

# MAD-UNI-FRA 161 Study

ODOT District 6  
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## Introduction

The area surrounding SR 161 corridor on the northwest side of Central Ohio is experiencing large scale development at a rapid pace. These developments are a mix of on-going and anticipated developments, with varying land use intensities and access needs. This SR 161 corridor study evaluated the impacts of the anticipated development to the SR 161 corridor between US 42 in Plain City (Union/Madison County) and US 33 interchange in Dublin (Union/Franklin County). This development area and the 6-mile long SR 161 corridor extend across several jurisdictions, including the village of Plain City, Madison County, Union County, Franklin County, the city of Dublin, and the townships of Darby, Jerome, and Washington.

For each development project, as rezoning or site development plans were prepared, traffic impact studies were conducted that concentrated on a limited number of intersections rather than assessing the entire corridor. This approach does not offer a comprehensive evaluation of the impacts throughout the corridor.

This comprehensive study documented available traffic impact studies and development site plans, and estimated trip generation for remaining parcels with some assumptions where data was unavailable. Future peak hour trips have been estimated, and traffic operations were analyzed to determine the effects of future growth on corridor performance. Based on the findings, the study identified necessary roadway improvements to maintain acceptable levels of service (LOS) and developed conceptual plans with planning-level cost estimates.

The findings provide valuable insights for future planning by illustrating the potential impacts of growth on the corridor and identifying necessary measures to maintain efficient traffic flow and preserve the operational integrity of SR 161 as an essential regional corridor.

## Study Area

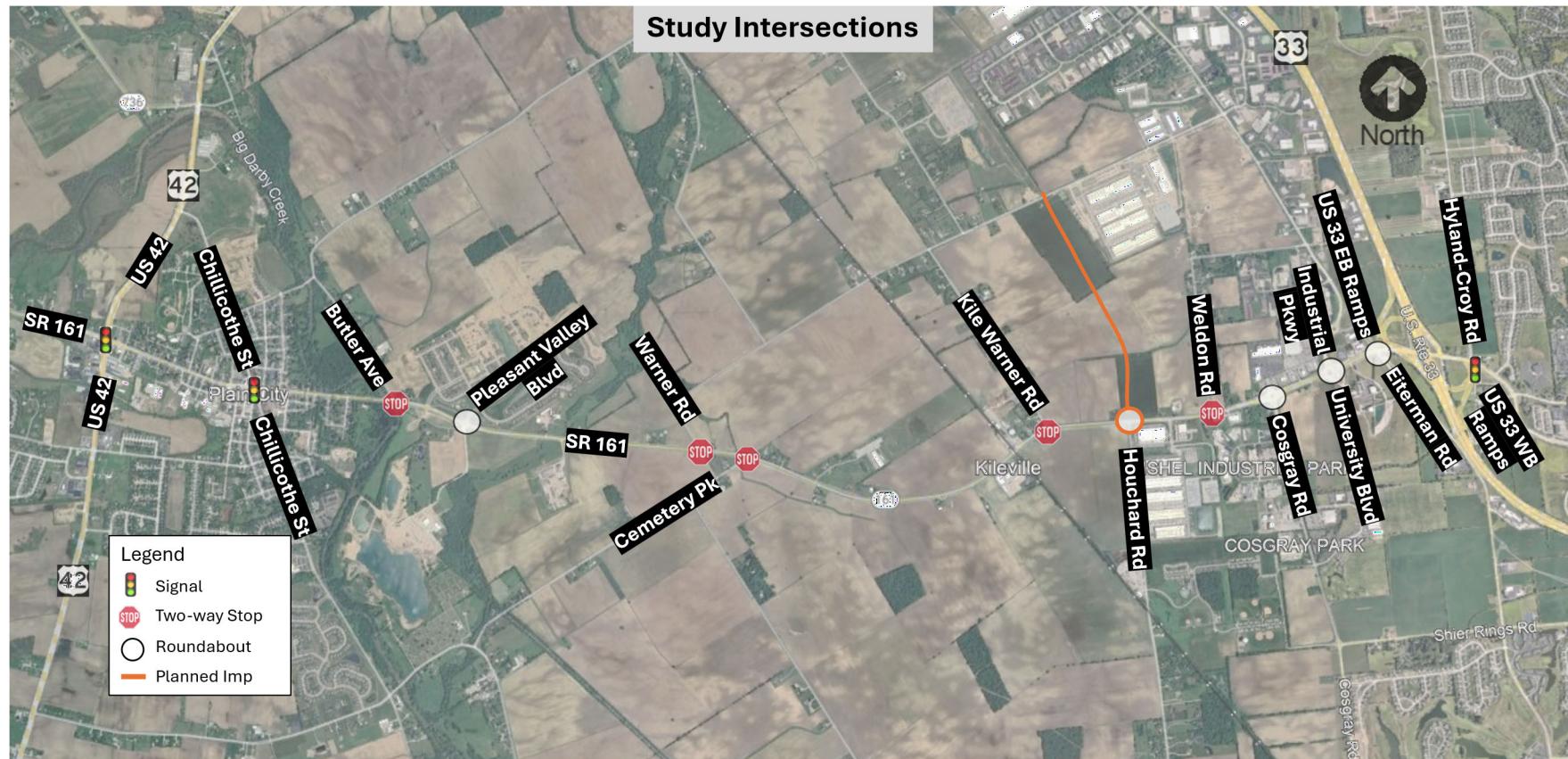
The following intersections were included for analysis. The project location map is shown in **Figure 1** and the study area is shown in **Figure 2**.

- SR 161 @ US 42
- SR 161 @ Chillicothe St
- SR 161 @ Butler Ave
- SR 161 @ Pleasant Valley Blvd
- SR 161 @ Kile Warner Rd
- SR 161 @ Cemetery Pk
- SR 161 @ Madison Gateway Access
- SR 161 @ Kile-Warner Rd
- SR 161 @ Houchard Rd
- SR 161 @ Weldon Rd
- SR 161 @ Cosgray Rd
- SR 161 @ Industrial Pkwy
- SR 161 @ US 33 EB Ramps / Eiterman Rd
- SR 161 @ US 33 WB Ramps / Hyland-Croy Rd

FIGURE 1: PROJECT LOCATION MAP



FIGURE 2: STUDY AREA MAP



## Development Details

Several residential, industrial, flex innovation/research, office and commercial development projects within the study area are close to completion, on-going, planned/approved or under planning/rezoning steps. The development area covered in this study is shown on Figure 3 and additional details for each development are listed below:

### Plain City

- Darby Station
- Madison Meadows
- The Run at Hofbauer Preserve
- The Hamlet on Darby
- Jefferson Village
- Madison Meadows II
- Maren Reserve
- The Spot
- Beachy Farms
- Oak Grove
- OFX Commerce Park
- Creekview Commerce Park
- Fischer Homes/Noah Beachy Farms
- Pulte Homes
- Arbor Homes

### Jerome Township/Union County

- Jerome Township Innovation District
- Residential Development (Area D)
- Industrial/Flex Innovation Space (Area G)
- Weldon Development

### Darby Township/ Madison County

- Greensquare
- Industrial Development (Area C)
- Madison Gateway
- Mixed Use Developments (Area E, Area F)

### Dublin

- Cosgray Commons
- OU Campus Expansion
- West Dublin Passenger Rail Station (Area A)

## Trip Generation & Distribution

### Trip Generation

Trip generation estimates were developed using the ITE Trip Generation Manual, 11th Edition. For developments with existing TISs including the JTID, Noah/Beachy Farms, Madison Gateway, Creekview Commerce, Weldon Development, trip generation was based on the land uses and volumes reported in those studies. For all other known developments or assumed developments without TIS data, the anticipated land use type and density assumptions are based on available land use plans, zoning maps or comprehensive plans. Trips have been estimated using the applicable ITE land use codes and standard rates.

A summary of trip generation estimates for the study area is provided in **Table 1**, which includes both developments confirmed through Traffic Impact Studies (TISs) and assumed developments for the area. Detailed land use data by development and the ITE trip generation data are included in **Appendix A**. This trip generation may not include internal capture or pass-by reductions for all developments. Additionally, trip distribution is not

considered in these tables; some traffic shown may not access SR 161 corridor or the study intersections.

FIGURE 3: STUDY AREA DEVELOPMENTS

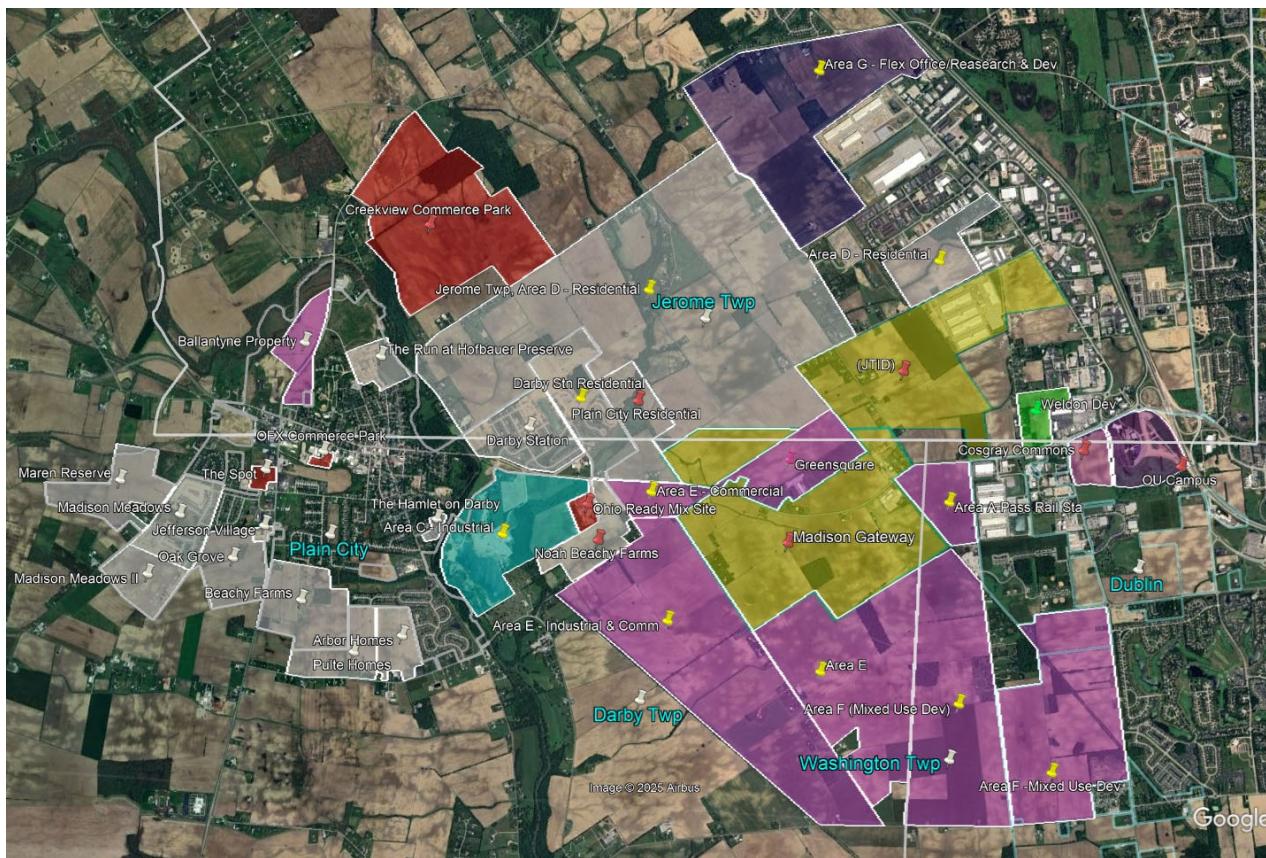


TABLE 1: TRIP GENERATION SUMMARY

Land Use Category	Size	Units	AM Peak			PM Peak		
			Total	Enter	Exit	Total	Enter	Exit
Industrial/ Manufacturing	3,729	KSF	2,959	2,333	626	2,889	762	2,127
	2,200	Emp						
Residential	13,299	DU	6,517	1,627	4,890	8,125	5,047	3,078
	300	beds						
Hotel/Retail	1,126	KSF	4,627	2,593	2,034	8,310	4,183	4,127
Office/Business	2,326	KSF	5,744	4,896	848	5,763	1,110	4,653
	5,800	Emp						
Total Trips			19,847	11,449	8,398	25,087	11,102	13,985

## Trip Distribution

Trip distribution percentages were assigned for each development based on the existing street network and engineering judgement. Along with the existing network, Houchard Road extension from SR 161 to Warner Road is assumed to be in place by 2030. The trip distribution percentages by development are included in **Appendix A** along with the land use and trip generation info.

Site trips for each of the study area developments have been assigned to the study intersections, and the resulting development traffic plates are also included in **Appendix A**.

# Traffic Volume Estimates

## Data Collection

Turning movement counts were available for several study intersections along the SR 161 corridor, collected between 2022 and 2025. These intersections include:

- SR 161 @ US 42 (Mar 25)
- SR 161 @ Chillicothe St (Mar 25)
- SR 161 @ Butler Ave SR 161 (Mar 25)
- SR 161 @ Pleasant Valley Blvd (Oct 24)
- SR 161 @ Warner Rd (Oct 24)
- SR 161 @ Cemetery Pk (Oct 24)
- SR 161 @ Kile-Warner Rd (Dec 22)
- SR 161 @ Houchard Rd (Jan 24)
- SR 161 @ Weldon Rd (Oct 22)
- SR 161 @ Cosgray Rd (Oct 22)

Turn count reports are included in [Appendix B](#).

## Background Volume Plates

Additional data sources have been utilized to establish the base traffic and to estimate background traffic for the three future scenario years (2030, 2040 and 2050).

- **Certified Traffic Volumes:** Certified traffic data from the US 33/SR 161 project (PID 80478) was used for the SR 161 corridor from Industrial Parkway/University Boulevard to Hyland Croy Road intersection including the US 33 interchange ramps. This data was used for traffic estimates in the eastern portion of the study area.
- **Peak to Design Hour Factors:** The ODOT published 'Peak Hour to Design Hour Factor' report data was utilized to convert the AM and PM peak count data to design hour volumes based on a given day of the month (traffic count).
- **MORPC Growth Rates:** Future traffic projections were developed using growth rates provided by the Mid-Ohio Regional Planning Commission (MORPC). These rates were applied to adjusted design hour volumes to estimate background traffic growth through the design years.

Volume smoothing and balancing were performed for the SR 161 intersections by taking existing driveways and adjacent land uses into account.

Background traffic plates are also included in [Appendix C](#).

## Future Build Volume Plates

Future Build traffic volumes were estimated by combining background traffic and development traffic from planned and approved projects. Traffic volume projections were prepared for three future years with the following assumptions on the amount of development traffic:

- **2030** – 2030 background volumes plus 30% of development traffic
- **2040** – 2040 background volumes plus 60% of development traffic
- **2050** – 2050 background volumes plus 100% of development traffic

Build traffic volume plates are also included in [Appendix C](#).

## Capacity Analysis

Intersections are graded using a level of service (LOS) designation expressed in terms of letter grades. Level of service is a quality measure describing operational conditions of a traffic stream with LOS A representing the highest quality traffic flow and minimal delay, and LOS F representing poor traffic operations, considerable delay, and substantial queueing.

**TABLE 2: LOS THRESHOLDS - INTERSECTIONS**

Level of Service	Signalized Intersection	Unsignalized Intersection
	Average Total Delay (sec/veh)	Average Total Delay (sec/veh)
A	≤10	≤10
B	>10 and ≤20	>10 and ≤15
C	>20 and ≤35	>15 and ≤25
D	>35 and ≤55	>25 and ≤35
E	>55 and ≤80	>35 and ≤50
F	>80	>50

HCS software was the default program utilized for the analysis, however, SIDRA software was used for multi-lane roundabouts since HCS software couldn't accurately evaluate the multi-lane roundabout configurations. Further, the SR 161 corridor between Cosgray Road and the Hyland Croy Road/US 33 WB ramps intersection has been analyzed with Transmodeler software due to the complexity of these 4 closely spaced intersections along with some free-flow ramps at SR 161/US 33 interchange. Intersection capacity was evaluated under the AM and PM peak periods for the 2030 and 2040 scenarios using the Build volume plates.

The existing intersection configuration, the current FRA-33/SR 161 interchange improvements project (PID 80748) along with the committed improvements under JTID Phase 1 will be the basis for the 2030 No-build analysis.

- The SR 161 and Houchard Road intersection will open as a roundabout with one entry lane per approach and a westbound right-turn bypass lane. The intersection footprint will be designed for a long-term multi-lane roundabout with two through lanes in each direction along SR 161, and a dedicated southbound left turn lane.
- When the Madison Gateway development comes on board, it is anticipated that their access point on SR 161 will be a roundabout.

The 2030 No-build geometry is shown on **Figure 4**.

### 2030 No-Build Analysis

Capacity analysis results for the section from US 42 to Weldon Road are presented in **Table 3**. Results for the SR 161 corridor between Cosgray Road and the Hyland Croy Road/US 33 WB ramps intersection, analyzed with TransModeler, are shown in **Table 4**. The HCS and SIDRA summary reports are included in **Appendix D**, and detailed TransModeler results are included in **Appendix E**.

The LOS results indicate that several intersections along the SR 161 corridor will experience LOS F on multiple approaches and, four intersections experience an overall intersection LOS

F during both peak periods. The SR 161 intersections with Warner Road, Cemetery Pike, Kile Warner Road, Houchard Road, Weldon Road and the segment between Industrial Parkway and the Hyland Croy Road/US 33 WB ramps show particularly poor operational conditions, with extreme delays and substantial queuing observed on northbound and southbound approaches. Improvements will be necessary at these intersections to achieve an acceptable LOS and improve traffic flow throughout the corridor.

FIGURE 4: 2030 NO-BUILD GEOMETRY

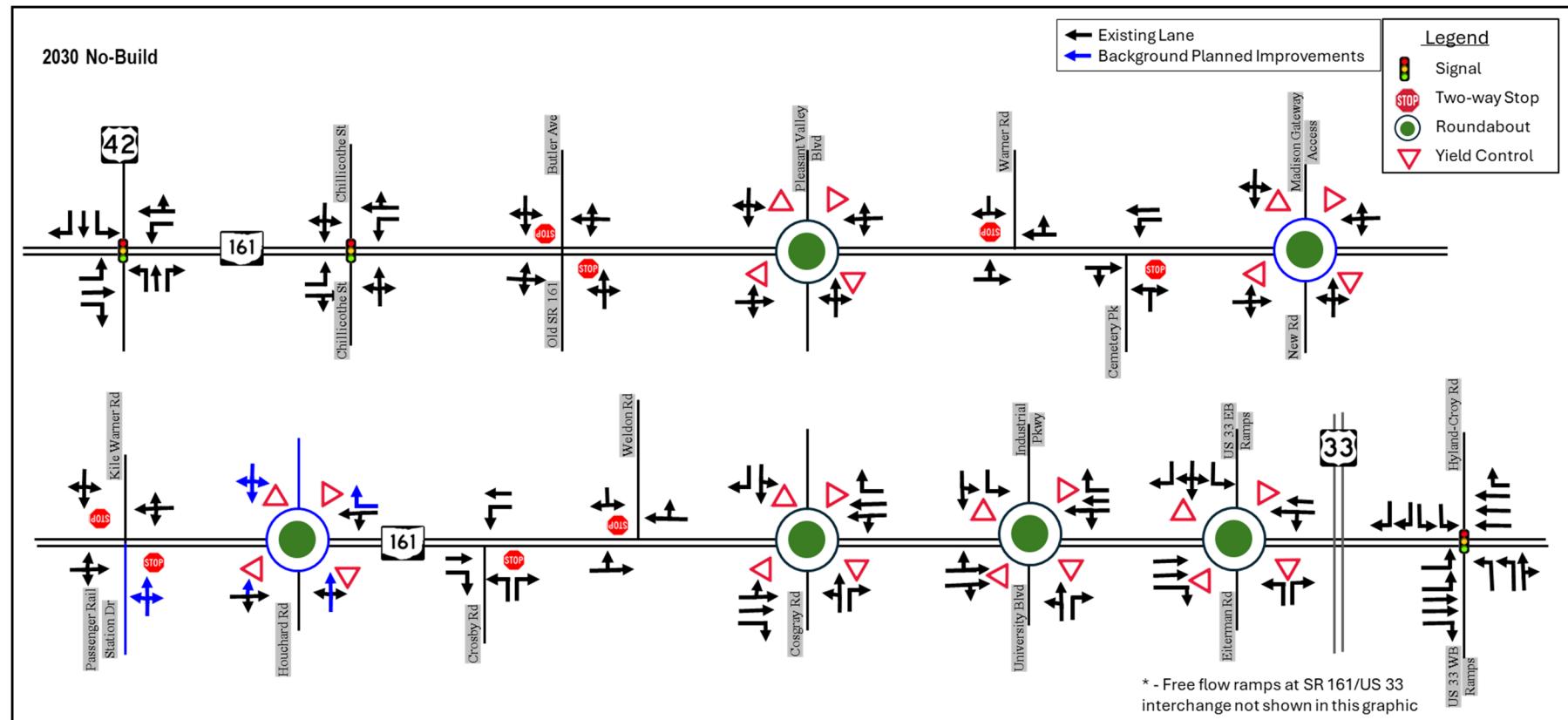


TABLE 3: 2030 LOS SUMMARY – NO BUILD SCENARIO

Intersection	AM PEAK					PM PEAK				
	EB Approach	WB Approach	NB Approach	SB Approach	Overall Int	EB Approach	WB Approach	NB Approach	SB Approach	Overall Int
SR 161 & US 42 (Signal)	C/25.0	C/28.4	C/29.2	C/25.8	<b>C/27.2</b>	C/31.2	C/32.1 (0.92)	C/24.2	D/35.6	<b>C/30.7</b>
SR 161 & Chillicothe St (Signal)	B/16.2	B/12.3	C/22.5	C/21.9	<b>B/16.8</b>	B/13.4	C/30.1 (0.95)	<b>E/59.6 (0.97)</b>	D/40.8	<b>C/31.7</b>
SR 161 & Butler Ave (Two-way Stop)	A/0.3	A/0.0	E/40.6 (0.01)	F/73.0 (0.52)	N/A	A/0.7	A/0.0	-	F/236.0 (0.96)	N/A
SR 161 & Pleasant Valley Blvd (Single Lane Roundabout)	C/16.8	A/7.6	A/9.4	A/6.0	<b>B/12.7</b>	B/10.2	D/34.7 (0.96)	A/7.8	B/13.3	<b>C/24.7</b>
SR 161 & Warner Rd (Two-way Stop)	A/1.2	-	-	F/246.1 (1.28)	N/A	A/2.1	-	-	F/300+ (3.90)	N/A
SR 161 & Cemetery Pk (Two-way Stop)	-	A/6.9	F/956.9 (2.96)	-	N/A	-	B/14.7	F/300+	-	N/A
SR 161 & Madison Gateway Access (Single Lane Roundabout)	F/102.4 (1.17)	B/12.3	C/16.5	A/8.8	<b>F/61.9</b>	F/56.4 (1.04)	F/198.0 (1.40)	C/16.6	E/49.9 (0.76)	<b>F/130.8</b>
SR 161 & Kile Warner Rd (Two-way Stop)	A/3.0	A/0.7	F/300+ (1.02)	F/300+ (4.09)	N/A	A/6.2	A/2.7	F/300+ (34.67)	F/300+	N/A
SR 161 & Houchard Rd (Single Lane Roundabout)	F/243.5 (1.50)	C/18.7	D/34.8	C/18.5	<b>F/134.3</b>	F/147.0 (1.28)	F/300+ (1.75)	F/98.0 (1.02)	F/163.7 (1.16)	<b>F/232.2</b>
SR 161 & Crosby Rd (Two-way Stop)	-	A/2.7	F/66.1 (0.22)	-	N/A	-	A/0.7	F/155.2 (1.03)	-	N/A
SR 161 & Weldon Rd (Two-way Stop)	A/5.5	-	-	F/300+ (5.13)	N/A	C/19.4	-	-	F/300+	N/A

Legend: A/10.0 - LOS/Delay in secs per veh; (0.10) – volume/capacity ratio, included for movements with LOS E/F or v/c over 0.90

TABLE 4: 2030 LOS SUMMARY – NO BUILD SCENARIO - COSGRAY TO HYLAND CROY (TRANSMODELER RESULTS)

Intersection	Appr.	Mvmt	2030 AM			2030 PM		
			LOS	Delay secs/veh	Queue (ft) Mean	LOS	Delay secs/veh	Queue (ft) Mean
SR 161, Cosgray Road (Roundabout)	Overall		A	5.9		C	22.5	
	EB	T	A	5.8	5.6	C	15.1	32.6
		T	A	6.1	8.3	C	16.6	47.2
		R	A	1.6	0	A	2.6	0.2
	WB	T	A	3.7	2	B	10.0	23.6
		T	A	3.1	1.3	A	6.5	10.7
		R	A	1.3	0	A	1.6	0
	NB	LT	B	11.1	7.7	C	18.1	40.8
		R	B	13.8	19.1	B	10.2	10.1
	SB	LT	B	11.1	2	F	191.3	318.5
		R	A	4.1	0.3	F	86.2	2.3
Industrial Parkway & SR 161 (Roundabout)	Overall		F	86.3		F	125	
	EB	LT	E	49	160.6	A	5.7	8.4
		TR	E	42.4	130.7	A	4.9	5.4
	WB	LT	A	6.8	9	F	63	84
		TR	A	7	8.7	F	76.5	103.2
	NB	LT	D	29.7	14.8	D	34.7	33.2
		R	C	20.1	6.9	B	11.4	6.6
	SB	L	F	336.5	835.3	F	1060.6	1674.5
		LTR	F	598.1	956.5	F	1583.2	1589.4
SR 161, US 33 EB Off-Ramp to SR 161 & Eiterman Road (Roundabout)	Overall		F	58.7		F	83.9	
	EB	T	E	35.7	28.2	A	8.9	1.5
		T	F	63.6	140.9	C	16.1	7.2
		R	D	26.1	0	A	3.8	0
	WB	LT	A	9.1	4.4	D	32.9	17.5
		T	A	9.7	3.4	E	47.7	70.8
	NB	TR	D	32	24.3	F	1156.1	1323.8
		R	C	21.4	11.4	F	1084.7	429.7
	SB	L	F	633.3	14.3	F	1200.3	62.5
		LTR	F	858.1	1405.7	F	1697	1635.2
SR 161, US 33 Off-Ramp to SR 161 & Hyland-Croy Road (Signal)	Overall		D	35.6		C	33.4	
	EB	L	E	55.2	15.1	E	68.5	23
		L	E	55.6	14.5	E	75.7	22.2
		T	C	33.1	56.3	C	28.9	42.7
		T	C	34.3	52.6	C	29.4	41.1
	WB	T	D	41.7	40.9	D	37.9	60.7
		T	D	45.2	56.1	D	42.9	76.5
		T	D	46.7	66	D	45	90.6
		R	A	6.9	2	B	17.1	24.2
	NB	L	C	34.7	110.2	C	31.8	94.1
		L	D	35.7	108.9	C	32.9	92.8
		TR	B	19.4	25.2	C	24.6	63.7
	SB	L	D	48.1	37.2	D	51.1	11.4
		L	D	47.4	35.8	D	50.9	12.3
		R	D	38.2	55.2	D	39.4	37.1
		R	C	24.3	39.2	C	22.7	23.4

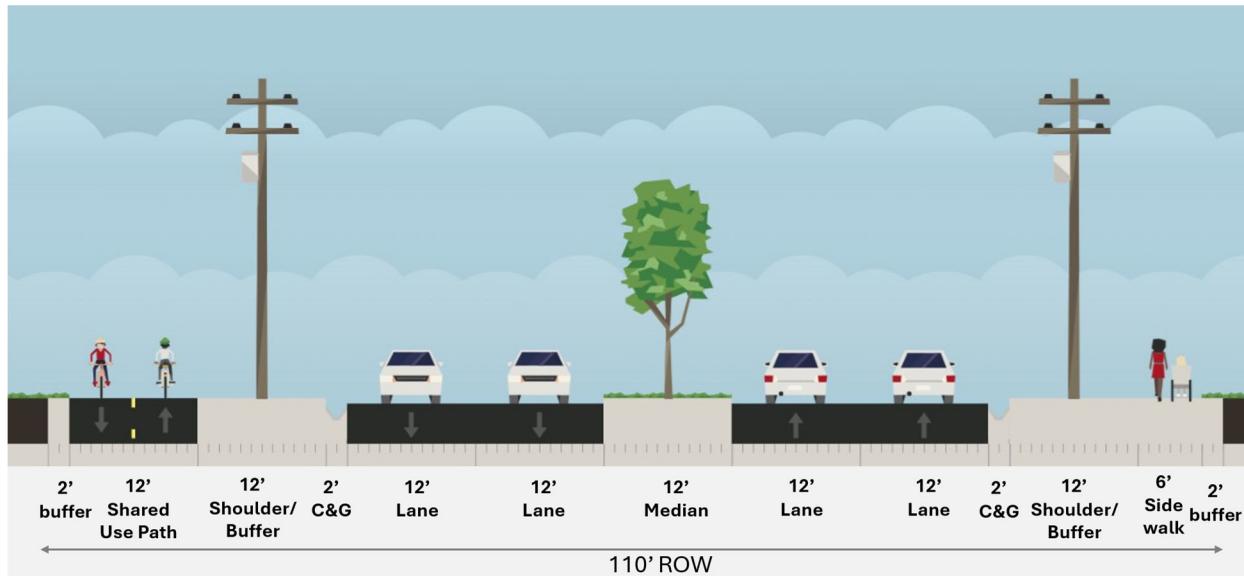
## 2030 Build Analysis

Capacity improvements are required for the SR 161 corridor between Warner Road and Cosgray Road to meet projected traffic demand. These improvements include:

- Widening of SR 161 corridor to a four-lane divided roadway from west of Cosgray Road to west of Warner Road.
- Intersection improvements include roundabouts at Weldon Road, Kile-Warner Road and a combined Warner Road/Cemetery Pike.

A typical section for the four-lane divided SR 161 corridor is shown on Figure 5. Figure 6 graphically shows the study intersection configurations.

**FIGURE 5: SR 161 CORRIDOR -FOUR LANE DIVIDED ROADWAY TYPICAL SECTION – 2030/PHASE I**



In the 2030 Build scenario, intersections along SR 161 from US 42 to Pleasant Valley Boulevard, as well as the intersections from Cosgray Road and the Hyland-Croy Road/US 33 WB ramps have no geometric changes and operate same as the 2030 No-Build scenario. Capacity analysis results for the 2030 Build scenario are presented in **Table 5**. The study intersections from the combined Warner Road/Cemetery Pike to Weldon Road have proposed improvements along with the widening of the SR 161 corridor. All these intersections are expected to operate at C or better during both the AM and PM peaks.

The intersection of SR 161 with Industrial Parkway will include a southbound bypass right turn lane, while this improvement provides some relief, this intersection is expected to continue to operate at LOS F under both peaks. **Appendix F** includes the 2030 Build capacity analysis reports. During the AM peak, southbound approaches will experience LOS F conditions at the Industrial Parkway and the US 33 EB ramps intersections.

During the PM peak, the roundabout intersections with the US 33 EB ramps and Industrial Parkway will be 10% over-capacity.

FIGURE 6: 2030 BUILD/PHASE I SCENARIO – INTERSECTION GEOMETRY

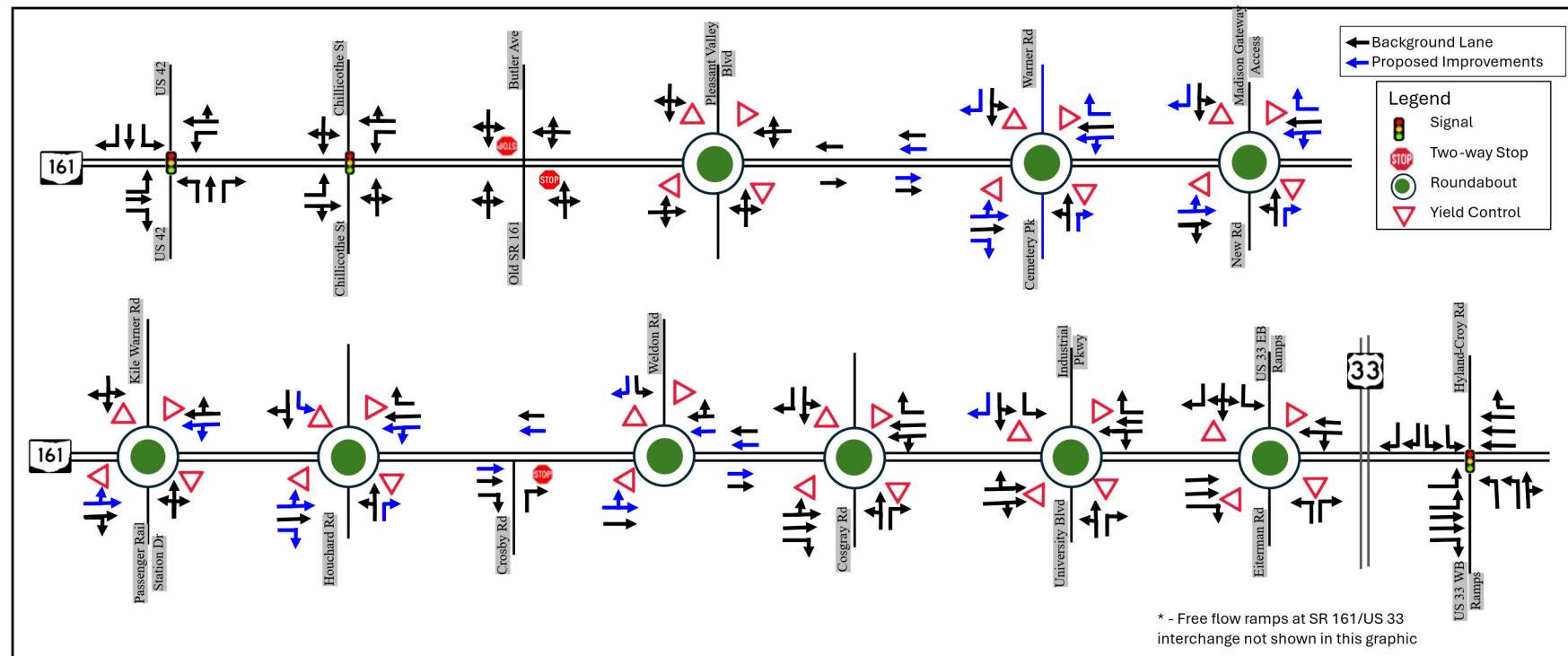


TABLE 5: 2030 LOS SUMMARY – BUILD SCENARIO

Intersection	AM PEAK					PM PEAK				
	EB Approach	WB Approach	NB Approach	SB Approach	Overall Int	EB Approach	WB Approach	NB Approach	SB Approach	Overall Int
SR 161 & US 42	SAME AS No Build-2030									
SR 161 & Chillicothe St										
SR 161 & Butler Ave										
SR 161 & Pleasant Valley Blvd										
SR 161 & Warner Rd / Cemetery Pk	A/8.9	A/5.0	C/18.2	A/7.2	<b>A/9.1</b>	A/9.5	A/9.8	B/10.7	D/30.3	<b>B/12.0</b>
SR 161 & Madison Gateway Access	A/9.9	A/5.0	B/12.2	A/7.0	<b>A/8.0</b>	A/8.9	A/9.6	B/11.2	C/21.8	<b>B/10.2</b>
SR 161 & Kile Warner Rd	B/14.1	A/6.8	C/20.6	B/12.7	<b>B/11.9</b>	B/10.3	B/10.9	B/10.6	D/25.6	<b>B/10.3</b>
SR 161 & Houchard Rd	B/12.0	A/5.7	C/15.5	A/9.4	<b>A/9.8</b>	A/9.6	C/16.2	C/19.8	D/25.9	<b>B/14.6</b>
SR 161 & Weldon Rd	A/9.0	A/6.5		A/8.3	<b>A/8.0</b>	A/9.7	B/12.5		C/23.4	<b>B/12.1</b>
SR 161/Cosgray Road	SAME AS No Build-2030									
SR 161 & Industrial Pkwy/ University Blvd	<b>E/45.5</b>	A/7.1	D/29.3	<b>F/231.1</b>	<b>F/64.0</b>	A/5.9	<b>F/73.9</b>	D/26.4	<b>F/300+</b>	<b>F/121.4</b>
SR 161 & US 33 EB Off-Ramp & Eiterman Road	SAME AS No Build-2030									
SR 161 & US 33 WB Off-Ramp/ Hyland-Croy Rd										

Legend: A/10.0      LOS/Delay in secs per veh; (0.10) – volume/capacity ratio, included for movements with LOS E/F or v/c over 0.90

## 2040 No-Build Analysis

The 2040 No-Build scenario is the scenario with 2040 background traffic plus 60% development traffic. Under this scenario, operational conditions along the SR 161 corridor are projected to worsen significantly when compared to 2030 due to the additional traffic. For analysis purposes, the No-build geometry for 2040 is same as the 2030 Build geometry. Capacity analysis results for the 2040 No-Build scenario are presented in **Table 6**, and TransModeler results are provided in **Table 7**. The HCS and SIDRA summary reports are included in **Appendix G**, and detailed TransModeler results are included in **Appendix H**.

- **AM Peak:**
  - Five intersections are expected to operate at an overall LOS F during the AM peak. Five other intersections experience LOS F or v/c ratios exceeding 1.0 for some movements/approaches while the overall intersection LOS is acceptable.
  - The four-lane widened section of SR 161 will be slightly over capacity in some sections, upto 18% over-capacity near Houchard Road in the eastbound direction during the AM peak.
  - The congestion is primarily worse with oversaturated conditions and substantial queuing along the SR 161 corridor from Cosgray Road through the US 33 interchange. The traffic demand in this section will be 20 percent to 30 percent over capacity.
- **PM Peak:**
  - All intersections are expected to operate at LOS F during the PM peak, resulting in significant delays and extended queuing throughout the corridor.
  - The two-lane/three lane section of SR 161 in Plain City is nearly 50 percent over capacity. The four-lane widened section between Weldon Road and Kile Warner Road is expected to be 14 percent to 30 percent over capacity in the westbound direction.
  - TransModeler simulation conducted for the SR 161 corridor between Cosgray Road and and US 33 WB Off-Ramp/Hyland-Croy Rd shows oversaturated conditions and substantial queuing on several intersection approaches. Some approaches are 40 percent to 60 percent over capacity.

These results show that corridor-wide improvements are necessary to meet the future traffic demand.

TABLE 6: 2040 LOS SUMMARY – NO BUILD SCENARIO

Intersection	AM PEAK					PM PEAK				
	EB Approach	WB Approach	NB Approach	SB Approach	Overall Int	EB Approach	WB Approach	NB Approach	SB Approach	Overall Int
SR 161 & US 42	D/48.0 (0.93)	E/63.4 (1.07)	D/36.5 (0.91)	D/51.6 (1.05)	D/48.6	E/57.3 (0.91)	F/166.5 (1.35)	D/42.6 (1.27)	F/119.6 (1.61)	F/104.4
SR 161 & Chillicothe St	E/59.7 (1.07)	D/45.2 (1.28)	F/90.8 (1.08)	E/76.0 (0.99)	E/61.8	C/21.0	F/161.2 (1.53)	F/306.0 (1.58)	F/245.6 (1.44)	F/152.2
SR 161 & Butler Ave	A/1.0	A/0.0	F/124.3 (0.03)	F/1131.3 (2.84)	N/A	A/3.5	A/0.0	-	F/5019.1 (10.08)	N/A
SR 161 & Pleasant Valley Blvd	F/127.7 (1.23)	B/13.8	C/16.7	B/10.2	F/77.9	F/51.1 (1.02)	F/231.5 (1.48)	B/13.3	F/63.2 (0.80)	F/154.4
SR 161 & Warner Rd / Cemetery Pk	D/34.4 (0.91)	A/7.9	F/205.2 (1.47)	C/23.0	E/49.7	D/25.9	E/41.1 (1.01)	A/7.9	F/450.9 (2.15)	F/79.1
SR 161 & Madison Gateway Access	F/57.8 (1.04)	A/7.6	E/35.7 (0.49)	C/17.6	E/35.5	D/26.3 (0.88)	E/38.5 (1.0)	E/39.2 (0.67)	F/290.9 (1.68)	F/55.0
SR 161 & Kile Warner Rd	D/27.4 (0.93)	A/9.4	D/32.0	C/21.0	C/20.4	C/18.0	F/80.4 (1.14)	E/41.5 (0.84)	F/251.4 (1.39)	F/62.6
SR 161 & Houchard Rd	F/130.4 (1.27)	B/10.9	E/44.2 (0.74)	F/52.0 (0.87)	F/74.9	F/56.4 (1.05)	F/143.4 (1.31)	F/367.3 (1.93)	F/139.5 (1.22)	F/131.7
SR 161 & Weldon Rd	D/31.1 (0.96)	B/13.2		C/22.8 (0.45)	C/23.3	D/28.7 (0.95)	F/128.5 (1.25)		F/540.6 (2.10)	F/123.8

Legend: A/10.0 - LOS/Delay in secs per vehicle; (0.20) – volume/capacity ratio, included for movements with LOS E/F or v/c over 0.90

TABLE 7: 2040 LOS SUMMARY – NO BUILD SCENARIO - COSGRAY TO HYLAND CROY SEGMENT

Intersection	Appr.	Mvmt	LOS	2040 AM		2040 PM	
				Delay (secs/veh)	Queue Mean	LOS	Delay (secs/veh)
SR 161, Cosgray Road (Roundabout)	Overall		F	145.6		F	180.5
	EB	T	F	211.5	125.3	F	321.6
		T	F	232.4	239.1	F	344.2
		R	F	194.1	0.1	F	305.4
	WB	T	A	3.3	1.4	B	10.2
		T	A	3	1	A	7.3
		R	A	1.6	0	A	1.8
	NB	LT	F	1494.7	30.3	F	201.5
		R	F	1879.5	1146.2	F	144.9
		LT	C	18	3	F	257.8
	SB	LT	A	6.9	0.3	F	117.1
		R	A	6.9	0.3	F	2.4
Industrial Parkway & SR 161 (Roundabout)	Overall		F	112.7		F	140.3
	EB	LT	F	76.6	248.8	B	11.9
		TR	F	61.5	177.4	B	11.4
	WB	LT	A	8.8	14.3	F	58.2
		T	A	9	14.1	F	71.3
	NB	LT	C	19	14.4	F	527.3
		R	B	11	5.3	F	246.9
	SB	L	F	778.8	1343.5	F	902
		LT	F	1416.3	1531.4	F	1611.4
		R	F	567	5.8	F	650.1
SR 161, US 33 EB Off-Ramp to SR 161 & Eiterman Road (Roundabout)	Overall		E	42.7		F	135.2
	EB	T	C	18.6	16.7	C	23.8
		T	E	39	90	E	42.4
		R	B	10.5	0	C	22.3
	WB	LT	B	12.4	6	F	98.6
		T	B	13	4.3	F	159.4
	NB	TR	E	37.6	36.3	F	1237.1
		R	D	28.1	24.3	F	1165.2
	SB	L	F	1458.7	8	F	1341.6
		LTR	F	1806.9	1968.2	F	2002.1
SR 161, US 33 Off-Ramp to SR 161 & Hyland-Croy Road (Signal)	Overall		F	87.5		F	103.1
	EB	L	E	57.3	10.8	E	61.4
		L	C	55	10.7	E	64.6
		T	C	32	52.1	C	30.2
		T	C	32.8	50.3	C	31.2
	WB	T	D	42.1	59.7	F	87.3
		T	D	48.8	78.3	F	94.4
		T	D	49.7	85.6	F	108.3
		R	A	6.6	2.1	B	17.5
	NB	L	F	164.2	392.2	F	212
		L	F	152.7	399.5	F	158.9
		TR	F	91.4	19.7	F	97.9
		L	D	46.2	34.2	D	48.3
	SB	L	D	47.6	34.6	D	53.3
		R	D	42.4	60.2	D	43.7
		R	C	30.7	47.9	C	30.7
		R	C	30.7	47.9	C	30.1

## 2040 Build Improvements & Analysis

- **SR 161 corridor – US 42 to Butler Avenue:** The 2040 No-build analysis results indicate the need for a 4-lane/5-lane section of SR 161 in Plain City from west of US 42 intersection to Cemetery Pike/Warner Road intersection. Further, widening of US 42 for additional through lanes may also be necessary near SR 161 intersection to achieve an acceptable Level of Service. The existing right-of-way along SR 161 between US 42 and Butler Avenue is significantly constrained for improvements due to adjacent infrastructure, including buildings, pedestrian facilities, utilities etc. These constraints make it impractical to widen the current two- or three-lane section with on-street parking to accommodate additional through lanes.

An alternative to widening SR 161 from US 42 to Butler Avenue may include additional roadway connections or bypass routes around Plain City. These improvements would enable regional traffic to circumvent the village and alleviate congestion along the SR 161 corridor and its intersections within Plain City.

- **SR 161 - Cemetery Pike/Warner Road to Cosgray Road:** Additional through lanes may be necessary from Houchard Road to Cosgray Road to meet the traffic demand. However, three-lane roundabouts are not viable. Additional auxiliary/turn lanes may be added at the study intersections to enhance capacity while still maintaining two through lanes in each direction along SR 161.
- **SR 161 - Cosgray Road to US 33 WB Ramps/Hyland Croy Road:** The SR 161 corridor between Cosgray Road and the US 33 WB Ramps/Hyland Croy Road has reached the maximum permitted size for its multi-lane roundabout design. Since expanding to include more through lanes would require an intersection reconfiguration, no additional alternatives were considered for this section.

A viable approach to meet the increased traffic demand from the additional development is to establish a strategic transportation network that includes additional roadway connections between Plain City and Dublin. This network would feature both north-south and east-west roadway connections, thereby enhancing capacity and regional connectivity, while minimizing congestion at the US 33/SR 161 interchange. Other regional improvements may include, but are not limited to, improvements along US 33, new interchanges, and/or upgrades to other existing interchanges along US 33 and I-270.

Minor auxiliary/turn lane improvements for the SR 161 intersections with Cemetery Pike/Warner Road, Madison Gateway, Kile Warner Road and Weldon Road intersections are shown on Figure 7. Capacity analysis results for the intersections with Build improvements are shown on Table 8, the proposed improvements increase capacity and reduce delays, but may not result in an overall acceptable LOS. The capacity analysis reports are included in Appendix I.

Additional improvements to Houchard Road intersection were evaluated. Although these improvements would reduce delay and improve LOS on Houchard Road approaches, they were found to negatively impact the SR 161 approaches by causing substantially longer queues and increased volume-to-capacity ratios (1.32 to 1.54). As a result, these improvements have not been included in this report.

FIGURE 7: 2040 BUILD/PHASE II – INTERSECTION GEOMETRY

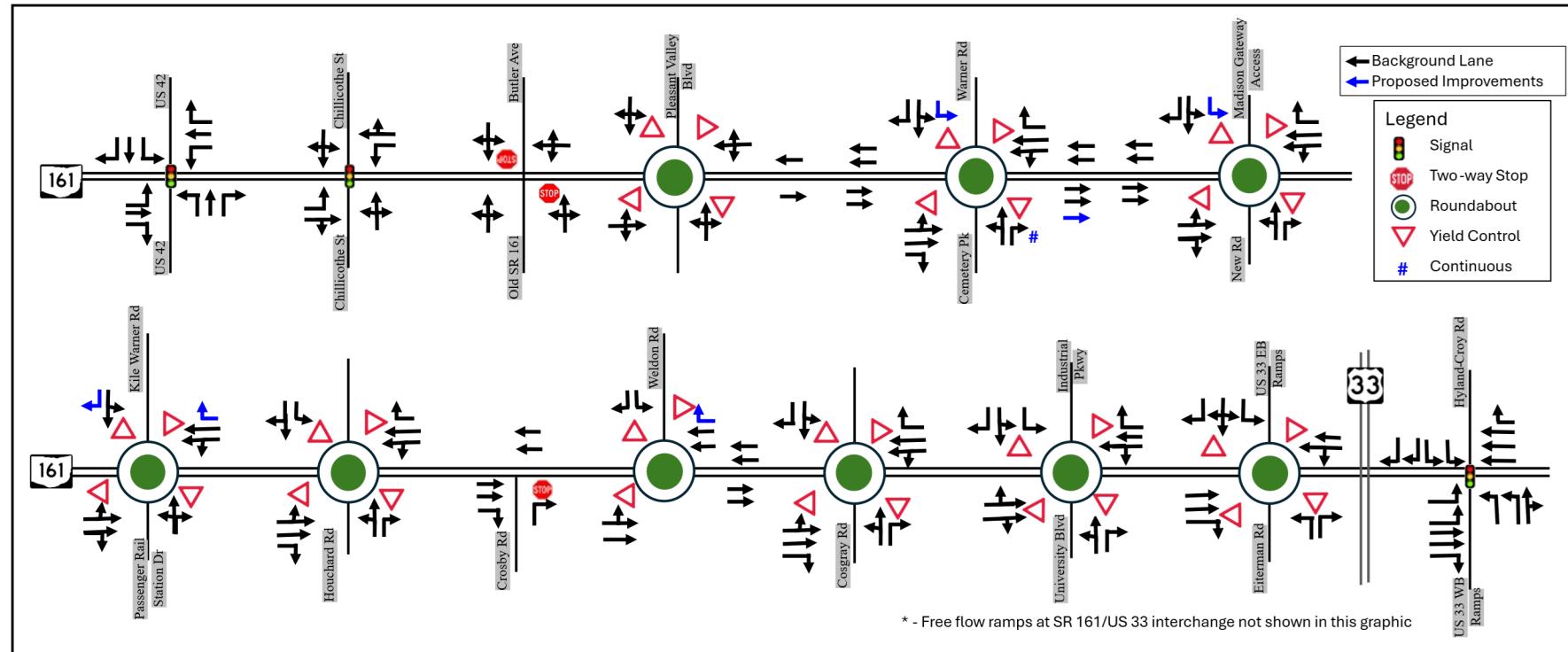


TABLE 8: 2040 LOS SUMMARY –BUILD SCENARIO

Intersection	AM PEAK					PM PEAK				
	EB Approach	WB Approach	NB Approach	SB Approach	Overall Int	EB Approach	WB Approach	NB Approach	SB Approach	Overall Int
SR 161 & Warner Rd / Cemetery Pk	E/35.7 (0.92)	A/7.9	A/6.9	B/14.0	C/19.4	E/48.6 (0.97)	E/41.2 (1.01)	A/8.1	F/156.0 (1.18)	F/52.4
SR 161 & Madison Gateway Access	F/53.3 (1.03)	A/6.9	E/36.9 (0.50)	B/13.4	D/32.6	E/42.4 (0.97)	E/37.8 (1.0)	E/48.2 (0.73)	F/100.3 (0.92)	E/45.1
SR 161 & Kile Warner Rd	D/27.4 (0.93)	A/8.4	D/32.0	C/15.5	C/19.8	C/21.2	F/56.8 (1.08)	E/44.3 (0.52)	F/98.6 (0.93)	E/44.2
SR 161 & Weldon Rd	D/31.1 (0.96)	B/10.4		C/22.8	C/22.2	E/43.4 (1.01)	F/68.7 (1.11)		F/253.2 (1.41)	F/74.7

Legend: A/10.0 - LOS/Delay in secs per vehicle; (0.20) – volume/capacity ratio, included for movements with LOS E/F or v/c over 0.90

## Conceptual Plans & Cost Estimates

A conceptual plan has been developed for Phase I build improvements along the SR 161 corridor and included in **Appendix J**. These improvements include widening of SR 161 corridor from the current two-lane section to a four-lane divided section from west of Warner Road to Cosgray Road where it ties into the current four-lane divided section. Intersection improvements include multi-lane roundabouts.

Planning level cost estimates have been developed for these improvements and included in **Appendix K**. The estimated construction cost for Phase I improvements is \$24.5 million. These estimates include construction costs with contingency, and do not include costs for right-of-way acquisition, design or utility relocation.

## Conclusions & Next Steps

The area surrounding SR 161 corridor on the northwest side of Central Ohio is experiencing large scale development at a rapid pace. This study evaluated the impacts of the anticipated development on and around the SR 161 corridor between US 42 in Plain City (Union/Madison County) and US 33 interchange in Dublin (Union/Franklin County).

- **Developments within study area:** Several residential, industrial, flex innovation/research, office and commercial development projects within the study area have been recently completed or are in the planning stages.
- This development area and the 6-mile long SR 161 corridor extend across several jurisdictions, including the village of Plain City, Madison County, Union County, Franklin County, the City of Dublin, and the townships of Darby, Jerome, and Washington.
- The proposed developments are anticipated to generate nearly 20,000 total trips in the AM peak and over 25,000 total trips during the PM peak hour; however, not all of this traffic will access the SR 161 corridor or the study intersections.
- Background traffic volume plates have been developed for three future scenarios: 2030, 2040 and 2050. For Build traffic volume plates, development traffic has been assigned to the future scenarios at 30% through 2030, 60% through 2040 and 100% development through 2050.

Based on the TISs/MOUs, etc. currently under review or approved by ODOT for this area, there is the possibility that 60% development traffic level could be reached prior to 2040.

- **Existing SR 161 corridor conditions:** SR 161 corridor is currently a two/three-lane roadway from US 42 to the west of Cosgray Road. Significant improvements have been implemented along SR 161 from Cosgray Road through the US 33 interchange recently, and include multi-lane roundabouts at Cosgray Road, Industrial Parkway/University Boulevard, US 33 EB Ramps/Eiterman Road. The intersection of US 33 WB ramps/Hyland Croy Road will be under signal control. Four directional ramps have been implemented at the US 33 interchange.
- Traffic analysis has been completed for future scenarios using the Build volumes and HCS, SIDRA or Transmodeler software as appropriate.

- 2030 No-Build analysis:** For this scenario, the existing intersection configuration, the current FRA-33/SR 161 interchange improvements project (PID 80748) along with the committed improvements under JTID Phase 1 will be the basis. The analysis showed that traffic conditions along SR 161 will worsen significantly by 2030. Several intersections will operate at Level of Service (LOS) F, meaning severe delays and long queues during both morning and evening peak periods. Key problem area includes the section from Warner Road to Weldon Road. The segment between Cosgray Road and US 33 interchange will also experience some congestion.

TABLE 9: 2030 NO-BUILD LOS SUMMARY

Intersection	AM PEAK					PM PEAK				
	Eastbound Approach	Westbound Approach	Northbound Approach	Southbound Approach	Overall Intersection	Eastbound Approach	Westbound Approach	Northbound Approach	Southbound Approach	Overall Intersection
SR 161 & US 42 (Signal)	C	C	C	C	C	C	C	C	D	C
SR 161 & Chillicothe St (Signal)	B	B	C	C	B	B	C	E	D	C
SR 161 & Butler Ave (Two-way Stop)	A	A	E	F	N/A	A	A	-	F	N/A
SR 161 & Pleasant Valley Blvd (Single Lane Roundabout)	C	A	A	A	B	B	D	A	B	C
SR 161 & Warner Rd (Two-way Stop)	A	-	-	F	N/A	A	-	-	F	N/A
SR 161 & Cemetery Pk (Two-way Stop)	-	A	F	-	N/A	-	B	F	-	N/A
SR 161 & Madison Gateway Dr (Single Lane Roundabout)	F	B	C	A	F	F	F	C	E	F
SR 161 & Kile Warner Rd (Two-way Stop)	A	A	F	F	N/A	A	A	F	F	N/A
SR 161 & Houchard Rd (Single Lane Roundabout)	F	C	D	C	F	F	F	F	F	F
SR 161 & Crosby Rd (Two-way Stop)	-	A	F	-	N/A	-	A	F	-	N/A
SR 161 & Weldon Rd (Two-way Stop)	A	-	-	F	N/A	C	-	-	F	N/A
SR 161/Cosgray Road	A	A	B	B	A	C	B	C	F	C
SR 161/Industrial/University	E	A	C	F	F	A	F	C	F	F
SR 161/US 33 EB Off-Ramp/ Eiterman Rd	E	A	C	F	F	B	D	F	F	F
SR 161/US 33 Off-Ramp/ Hyland-Croy	C	D	D	D	D	C	D	C	D	C

- 2030 Build analysis: The proposed improvements in Phase I, including widening SR 161 to a four-lane divided roadway from west of Warner Road to Cosgray Road and upgrading intersections to roundabouts, significantly improve traffic conditions. Most intersections will operate at an acceptable LOS (LOS D or better) during both peak periods. The SR 161 corridor from US 42 to Weldon Road will perform well overall.

At the SR 161/Industrial Parkway intersection, a southbound right turn bypass lane will be added. No other improvements are recommended on SR 161 between Cosgray Road and the Hyland-Croy Road/US 33 WB ramps. This segment will experience degradation in operation and delay during the PM peak with significant delays in the westbound direction and for the US 33 EB exit ramp approach and Industrial Parkway approach. The roundabout intersections with the US 33 EB ramps and Industrial Parkway will be 10% overcapacity. During the AM peak, southbound approaches will experience LOS F conditions at the Industrial Parkway and the US 33 EB ramps intersections.

TABLE 10: 2030 BUILD LOS SUMMARY

Intersection	AM PEAK					PM PEAK				
	EB Approach	WB Approach	NB Approach	SB Approach	Overall Int	EB Approach	WB Approach	NB Approach	SB Approach	Overall Int
SR 161 & US 42	C	C	C	C	C	C	C	C	D	C
SR 161 & Chillicothe St	B	B	C	C	B	B	C	E	D	C
SR 161 & Butler Ave	A	A	E	F	N/A	A	A	-	F	N/A
SR 161 & Pleasant Valley Blvd	C	A	A	A	B	B	D	A	B	C
SR 161 & Warner Rd / Cemetery Pk*	A	A	C	A	A	A	A	B	D	B
SR 161 & Madison Gateway Access*	A	A	B	A	A	A	A	B	C	B
SR 161 & Kile Warner Rd*	B	A	C	B	B	B	B	B	D	B
SR 161 & Houchard Rd*	B	A	C	A	A	A	C	C	D	B
SR 161 & Weldon Rd*	A	A		A	A	A	B		C	B
SR 161/Cosgray Road	A	A	B	B	A	C	B	C	F	C
SR 161 & Industrial Pkwy/University	E	A	D	F	F	A	F	D	F	F
SR 161 & US 33 EB Off-Ramp & Eiterman Rd	E	A	D	F	F	B	E	F	F	F
SR 161 & US 33 Off-Ramp & Hyland-Croy Rd	D	D	C	D	D	D	D	C	D	C

\* - SR 161 section with 4-lane widening, roundabout intersection configuration

- **2040 No-build analysis:** Phase I improvements will be the basis for 2040 No-build analysis. This scenario includes background traffic plus 60% development traffic, this additional growth in the area will worsen traffic conditions along SR 161 dramatically by 2040. Several intersections will operate at Level of Service (LOS) F, meaning severe delays and long queues during both morning and evening peak periods are anticipated.
  - » Key problem areas include SR 161 intersections at US 42, Chillicothe St, Butler Avenue, Pleasant Valley Blvd. in Plain City and the segment between Cosgray Road and the Hyland-Croy Road/US 33 ramps.
  - » The two-lane/three lane section of SR 161 in Plain City is nearly 50 percent over capacity during the PM peak.
  - » The four-lane widened section of SR 161 between Warner Road and Cosgray Road (Phase I improvement) will be slightly over capacity in some sections, upto 18% over-capacity in the eastbound direction during the AM peak, and up to 30% over capacity in the westbound direction between Cosgray Road and Houchard Road.
  - » The US 33/SR 161 interchange area, primarily the roundabout intersections with the US 33 EB ramps and Industrial Parkway will be 40% to 60% over capacity by 2040.

TABLE 11: 2040 NO-BUILD LOS SUMMARY

Intersection	AM PEAK					PM PEAK				
	EB Approach	WB Approach	NB Approach	SB Approach	Overall Int	EB Approach	WB Approach	NB Approach	SB Approach	Overall Int
SR 161 & US 42	D	E	D	D	D	E	F	D	F	F
SR 161 & Chillicothe St	E	D	F	E	E	C	F	F	F	F
SR 161 & Butler Ave	A	A	F	F	N/A	A	A	-	F	N/A
SR 161 & Pleasant Valley Blvd	F	B	C	B	F	F	F	B	F	F
SR 161 & Warner Rd / Cemetery Pk	D	A	F	C	E	D	E	A	F	F
SR 161 & Madison Gateway Access	F	A	E	C	E	D	E	E	F	F
SR 161 & Kile Warner Rd	D	A	D	C	C	C	F	E	F	F
SR 161 & Houchard Rd	F	B	E	F	F	F	F	F	F	F
SR 161 & Weldon Rd	D	B		C	C	D	F		F	F
SR 161/Cosgray Road	F	A	F	B	F	F	A	F	F	F
SR 161 & Industrial Pkwy/ University Blvd	F	A	C	F	F	B	F	F	F	F
SR 161 & US 33 EB Off-Ramp & Eiterman	C	A	D	F	E	E	F	F	F	F
SR 161 & US 33 Off-Ramp & Hyland-Croy	D	D	F	C	F	D	E	F	D	F

- **2040 Build analysis:** Phase II Build improvements include auxiliary/turn lane improvements at various intersections from Warner Road through Weldon Road.
  - » Significant improvements including widening of SR 161 to a 4-lane divided section from west of US 42 to Warner Road will be required to accommodate 2040 build traffic. Auxiliary turn lanes will be necessary at various intersections. Considering the existing infrastructure constraints along the SR 161 corridor in Plain City from US 42 through Butler Avenue, other regional improvements will be essential to meet future traffic demand, this may include additional roadway connections or bypass routes around Plain City.
  - » Also, the SR 161 corridor between Cosgray Road and the US 33 WB Ramps/Hyland Croy Road currently utilizes the maximum footprint allowed for the multi-lane roundabout configuration. Hence no additional improvements were evaluated for this section. However, broader regional improvements will need to be considered to address future demand. These may include, but are not limited to, enhancements along US 33, as well as upgrades to existing interchanges or new interchanges along US 33 and I-270.
  - » Even with Phase II improvements in place, some approaches and intersections will be over-capacity with LOS F during peak hours. The SR 161 corridor between Cemetery Pike and Weldon Road can be up to 10 percent over capacity during the PM peak by 2040.

TABLE 12: 2040 BUILD LOS SUMMARY

Intersection	AM PEAK					PM PEAK				
	EB Approach	WB Approach	NB Approach	SB Approach	Overall Int	EB Approach	WB Approach	NB Approach	SB Approach	Overall Int
SR 161 & US 42	SAME AS NO BUILD-2040									
SR 161 & Chillicothe St										
SR 161 & Butler Ave										
SR 161 & Pleasant Valley Blvd										
SR 161 & Warner Rd/Cemetery Pk	E	A	A	B	C	E	E	A	F	F
SR 161 & Madison Gateway Access	F	A	E	B	D	E	E	E	F	E
SR 161 & Kile Warner Rd	D	A	D	C	C	C	F	E	F	E
SR 161 & Houchard Rd	SAME AS NB-2040									
SR 161 & Weldon Rd	D	B		C	C	E	F		F	F
SR 161 @ Cosgray Rd	SAME AS NO BUILD-2040									
SR 161 & Industrial Pkwy										
SR 161 & US 33 EB Ramps/Eiterman Rd										
SR 161 & US 33 WB Ramps/Hyland-Croy										

- **2050 scenario with 100% development traffic:** To accommodate the projected 2050 traffic demand, including all development-related traffic, the SR 161 corridor would require a 6-lane or 8-lane roadway. However, the effectiveness of these upgrades may not be fully achieved due to the limiting capacity of the US 33/SR 161 interchange at the eastern end. Detailed analysis has not been performed for the 2050 traffic conditions.
- To manage growing demand from future development in the project vicinity, a strategic transportation network with more local roadway connections between Plain City and Dublin will be essential. Adding roadway connections would boost capacity, improve regional connectivity, and limit congestion at the existing US 33/SR 161 interchange. In addition, other regional improvements will need to be considered, such as improvements along US 33, constructing new interchanges and/or upgrading other existing interchanges along US 33 and I-270 corridors.
- As a near term strategy, an implementation plan is essential for implementing Phase I improvements. The estimated construction cost associated with these improvements is \$24.5 million not including costs for right-of-way, design or utility relocation.