	#158	98	0
Internal Link Dist (ft)		5255			745			785			967	
Turn Bay Length (ft)	130		100	130		100	180		160	300		100
Base Capacity (vph)	339	1426	724	250	1479	751	334	391	605	228	483	542
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.98	0.05	0.39	0.40	0.12	0.13	0.78	0.63	0.82	0.23	0.16

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	66	1121	65	92	1058	39	245	95	170	105	268	169
Future Volume (veh/h)	66	1121	65	92	1058	39	245	95	170	105	268	169
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1870	1870	1826	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	72	1218	71	100	1150	42	266	103	185	114	291	184
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	11	2	2	5	2	2	2	2	2	2	2	2
Cap, veh/h	179	1444	644	213	1272	567	304	440	373	375	336	285
Arrive On Green	0.05	0.41	0.41	0.05	0.36	0.36	0.11	0.24	0.24	0.06	0.18	0.18
Sat Flow, veh/h	1654	3554	1585	1739	3554	1585	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	72	1218	71	100	1150	42	266	103	185	114	291	184
Grp Sat Flow(s),veh/h/ln	1654	1777	1585	1739	1777	1585	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	2.4	27.9	2.5	3.2	27.7	1.6	10.0	4.0	9.1	4.7	13.6	9.7
Cycle Q Clear(g_c), s	2.4	27.9	2.5	3.2	27.7	1.6	10.0	4.0	9.1	4.7	13.6	9.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	179	1444	644	213	1272	567	304	440	373	375	336	285
V/C Ratio(X)	0.40	0.84	0.11	0.47	0.90	0.07	0.88	0.23	0.50	0.30	0.87	0.65
Avail Cap(c_a), veh/h	194	1444	644	217	1282	572	304	488	413	375	384	325
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.8	24.2	16.6	20.6	27.5	19.1	27.7	27.9	29.8	28.2	35.9	34.3
Incr Delay (d2), s/veh	1.5	4.7	0.1	1.6	9.2	0.1	23.6	0.3	1.0	0.5	16.8	3.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	11.6	0.9	1.3	12.4	0.6	6.5	1.8	3.5	2.0	7.5	4.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	23.3	28.9	16.7	22.2	36.7	19.1	51.3	28.2	30.9	28.6	52.7	37.9
LnGrp LOS	C	C	B	C	D	B	D	C	C	C	D	D
Approach Vol, veh/h		1361			1292			554			589	
Approach Delay, s/veh		28.0			35.0			40.2			43.4	
Approach LOS		C			C			D			D	

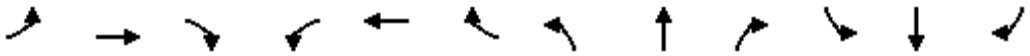
Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.8	45.6	14.0	21.7	13.2	41.3	9.0	26.7
Change Period (Y+Rc), s	4.0	9.0	4.0	5.5	9.0	* 9	4.0	5.5
Max Green Setting (Gmax), s	5.0	34.0	10.0	18.5	5.0	* 33	5.0	23.5
Max Q Clear Time (g_c+I1), s	5.2	29.9	12.0	15.6	4.4	29.7	6.7	11.1
Green Ext Time (p_c), s	0.0	3.8	0.0	0.6	0.0	2.6	0.0	0.9

Intersection Summary	
HCM 6th Ctrl Delay	34.5
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.

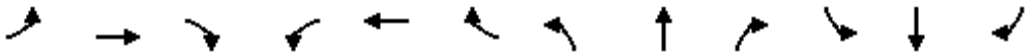
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	72	1218	71	100	1150	42	266	103	185	114	291	184
v/c Ratio	0.43	0.87	0.10	0.54	0.83	0.06	0.82	0.20	0.32	0.31	0.81	0.38
Control Delay	21.1	33.6	0.3	23.0	31.9	0.2	43.5	27.2	6.0	22.4	52.5	5.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.1	33.6	0.3	23.0	31.9	0.2	43.5	27.2	6.0	22.4	52.5	5.2
Queue Length 50th (ft)	21	339	0	27	321	0	109	46	0	42	157	0
Queue Length 95th (ft)	45	#474	0	#60	#448	0	#200	88	49	80	#274	36
Internal Link Dist (ft)		5255			745			1155			1058	
Turn Bay Length (ft)	130		100	130		100	180		160	300		100
Base Capacity (vph)	168	1398	731	186	1384	726	325	520	576	373	400	511
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.87	0.10	0.54	0.83	0.06	0.82	0.20	0.32	0.31	0.73	0.36

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	59	1289	36	89	544	82	40	280	352	171	100	79
Future Volume (veh/h)	59	1289	36	89	544	82	40	280	352	171	100	79
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1841	1856	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	64	1401	39	97	591	89	43	304	383	186	109	86
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	4	3	2	2	2	2	2	2
Cap, veh/h	328	1428	637	177	1235	555	316	407	427	239	242	191
Arrive On Green	0.04	0.40	0.40	0.05	0.35	0.35	0.03	0.22	0.22	0.06	0.25	0.25
Sat Flow, veh/h	1781	3554	1585	1781	3497	1572	1781	1870	1585	1781	969	764
Grp Volume(v), veh/h	64	1401	39	97	591	89	43	304	383	186	0	195
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1749	1572	1781	1870	1585	1781	0	1733
Q Serve(g_s), s	2.0	34.9	1.4	3.1	11.8	3.5	1.7	13.6	19.5	5.5	0.0	8.5
Cycle Q Clear(g_c), s	2.0	34.9	1.4	3.1	11.8	3.5	1.7	13.6	19.5	5.5	0.0	8.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.44
Lane Grp Cap(c), veh/h	328	1428	637	177	1235	555	316	407	427	239	0	433
V/C Ratio(X)	0.20	0.98	0.06	0.55	0.48	0.16	0.14	0.75	0.90	0.78	0.00	0.45
Avail Cap(c_a), veh/h	348	1428	637	184	1346	605	371	407	427	239	0	433
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	17.7	26.5	16.4	22.4	22.6	19.9	26.2	32.8	31.6	30.9	0.0	28.4
Incr Delay (d2), s/veh	0.3	19.4	0.0	3.1	0.3	0.1	0.2	7.4	21.3	14.9	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	17.2	0.5	1.3	4.6	1.3	0.7	6.9	10.2	2.3	0.0	3.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	18.0	45.9	16.5	25.5	22.9	20.0	26.4	40.2	52.8	45.8	0.0	29.2
LnGrp LOS	B	D	B	C	C	C	C	D	D	D	A	C
Approach Vol, veh/h		1504			777			730			381	
Approach Delay, s/veh		44.0			22.9			46.0			37.3	
Approach LOS		D			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.6	45.0	8.1	27.9	13.0	40.6	11.0	25.0
Change Period (Y+Rc), s	4.0	9.0	5.5	5.5	9.0	* 9	5.5	5.5
Max Green Setting (Gmax), s	5.0	36.0	5.4	19.6	5.0	* 35	5.5	19.5
Max Q Clear Time (g_c+I1), s	5.1	36.9	3.7	10.5	4.0	13.8	7.5	21.5
Green Ext Time (p_c), s	0.0	0.0	0.0	0.4	0.0	9.7	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	38.8
HCM 6th LOS	D

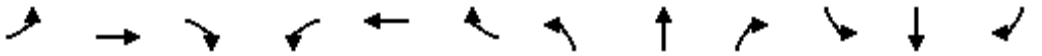
Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	64	1401	39	97	591	89	43	304	383	186	195
v/c Ratio	0.19	0.94	0.05	0.51	0.41	0.12	0.12	0.81	0.67	0.79	0.41
Control Delay	13.2	39.4	0.1	21.1	20.2	1.1	21.4	51.1	22.4	51.3	26.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.2	39.4	0.1	21.1	20.2	1.1	21.4	51.1	22.4	51.3	26.1
Queue Length 50th (ft)	18	406	0	24	128	0	16	163	113	77	76
Queue Length 95th (ft)	39	#567	0	51	175	8	39	#281	210	#180	143
Internal Link Dist (ft)		5255			745			785			967
Turn Bay Length (ft)	130		100	130		100	180		160	300	
Base Capacity (vph)	333	1486	749	190	1444	737	345	423	596	234	473
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.94	0.05	0.51	0.41	0.12	0.12	0.72	0.64	0.79	0.41

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	66	1121	65	92	1058	39	245	95	170	105	268	169
Future Volume (veh/h)	66	1121	65	92	1058	39	245	95	170	105	268	169
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1870	1870	1826	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	72	1218	71	100	1150	42	266	103	185	114	291	184
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	11	2	2	5	2	2	2	2	2	2	2	2
Cap, veh/h	136	1347	601	153	1203	536	292	627	531	457	284	180
Arrive On Green	0.04	0.38	0.38	0.04	0.34	0.34	0.13	0.34	0.34	0.06	0.27	0.27
Sat Flow, veh/h	1654	3554	1585	1739	3554	1585	1781	1870	1585	1781	1071	677
Grp Volume(v), veh/h	72	1218	71	100	1150	42	266	103	185	114	0	475
Grp Sat Flow(s),veh/h/ln	1654	1777	1585	1739	1777	1585	1781	1870	1585	1781	0	1748
Q Serve(g_s), s	3.5	39.7	3.6	4.6	38.8	2.2	13.9	4.7	10.8	5.6	0.0	32.5
Cycle Q Clear(g_c), s	3.5	39.7	3.6	4.6	38.8	2.2	13.9	4.7	10.8	5.6	0.0	32.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.39
Lane Grp Cap(c), veh/h	136	1347	601	153	1203	536	292	627	531	457	0	464
V/C Ratio(X)	0.53	0.90	0.12	0.65	0.96	0.08	0.91	0.16	0.35	0.25	0.00	1.02
Avail Cap(c_a), veh/h	136	1347	601	153	1204	537	306	634	537	465	0	464
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	31.5	35.9	24.7	31.3	39.6	27.5	34.9	28.6	30.6	29.7	0.0	45.0
Incr Delay (d2), s/veh	3.9	8.9	0.1	9.6	16.5	0.1	29.0	0.1	0.4	0.3	0.0	48.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	18.2	1.4	2.3	19.1	0.9	7.7	2.2	4.2	2.4	0.0	19.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	35.4	44.8	24.8	40.9	56.2	27.6	63.8	28.8	31.0	30.0	0.0	93.0
LnGrp LOS	D	D	C	D	E	C	E	C	C	C	A	F
Approach Vol, veh/h		1361			1292			554			589	
Approach Delay, s/veh		43.2			54.1			46.4			80.8	
Approach LOS		D			D			D			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.0	55.4	20.0	38.0	14.0	50.4	11.5	46.6
Change Period (Y+Rc), s	4.0	9.0	4.0	5.5	9.0	* 9	4.0	5.5
Max Green Setting (Gmax), s	5.0	43.0	17.0	32.5	5.0	* 42	8.0	41.5
Max Q Clear Time (g_c+I1), s	6.6	41.7	15.9	34.5	5.5	40.8	7.6	12.8
Green Ext Time (p_c), s	0.0	1.3	0.1	0.0	0.0	0.7	0.0	1.2

Intersection Summary	
HCM 6th Ctrl Delay	53.2
HCM 6th LOS	D

Notes

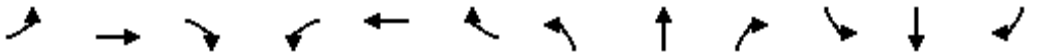
User approved pedestrian interval to be less than phase max green.

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	72	1218	71	100	1150	42	266	103	185	114	475
v/c Ratio	0.59	0.95	0.11	0.75	0.87	0.06	0.87	0.16	0.28	0.24	0.97
Control Delay	40.8	52.9	0.3	53.4	44.0	0.2	56.7	28.1	5.0	21.1	74.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.8	52.9	0.3	53.4	44.0	0.2	56.7	28.1	5.0	21.1	74.1
Queue Length 50th (ft)	32	482	0	42	451	0	147	55	0	50	347
Queue Length 95th (ft)	#70	#632	0	#123	#592	0	#292	97	49	87	#562
Internal Link Dist (ft)		5255			745			1155			1058
Turn Bay Length (ft)	130		100	130		100	180		160	300	
Base Capacity (vph)	123	1283	657	134	1325	675	317	652	674	482	500
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.95	0.11	0.75	0.87	0.06	0.84	0.16	0.27	0.24	0.95

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	59	1289	36	89	544	82	40	280	352	171	100	79
Future Volume (veh/h)	59	1289	36	89	544	82	40	280	352	171	100	79
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1841	1856	1870	1870	1870	1870	1870	1841
Adj Flow Rate, veh/h	64	1401	39	97	591	89	43	304	383	186	109	86
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	4	3	2	2	2	2	2	4
Cap, veh/h	297	1354	604	153	1192	536	305	321	347	196	115	330
Arrive On Green	0.04	0.38	0.38	0.05	0.34	0.34	0.17	0.17	0.17	0.17	0.17	0.17
Sat Flow, veh/h	1781	3554	1585	1781	3497	1572	1781	1870	1585	1143	670	1560
Grp Volume(v), veh/h	64	1401	39	97	591	89	43	304	383	295	0	86
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1749	1572	1781	1870	1585	1813	0	1560
Q Serve(g_s), s	2.4	40.0	1.6	3.7	14.1	4.2	2.2	16.9	18.0	16.9	0.0	4.8
Cycle Q Clear(g_c), s	2.4	40.0	1.6	3.7	14.1	4.2	2.2	16.9	18.0	16.9	0.0	4.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	0.63		1.00
Lane Grp Cap(c), veh/h	297	1354	604	153	1192	536	305	321	347	311	0	330
V/C Ratio(X)	0.22	1.03	0.06	0.63	0.50	0.17	0.14	0.95	1.10	0.95	0.00	0.26
Avail Cap(c_a), veh/h	327	1354	604	153	1249	562	305	321	347	311	0	330
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.9	32.5	20.6	26.9	27.5	24.2	36.9	43.0	41.0	43.0	0.0	34.5
Incr Delay (d2), s/veh	0.4	33.9	0.0	8.1	0.3	0.1	0.2	36.7	79.0	37.6	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	22.5	0.6	1.8	5.7	1.5	1.0	11.0	16.5	10.6	0.0	1.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	22.3	66.4	20.7	35.0	27.8	24.3	37.1	79.7	120.0	80.6	0.0	34.9
LnGrp LOS	C	F	C	D	C	C	D	E	F	F	A	C
Approach Vol, veh/h		1504			777			730			381	
Approach Delay, s/veh		63.4			28.3			98.3			70.3	
Approach LOS		E			C			F			E	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.0	49.0		23.5	13.2	44.8		23.5				
Change Period (Y+Rc), s	4.0	9.0		5.5	9.0	* 9		5.5				
Max Green Setting (Gmax), s	5.0	40.0		18.0	6.0	* 38		18.0				
Max Q Clear Time (g_c+I1), s	5.7	42.0		18.9	4.4	16.1		20.0				
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	9.9		0.0				

Intersection Summary			
HCM 6th Ctrl Delay		63.6	
HCM 6th LOS		E	

Notes

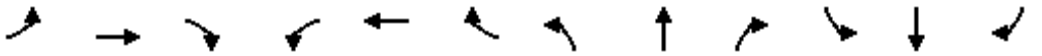
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	64	1401	39	97	591	89	43	304	383	295	86
v/c Ratio	0.21	1.04	0.06	0.62	0.44	0.13	0.14	0.95	0.74	0.95	0.23
Control Delay	17.3	68.1	0.2	34.3	26.1	2.1	38.4	84.1	33.7	85.2	2.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.3	68.1	0.2	34.3	26.1	2.1	38.4	84.1	33.7	85.2	2.9
Queue Length 50th (ft)	23	~536	0	32	160	0	25	204	164	198	0
Queue Length 95th (ft)	48	#673	0	#85	212	16	57	#372	280	#364	13
Internal Link Dist (ft)		5255			745			785		967	
Turn Bay Length (ft)	130		100	130		100	180		160		100
Base Capacity (vph)	309	1348	680	156	1338	681	303	319	516	309	382
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	1.04	0.06	0.62	0.44	0.13	0.14	0.95	0.74	0.95	0.23

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	66	1121	65	92	1058	39	245	95	170	105	268	169
Future Volume (veh/h)	66	1121	65	92	1058	39	245	95	170	105	268	169
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1737	1870	1870	1826	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	72	1218	71	100	1150	42	266	103	185	114	291	184
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	11	2	2	5	2	2	2	2	2	2	2	2
Cap, veh/h	141	1266	565	164	1114	497	300	315	345	107	273	394
Arrive On Green	0.04	0.36	0.36	0.05	0.31	0.31	0.17	0.17	0.17	0.21	0.21	0.21
Sat Flow, veh/h	1654	3554	1585	1739	3554	1585	1781	1870	1585	519	1325	1585
Grp Volume(v), veh/h	72	1218	71	100	1150	42	266	103	185	405	0	184
Grp Sat Flow(s),veh/h/ln	1654	1777	1585	1739	1777	1585	1781	1870	1585	1844	0	1585
Q Serve(g_s), s	3.0	34.3	3.1	4.0	32.0	1.9	14.9	4.9	10.6	21.0	0.0	10.1
Cycle Q Clear(g_c), s	3.0	34.3	3.1	4.0	32.0	1.9	14.9	4.9	10.6	21.0	0.0	10.1
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	0.28		1.00
Lane Grp Cap(c), veh/h	141	1266	565	164	1114	497	300	315	345	380	0	394
V/C Ratio(X)	0.51	0.96	0.13	0.61	1.03	0.08	0.89	0.33	0.54	1.07	0.00	0.47
Avail Cap(c_a), veh/h	152	1266	565	164	1114	497	314	330	357	380	0	394
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	27.1	32.2	22.1	26.9	35.0	24.7	41.5	37.3	35.4	40.5	0.0	32.6
Incr Delay (d2), s/veh	2.8	17.0	0.1	6.3	35.5	0.1	24.1	0.6	1.5	65.1	0.0	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	16.8	1.1	1.8	18.6	0.7	8.5	2.3	4.2	16.0	0.0	3.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.0	49.2	22.2	33.3	70.5	24.8	65.6	37.9	36.8	105.7	0.0	33.5
LnGrp LOS	C	D	C	C	F	C	E	D	D	F	A	C
Approach Vol, veh/h		1361			1292			554			589	
Approach Delay, s/veh		46.8			66.2			50.8			83.1	
Approach LOS		D			E			D			F	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.0	45.4		25.0	13.4	41.0		22.7				
Change Period (Y+Rc), s	4.0	9.0		4.0	9.0	* 9		5.5				
Max Green Setting (Gmax), s	5.0	33.5		21.0	5.0	* 32		18.0				
Max Q Clear Time (g_c+I1), s	6.0	36.3		23.0	5.0	34.0		16.9				
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	0.0		0.3				

Intersection Summary			
HCM 6th Ctrl Delay		59.6	
HCM 6th LOS		E	

Notes

User approved pedestrian interval to be less than phase max green.

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	72	1218	71	100	1150	42	266	103	185	405	184
v/c Ratio	0.49	1.02	0.12	0.62	0.92	0.07	0.87	0.32	0.32	1.04	0.44
Control Delay	29.4	64.8	1.7	35.0	46.0	0.2	67.6	38.8	5.8	97.1	9.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.4	64.8	1.7	35.0	46.0	0.2	67.6	38.8	5.8	97.1	9.8
Queue Length 50th (ft)	27	~438	0	34	~395	0	165	58	0	~283	17
Queue Length 95th (ft)	55	#571	10	#86	#541	0	#300	107	50	#468	50
Internal Link Dist (ft)		5255			745			1155		1058	
Turn Bay Length (ft)	130		100	130		100	180		160		100
Base Capacity (vph)	146	1194	610	160	1244	630	321	338	575	388	418
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.49	1.02	0.12	0.63	0.92	0.07	0.83	0.30	0.32	1.04	0.44

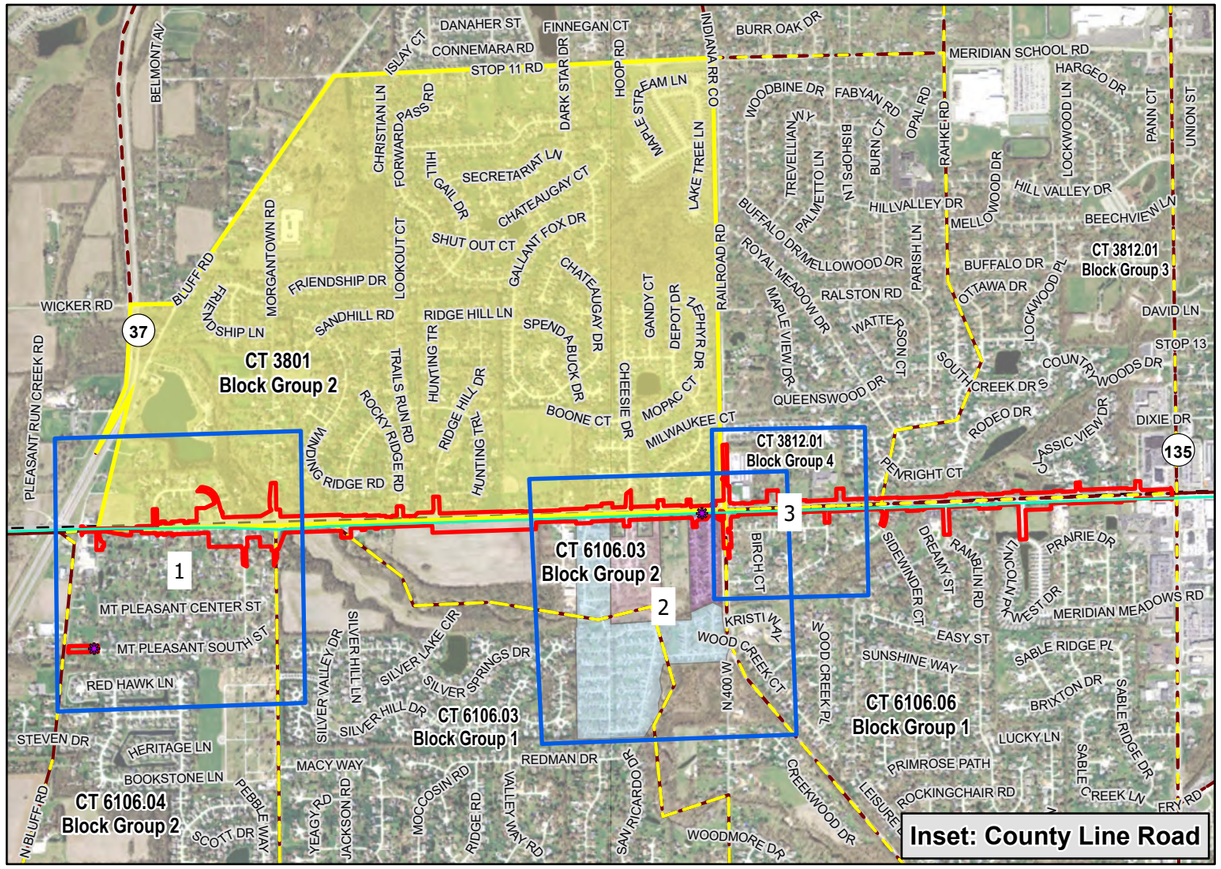
Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Environmental Justice Attachments - for text of Analysis see the CE Text

	Residential Relocations	ROW Acquisition	Changed Community Access	Tree Clearing	Air Quality and Noise Impacts due to Increased Capacity	Temporary Impacts of Dust, Noise, etc.	Maintenance of Traffic (MOT)
EJ Community – Census Tract 3801, Block Group 2	2	4.85 acres permanent; 2.45 acres temporary	Yes – Morris Road will be closed at County Line Road	Yes	Possible	Yes	Yes
EJ Community – Winterbrook/Center Grove Estates Mobile Home Community	None	0.32 acre permanent; 0.37 acre temporary	No	Yes	Possible	Yes	Yes
EJ Community – Glendale Park Community	None	0.20 acre permanent; 0.28 acre temporary	No	Yes	Possible	Yes	Yes
Shadybrook Mobile Home Park	None	0.39 acre permanent; 0.35 acre temporary	Yes – Access Road will be relocated to the west	Yes	Possible	Yes	Yes
Non-EJ Communities	7	14.1 acres permanent; 3.71 acres temporary	Yes – Mount Pleasant Street East will be closed at County Line Road. A new local access road will be constructed to connect with N. Bluff Road	Yes	Possible	Yes	Yes



Environmental Justice Map

County Line Road Expansion
Marion & Johnson Counties, Indiana
Des 2002553

Community of Comparison (COC): White River Township & Perry Township
Data: 2015-2019 American Community Survey (ACS) B17021, Poverty Status of Individuals by Living Arrangement

HNTB
Graphics created by HNTB Corporation (2023)

Legend

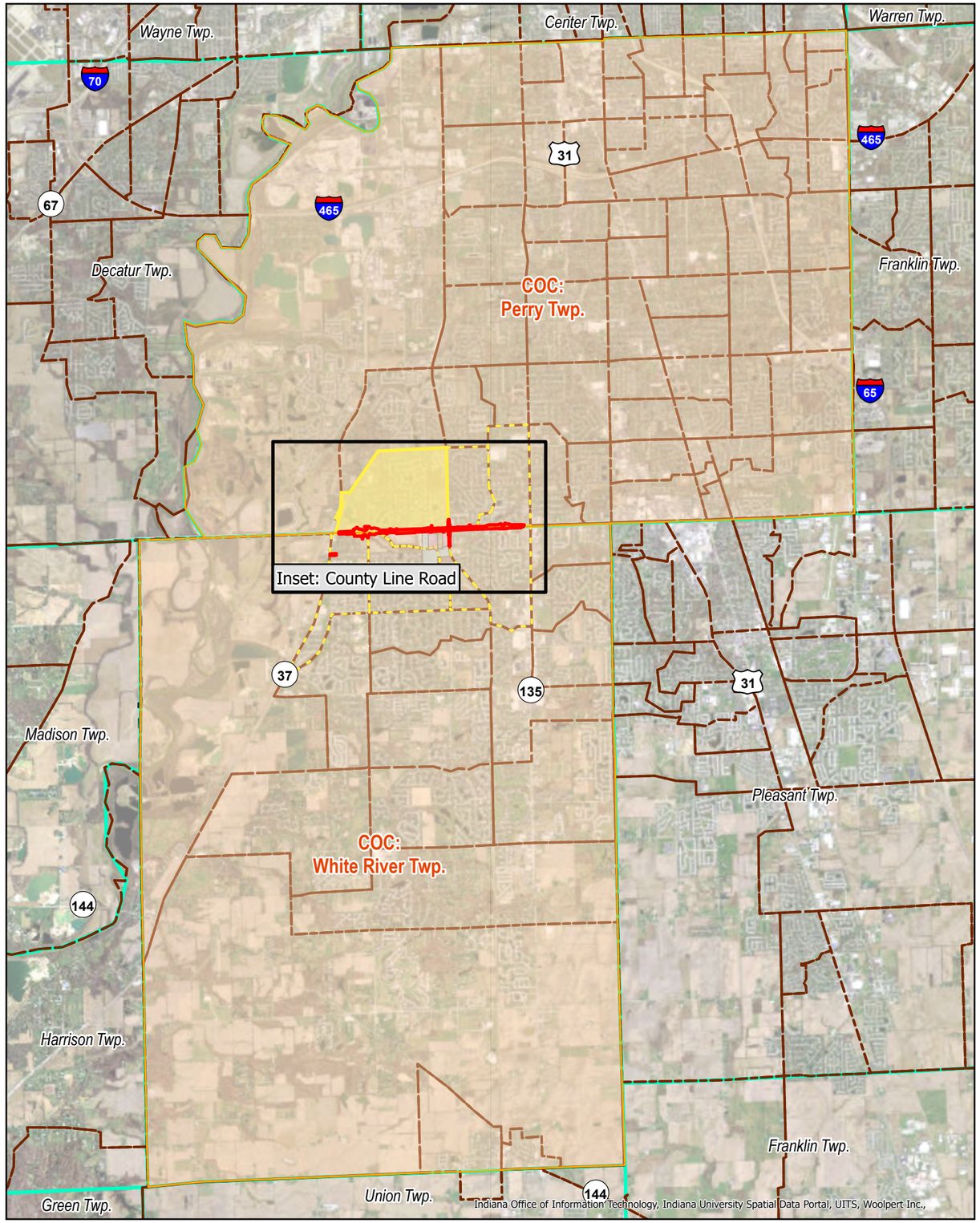
- EJ Community: Block Group 2, Census Tract 3801
- Affected Community (AC) Block Groups
- Community of Comparison
- Census Block Group Boundary (2015-2019 ACS)
- Minor Civil Divisions (Civil Twps)
- County Line Road Project Area
- County Boundaries

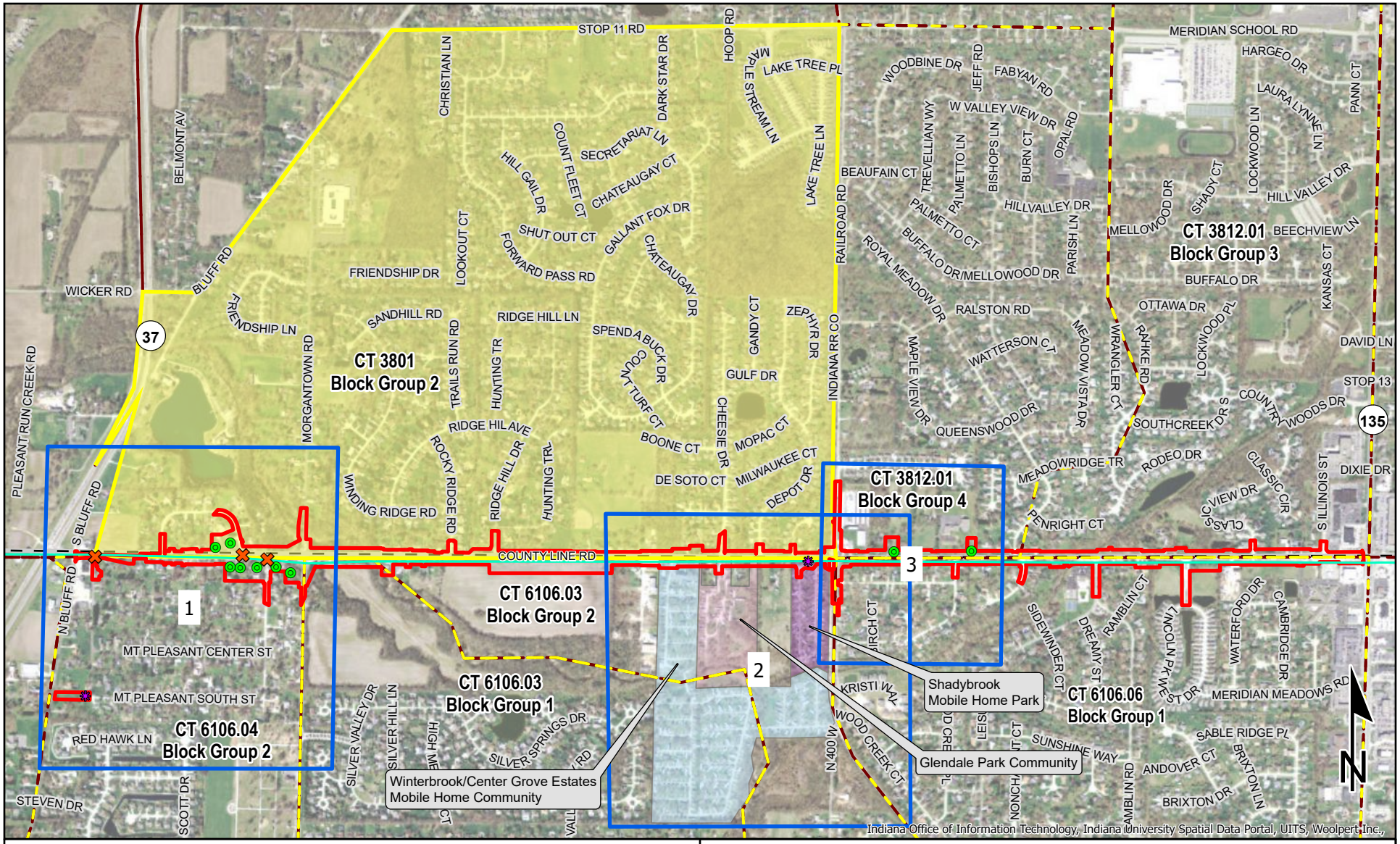
Mobile Home Communities

- Glendale Park Community
- Shadybrook Mobile Home Park
- Winterbrook/ Center Grove Estates Mobile Home Community

N

Map Scales:
County Line Inset: 1 in = 1,800 ft | COC Map: 1 in = 8,000 ft





- Permanent Road Closures
- Proposed Relocations
- Change of Access
- EJ Community: Block Group 2, Census Tract 3801
- Block Group Boundaries: 2015-2019 ACS
- Affected Community (AC) Block Groups
- County Line Road Project Area
- Map Page
- Minor Civil Divisions (Civil Twps)
- County Boundaries

Mobile Home Parks

- Glendale Park Community
- Shadybrook Mobile Home Park
- Winterbrook/ Center Grove Estates Mobile Home Community

0 700 1,400 Feet

County Line Road Project Area Map: Environmental Justice

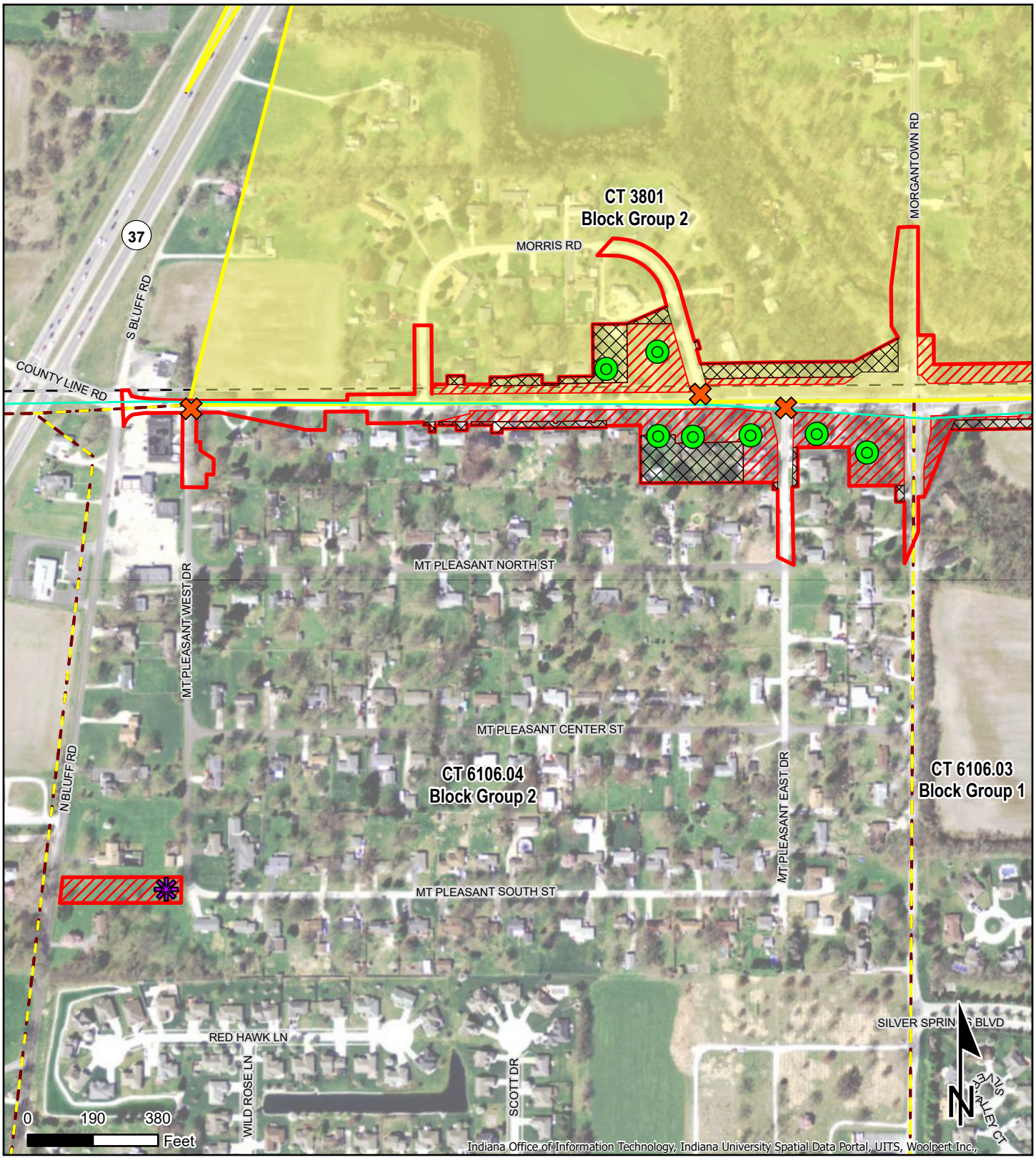
County Line Road Expansion
Marion & Johnson Counties, Indiana

Des. No. 2002553

1 inch = 1,400 ft

HNTB

Graphics created by HNTB Corporation (2023)



Environmental Justice Map: Inset 1

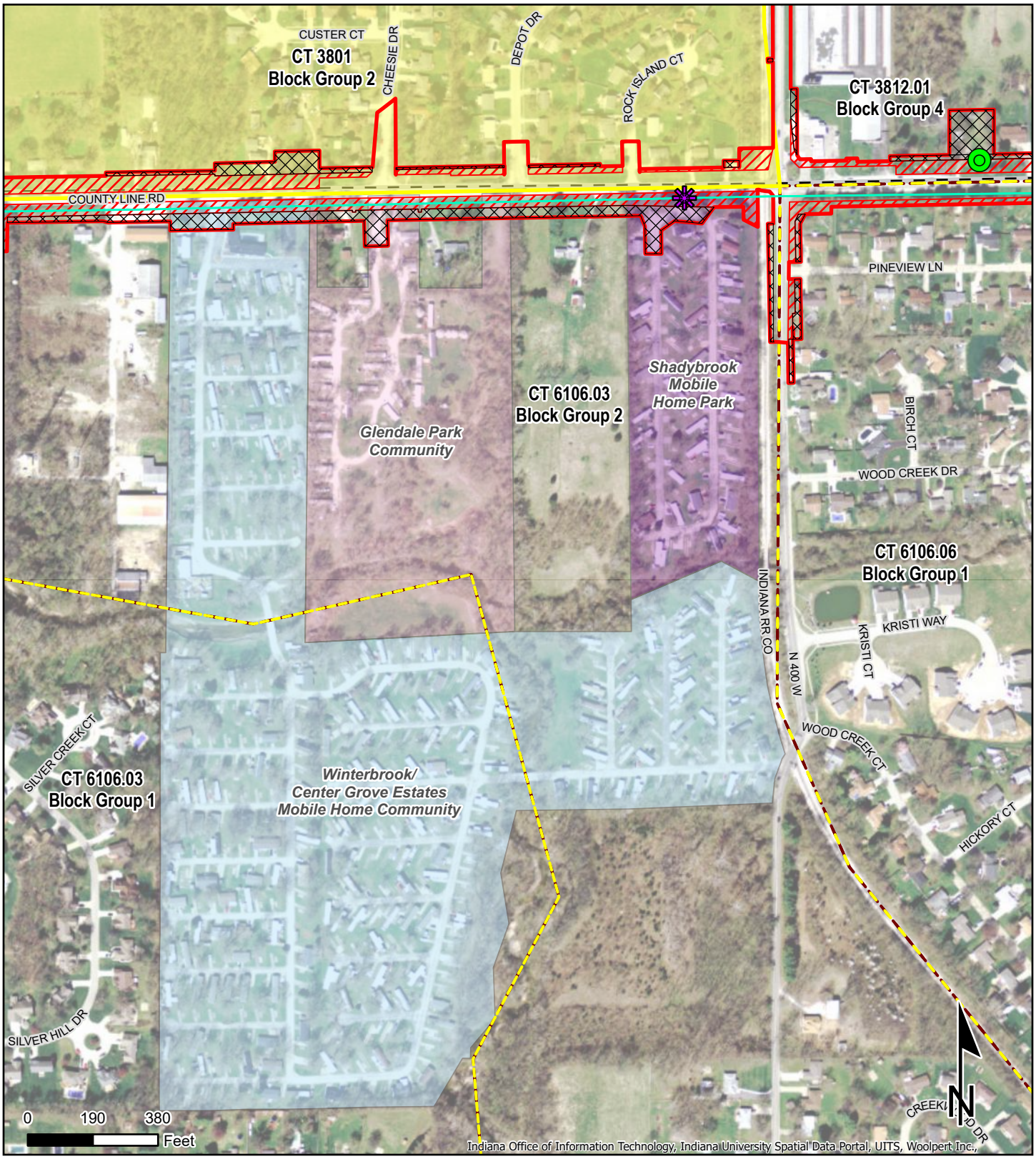
County Line Road Expansion
Marion & Johnson Counties, Indiana
Des No. 2002553

HNTB
Graphics created by HNTB Corporation (2023)

Scale:
1 in = 400 ft

- EJ Community: Block Group 2, Census Tract 3801
- Affected Community (AC) Block Groups
- Block Group Boundaries: 2015-2019 ACS
- Minor Civil Divisions (Civil Twps)
- County Line Road Project Area
- County Boundaries
- Permanent Road Closures
- Proposed Relocations
- Change of Access
- Proposed New Right-of-Way
- Proposed Temporary Right-of-Way

Mobile Home Parks
- Glendale Park Community
- Shadybrook Mobile Home Park
- Winterbrook/ Center Grove Estates Mobile Home Community



Environmental Justice Map: Inset 2

County Line Road Expansion
Marion & Johnson Counties, Indiana
Des No. 2002553

HNTB

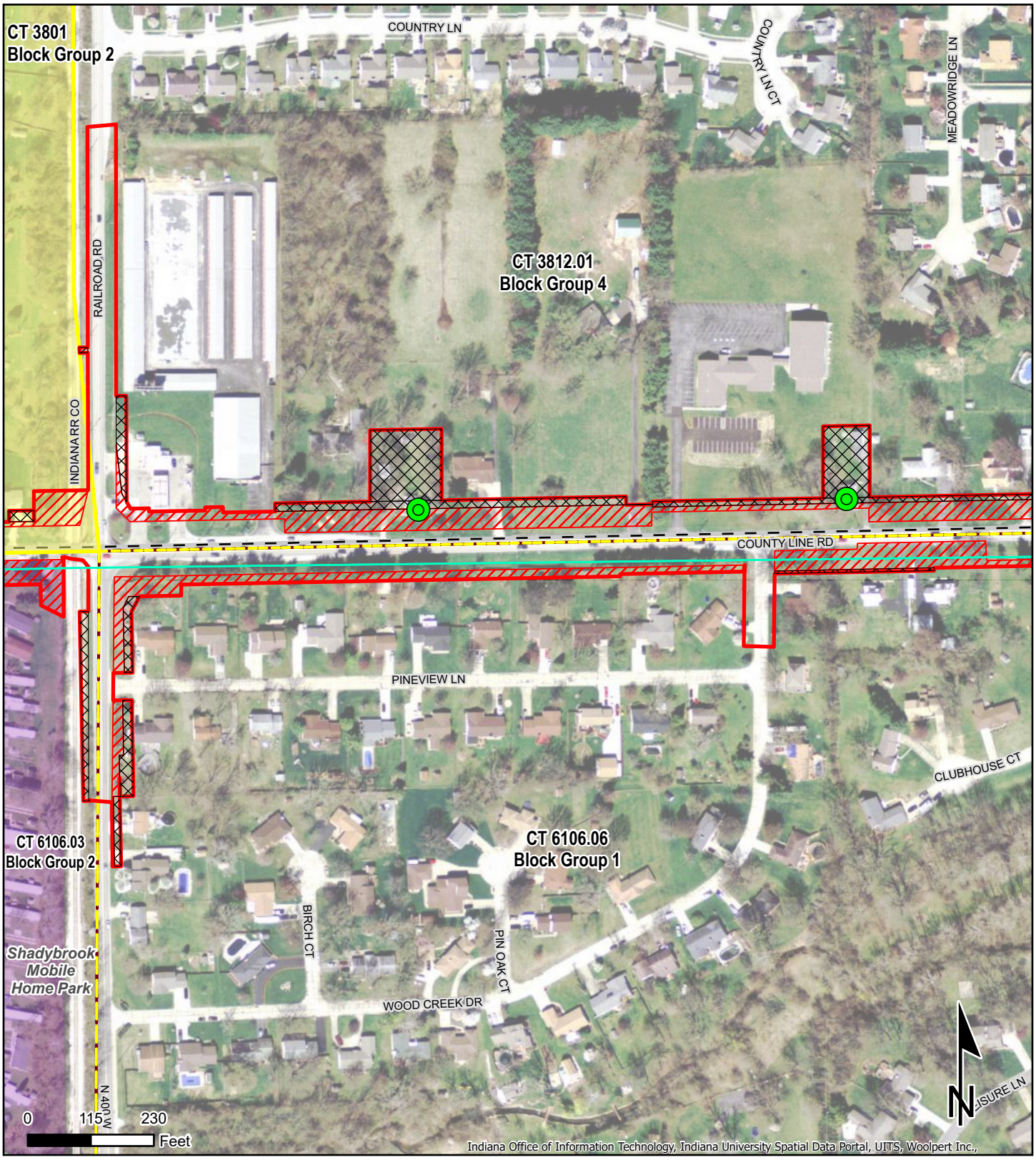
Graphics created by HNTB Corporation (2023)

Scale:
1 in = 400 ft

- EJ Community: Block Group 2, Census Tract 3801
- Affected Community (AC) Block Groups
- Block Group Boundaries: 2015-2019 ACS
- Minor Civil Divisions (Civil Twps)
- County Line Road Project Area
- County Boundaries
- Permanent Road Closures
- Proposed Relocations
- Change of Access
- Proposed New Right-of-Way
- Proposed Temporary Right-of-Way

Mobile Home Parks

- Glendale Park Community
- Shadybrook Mobile Home Park
- Winterbrook/ Center Grove Estates Mobile Home Community



Environmental Justice Map: Inset 3

County Line Road Expansion
Marion & Johnson Counties, Indiana
Des No. 2002553

HNTB
Graphics created by HNTB Corporation (2023)

Scale:
1 in = 250 ft

- EJ Community: Block Group 2, Census Tract 3801
- Affected Community (AC) Block Groups
- Block Group Boundaries: 2015-2019 ACS
- Minor Civil Divisions (Civil Twps)
- County Line Road Project Area
- County Boundaries
- Permanent Road Closures
- Proposed Relocations
- Change of Access
- Proposed New Right-of-Way
- Proposed Temporary Right-of-Way

Mobile Home Parks
- Glendale Park Community
- Shadybrook Mobile Home Park
- Winterbrook/ Center Grove Estates Mobile Home Community

From: Fair, Terri
To: Susan Harrington
Cc: Passmore, Andrew D; Christine Meador
Subject: County Line Road EJ Analysis - Des 2002553
Date: Thursday, August 31, 2023 1:21:53 PM
Attachments: REV Des. No. 2002553_CL Road_EJ Analsysis_8.23.23.pdf

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INDOT-Environmental Services Division (ESD) has reviewed the project information along with the Environmental Justice (EJ) Analysis for the above referenced project. With the information provided, the project may require minimal right-of-way. There will be relocations. With the information provided, the relocations would not disrupt community cohesion or create a physical barrier. INDOT-ESD would not consider the impacts associated with this project as causing a disproportionately high and adverse effect on minority and/or low-income populations of EJ concern relative to non-EJ populations in accordance with the provisions of Executive Order 12898 and FHWA Order 6640.23a. No further EJ Analysis is required.

SOUTH COUNTY LINE ROAD SCOPING REPORT

I-69 (SR 37) to SR 135 (S Meridian Street)

Dated: November 20, 2019

PREPARED FOR

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Contents

Appendices of report not included

1. Project Purpose and Need

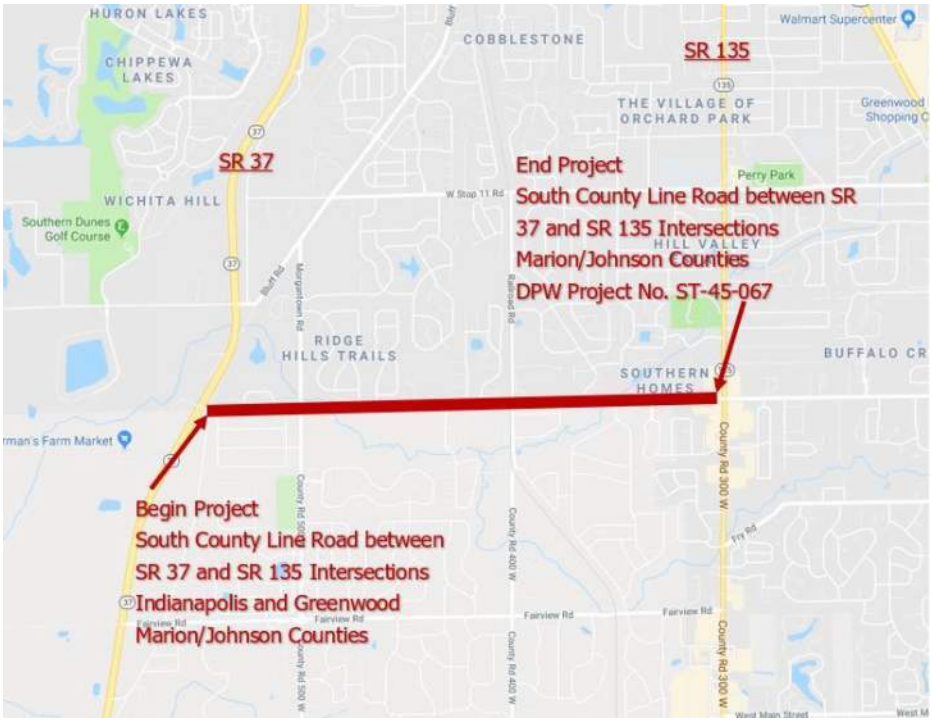
This report defines the proposed scope of a project to add travel lanes to South County Line Road between SR 37 and SR 135 within the City of Indianapolis, Indiana. This project is identified as a planned expansion in the 2016 Marion County Thoroughfare Plan, as part of an effort to improve east-west road capacity in the southern part of the county. The portion of the project between SR 37 and Morgantown Road is identified as a priority planned expansion, as this segment is experiencing the fastest growth. The upgrade of SR 37 to I-69 is currently under design and will be constructed to include a new interchange at County Line Road by 2025. Forecast traffic demand along County Line Road will exceed the capacity of its existing two-lane configuration within the time frame analyzed for this study.

2. Study Area

2.1 Project Location

County Line Road is an east-west arterial located at the southern border of Marion County and northern border of Johnson County. The 2.5-mile segment of County Line Road studied for this project is between SR 37 (future I-69) and SR 135 (S Meridian Street). The project segment is located in White River Township in Johnson County and Perry Township in Marion County.

Figure 1. Project Area Map



2.2 Existing Conditions of County Line Road

County Line road is a two-lane primary arterial with current traffic volumes ranging from 5,600 vehicles per day near SR 37 to 12,000 vehicles per day closer to SR 135. Most of the project corridor is residential with some businesses near the two State Routes of 37 and 135 intersections. The road expands to 5 lanes (2 lanes each direction with a turning lane to Meridian Street) between SR 135 and South Illinois Street. This section also has sidewalks along with a curb and gutter. There are shoulders on both sides of the road between South Illinois Street and Royal Meadow Drive. Recent traffic counts in this 5-lane section are 18,300 vehicles per day.

The current posted speed on County Line road is 30 mph from SR 37 to Morgantown Road, and 40 mph from Morgantown Road to SR 135. Most of the project area has existing homes on the North and South sides of the project, with some businesses near either end of the project limits by SR 37 and SR 135.

There are two major intersections along County Line Road in the segment being studied. One intersection is at Railroad Road/Peterman Road. The name of this crossing road is Railroad Road in Marion County and Peterman Road in Johnson County. This intersection is controlled by a 4-way stop sign, with a single approach lane from all four directions. The Indiana Rail Road has a single-track rail line immediately adjacent to Railroad Road/Peterman Road, with an at-grade crossing of County Line Road less than 50 feet west of the intersection. The crossing has overhead flashers but no gates.

The second major intersection is at Morgantown Road. This intersection is controlled by a traffic signal and has left turn lanes in all directions. There is a steep hill on County Line Road just west of this intersection, with an existing roadway grade of approximately 9 percent.

There are two existing bridges on County Line Road in the study corridor. One bridge goes over Pleasant Run Creek (approximately 100 feet in length), which lies approximately 650 feet east of the Morgantown Road intersection. The other bridge runs over Buffalo Creek (approximately 150 feet in length), located just west of Leisure lane on County Line Road. The Flood Plains for both are shown in Appendix G-5 and G-6. A bridge carrying Morgantown Road over Pleasant Run Creek is approximately 200 feet north of County Line Road and was recently reconstructed.

Existing Drainage in the area is collected by curb and gutter, along with shallow ditches on both sides of County Line Road. There are also ditches that run on both sides of the railroad track near the intersection with Railroad Road. There are cross culverts near Pleasant Run Creek and at Buffalo

Creek, and at the railroad intersection area. Please see Appendix G-4 for more details at these areas. There is a curb and gutter with inlets and a trunk system between SR 135 and just west of South Illinois Street and at Morgantown Road.

3. Environmental Conditions – Red Flag Investigation

An environmental Red Flag Investigation (RFI) was conducted to provide a general overview of the environmental conditions of the project area, highlight areas that may need additional environmental work or coordination, highlight areas may need to be avoided (e.g., Superfund sites, wetland mitigation sites, or similar), and assist in prioritizing projects. One (1) recreation facility is located adjacent to the project area. Coordination with Carefree Club Inc would occur. One (1) private airport is located within the 0.5 mile search radius. Hillenburg airport is located approximately 0.3 miles northwest of the project area. Coordination with the Hillenburg airport owner will occur. One wetland is located adjacent to the project area at the intersection of Classic View Dr and County Line Rd. Two (2) stream segments, Buffalo Creek and Pleasant Run Creek, flow through the project area. The project area is located within floodplains (coordination only). See Appendix B for the complete RFI report.

4. Utilities

The anticipated project area falls along a dividing line for service areas for many utility companies. The north side of County Line Road is primarily served by Citizens/CEG for natural gas, water, and sanitary sewer. The south side is served by Vectren (Centerpoint) gas, and where properties have water and sanitary services, they are served by Johnson County.

Electric distribution lines are located along the north side of County Line Road and along the west side of Railroad Road. Along the project corridor, cable, telecom, and fiber lines are underbuilt on IP&L's electric poles. Further survey and utility coordination will be required to determine the full impacts to underground cable and fiber facilities.

Enterprise Products owns and maintains a transmission pipeline crossing County Line Road approximately 2,800 feet east of Railroad Road.

Approximate costs for utility relocation have been developed for this report. Making some preliminary assumptions on which utilities are reimbursable, the approximate reimbursable cost is $1.3 Million.

Prior to the acquisition of right of way, consideration should be made to accommodate utilities within the right of way outside the anticipated construction limits to allow utilities to relocate prior to construction and to minimize the need for utility companies to acquire easements, as doing so may impact the project schedule if the project development timeline is compressed or accelerated.

See Appendix C for supporting information regarding utilities.

5. Railroad Coordination

The Indiana Rail Road Company owns and maintains a rail line adjacent Railroad Road and Peterman Road. This single-track rail line has an at-grade crossing (DOT crossing #292261E) with County Line Road immediately west of the its intersection with Railroad Road/Peterman Road. The crossing has overhead flashers but no crossing gates.

The widening of County Line Road will necessitate a reconstruction of the pavement surface at the grade crossing, the relocation (or replacement) of the existing gantry/flashing indicators, and potentially the installation of new automatic gates. The approximate cost for the railroad work at this location is $450,000. This assumes that the existing gantry and signal indicators will need to be replaced and that gate arms will be installed.

Railroad coordination will be required for successful completion of this work and sufficient schedule considerations should be made to ensure this work does not impact the project construction or relocation of utilities. The Federal Railroad Administration (FRA) records for this crossing can be found in Appendix D.

6. Related Projects

There are several INDOT and DPW projects either recently completed, under construction, or scheduled to start in the near future that may have an effect on County Line Road regarding traffic flow patterns.

- DES 1700158: Intersection improvement at SR 135 & County Line road to add capacity and reduce backups at the intersection.
- DES 1401717: Bridge rehabilitation on Morgantown Road over Pleasant Run Creek that includes widening, and superstructure replacement (recently completed).

- DES 0300382: i-69 Section 6 – SR 39 to I – 465. Martinsville to Indianapolis. This project will upgrade existing SR 37 to I-69 and include a roundabout interchange at County Line Road. See attached Plan and Profile Sheets (Appendix F).

7. Traffic

7.1 Traffic Forecast

Forecast information provided by the Indianapolis Metropolitan Planning Organization (MPO) from the Indianapolis Regional Travel Demand Model provided the basis for traffic forecasts developed for the County Line Road added travel lanes project. MPO travel demand output for the following model scenarios were evaluated for this scoping report:

- 2020 Existing plus Committed scenario. This reflects 2020 traffic demand on the existing road network, with new projects expected to open by 2020.
- 2025 No Build scenario. This reflects 2025 traffic demand on the existing network, with funded projects that are expected to open by 2025. This includes the upgrade of SR 37 to I-69 from Martinsville to I-465, with an interchange at County Line Road. The extension of Ameriplex Parkway from SR 67 to the White River, which is currently under development by the City of Indianapolis, is also included in this scenario.
- 2025 Build scenario. This modifies the 2025 No Build scenario by widening County Line Road to provide 4 travel lanes from I-69 to Morgantown Road.
- 2045 No Build scenario. This reflects 2045 traffic demand on the existing network, with funded projects that are expected to open by 2045.
- 2045 Build scenario. This modifies the 2045 No Build scenario by widening County Line Road to provide 4 travel lanes from I-69 to SR 135.

Table 1 provides a comparison of average daily traffic volume forecasts on the road segments included in this study for the various scenarios. Historic count data available from the INDOT Traffic Count Database System is included in the table. 2045 volume forecasts for the I-69 Section 6 Refined Preferred Alternative, as provided in the I-69 Section 6 Environmental Impact Statement (EIS)[1] are also provided for comparison. The I-69 Section 6 EIS forecast reflects widening of County Line Road

[1] Final Environmental Impact Statement, I-69 Section 6, Martinsville to Indianapolis, Federal Highway Administration and Indiana Department of Transportation, February 2018. Available at: https://www.in.gov/indot/projects/i69/2515.htm

from I-69 to Morgantown Road. Peterman Road/Railroad Road is not included in the travel demand model network provided by the Indianapolis MPO, so forecasts are not available. Traffic demand growth rates were assumed to be similar to those on Morgantown Road.

Table 1. Average Daily Travel Volume Counts and Forecasts (veh/day)

	County Line Road	County Line Road	County Line Road	Morgantown Road	Morgantown Road	Peterman Road
	SR 37 to Morgantown	Morgantown to Railroad	Railroad to SR 135	County Line to Fairview	County Line to Bluff	County Line to Stop 11
Historic Count and Year	5,577 (2014)	NA	12,041 (2014)	8,095 (2019)	5,488 (2019)	5,618 (2019)
2020 E+C MPO Forecast	15,700	8,700	9,800	23,000	11,000	NA
2025 No Build MPO Forecast	17,000	11,400	11,500	19,000	12,900	NA
2045 No Build MPO Forecast	24,300	13,600	13,100	25,400	20,200	NA
2045 I-69 EIS Forecast*	22,300	14,900	NA	14,200	NA	NA
2025 Build MPO Forecast	21,000	11,700	11,700	12,500	21,400	NA
2045 Build MPO Forecast	32,400	26,900	28,000	26,400	19,600	NA

*The I-69 Section 6 EIS included widening of County Line Road between I-69 and Morgantown Road.

Peak hour turning movements Traffic forecasts were developed for the 2025 and 2045 Build conditions based on September 2019 peak period turning movement counts and the travel demand forecasting provided by the Indianapolis MPO. Travel demand model outputs for the future Build scenarios were compared to the output for the 2020 Existing plus Committed scenario to determine volume growth by road segment and direction. This growth was applied to the recent turning movement counts and adjustments were made to assure reasonable balance along County Line Road. As stated above, traffic demand growth rates on Railroad Road/Peterman Road were assumed to be similar to those on Morgantown Road, since it was not included in the MPO travel demand model. Existing and forecast peak hour turning movement volumes are shown for the intersection of County Line Road and Morgantown Road in **Table 2** and for County Line Road and Railroad Road/Peterman Road in **Table 3**.

Table 2. Existing and Forecast Peak Hour Volumes at County Line Road & Morgantown Road (veh/day)

AM Peak Hour		Morgantown Rd Northbound			Morgantown Rd Southbound			County Line Rd Eastbound			County Line Rd Westbound		
		L	T	R	R	T	L	L	T	R	R	T	L
2019 Count	Total	100	355	89	7	60	28	14	242	28	27	200	40
	Truck	-	-	1	-	-	3	1	7	2	1	10	-
2025 Forecast	Total	109	355	99	10	84	42	18	392	36	50	372	75
	Truck	-	-	2	-	-	5	2	12	3	2	18	1
2045 Forecast	Total	139	414	174	17	125	82	37	1,140	73	108	844	157
	Truck	-	-	2	-	-	10	3	24	5	4	39	4

PM Peak Hour		Morgantown Rd Northbound			Morgantown Rd Southbound			County Line Rd Eastbound			County Line Rd Westbound		
		L	T	R	R	T	L	L	T	R	R	T	L
2019 Count	Total	24	134	69	44	475	50	19	276	80	27	298	90
	Truck	1	1	-	-	1	-	-	1	-	-	1	-
2025 Forecast	Total	28	145	85	53	501	64	23	421	89	36	402	114
	Truck	2	1	-	-	1	-	-	2	-	-	2	-
2045 Forecast	Total	52	230	204	102	581	155	39	964	115	70	1,212	177
	Truck	2	2	-	-	2	-	-	4	-	-	5	-

Table 3. Existing and Forecast Peak Hour Volumes at County Line Road & Railroad Road/Peterman Road (veh/day)

AM Peak Hour		Peterman Rd Northbound			Railroad Rd Southbound			County Line Rd Eastbound			County Line Rd Westbound		
		L	T	R	R	T	L	L	T	R	R	T	L
2019 Count	Total	23	165	217	26	68	83	31	368	13	31	195	31
	Truck	-	-	-	1	-	-	1	11	-	-	11	-
2025 Forecast	Total	28	165	221	42	95	118	45	542	19	37	352	37
	Truck	-	-	-	1	-	-	2	18	-	-	16	1
2045 Forecast	Total	42	192	237	73	141	210	141	1,321	58	103	877	101
	Truck	-	-	-	3	-	-	4	59	-	-	43	2

PM Peak Hour		Peterman Rd Northbound			Railroad Rd Southbound			County Line Rd Eastbound			County Line Rd Westbound		
		L	T	R	R	T	L	L	T	R	R	T	L
2019 Count	Total	68	102	109	88	188	68	25	293	22	37	325	67
	Truck	1	1	1	-	1	-	-	-	1	-	2	-
2025 Forecast	Total	75	105	113	105	204	77	35	412	30	42	471	75
	Truck	2	1	1	-	1	-	-	-	1	-	3	-
2045 Forecast	Total	190	152	246	270	253	172	69	1,037	52	97	1,201	147
	Truck	4	2	3	-	2	-	-	-	3	-	12	-

7.2 Traffic Analysis

Typical Section Requirements

The through lane requirements for County Line Road were verified by comparing 2045 average daily traffic forecasts to the service volume thresholds for a signalized arterial. The maximum volume that can be served with acceptable LOS D on County Line Road in its existing two-lane configuration is estimated to be 12,750 vehicles per day, based on generalized service volume estimated developed by the Florida Department of Transportation and shown in **Appendix E**.[2] The 2045 No Build scenario demand estimated for each segment of County Line Road exceeds 12,750 vehicles per day, as shown in Table 1, and a two-lane arterial will therefore provide insufficient capacity. An arterial with four travel lanes and turn lanes at intersections will provide sufficient capacity to serve the 2045 Build scenario volumes. Due to the number of driveway and street intersections along County Line Road, a two-way center left turn lane is recommended for safety and capacity.

It is noted that forecast demand on Morgantown Road and Railroad/Peterman Road also exceed the maximum acceptable two-lane arterial volumes, and these roads may require additional travel lanes in the future.

Intersection Traffic Control

A traffic signal was installed at the intersection of County Line Road and Morgantown Road in 2014. While no formal signal warrant analysis was conducted for this scoping study, MPO daily traffic forecasts indicate that the volumes at the intersection would continue to meet Indiana MUTCD traffic signal warrants under either the 2025 No Build or 2025 Build scenario.[3] A traffic signal is preferred over a roundabout at this intersection due to the steep grade on the west approach and the Pleasant Run Creek crossings on the north and each approaches that would increase the cost of widening on these approaches.

The intersection of County Line Road and Railroad Road/Peterman Road is currently controlled by an all-way stop. The City of Indianapolis does not propose to include this segment of County Line Road in the first phase of the added travel lanes project that would open to traffic in 2025. Examination of existing daily counts and MPO forecasts indicate that this intersection is likely to warrant a traffic

[2] 2012 Generalized Service Volume Tables, Florida Department of Transportation Systems Planning Office, December 2012. Available at: https://www.fdot.gov/planning
[3] Indiana Manual on Uniform Traffic Control Devices, 2011 Edition. Table 4C-2.

signal by the 2045 design year, so a signal was assumed for purposes of determining intersection lane configuration and turn lane lengths. Opening year traffic control at this intersection will need to be confirmed once a schedule for widening this segment of County Line Road has been determined.

A traffic signal is preferred over a roundabout at the intersection of County Line Road and Railroad Road/Peterman Road due to the railroad immediately adjacent to the intersection. If a roundabout is constructed at this location, it is recommended that the roundabout be moved either to the east so that the railroad crosses only the west approach or to the west so that the railroad bisects the roundabout.

Intersection Lane Configuration and Level of Service

Intersection turn lane recommendations are based on design year capacity analysis and the warrants in Section 46-4.0 of the Indiana Design Manual Turn.

County Line Road is an arterial and is forecast to experience a significant increase in traffic after construction of I-69. Therefore, left and right turn lanes are recommended on County Line Road in both directions at its intersections with both Morgantown Road and Railroad Road/Peterman Road.

Left and right turn lane recommendations for the Morgantown Road and Railroad Road/Peterman Road approaches to County Line Road were developed based on design year capacity analysis. Both a left turn lane and a right turn lane are recommended for all approaches, as they are needed for capacity. Each of these movements has a forecast demand of more than 100 vehicles per hour in the AM peak hour and/or PM peak hour during the 2045 design year.

Capacity analysis was conducted for the intersections of County Line Road with Morgantown Road and with Railroad Road/Peterman Road using Synchro 10 traffic analysis software. Both the 2045 AM and PM peak hour build forecasts were evaluated. Analysis output reports are provided in Appendix E.

Turn lane storage lengths were determined based on the queue lengths observed from microsimulation of the 2045 AM and PM peak hour traffic with optimized signal timing. Five 60-minute simulation runs were conducted for each peak hour using SimTraffic microsimulation software, and queueing information was averaged from these runs. The storage length for each turn lane was set to accommodate the higher of the AM peak or PM peak 95th percentile queue length, which is the length that is expected to be exceeded only five percent of the time under the forecast conditions. A

minimum storage length of 100 feet was used. The recommended intersection lane configurations, Level of Service and queueing results, and recommended minimum turn lane storage lengths are shown in **Table 4**. The lengths in the table only include full-width storage requirements and exclude entrance taper lengths. Turn lane lengths are assumed to exclude deceleration due to the developed urban area and speeds of 40 mph or less. Turn lanes would ideally be longer than the 95th percentile queue length in the adjacent through lane so that vehicles could enter turn lanes unimpeded. However, this would require significant additional cost and impact at these intersections. SimTraffic queueing reports are included in **Appendix E**.

Table 4. Lane Configuration and Recommended Minimum Turn Lane Storage Lengths

County Line Rd & Morgantown Rd												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lanes	↰	↑↑	↱	↰	↑↑	↱	↰	↑	↱	↰	↑	↱
Level of Service	B/C	D/D	B/C	D/D	C/D	B/C	C/C	E/C	C/C	C/C	C/E	C/C
95th % Queue Length (ft)	57	388	80	167	388	66	111	450	81	168	658	71
Turn Lane Length (ft)	100		100	170		120	120		100	170		100
County Line Rd & Railroad Rd/Peterman Rd												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lanes	↰	↑↑	↱	↰	↑↑	↱	↰	↑	↱	↰	↑	↱
	B/B	C/C	B/B	C/C	C/C	B/B	C/C	C/C	E/D	D/C	C/D	C/E
95th % Queue Length (ft)	124	364	58	128	319	46	171	179	158	300	257	91
Turn Lane Length (ft)	130		100	130		100	180		160	300		100

8. Roadway Design

8.1 Typical Section

The proposed typical section for County Line Road follows the Metropolitan Area 4-Lane Primary Urban Arterial roadway typical section provided in the 2016 Marion County Thoroughfare Plan. The typical section includes two 11-foot lanes in each direction, one 13-foot center two-way left turn lane, and curb & gutter. The north side will have a 6-foot sidewalk separated by a 6-foot grass buffer, and the south side will have a 10-foot multi-use path separated by a 6-foot grass buffer. Typical proposed right of way width is 119 feet. Please see Appendix A for more details.

8.2 Geometrics

Recommended Geometric Design Criteria for the County Line Road Project are those for reconstruction of a suburban arterial with four or more lanes, as shown in Figure 53-6 of the Indiana Design Manual.

Table 5. Existing and Proposed Design Features

Feature	Existing	Proposed
Functional Classification	Urban Arterial	Urban Arterial
Travel Lanes	2 lanes @ 11-feet wide	4 Lanes @ 11-feet wide, 1 Lane @ 13-feet wide
Design Speed	N/A	40 mph
Posted Speed	30 mph, 40 mph	40 mph
Drainage	Ditches, Curb & Gutter	Curb & Gutter with enclosed Drainage
Pedestrian Accommodation	Few Sidewalks near SR 135 & County Line Road on both side of the road.	6-foot sidewalk on North side of County Line Road
Bicycle Accommodation	None	10-foot multi-use path on South side of County Line Road

8.3 Alignments & Centerline Alternatives

Horizontal and vertical geometry for the proposed County Line Road project was set according to the Indiana Design Manual, using a design speed of 40mph. The centerline of the proposed widened County Line Road will closely follow the existing centerline. However, the potential cost and impacts were reviewed for three alignment alternatives at the steep grade just west of Morgantown Road. Following are some of the criteria that were taken into consideration.

- R/W
- Drainage
- Cost
- Railroad Crossing
- Traffic Analysis
- Steep Vertical Grade west of Morgantown Intersection
- Utilities Relocations

The proposed vertical profile was designed for 40 mph, located just west of the Morgantown Road intersection. The difference in elevation between the ground and the steep ridge area vertical hill is almost 50 feet. A 40 mph urban arterial design criteria was used to reduce the elevation of the hill in order to accommodate the intersection and stopping sight distance at Morgantown Road. This design cuts the steep hill by approximately 25 feet in elevation. This means all the side roads that are on the hill will need to be adjusted back, along with the total take of properties as shown in the Appendix A. There are other ramifications if the Vertical Profile is adjusted, such as earthwork cost, utilities relocation cost around the ridge, drainage, and possibly adding retaining walls. The vertical curves used for the 40 mph design speed will greatly improve any sight distance issues that could arise. Multiple design alternatives were considered in order to ensure that impact on the area was minimized while still meeting all the design criteria.

8.3.1 Alignment Alternative 1 (Preferred Alternative)

In this alternative, the horizontal existing centerline was used throughout the project limits, splitting the proposed center turning lane in half (6.5 feet on each side) and expanding the proposed foot print to 119 feet as shown in the typical section.

The vertical profile was matched to existing ground as much as possible, except just west of Morgantown Road, where the profile grade of the existing steep hill was revised to meet 40 mph design criteria. The existing steep grade (approximately 9%) does not meet design standards currently. See Appendix A for the horizontal and vertical profile of Alternative 1.

8.3.2 Alignment Alternative 2

In this alternative, the horizontal alignment for County Line Road was set using the existing centerline, except that it was shifted to the south of the current existing centerline by 26 feet near the

Morgantown Road intersection to avoid some of the existing homes on the North side of the street. The vertical profile for the alignment maintains the 40 mph design speed through this horizontal alignment shift. The horizontal and vertical profile of Alternative 2 is shown in Appendix A.

8.3.3 Alignment Alternative 3

In this alternative, the horizontal alignment for County Line Road was set using the existing centerline, except where it is shifted to the north of the current existing centerline by 36 feet near the Morgantown Road intersection. The vertical profile for the alignment maintains the 40 mph design speed through this horizontal alignment shift. The horizontal and vertical profile of Alternative 3 is shown in Appendix A.

8.4 Preferred Alignment

Alternative 1 was identified as the preferred horizontal alignment for the following reasons:

- It has the least impact of property owners and R/W takes
- Least impact on railroad crossing
- Easier to upgrade Morgantown Road intersection without impacting the newly built bridge just North of the intersection on Morgantown Road.
- Less impact on Pleasant Run Creek and Buffalo Creek bridges since the impact is equally distributed on both sides without possibly realigning the channel that are required in both Alternatives 2 and 3.

9. Drainage and Detention

Existing drainage consists of curb and gutter along with roadside ditches. Existing impervious areas consist of two 11 foot lanes and shoulders throughout the roadway. Most existing storm water along this segment of County Line Road is collected and will drain to either Pleasant Run Creek or Buffalo Creek, as shown in Appendix G. The proposed typical section will increase the impervious footprint of County Line Road by adding two new travel lanes and a center turn lane, as well as sidewalk, a multiuse path, and turn lanes at the two major intersections. The proposed project will include curb and gutter, inlets, and an enclosed storm drainage system, along with manholes, occasional cross culverts, and ditches behind the side walk and multiuse path.

• Existing Impervious area: 8 Acres

• Proposed Impervious area: 22 Acres

• Increase of Impervious area: 14 Acres

The increase in impervious areas due to new added lanes, sidewalk and multiuse shared path, will require new detention areas as shown on the plan drawings in Appendix A. Due to the existing floodplain location and multiple anticipated project outfalls, 1.5 acres of detention will be required at multiple locations distributed through the project site, rather than a single downstream location.

10. Maintenance of Traffic

The County Line Road corridor between SR 37 and SR 135 (Meridian Street) mostly consists of residential neighborhoods on both sides of the streets with some commercial areas near the two ends, including a gas station at Railroad Road. Maintenance of traffic was analyzed to show what the best and most cost-effective method would be in order to build this project while having access to all of the residential and commercial driveways. The best way utilizes two-phase construction.

- Build one side while shifting the traffic on the other side.
- Add temporary pavement in order to maintain existing traffic.
- All drives need to have access at all times
- Bridge replacement will also take place during the part width construction.
- Temporary traffic signals may need to be utilized.
- Cross Culverts need to be constructed in two phases.

A total closure of County line road is not advised due to heavy traffic and driveway access in the area.

11. Conclusion and Recommendation

HNTB recommends that entire corridor should be designed for a 40 mph design speed, both horizontally and vertically by using the existing centerline as a baseline. In order to accommodate the 40 mph design speed and sight distance requirements, there will be approximately 25 feet of cut for the crest hill located east of Morgantown Road.

Retaining walls are not recommended due to nearby driveways, side roads, and sight distance issues. Improving storage lengths are also recommended at Railroad Road and Morgantown Road, to accommodate present and future traffic demands.

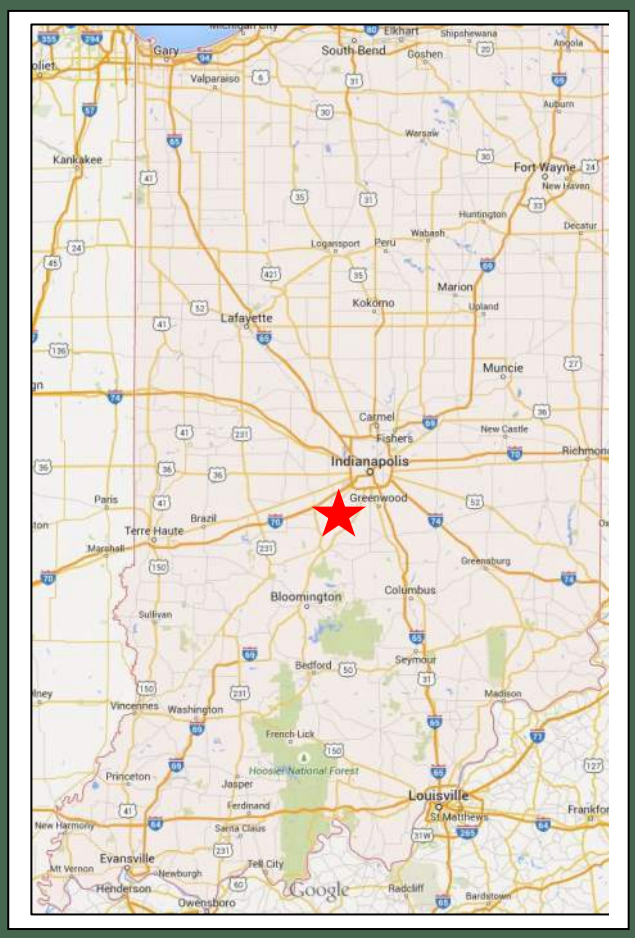
12. Cost Estimate

The cost estimate was prepared based upon the Preferred Horizontal and Vertical Alignments (Alternative 1). This estimate is broken down into two parts: Phase I and Phase II. Phase I consists of the estimate from SR 37 to Morgantown Road, and Phase II spans from Morgantown Road to the end of the project at SR 135 (Meridian Street).

Table 6. Cost Estimate for Phase I and Phase II

Item	Phase I Cost	Phase II Cost
Total Construction Cost (CN)	$7,570,000	$21,190,000
Utilities & Railroad Xing Upgrade (UT)	$240,000	$1,800,000
Construction Engineering (CE)	$950,000	$2,650,000
Professional Engineering (PE)	$760,000	$2,120,000
Total R/W Cost (RW)	$1,430,000	$2,500,000
Grand Total Cost	**$10,950,000**	**$30,260,000**

The scoping report cost analysis was performed using the major items using industry standard unit prices. A contingency of 30% was added for other items identified during final design. A more comprehensive cost estimate of both phases can be found in Appendix H.



Project Location Map

Hydraulic Analysis Report

County Line Road over Pleasant Run Creek Bridge Replacement

Date: December 15, 2022

Overall Project Des Number: 2002553, Str Des Number: 2100121

Existing Str Number: BR-45-004

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Hydraulic Analysis Report
Bridge Replacement for County Line Road over Pleasant Run Creek

Johnson County, Indiana
Project DES#: 2002553
Existing Structure Number: BR-45-004
Prepared by HNTB – 12/15/2021

Fred S. Berry, P.E.
Registered Engineer No. 11500309
State of Indiana

Table of Contents

Attachments not included for brevity

1. Introduction

HNTB has been contracted by Indianapolis Department of Public Works (DPW) to design additional travel lanes for County Line Road from SR 37 to SR 135. The bridge carrying County Line Road over Pleasant Run Creek is proposed to be replaced as part of this. A hydraulic analysis was performed on this crossing in Johnson County, Indiana, 0.60 miles east of I-69. A bridge inspection conducted in July 2020 states that the bridge was built in 1973. It is three-span, prestressed concrete continuous bridge with an open span of approximately 129.5 feet and an out-to-out width of 31.5 ft.

A Construction in a Floodway (CIF) permit from Indiana Department of Natural Resources (IDNR) will be required. The existing and proposed bridge plans, Bridge Inspection Report with photographs, and general location map can be found, respectively, in ***Appendix A***.

2. Hydrologic Analysis

The drainage area for County Line Road crossing Pleasant Run Creek is 24.1 square miles. The bridge is also located within the mapped floodway for White River. Therefore, this stream is within the jurisdiction of IDNR Division of Water (DOW). Pleasant Run Creek, at this location, is located within a Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) floodway. The effective FIS reports and models, dated April of 2016 and January of 2021, were used to determine the 100-year flow rate. The highest values from the effective FIS models were used in the hydraulic analysis as the two FIS reports gave differing flow values at County Line Road. The FIS model uses variable flow, therefore a 100-year flow rate of 6,200 cfs is used upstream of RS 5071 and 6,700 cfs is used at RS 5071. The FIS report is included in ***Appendix B***.

3. Hydraulic Analysis/Modeling Procedure

The hydraulic analysis was performed using HEC-RAS software (Version 5.0.5) and analyzed for the peak 100-year discharges discussed in Section 2 of this report. This hydraulic analysis was performed per INDOT Hydraulic guidelines, DPW Stormwater Standards and IDNR's General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana. The study reach was estimated to be about 3,440 feet, using the equation from Section 3.5 of the General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana, based on an average hydraulic depth and channel slope of 6.68 feet and 0.199%, respectively. This estimated study reach was used as a guideline when determining the study reach to be modeled. The total modeled reach is approximately 3,800 feet.

3.1 Effective/Duplicate Effective Model

The effective FIS model for Pleasant Run Creek in Marion County, dated 2001, and the effective FIS model for Pleasant Run Creek in Johnson County, dated 2014, were downloaded from the IDNR Hydraulic Modeling Library for use in development of this hydraulic model. They were opened and run in HEC-RAS version 5.0.5. These two effective models were merged in this area to form the duplicate effective model.

3.2 Corrected Effective Model

A corrected effective model was developed to be a base model. The duplicate effective model was copied and truncated by removing all cross sections upstream of Johnson County FIS XS B (RS 7435), and all cross sections downstream of Marion County FIS XS E (RS 3689). Additional cross-sections were cut between the FIS cross-sections, including bounding cross-sections for the Pleasant Run Creek bridge. All the existing cross sections were digitized and georeferenced for use in ArcMap and HEC-RAS RAS Mapper. A corrected effective conditions cross section map can be found in ***Figure 2*** in ***Appendix C.*** Model input data is described in the following:

3.2.1 IDNR Previous Project Hydraulic Modeling Library Search

A search was completed of previously approved IDNR permits within the study reach to determine if there were old projects that needed to be taken into account. During the search, one project was identified that needed to be accounted for in the corrected effective and existing conditions models. FW-16732 was an approved permit from 1995 for fill within the floodway. The impacts from this permit included minor fill along the banks of Pleasant Run Creek at Marion County FIS XS E. Since this is within the study reach, the effects of this permit were included in the corrected effective and existing conditions model geometries. Review of the 1995 permit model showed that it was in the NGVD 29 datum. This was converted to NAVD 88 by subtracting 0.4 feet based on the 2016 Marion County FIS. The existing conditions Marion County FIS XS E incorporates the channel of the FIS cross section and the LiDAR terrain for the overbanks. For the corrected effective model, the overbanks were modified to reflect the pre-project geometry of the permit model. Since no other known work within the floodway has occurred at this location, the pre-project model was assumed to reflect 1973 conditions. Since Marion County FIS XS E is the most downstream model cross section and a known water surface elevation was used as the boundary condition, these changes are not reflected as water surface elevation changes at Marion County FIS XS E. However, the effects can be observed in the model results upstream of Marion County FIS XS E because the fill in the floodway increases the energy grade line at that cross section.

3.2.2 Cross Section Geometry

Survey data was collected by DLZ in October 2020 for the project area. The survey data consisted of physical survey points at the structures and in the channel, and aerial survey for the nearby area within the construction limits. Statewide LiDAR data from 2012 was obtained to use in the remaining study reach outside the survey limits. One terrain file was created for use in RAS Mapper by merging the survey data with the LiDAR data. The survey data makes up the terrain data within the construction limits.

The project construction limits lie between Marion County FIS XS E and Johnson County FIS XS E. The bridge bounding cross sections were created form the survey surface. All other cross sections were placed at locations of existing FIS cross sections. They use LiDAR data for the overbanks and FIS data for the channels.

Ineffective flow areas were designated based on topographic obstructions; a 2:1 expansion ratio was used downstream of obstructions.

3.2.3 Structures
There are two bridges within the project limits – from upstream to downstream, these are at County Line Road and Morgantown Road. The existing County Line Road bridge has an open span of 129.5 ft and is skewed 30 degrees. All bridges in the model were modified from their FIS models.

Ineffective flow locations were updated for all structures based on 2:1 expansion and 1:1 contraction ratios. Contraction and expansion coefficients were changed from 0.1 and 0.3 to 0.3 and 0.5 within the expansion and contraction areas.

3.2.4 Manning's Roughness Coefficients
Manning's n values within the channel and overbanks were modified from the original FIS due to the original roughness coefficients not being representative of the area as well as horizontal variation across cross-sections.

Manning's n values within the channel and floodplain were set using aerial imagery. Roughness values were set to vary horizontally and were measured from Google Earth imagery in RAS Mapper. Associated Manning's n values were found using figure 202-2C in the Indiana Design Manual (IDM).

3.2.5 Boundary Conditions
A peak discharge of 6,700 cubic feet per second (cfs) was used for the 100-year flow. These were taken from the effective FIS Report at the Johnson County Line.

The boundary condition for all models was the known water surface elevations for the 100-year for FIS XS E (RS 3689) of 675.2 ft. This was determined by the IDNR to be the appropriate value in a permit review conducted by the Division of Water.

3.3 Existing Conditions Model
The corrected effective model and existing conditions models are duplicates of one another with the effects of FW-16732 being applied as described in Section 3.2.1 of this report.

3.4 Proposed Conditions Model
The proposed conditions model is a duplicate of the existing conditions model, except the existing Pleasant Run Creek bridge is replaced with a new bridge.

The proposed bridge is a three-span option (40-ft span, 60-ft span, 40-ft span) with spill through abutments and an out-to-out deck width of 85 feet. The open span of this bridge is 137 feet and it is skewed 20˚.

The proposed bridge reduces the water surface from existing to proposed conditions at most locations. There is an increase just downstream of the County Line Road bridge but with the corrected effective it is still less than the 0.14 ft increase. Therefore, these bridges meet both INDOT and IDNR standards.

A detention pond is proposed to be built south of County Line Road and east of the Pleasant Run Creek bridge. Fill for the proposed pond encroaches into the current effective floodway

upstream of the new Pleasant Run Creek bridge. The proposed model was updated to include fill from the pond, represented in the model at RS 5486 and 6132 with blocked obstructions. Ineffective flow stations were applied to RS 5486, 6132 and 6939 to account for expansion and contraction due to the fill. Expansion and contraction coefficients were not changed due to this fill in the floodway because the fill is creating an abrupt contraction in the floodplain and thus does not require increased expansion and contraction coefficients. The pond layout with cross sections can be seen in ***Figure 3*** in ***Appendix C.*** A detention pond plan sheet can be found in ***Appendix C.***

4. Hydraulic Analysis/Modeling Results

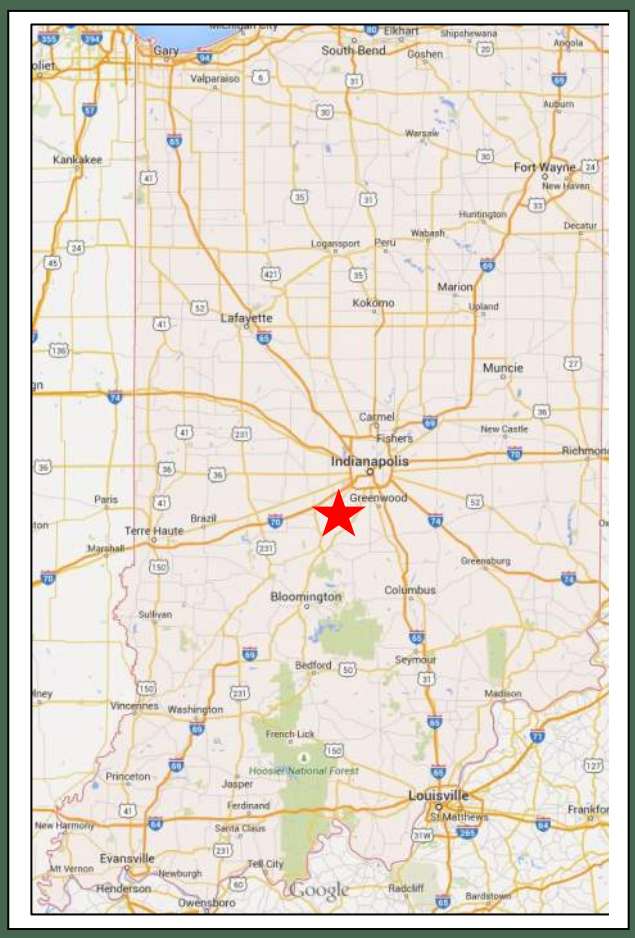
The hydraulic modeling calculations and results can be found in ***Appendix C*** and are summarized below in ***Tables 1 & 2***. The IDNR Project Evaluation Table is also illustrated in ***Appendix C***.

Table 1: County Line Road over Pleasant Run Creek Site Parameters

Drainage Area	24.1 square miles
Q_{100} Discharge	6,700 ft^3/s

Table 2: County Line Road over Pleasant Run Creek 100-year Hydraulic Results Summary

Parameter	Existing	Proposed
Structure	129.5 ft Opening Total Span Pressed Concrete Continuous Bridge	137 ft Opening Total Span Continuous Composite Steel Beam Bridge
Q_{100} Headwater Elevation	678.86 ft NAVD 1988	678.32 ft NAVD 1988
Road Overflow Area	0 ft^2	0 ft^2
Q_{100} Average Velocity	8.94 ft/s	7.51 ft/s
Minimum Low-Structure Elevation	679.98 ft NAVD 1988	679.47 ft NAVD 1988
Skew	30	20



Project Location Map

Hydraulic Analysis Report

County Line Road over Buffalo Creek Bridge Replacement

Date: Mar 22, 2021
Resubmittal: May 21, 2021
Resubmittal: June 2, 2021

Overall Project Des Number: 2002553, Str Des Number: 2100122

Existing Str Number: BRM-B107(1)

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Hydraulic Analysis Report
Bridge Replacement for County Line Road over Buffalo Creek

Johnson County, Indiana
Project DES#: 2002553
Existing Structure Number: BRM-B107(1)
Prepared by HNTB – 6/2/2021

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Table of Contents

Attachments not included for brevity

1. Introduction

HNTB has been contracted by Indianapolis Department of Public Works (DPW) to design additional travel lanes for County Line Road from SR 37 to SR 135. The bridge carrying County Line Road over Buffalo Creek is proposed to be replaced as part of this. A hydraulic analysis was performed on this crossing in Johnson County, Indiana, 0.55 miles west of Meridian St on the Marion/Johnson County Line. A bridge inspection conducted in July 2018 states that the bridge was built in 1987. It is a three-span, concrete continuous bridge with an open span of approximately 79.5 feet and an out-to-out width of 47.0 ft.

A Construction in a Floodway (CIF) permit from Indiana Department of Natural Resources (IDNR) will be required. The existing and proposed bridge plans, Bridge Inspection Report with photographs, and general location map can be found**,** respectively, in ***Appendix A***.

2. Hydrologic Analysis

The drainage area for County Line Road crossing Buffalo Creek is 3.45 square miles. Therefore, this stream is within the jurisdiction of IDNR Division of Water (DOW). Buffalo Creek, at this location, is located at the downstream end of a Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) floodway for Marion County. The effective FIS for Marion County, dated 2003, was used to determine the 100-year and 500-year flow rates used in the model. The 100-year and 500-year flow rates at the bridge crossing are 2,300 cfs and 3,100 cfs, respectively. The effective FIS flow rates vary within the study reach. The 100-year and 500-year flow rates are applied to the model as described below in **Table 1.** The FIS model uses variable flow, therefore two more flow rates are used starting at unique stations. The FIS report is included in ***Appendix B***.

Table 1: Effective FIS Flow Rates and Locations Applied

Model River Stations	100-Year Flow Rate (cfs)	500-Year Flow Rate (cfs)
6864	2,000	2,650
5265	2,050	2,750
4390	2,300	3,100

3. Hydraulic Analysis/Modeling Procedure

The hydraulic analysis was performed using HEC-RAS software (Version 5.0.5) and analyzed for the peak 100-year discharge. This hydraulic analysis was performed per INDOT Hydraulic guidelines, DPW Guidelines, and IDNR's General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana. The study reach was estimated to be about 876 feet, using the equation from Section 3.5 of the General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana, based on an average hydraulic depth and channel slope of 2.57 feet and 0.365%, respectively. This estimated study reach was used as a guideline when determining the study reach to be modeled. The total modeled reach is approximately 5,905 feet.

3.1 Effective/Duplicate Effective Model

The effective FIS model for Marion County, dated 2003, was downloaded from the IDNR Hydraulic Modeling Library. The downstream end of the model extends into Johnson County and was utilized for development of the corrected effective model. It was opened and run in HEC-RAS version 5.0.5. This is the duplicate effective model.

This stream does not have a FEMA delineated floodway in Johnson County. However, the Marion County FIS model extends into Johnson County beyond the model reach for this bridge replacement model. And, IDNR has developed a model and DNR floodway available on the IDNR website. This model (FI-14922, developed in 2001) uses the same geometry as the effective Marion County FIS model. But the FI-14922 model resulted in IDNR effective floodway and water surface elevations. The water surface elevation of 693.9 ft NAVD 88 from IDNR XS C as seen on the Indiana Floodplain Information Portal was used as the downstream boundary condition for the 100-year event.

3.2 Corrected Effective Model

A corrected effective model was developed to be a base model. The duplicate effective model was copied and truncated by removing all cross sections upstream of Marion County FIS XS F (RS 6864). Although the FIS model is from 2003, the vertical datum appears to be NGVD 29 based upon comparisons between the FIS profile and the model profile. Therefore, FIS data used in the corrected effective model has had elevations reduced by 0.4 feet based on the FIS report.

Additional cross-sections were cut between the FIS cross-sections, including bounding cross-sections for the Buffalo Creek bridge. All the existing cross sections were digitized and georeferenced for use in ArcMap and HEC-RAS RAS Mapper. A corrected effective conditions cross section map can be found in ***Figure 2*** in ***Appendix C.*** Model input data is described in the following:

3.2.1 IDNR Previous Project Hydraulic Modeling Library Search

A search was completed of previously approved IDNR permits within the study reach to determine if there were old projects that needed to be taken into account. No projects that needed to be included were found within the project limits.

FI-14922, a floodway determination model in Johnson County, was utilized in model development. This was previously described in Section 3.1.

3.2.2 Cross Section Geometry

Survey data was collected by DLZ in October 2020 for the project area. The survey data consisted of physical survey points at the structures and in the channel, and aerial survey for the nearby area within the construction limits. Statewide LiDAR data from 2012 was obtained to use in the remaining study reach outside the survey limits. One terrain file was created for use in RAS Mapper by merging the survey data with the LiDAR data. The survey data makes up the terrain data within the construction limits, and the LiDAR data fills in the rest of the terrain within the study reach.

The project construction limits lie between Marion County FIS XS B (RS 3841) and RS 2738 in

Johnson County. Additional cross-sections were created to more accurately represent flow conditions. For cross-sections developed using LiDAR data, channel data was edited to match FIS cross-section geometry and channel slope. For several cross-sections, the LiDAR channel bottom was lower in elevation than the adjusted FIS channel bottom. In these cases, the LiDAR channel data was used. Bounding cross-sections for the bridge were developed using the survey surface.

Ineffective flow areas were designated based on topographic obstructions.

3.2.3 Structures

There are two bridges within the project limits – from downstream to upstream, these are at County Line Road and Country Woods Drive, at RS 5750. The County Line Road bridge has an open span of 79.5 ft and is skewed 35 degrees. The County Line Road bridge was based on survey data and supplemented with existing plans, which can be found in ***Appendix A.*** All bridges in the model were modified from their FIS models.

Ineffective flow locations were updated for all structures based on 2:1 expansion and 1:1 contraction ratios. Contraction and expansion coefficients were changed from 0.1 and 0.3 to 0.3 and 0.5 within the expansion and contraction areas.

3.2.4 Manning's Roughness Coefficients

Manning's n values within the channel and overbanks were modified from the original FIS due to the original roughness coefficients not being representative of the area as well as horizontal variation across cross-sections.

Manning's n values within the channel and floodplain were set using aerial imagery. Roughness values were set to vary horizontally and were measured from Google Earth imagery in RAS Mapper. Associated Manning's n values were found using figure 202-2C in the Indiana Design Manual (IDM).

3.2.5 Boundary Conditions

A known water surface elevation of 693.9 ft NAVD 88 from IDNR XS C as seen on the Indiana Floodplain Information Portal was used as the downstream boundary condition for the 100-year event. The 500-year boundary condition was estimated to be 0.6 feet higher than the 100-year based on comparison of the 100-year and 500-year profiles in the Marion County FIS report. The FIS report is included in ***Appendix B***.

3.3 Existing Conditions Model

The corrected effective model and existing conditions models are duplicates of one another.

3.4 Proposed Conditions Model

The proposed conditions model is a duplicate of the existing conditions model, except the existing Buffalo Creek bridge is replaced with a new bridge.

The proposed bridge is a three-span option (34-ft span, 41-ft span, 34-ft span) with spill through abutments and an out-to-out deck width of 84 feet and 2 inches. The open span of this bridge is 106 feet and it is skewed 35˚.

The proposed bridge reduces the water surface from existing to proposed conditions at all locations.

3.5 Natural Conditions Model

The natural conditions model was created by copying the proposed conditions model and deleting bridges and the effects from the bridge expansion and contraction.

4. Hydraulic Analysis/Modeling Results

The hydraulic modeling calculations and results can be found in ***Appendix C,*** and are summarized below in ***Tables 2 & 3***:

Table 2: County Line Road over Buffalo Creek Site Parameters

Drainage Area	3.45 square miles
Q_{100} Discharge	2,300 ft^3/s
Q_{100} Elevation	702.09 NAVD 1988

Table 3: County Line Road over Buffalo Creek 100-year Hydraulic Results Summary Table

Parameter	Existing	Proposed
Structure	79.5 ft Total Opening Span Concrete Continuous Bridge	106 ft Total Opening Span Reinforced Concrete Slab Bridge
Q_{100} Headwater Elevation	705.44 ft NAVD 1988	704.90 ft NAVD 1988
Backwater at Q_{100}	2.89 ft	2.35 ft
Gross Waterway Area Below Q_{100} Elevation	168.95 ft^2	188.15 ft^2
Road Overflow Area	0 ft^2	0 ft^2
Q_{100} Average Velocity	11.75 ft/s	10.28 ft/s
Minimum Low-Structure Elevation	706.52 ft NAVD 1988	706.36 ft NAVD 1988
Skew	35	35

4.1 Scour Analysis

HEC-RAS scour analysis was used to determine the depth and elevation of scour for the proposed bridge. The scour analyses assumed a particle size of 0.01 mm and were performed using the 100-year and 500-year flows. The results of the scour calculations are shown below in ***Tables 4 & 5:***

Table 4: 1% Exceedance Probability Scour Analysis	
Parameter	**Proposal 1**
Contraction Scour	7.34 ft
Pier Scour	4.71 ft
Total Scour	12.05 ft
Flow Line Elevation	696.43 ft
Low Scour Elevation	684.38 ft
Maximum Velocity	12.98 ft/s

Table 5: 0.2% Exceedance Probability Scour Analysis	
Parameter	**Proposal 1**
Contraction Scour	8.64 ft
Pier Scour	7.81 ft
Total Scour	16.45 ft
Flow Line Elevation	696.43 ft
Low Scour Elevation	679.98 ft
Maximum Velocity	14.30 ft/s

The HEC-RAS calculated scour report is included in ***Appendix C***. Contraction scour was analyzed using the live bed equation. The 500-year total scour exceeds the 100-year total scour for the bridge. Abutments shall be lined with Class 2 riprap in accordance with Indiana Design Manual Figure 203-3B. Pier piles shall be driven below the 500-year scour elevation to avoid scour, per the Indiana Design Manual.