FINAL DRAFT

Lorain at Lear Nagle Traffic Study

#287 Urban Intersection – ODOT 2024 HSIP Priority List

City of North Ridgeville, OH | January 3, 2025

CITY OF NORTH Ridgeville

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CHAPTER 1

Executive Summary

Lorain at Lear Nagle Traffic Study

1 Executive Summary

1.1 Project Background

The City of North Ridgeville retained Woolpert to evaluate safety and traffic operations within a study area centered at the Lorain Rd intersection with Lear Nagle Rd (circled in blue) in the SE corner of the City of North Ridgeville (Figure 1). The study area is bounded by Lorain Rd from the I-480 WB Ramps to Victory Ln and on Lear Nagle Rd from Chestnut Ridge Rd to Lorain Rd. **The intersection is ranked #287 out of the top 500 Urban Intersections on the Ohio Department of Transportation (ODOT) Highway Safety Improvement Program (HSIP) Priority List**.

The study area includes the following roadway sections:

- Lear Nagle Rd from Chestnut Ridge Rd to Lorain Rd
- Lorain Rd from Victory Ln to the I-480 WB Exit Ramps
- Cypress Ave from Lear Nagle Rd to Lorain Rd (scheduled to be completed in 2025)

The **primary study intersection** is the signalized intersection of Lorain Rd at Lear Nagle Rd.

Figure 1 - Study Area (Primary Study Intersection Circled in Blue)

Lear Nagle Rd (Figure 2**)** is a three-lane (including center two-way left turn lane) major collector that runs generally northwest to southeast through the intersection with Lorain Rd before turning due east after the Lorain Rd intersection where the corridor becomes two lanes and is signed as Cook Rd. Lear Nagle Rd has a posted speed limit of 35 MPH and is posted as "No Trucks". At the signalized intersection with Lorain Rd, Lear Nagle Rd has southbound dual left turn lanes that operate as protected only (green arrow). Cook Rd northbound has a single left turn lane which operates as a protected/permissive (green arrow/green ball) movement. The Cook Rd northbound approach is aligned at a near perpendicular angle to Lorain Rd, however immediately east of the intersection there is horizontal curvature where Cook Rd turns due east from southeast.

Figure 2 - Lear Nagle Rd Southbound Approach to Lorain Rd (PM Peak Period)

Lorain Rd (SR 10) is a five-lane (including center two-way left turn lane) minor arterial that runs generally southwest to northeast through the intersection with Lear Nagle Rd. Lorain Rd is posted for 35 MPH and is a truck route providing access to/from both I-480 on the east end of the study area and I-80 (Ohio Turnpike) just west of the study area. Both Lorain Rd approaches to Lear Nagle Rd have a single left turn lane that operate as protected/permissive. The westbound approach to Lear Nagle Rd also has an exclusive right turn lane that operates with an overlap phase that runs concurrent with the Lear Nagle Rd southbound left turn phase.

Cypress Ave is a two-lane local road that connects an area of future development to Lear Nagle Rd. The intersection of Cypress Ave and Lear Nagle Rd is stop controlled for Cypress Ave and sees minimal to no traffic as no development has occurred on Cypress Ave as of 2024. The City of North Ridgeville has plans to connect Cypress Ave to Lorain Rd at a new signalized intersection that will be partially in the City of North Olmsted but will be a signal maintained and operated by the City of North Ridgeville. The City of North Ridgeville has recently received funding for construction, and the project will be completed in 2025. For this study, the existing condition analysis will not include the Cypress Ave intersection with Lorain Rd, however it will be included in the proposed condition analysis.

The study area is adjacent to the I-480 at SR 10/I-80 (Ohio Turnpike) interchanges, and the I-480 at Lorain Rd interchange. Lorain Rd through the study area is primarily commercial in land use from I-480 west through Victory Ln. Lear Nagle Rd (known as Cook Rd east of Lorain Rd) is primarily commercial in land use south of I-480, and residential north of I-480. Lorain County Community College (LCCC) maintains its University Partnership Ridge Campus facility on the south side of Lorain Rd north and east of the primary study intersection.

1.2 Purpose and Need

In the compact and urbanized study area, numerous rear end, angle, and right/left turn crashes are occurring at and approaching the Lorain Rd/Lear Nagle Rd intersection. Existing crash patterns are driven in part by a lack of access management, and severely oversaturated signalized intersections that cannot process vehicle movement demand

efficiently. As the movement of Lorain Rd to/from Lear Nagle Rd serves as a primary gateway for the southern half of North Ridgeville, the oversaturated condition results in significant vehicle delay and driver frustration, and a hot spot for vehicle crashes.

The purpose of this study is to evaluate travel patterns within the study area, examine crash trends, and develop strategies to address significant queueing and corridor congestion. Specifically, the study will focus on developing short- and long-term countermeasures to address:

- Crash patterns at the Sheetz/McDonald's driveways off Lear Nagle Rd
- Queueing/Traffic Operations at Lorain Rd and Lear Nagle Rd/Cook Rd
- Travel patterns to/from Lear Nagle Rd and I-480

1.3 Evaluation and Analysis

Woolpert collected 2021-2023 crash data (the three most recent years available) for the study area using ODOT's Traffic Information Mapping System (TIMS) and the GIS Crash Analysis Tool (GCAT). From 2021 through the end of 2023 there were 225 crashes occurred in the study area representing 13.9% of all crashes within the City of North Ridgeville during that period.

Woolpert collected 13-hour traffic counts at the five study area intersections on Thursday, July 18, 2024. Woolpert used these counts to conduct existing and proposed condition capacity analysis in the study area, and to inform the development of proposed countermeasures.

Woolpert also conducted a StreetLight analysis of the study area focusing on where people who use Lear Nagle Rd are coming from and going to. Based upon this analysis, Lear Nagle Rd serves a primarily commuter user group and connects the City of North Ridgeville to I-480 and the broader region through SR 10 and the Ohio Turnpike (I-80). There are limited options for vehicles intending to travel from North Ridgeville to I-480 other than Lear Nagle Rd, which leads to the heavy congestion seen in the study area every day as demand exceeds capacity through the study area.

1.4 Recommended Countermeasures

Woolpert developed short- and long-term proposed countermeasures to address existing crash patterns and to address congestion and poor traffic operations. Based on a detailed evaluation of countermeasures, including safety, capacity, and benefit/cost analysis Woolpert recommends the following countermeasures:

Short Term Alternatives

- Optimize signal timing for AM and PM peak period to account for present day demand, and monitor changing vehicle demand for continuous optimization in the short term

Lorain Rd Corridor:

- Convert the existing Lorain Rd/Lear Nagle Rd signalized intersection to a Restricted Crossing U-Turn (RCUT) intersection with roundabout U-Turns at Victory Ln and the I-480 EB Ramp
- Conduct an Interchange Modification Study for the proposed multi-lane roundabout at the I-480 EB ramp and a multi-lane roundabout at the I-480 WB ramp

Lear Nagle Rd Corridor:

- Construct a multi-lane roundabout at Lear Nagle Rd and Cypress Ave striped for single-lane operation in the opening year, but capable of facilitating quick conversion to multi-lane operation once volume demand reaches multi-lane threshold
- Convert existing Sheets/McDonalds driveways from full access to Right-In, Right-Out only following completion of Lorain Rd RCUT and Cypress Ave Roundabout
- Construct a multi-lane roundabout at Lear Nagle Rd and Chestnut Ridge Rd
  Widen Lear Nagle Rd from three lanes to four lanes between Chestnut Ridge Rd and Lorain Rd with a raised median installed between Cypress Ave and Chestnut Ridge Rd

CHAPTER 2

Crash Data Analysis

Lorain at Lear Nagle Traffic Study

2 Crash Data Analysis

Woolpert collected 2021-2023 crash data for the study area using ODOT's Traffic Information Mapping System (TIMS) and the GIS Crash Analysis Tool (GCAT). During the crash data period a total of 225 crashes occurred in the study area, which represents 13.9% of all crashes within the City of North Ridgeville during that period.

From 2021-2023 there were 172 crashes were property damage only (PDO) crashes and 53 injury crashes (including four serious injuries) for an overall study area injury rate of 23.6%. From a multi-modal perspective, only one crash involved a pedestrian and occurred in the parking lot of a business. There were no crashes involving a bicycle. Most crashes in the study area occurred at the Lorain Rd/Lear Nagle Rd signalized intersection, with 130 total crashes (57.8%) during the 2021-2023 data collection period. Figure 3 and Table 1 present crash data statistics for the study area. Complete crash data for the study area is presented in **Appendix A**.

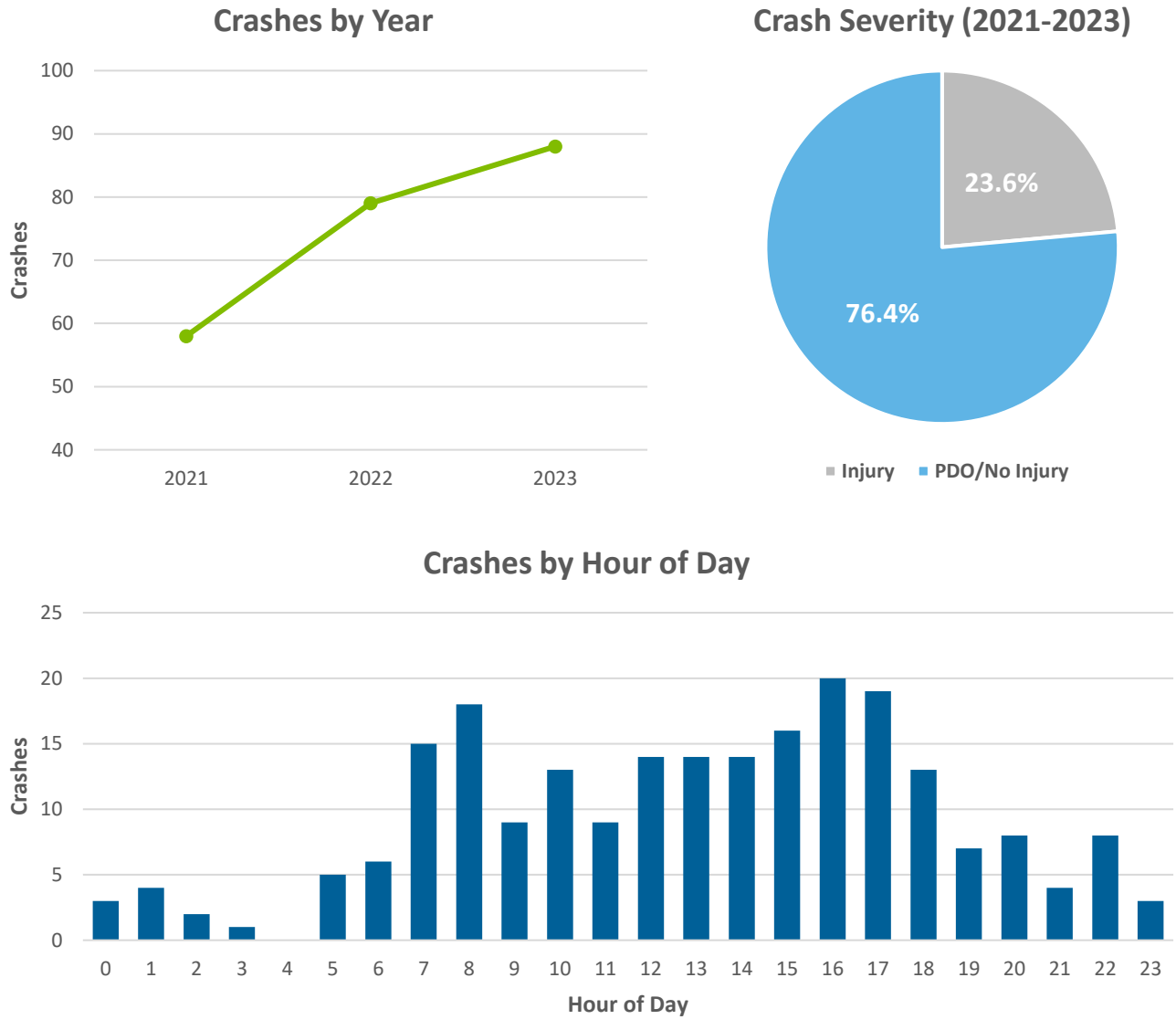


Figure 3 - Study Area Crash Data Summary

Table 1 - Crashes by Crash Type (Overall Study Area, 2021-2023)

Crash Type	Frequency	% of Total
Rear End	75	33.33%
Angle	59	26.22%
Sideswipe - Passing	31	13.78%
Left Turn	24	10.67%
Right Turn	13	5.78%
Fixed Object	11	4.89%
Backing	8	3.56%
Other	2	0.89%
Pedestrian	1	0.44%
Head On	1	0.44%

Rear end crashes were most common within the study area, followed by angle and sideswipe-passing crash types. The high frequency of rear end crashes indicates corridor congestion as a primary factor for crashes in the study area. Unit estimated speed at the time of collision was less than 15 MPH in roughly 60% of all crashes and "Following Too Closely/Assured Clear Distance Ahead (ACDA)" was the primary contributing factor in OH-1 crash reports reviewed by Woolpert, further indicating congestion as a leading factor for rear end crashes in the study area.

The prevalence of angle (where two or more opposing vehicles strike each other at a 45- to 90-degree angle), right turn, and left turn crashes is significant given the number of signalized intersections in the study area. Traffic signals protect against angle, right turn, and left turn crashes by assigning the right of way to movements through signal indications. Further review of the crash data indicates that many of the angle, left turn, and right turn crashes are not occurring at the signalized intersection but at driveways immediately up and downstream from the signalized intersection within the intersection area of influence.

2.1 State Priority List Rankings

The intersection of Lorain Rd, Lear Nagle Rd, and Cook Rd ranked as the **#287 Urban Intersection** on the ODOT Highway Safety Improvement Program (HISP) Priority List for 2024 based on the number of crashes at the intersection from 2019 to 2023. Based on moderate frequency of injury crashes over the same period, the intersection also appeared on ODOT's Safety Integrated Project (SIP) location list for 2024, as a **priority location for low-cost improvements**.

Low-cost improvements, those typically under $500,000 total, are eligible for funding under ODOT's Abbreviated Safety Funding process. Unlike the formal safety funding process which funds high-cost improvements such as physical geometric changes and requires a 30% or greater injury percentage, the abbreviated funding process for low-cost improvements is intended to accommodate non-complex, simple projects that can be installed within two years. There is no minimum injury rate required for abbreviated funding, and only three crashes per year at a given location are required to be eligible for funding under the program.

Applications for the abbreviated safety program are accepted year-round, with four funding rounds typically aligned with the end of a calendar quarter. Abbreviated program funding is primarily available for construction, with a preference given to projects implementing FHWA proven safety countermeasures, and locations with a history of high severity injury crashes and/or pedestrian focused treatments.

2.2 Lorain Rd at Lear Nagle Rd (#287 Urban Int., 2024 HISP)

Of the 225 crashes in the study area from 2021-2023, 130 (57.8%) crashes occurred at the signalized intersection of Lorain Rd at Lear Nagle Rd. The injury rate at the primary study intersection was 23.1%, including two serious injuries. Crashes at Lorain/Lear Nagle follow the same time of day trends as the overall study area with a defined AM, Midday, and PM peak period, indicating a heavy commuter movement using the intersection as an access to/from the City of North Ridgeville, and the Lorain Rd/I-480 and Lorain Rd/I-80 (Ohio Turnpike) interchanges (Figure 4).

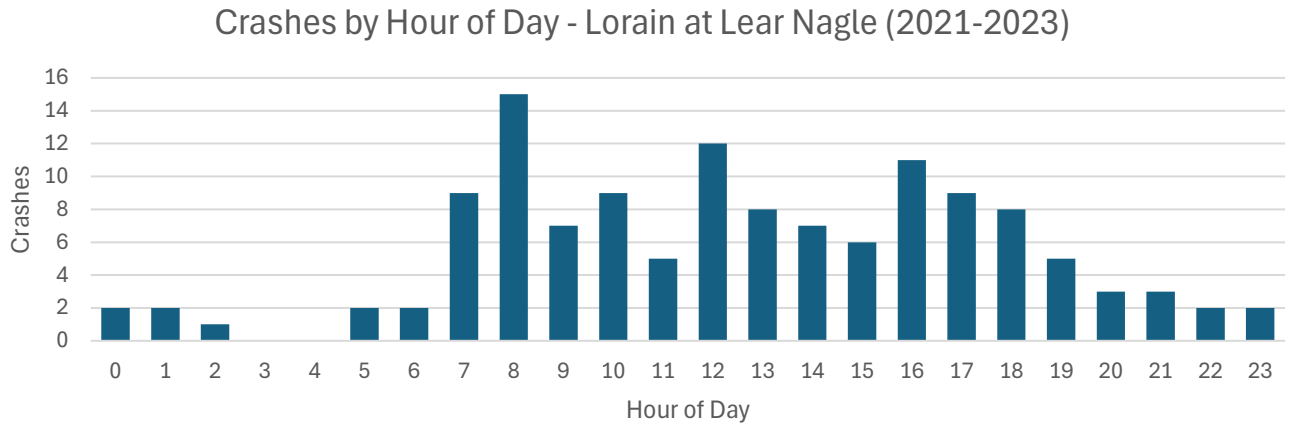


Figure 4 - Crashes by Time of Day at Lorain Rd/Lear Nagle Rd Intersection

Like the study area, the crash trend at the intersection is increasing over the crash data period. Unlike the study area, the predominant crash type at the primary study intersection was angle, followed by rear end. When angle crashes at the intersection are combined with left and right turn crashes, the trio of similar crash types account for 51% of all crashes at the intersection. Figure 5 presents an overview of trends and crash types at the Lorain Rd/Lear Nagle Rd intersection.

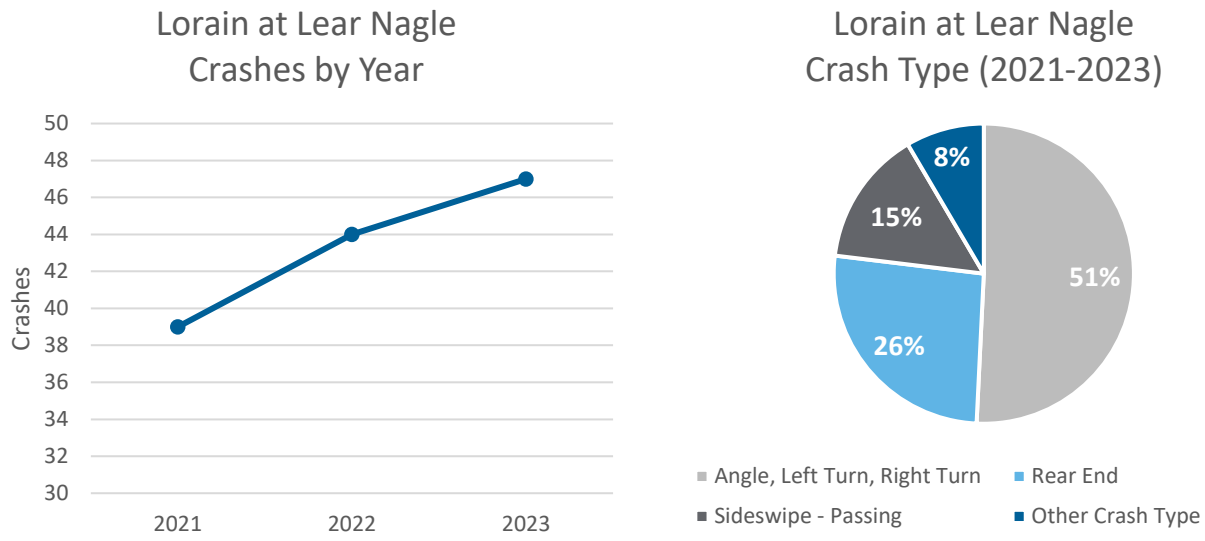


Figure 5 - Crash Data Overview at Lorain Rd/Lear Nagle Rd Intersection

2.2.1 Lear Nagle Rd Driveway Access

Nearly one-third of all crashes at the Lorain Rd/Lear Nagle Intersection occurred at the Lear Nagle Rd driveways for the Sheetz/North Ridgeville KinderCare and the McDonald's (Figure 6, Intersection Circled in Blue). Both driveways are full access, allowing left and right entry and exit movements from the driveways and from Lear Nagle Rd. Left turn exiting movements from driveways on to Lear Nagle Rd require vehicles to cross over the existing southbound dual left turn lanes on Lear Nagle Rd.

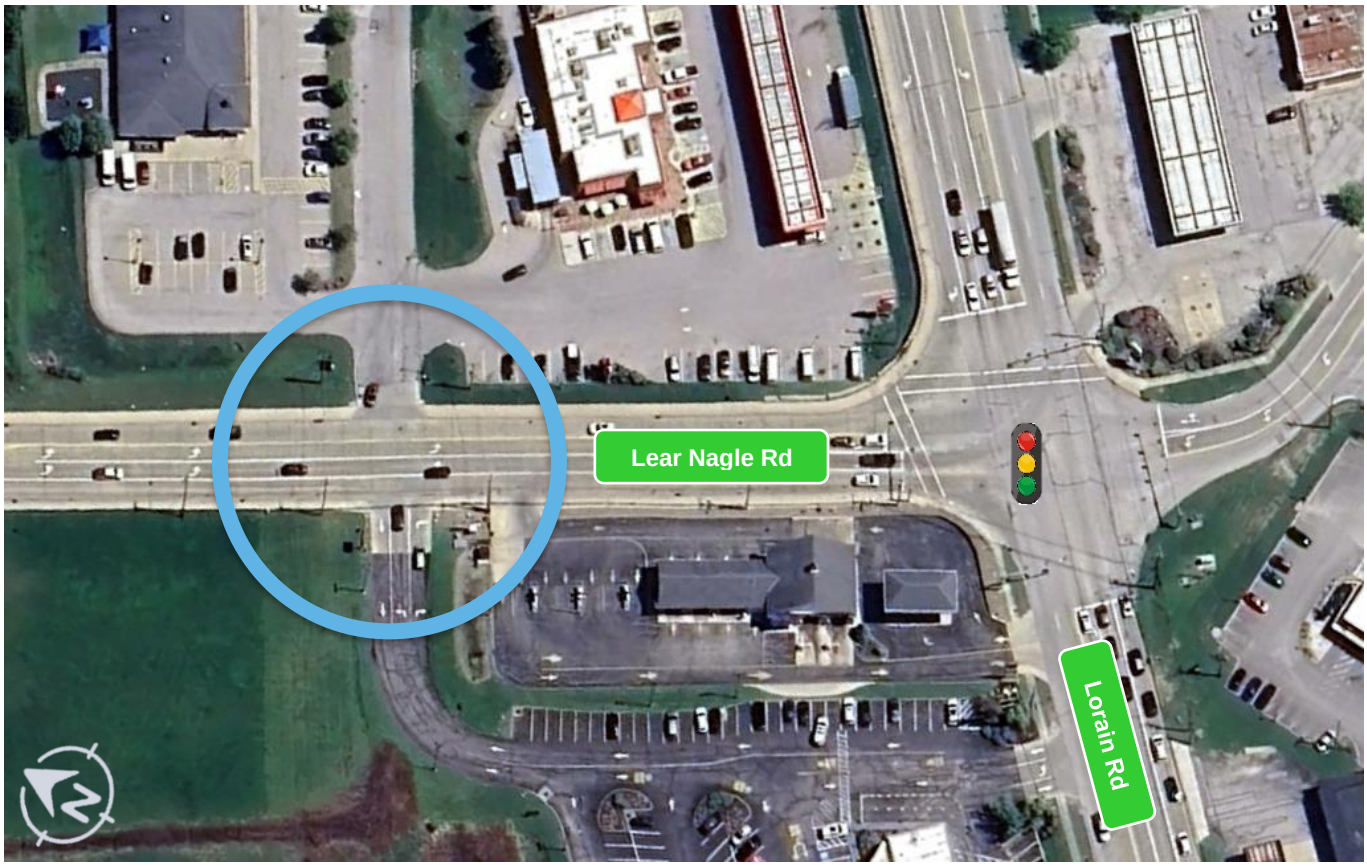


Figure 6 - Access Driveways on Lear Nagle Rd Approaching Lorain Rd

From 2021-2023, 45 crashes occurred at this set of driveways, including 12 injury crashes for an injury rate of 26.7% which is higher than the Lorain Rd/Lear Nagle Rd intersection total. The combination of angle, left turn, and right turn crashes account for 75.6% of all crashes at the driveways, including all injury crashes observed (Table 2).

Table 2 - Crash Data Overview at Lear Nagle Rd Driveways Approaching Lorain Rd

Crash type	Frequency	% of Total
Angle	25	55.6%
Sideswipe - Passing	9	11.1%
Left Turn	5	4.4%
Right Turn	4	8.9%
Rear End	2	20.0%

The predominant crash pattern at the driveways involved left turns from the McDonald's driveway onto Lear Nagle Rd northbound, which accounted for more than half of all crashes at the driveways. A crash diagram of the primary study intersection and adjacent driveways is presented following Figure 8 and again in **Appendix B**.

Beyond the observed crash data, near misses are common. Vehicles accessing drives off both Lear Nagle Rd and other commercial drives on Lorain Rd adjacent to the primary study intersection cause additional congestions beyond that of the intersection itself resulting in near miss rear end accidents. Woolpert observed vehicles waiting to access adjacent driveways causing delays on Lear Nagle Rd and impacting the capacity and operation of the dual left turn lanes providing access to Lorain Rd eastbound (Figure 7). Woolpert also observed vehicles making U-turns from westbound Lorain Rd back to eastbound Lorain Rd at the end of the existing concrete median near the Dunkin Donuts restaurant (Figure 8).

Figure 7 - Vehicle (Circled) Waiting to Turn Left into Sheetz – Note Resultant Left Turn Lane Imbalance

Figure 8 - Vehicle Making U-Turn from Westbound Lorain Rd at Dunkin Donuts Drive

2.3 Existing Condition Safety Performance

Woolpert used ODOT's Economic Crash Analysis Tool to conduct a Highway Safety Manual (HSM) safety performance analysis of the existing condition at the primary study intersection to determine whether current crash patterns warrant a potential for safety improvement (PSI).

The existing condition ECAT analysis indicated that there is a notable PSI at the Lorain Rd/Lear Nagle Rd intersection, primarily as it relates to property damage only crashes. A positive PSI indicates that the study intersections experience more crashes per year (known to ECAT as "Expected Crashes") than would be predicted for similar sites "Predicted Crashes". "Expected Crashes" are not a one-to-one representation of existing crash data but are instead evaluated in the context of the existing geometry and site conditions. Similarly, predicted crashes are based on HSM formulas for comparable geometries and site conditions. A PSI is a key factor in the justification of safety improvements at a subject location.

The primary study intersection (including adjacent driveways approaching the intersection) has a PSI of 22.0 crashes/year, representing a difference between a predicted average crash frequency of 11.8 crashes/year and the expected crash frequency of 33.8 crashes/year (Figure 9). These results indicate that safety improvements are warranted at the primary study intersection.

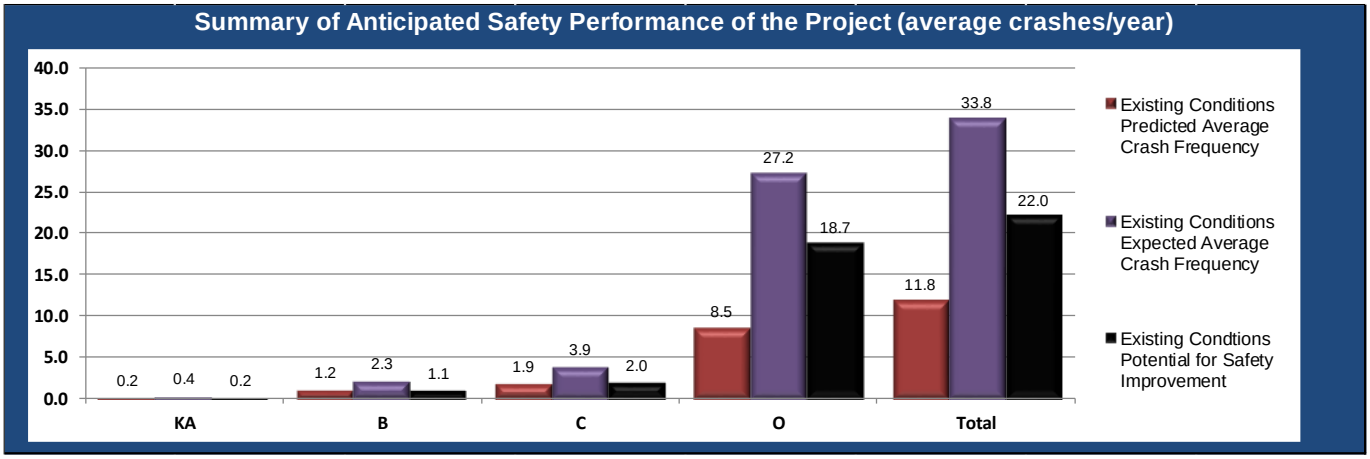


Figure 9 - Existing Condition HSM Safety Performance Analysis Results

CHAPTER 3

Existing Condition Analysis

Lorain at Lear Nagle Traffic Study

3 Existing Condition Analysis

3.1 Data Collection

Woolpert collected 13-hour turning movement counts on Thursday, July 18, 2024 at five intersections within the study area. Turning movement counts included video at each intersection and accounted for the normal AM, Midday, and PM peak periods. Woolpert utilized the counts to conduct a capacity analysis and origin-destination analysis of the study area. During the count collection period, the eastbound I-80 entrance ramp from Lorain Rd was closed for construction. This ramp is outside of the study area, and its closure does not significantly impact the analysis or recommendations of this study. The five intersections counted include:

- Lear Nagle Rd at Chestnut Ridge Rd
- Lorain Rd at Victory Ln
- Lorain Rd at Lear Nagle Rd
- Lorain Rd at I-480 EB Ramps
- Lorain Rd at I-480 WB Ramps

Traffic count data is presented in **Appendix C**.

Woolpert supplemented traffic count collection with an in-person field review on August 13, 2024. Specific emphasis was given to existing signal operations and queueing. Woolpert collected field observations in both the AM and PM peak period to account for varying peak movements.

3.2 Travel Pattern Analysis

The primary travel pattern through the study area is a commuter pattern that connects the City of North Ridgeville to the regional freeway network via I-480 at Lorain Rd. This is most clear at the primary study intersection of Lorain Rd at Lear Nagle Rd where the two heaviest movements across the 13-hour traffic count collection period were the paired movements of the Lear Nagle Rd southbound left and the Lorain Rd westbound right (Figure 10).

The paired movements account for the largest proportion of volume during a typical 13-hour period (31.8% of all movements). Further, the total bi-directional volume on the north leg (southbound) of Lear Nagle Rd during the typical 13-hour period is nearly identical to the east leg (westbound) of Lorain Rd, which is notable considering the physical and geometric differences between both corridors.

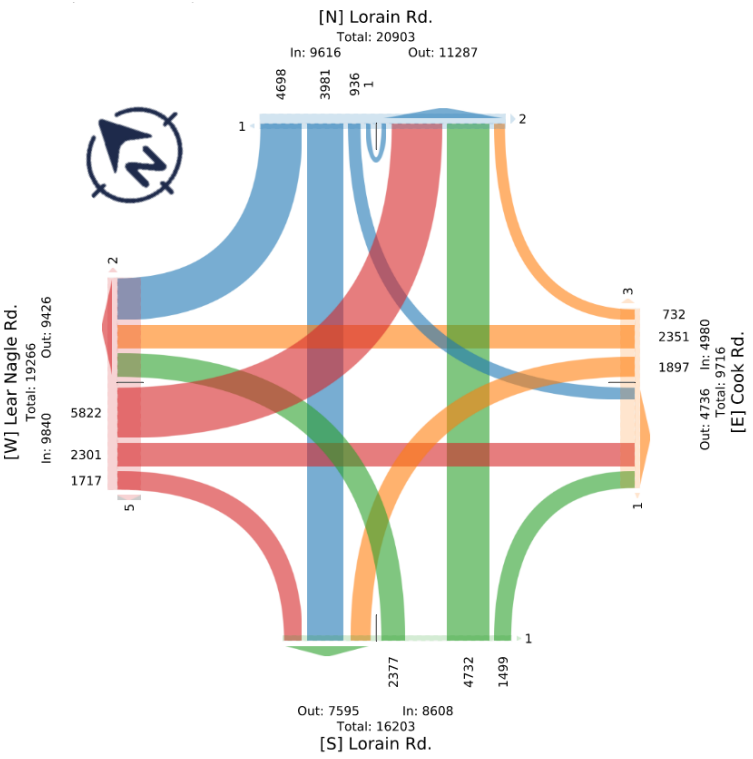


Figure 10 - 13-Hour Turning Movement Count Proportions

Overall, the Lear Nagle Rd southbound left turn is the highest volume individual movement at the intersection in the AM and Midday Peak Period, and second highest (behind westbound right) in the PM Peak Period. Woolpert observed a notable lane imbalance between the dual southbound left turns, with most vehicles preferring the outside left turn lane as this lane becomes the right turn lane onto I-480 eastbound from Lorain Rd. This imbalance contributes to intersection inefficiency as it leaves available capacity unused.

3.3 StreetLight Analysis

Woolpert conducted a Top Route Zone Analysis using StreetLight and its database of historical travel pattern information. This analysis evaluates the paths taken by vehicles that pass through a specific point. This is different from an Origin-Destination (O-D) analysis in that it does not use a defined start or end point for the analysis, and only evaluates where vehicles came from and where they are going. Data for this analysis was collected by StreetLight during April-May 2022, September-October 2022, and April-May 2023.

Woolpert placed the analysis "entry/exit" gate at a location between the Ohio Turnpike overpass and the Sheetz/McDonald's drives on Lear Nagle Rd. The intent of this location is to capture the commuter travel patterns through the study area. The analysis confirmed the primarily commuter nature of travel patterns through the study area. In the high-level analysis, the AM peak (Yellow, Figure 11) movement comes from central and southern North Ridgeville and proceeds to I-480 eastbound before joining I-71 northbound or continuing east. In the PM peak (blue, Figure 12), the pattern reverses.

Figure 11 - AM Peak Regional Travel Pattern

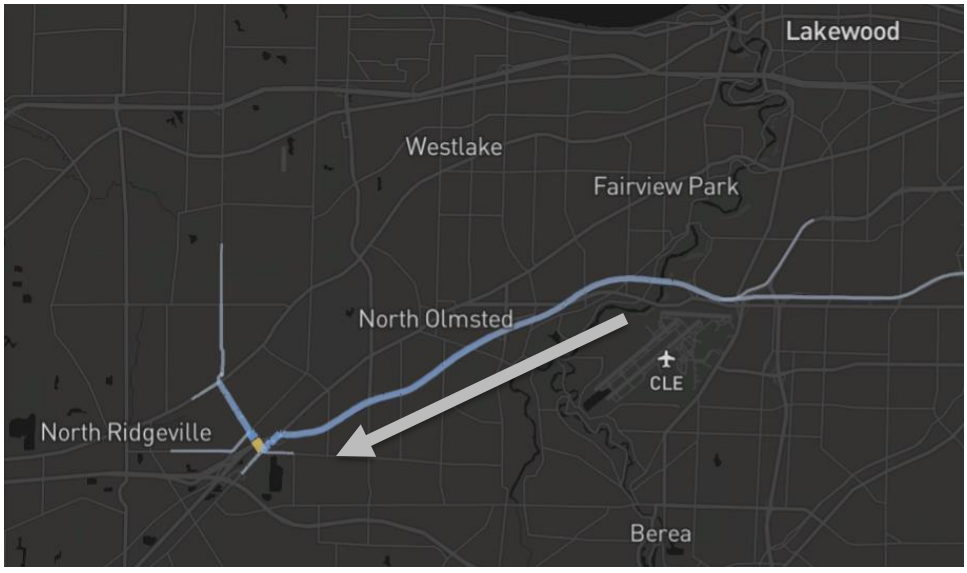


Figure 12 - PM Peak Regional Travel Pattern

Examining the study area specifically, there is little change from the bigger picture. The overwhelming majority of movements in the AM (Figure 13) and PM (Figure 14) peak are Lear Nagle Rd to/from I-480. In the PM Peak, there is a more variation in vehicle paths, with vehicles coming from I-480 eastbound distributing into the roadway network across southern North Ridgeville via Chestnut Ridge Rd, Bainbridge Rd, and Center Ridge Rd.

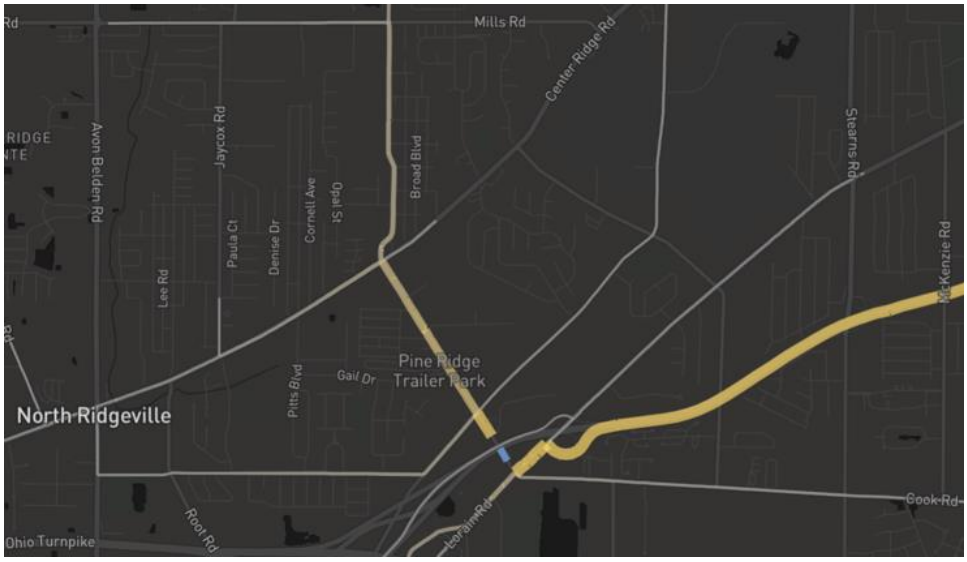


Figure 13 - AM Peak Travel Patterns Through Study Area

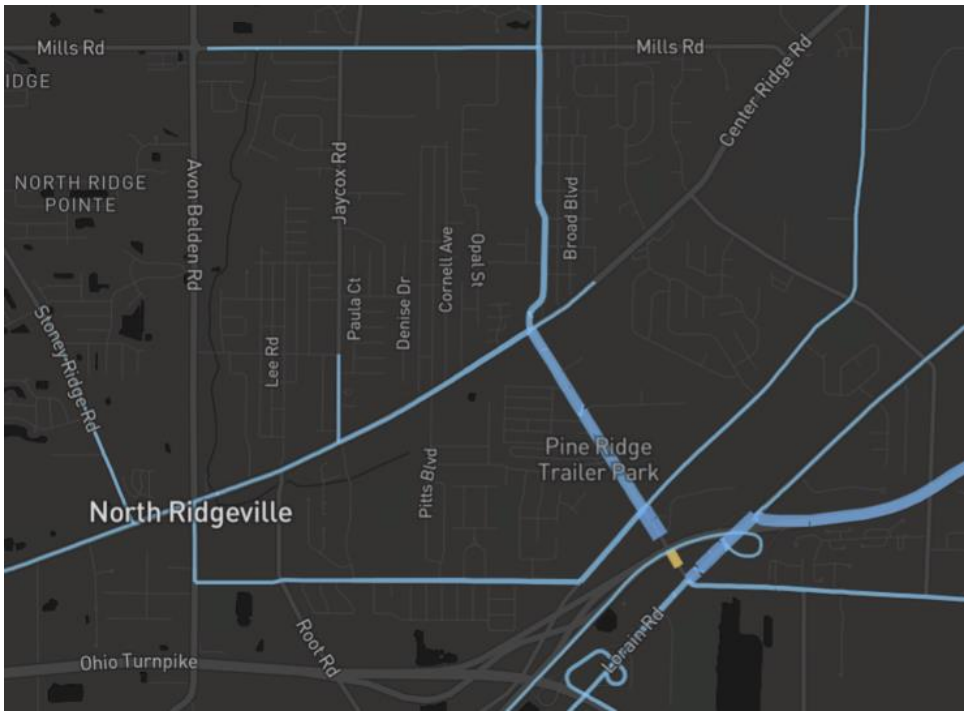


Figure 14 - PM Peak Travel Patterns Through Study Area

3.4 Multimodal Evaluation

There is existing sidewalk along both sides of Lear Nagle Rd on the southbound approach to Lorain Rd with curb ramps and pedestrian signals/pushbuttons on both the NW and SW quadrants of the intersection. A crosswalk is present along the north side of the intersection to cross Lear Nagle Rd (Figure 15) and another crosswalk is present from the NW quadrant to the NE quadrant crossing Lorain Rd. There is an accessible curb ramp and pedestrian signal/pushbutton in the NE quadrant along with sidewalk extending south along Cook Rd towards the County Line. Sidewalk is also present along Lorain Rd, extending on the north side of the roadway from Culver's through Lorain/Lear Nagle to the I-480 interchange and on the south side of Lorain Rd from Victory Ln to the I-480 interchange.

Figure 15 - Existing Crosswalk Across Lear Nagle Rd (Note Lorain Rd Crossing Width)

Limited pedestrian activity was observed along the corridor during field observations, and only 15 pedestrian movements were observed during the 13-hour traffic counts collected in July of 2024. Of note, five of the 15 pedestrian movements occurred at unmarked locations at the intersection: four crossing Cook Rd on the east side of the intersection, and one crossing Lorain Rd on the south side of the intersection.

3.5 Existing Geometrics

The intersection sits several feet above adjacent properties in the NW and SW quadrants, with a substantial retaining wall between the intersection and the Sheetz gas station property in the NW quadrant. While Cook Rd approaches at an angle to the intersection, horizontal curvature is present immediately prior to the intersection to create a near 90-degree angle between Lorain Rd and Lear Nagle Rd/Cook Rd. The existing right of way along Lorain Rd varies between 90 and 100 feet approaching the intersection with the roadway and existing sidewalks taking up much of that width. A pole line is present along the west side of Lear Nagle Rd, the east side of Cook Rd, and both sides of Lorain Rd.

There is limited available right of way for additional widening or geometric modifications on any approach, with adjacent properties (including two active gas stations) beginning at the back of walk in the NW, SW, and NE quadrants of the intersection (Figure 16).

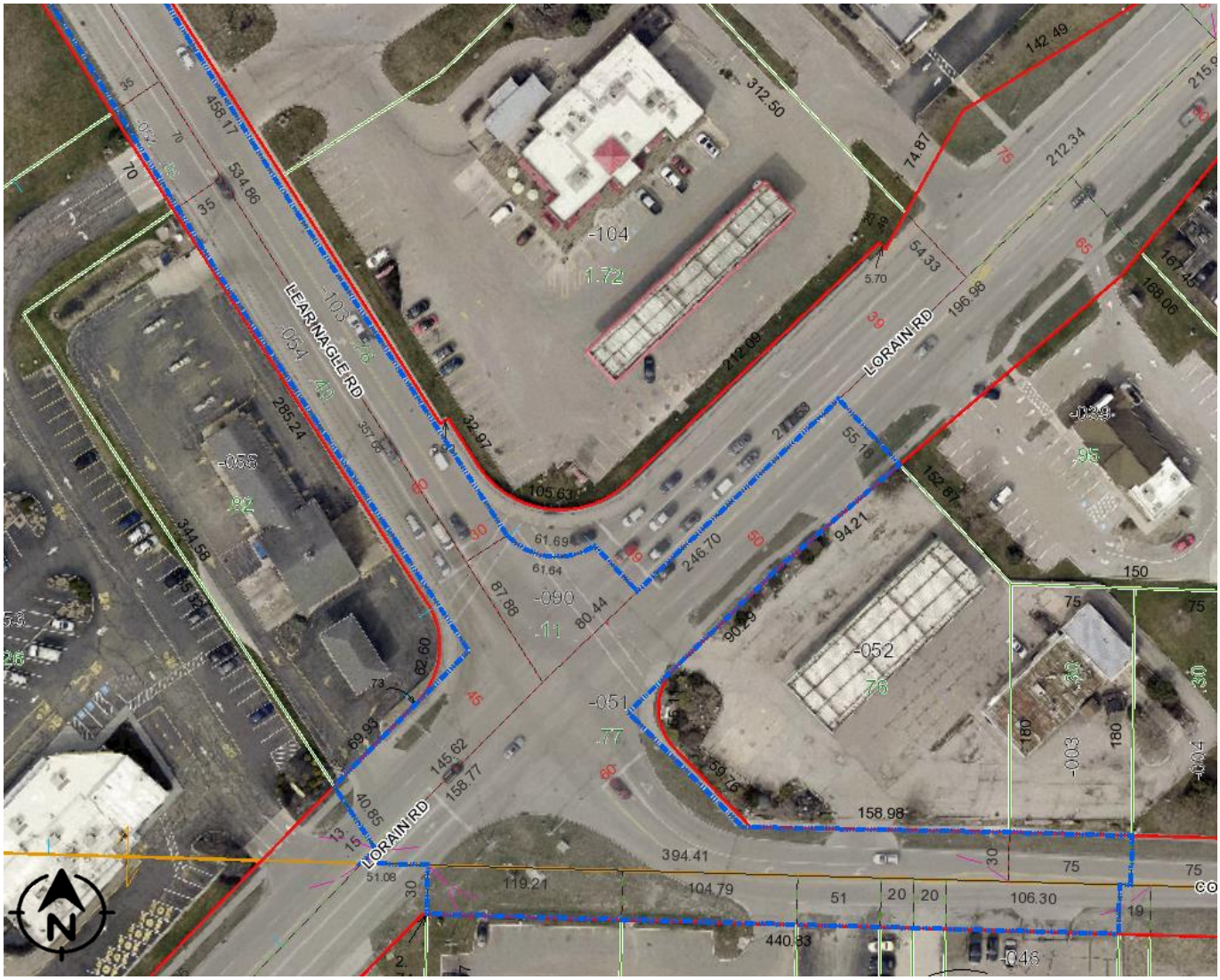


Figure 16 - Existing Right of Way at Lorain Rd/Lear Nagle Rd (Image from Lorain County Auditor GIS Map)

3.6 Capacity Analysis

Woolpert modeled the study area signals and roadway network in TransModeler 7 to evaluate traffic operations and identify movements with significant delay that could be improved through signal timing optimization and/or geometric changes. Woolpert obtained existing traffic signal timing data from the City of North Ridgeville and used that, along with 13-hour traffic count data to populate the microsimulation model. Woolpert utilized guidance in the ODOT Analysis and Traffic Simulation (OATS) Manual to construct, calibrate, and validate the existing condition model. To maintain consistency among all analyses, the existing condition model also serves as the base model for all proposed condition analyses.

Level of Service (LOS) results are presented based on Highway Capacity Manual (HCM) methodology, which defines LOS as a letter scale based on intersection delay in seconds/vehicle (Table 3). An LOS of D or better is assumed to be an acceptable LOS.

The existing condition is defined as the existing roadway geometry, lane use, and signal timings. No optimization or improvements were made prior to running the existing condition capacity analysis in TransModeler. Table 4 presents LOS, delay, and maximum queueing by approach and overall, at each intersection. All results shown reflect the average of 10 microsimulation runs, per OATS manual guidance. Existing condition capacity analysis results are presented in **Appendix D**.

Table 3 - HCM LOS Definitions

Level of Service	Signalized (sec./veh.)	Unsignalized (sec./veh.)
A	≤ 10 sec.	≤ 10 sec.
B	10-20 sec.	10-15 sec.
C	20-35 sec.	15-25 sec.
D	35-55 sec.	25-35 sec.
E	55-80 sec.	35-50 sec.
F	> 80 sec.	> 50 sec.

Table 4 - Existing Condition LOS and Queue Analysis Results

Existing Condition		AM Peak			Midday Peak			PM Peak		
Intersection/Movement		**LOS**	**Delay (sec./veh.)**	**Avg. Queue (ft.)****	**LOS**	**Delay (sec./veh.)**	**Avg. Queue (ft.)****	**LOS**	**Delay (sec./veh.)**	**Avg. Queue (ft.)****
Lear Nagle Rd at Chestnut Ridge Rd	NB	B	12.6	35.8	C	29.3	46.9	C	24.9	139.3
	SB	C	20.8	89.3	B	17.5	59.8	C	34.3	168.3
	WB	C	28.1	13.2	C	28.5	15.7	C	26.2	33.4
	EB	C	28.3	57.1	B	11.7	35.1	C	26.1	41.8
	Overall	C	20.2		B	16.7		C	27.9	
Lorain Rd at Lear Nagle Rd	NB	***F***	***266.8***	808.7	***D***	***35.8***	72.0	***F***	***80.6***	197.3
	SB	***D***	***39.1***	138.3	C	28.5	88.6	***D***	***35.0***	106.9
	WB	B	16.3	33.0	C	24.7	62.9	***F***	***93.9***	754.9
	EB	***D***	***35.6***	114.9	C	25.2	67.6	***F***	***120.4***	817.2
	Overall	***E***	***64.1***		C	27.6		***F***	***82.5***	
Lorain Rd at I-480 EB Ramps	NB	C	33.4	42.8	C	32.6	23.9	C	30.3	24.0
	SB*	C	31.1	0.8	***D***	***42.2***	1.1	***D***	***44.4***	3.3
	WB	A	2.2	2.8	A	1.1	3.1	C	26.9	208.5
	EB	***D***	***43.4***	164.8	A	2.0	12.0	A	5.6	23.0
	Overall	C	32.1		A	3.9		B	18.6	
Lorain Rd at I-480 WB Ramps	NB	***D***	***38.1***	70.3	***D***	***38.6***	90.6	***D***	***39.3***	257.8
	WB	A	5.1	4.3	A	6.3	8.3	B	17.0	31.0
	EB	A	2.3	2.0	A	4.4	5.5	B	18.4	23.2
	Overall	B	18.9		C	21.5		C	29.4	

**The SB approach at the Lorain Rd/I-480 EB Ramps is an access drive for Leppo Rents that sees minimal volume throughout the day*
***Average Queue represents a one-hour average. The maximum individual queue may be significantly larger, see **Appendix D**.*

As shown in Table 4, the congestion occurring throughout the day in the study area starts at the Lorain Rd at Lear Nagle Rd signalized intersection. This congestion is most severe in the PM peak period, however there is still notable congestion in the AM Peak Period. This result is in line with the movement patterns observed during the 13-hour traffic count and highlight the challenges faced by the signal at Lorain Rd/Lear Nagle Rd to process a heavy and paired SB left turn and WB right turn movement without impacting other high demand movements at the intersection.

3.6.1 Southbound Left /Westbound Right at Lorain/Lear Nagle

The existing signalized intersection at Lorain Rd and Lear Nagle Rd operates at a failing LOS during the AM and PM peak. Much of the operational challenges at this intersection relate back to the paired southbound left turn from Lear Nagle onto Lorain and the westbound right from Lorain onto Lear Nagle. The southbound left turn movement represents 59.2% of all southbound demand across the 13-hour traffic count collection period and paired westbound right turn movement represents 48.9% of all westbound demand over the same period.

Such high proportions of turning volumes are not common for most intersections, and thus present challenges from a signal timing perspective. The need to service turning demand is balanced against the need to service thru movements, especially when considering signal timing for pedestrian movements through the intersection. To meet ADA requirements, signals must be timed to provide sufficient time for a pedestrian to utilize the crosswalk before the green phase ends. To this end, pushbuttons are provided for every available pedestrian movement at the intersection.

In the existing condition, the Lorain/Lear Nagle signal is only providing sufficient pedestrian time when the pushbutton is actuated ("actuated only" operation). This type of operation takes the signal out of coordination with its adjacent signals to service the pedestrian phase completely, before recovering back into coordination over several subsequent cycles. While actuated only pedestrian operation allows the signal to service vehicle movements effectively, the primary drawback is the potential that pedestrians go un-serviced/underserviced in the event of a pushbutton malfunction.

The existing signal timings favor the southbound left/westbound right turn movement pair. Table 5 presents the proportion of signal green time allocated to the southbound left turn phase vs. the southbound thru/right movement. Note that the existing southbound left turn phase operates as "protected only" meaning that there is no "permissive" (green ball) phase where vehicles can turn left after yielding to opposing thru movements. Also note that there is an existing overlap phase in each peak period, meaning that while the southbound left turn is displaying a green arrow, the westbound right turn is also displaying a green arrow. The proportions show that green time is adequately proportioned to favor the southbound left turn movement given the existing proportion of demand.

Table 5 - Existing Proportion of Green Time Allocated to the Southbound Left Turn Movement

Signal Timing Period	% of Volume SBL vs. SBT/R	% of Green SBL vs. SBT/R
AM Peak	69.7%	62.3%
Midday Peak	45.4%	57.6%
PM Peak	54.1%	57.6%

Ultimately, a combination of very high demand, startup lost time (the time it takes vehicles to start moving from a stopped condition), and geometrically constrained capacity result in failing LOS for not just the paired southbound left/westbound right movement, but also the intersection overall.

3.6.2 Signal Warrant Analysis – Lorain Rd at Victory Ln

Woolpert evaluated the Lorain Rd/Victory Ln TWSC intersection to determine if a traffic signal is warranted at the intersection. This intersection sees a lot of event traffic arriving and departing from the Victory Sports Park athletic complex on the south end of Victory Ln. Due to the sporadic and primarily evening to late evening nature of this traffic, it is challenging to capture the full nature of movements during a 13-hour daytime count. Additionally, traffic signals are not typically installed at locations where only sporadic bursts of traffic occur, unless those instances are large enough to impact the surrounding roadway network.

Based on 13-hour traffic counts collected at the intersection, the intersection does not warrant a signal under the 8-hour, 4-hour, or peak hour traffic signal warrant metrics. A westbound left turn lane is warranted at the intersections per ODOT Location and Design Manual (L&D), Volume 1 Figure 401-5c, in both the AM and PM peak periods. Per L&D Figures 401-9 and 401-10, the warranted length of a westbound left turn lane is 150 ft based on PM peak period volumes. Signal warrant analysis information is presented in **Appendix E**. Turn lane warrants and calculations are presented in **Appendix F**.

CHAPTER 4

Alternatives Evaluation

Lorain at Lear Nagle Traffic Study

4 Alternatives Evaluation

Woolpert evaluated potential short-, medium- and long-term alternatives to address existing crash patterns, traffic counts, movement patterns, and traffic operations in the study area. All alternatives presented have independent utility but a combination of alternatives at separate locations within the study area may be necessary to fully address existing safety and traffic concerns.

4.1 Regional Growth

The City of North Ridgeville and eastern Lorain County are experiencing rapid growth in the form of new housing and commercial developments, adding vehicles to the local roadway network and impacting existing infrastructure. Woolpert obtained 25-year growth projections from the Northeast Ohio Areawide Coordinating Agency (NOACA) to identify projected volumes on segments within the study area. Figure 17 presents NOACA's 2050 cumulative growth projections vs. present day traffic for the AM and PM peak period.

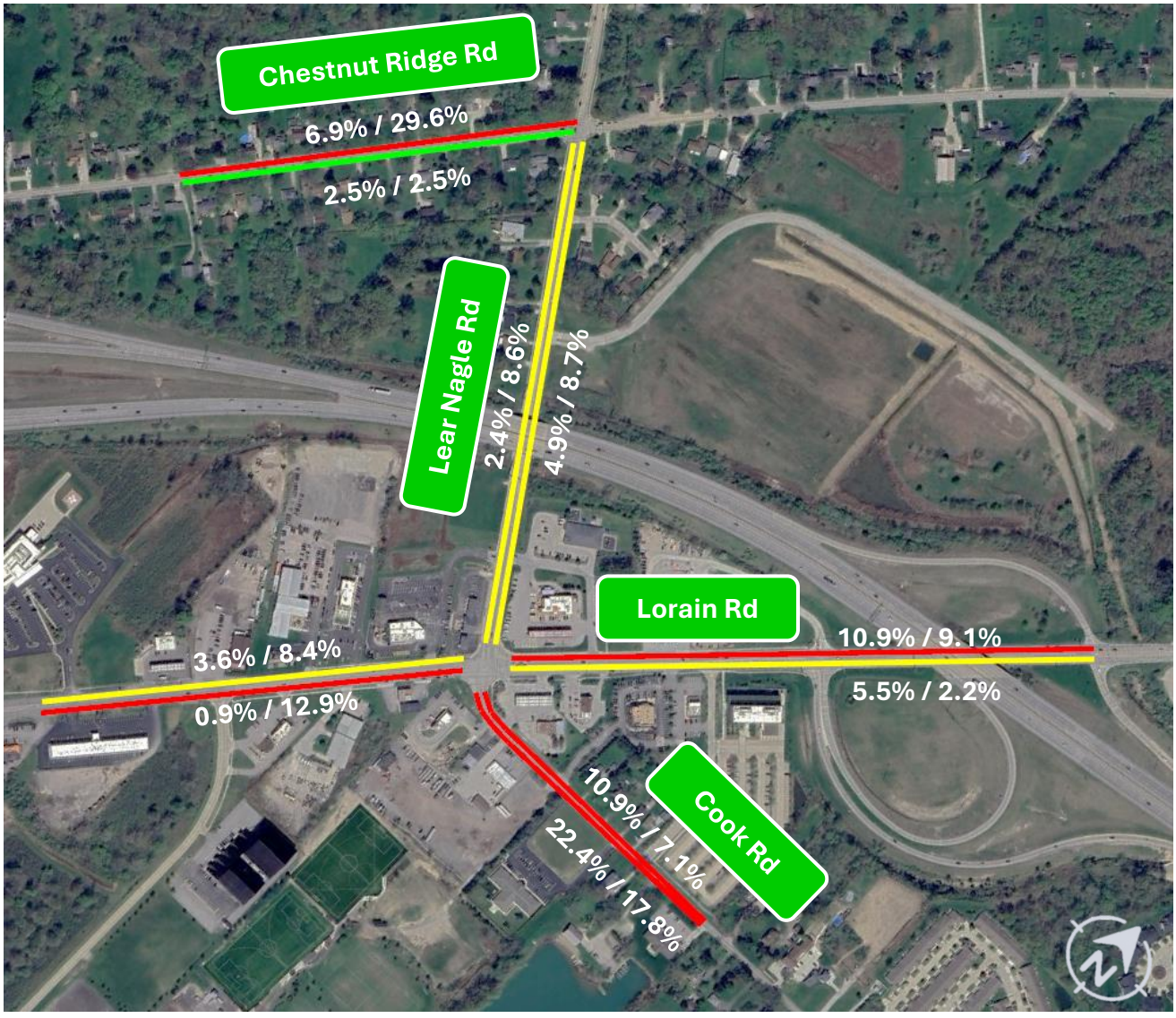


Figure 17 - NOACA Growth Projections for AM/PM Peak Period (2025 to 2050 Total Growth)

NOACA projects study area segment growth rates between 0.15%-0.80%/year in the AM peak period, and 0.35%-0.65%/year in the PM peak period. In general, total growth in the 2050 analysis year compared to 2024 volumes is approximately 10%, with higher rates (15-20%) on Cook Rd south of the primary study intersection. 2025 and 2050 volume plates are presented in **Appendix G**.

As growth increases, the strain on the existing roadway network will grow. In the existing condition, the primary study intersection is oversaturated, and the existing southbound left/westbound right paired movement is over-capacity. North of the primary study intersection, at Lear Nagle Rd and Chestnut Ridge Rd, continued volume growth will also reach oversaturated levels by 2050 without capacity improvements. The Lear Nagle Rd Corridor is the primary connection for demand from Bainbridge Rd (via Chestnut Ridge Rd) and Center Ridge Rd to the I-480 interchange on Lorain Rd. Given the level of projected growth, capacity improvements will be necessary on the Lorain Rd and Lear Nagle Rd corridors.

4.2 Physical Constraints

Woolpert explored a wide variety of alternatives for the study area. In general, the intent of the alternatives presented is to minimize necessary right of way acquisition and any impacts to property. Conventional widening alternatives were explored at a high level but were determined to be too impactful to adjacent properties. At Lorain Rd/Lear Nagle Rd, both a gas station (Figure 18) and car wash are immediately adjacent to the roadway and below grade. A retaining wall separates the businesses from the roadway; any widening to Lorain Rd or Lear Nagle Rd would directly impact this retaining wall and likely require total property takes.

Woolpert focused on short-term alternatives that required no physical changes to the roadway, and long-term alternatives that could stay within the existing curb-to-curb widths at the Lorain Rd/Lear Nagle Rd intersection and/or resulted in minimal impacts to existing properties.

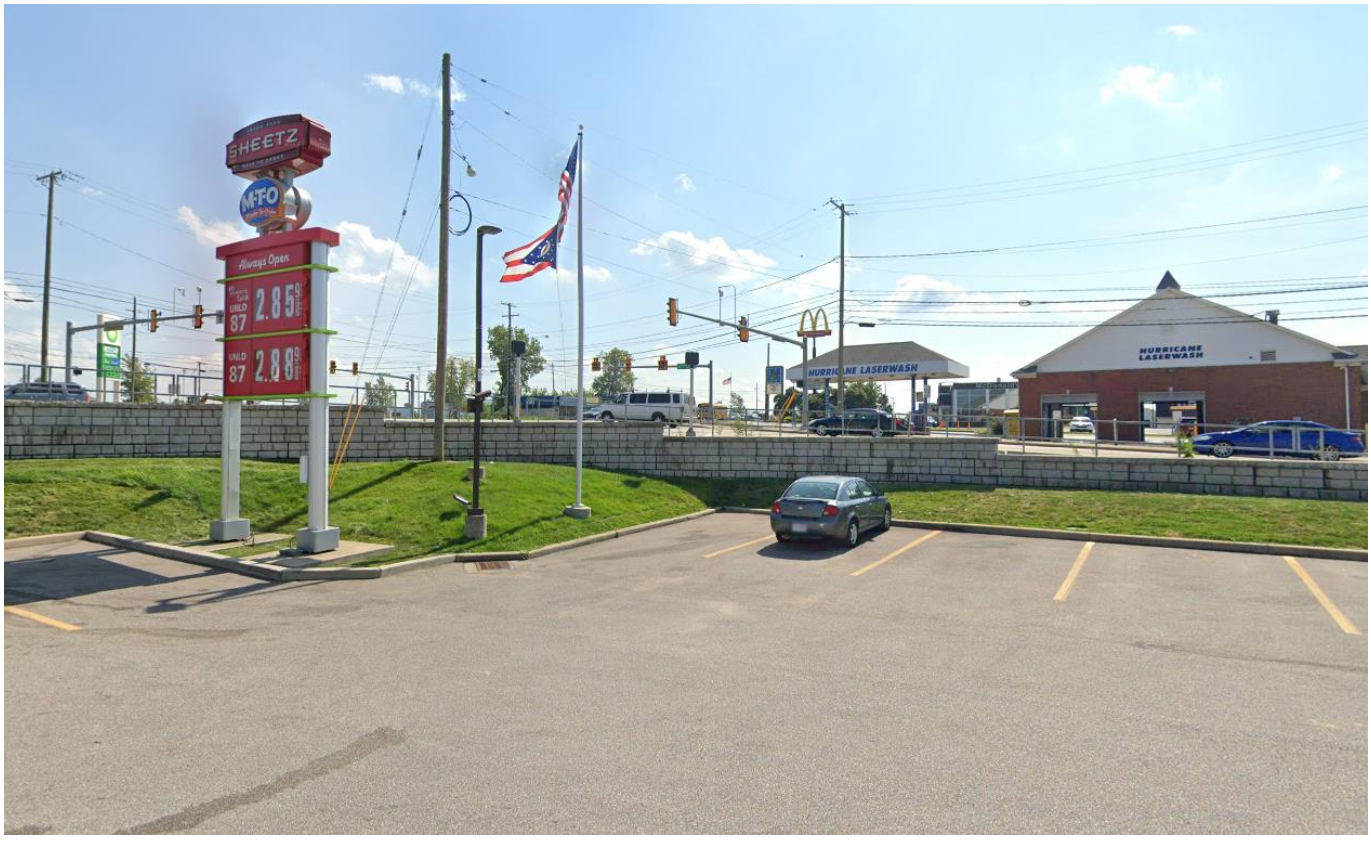


Figure 18 - Retaining Wall and Embankment at Sheetz Property (NW Quadrant) (Google)

4.3 Short-Term Improvements

4.3.1 Signal Timing Optimization

Woolpert explored signal timing optimization as a short-term improvement strategy for the study area. At each signalized intersection, Woolpert optimized the existing signal timings by adjusting signal splits and offsets to maximize green time to high demand movements while attempting to minimize the overall impact to the lower demand movements. In the existing condition, several movements are over capacity. Signal timing optimization can address this condition to an extent, but future growth will likely necessitate physical roadway improvements.

The signals at Lorain Rd/Lear Nagle Rd, and at Lear Nagle Rd/Chestnut Ridge Rd are the most in need of optimization and are the most impactful to the study area overall. At Lorain Rd/Lear Nagle Rd, existing signal timings favor the southbound left/westbound right movement, which is the heaviest movement pair throughout the day. Because of downstream lane use at the I-480 EB entrance ramp, there is a severe lane imbalance for the southbound dual left turn movement. This lane imbalance results in capacity loss when drivers favor the rightmost left turn lane.

Woolpert optimized signal timings for both the 2025 present day condition, and the 2050 full growth condition. As shown in Table 6, signal timing optimization provides marginal improvement for 2025 volumes. Without physical improvements to the roadway, signal timing optimization alone cannot accommodate 2050 volumes (Table 7).

Table 6 – 2025 LOS Results for Signal Timing Optimization

Optimized Signal Timings		2025 AM Peak			2025 PM Peak		
Intersection/Movement		LOS	Delay (sec./veh.)	95th % Queue (ft.)**	LOS	Delay (sec./veh.)	95th % Queue (ft.)**
Lear Nagle Rd at Chestnut Ridge Rd	NB	B	11.2	112.5	C	21.9	259.8
	SB	C	21.2	258.6	C	24.4	323.8
	WB	C	27.8	81.5	**D**	**37.9**	130.0
	EB	C	28.1	139.2	**D**	**48.4**	186.2
	Overall	B	19.6		C	28.2	
Lorain Rd at Lear Nagle Rd	NB	**D**	**47.2**	319.3	**E**	**79.8**	456.8
	SB	**D**	**36.0**	223.7	**D**	**53.3**	345.9
	WB	C	23.9	110.4	**E**	**76.5**	899.7
	EB	**D**	**37.1**	187.5	**D**	**52.4**	360.9
	Overall	**D**	**35.5**		**E**	**65.3**	
Lorain Rd at I-480 EB Ramps	NB	C	33.6	126.0	C	32.5	81.2
	SB*	-	-	-	-	-	-
	WB	A	4.9	28.2	A	6.7	129.9
	EB	**D**	**45.9**	321.5	A	3.8	47.2
	Overall	C	34.4		A	7.3	
Lorain Rd at I-480 WB Ramps	NB	**D**	**39.0**	157.8	C	31.8	277.8
	WB	A	6.0	22.2	B	16.9	104.9
	EB	A	5.4	19.3	B	10.5	41.1
	Overall	C	20.3		C	23.6	

**The SB approach at the Lorain Rd/I-480 EB Ramps is an access drive for Leppo Rents that sees minimal volume throughout the day*
***95th Percentile Queue Lengths represent longest lane queue*

Table 7 – 2050 LOS Results for Signal Timing Optimization

Optimized Signal Timings		2050 AM Peak			2050 PM Peak		
Intersection/Movement		LOS	Delay (sec./veh.)	95th % Queue (ft.)**	LOS	Delay (sec./veh.)	95th % Queue (ft.)**
Lear Nagle Rd at Chestnut Ridge Rd	NB	B	18.6	85.4	D	38.2	304.7
	SB	C	24.5	325.4	F	197.5	1311.0
	WB	C	30.3	53.5	C	34.1	138.4
	EB	D	35.9	109.8	D	40.9	139.7
	Overall	C	25.5		E	74.5	
Lorain Rd at Lear Nagle Rd	NB	F	346.5	2538.5	F	460.9	2663.8
	SB	E	63.3	337.1	F	234.5	1217.2
	WB	D	36.9	171.9	F	75.0	878.1
	EB	D	53.8	263.8	F	111.4	816.6
	Overall	F	98.1		F	169.4	
Lorain Rd at I-480 EB Ramps	NB	E	68.6	249.1	C	22.3	72.6
	SB*	-	-	-	-	-	-
	WB	B	18.6	174.0	F	88.1	806.3
	EB	D	54.4	523.5	B	13.4	194.6
	Overall	D	46.8		D	54.0	
Lorain Rd at I-480 WB Ramps	NB	D	44.1	197.2	F	210.8	1174.9
	WB	A	7.2	34.2	C	27.8	242.7
	EB	A	4.8	20.0	D	52.1	142.7
	Overall	C	22.9		E	72.2	

**The SB approach at the Lorain Rd/I-480 EB Ramps is an access drive for Leppo Rents that sees minimal volume throughout the day*
***95th Percentile Queue Lengths represent longest lane queue*

One drawback to this method of signal timing optimization is that it requires all pedestrian phases to be run "actuated only" as several movements on lower demand approaches have had split times reduced below the pedestrian clearance interval to favor higher demand movements. This is a common strategy in signal timing design but favors vehicles over pedestrians. In actuated only operation, the signal will service the appropriate pedestrian clearance interval only after the appropriate pushbutton has been actuated. This will require the signal to come out of coordination while servicing the pedestrian movement before recovering back into coordination following a few cycles.

To accommodate future growth and changes in movement patterns, signal optimization should be revisited regularly to ensure they continue to meet existing demand and travel patterns. An Advanced Traffic Management System (ATMS) such as Econolite Centracs or Cubic GridSmart can modify individual signal timings and corridor timing parameters in real time to address changing demand patterns but cannot completely address oversaturated conditions where volume demand significantly exceeds available roadway capacity. Complete capacity analysis results for the signal optimization analysis are presented in **Appendix H**.

4.3.2 Access Management at Sheetz/McDonald's Drive

Nearly one-third of all crashes within the Lorain Rd/Lear Nagle Rd intersection area occurred at the Sheetz/McDonalds full access drives north of the signalized intersection. Most of the crashes at this location involved either left turning vehicles existing the drives onto Lear Nagle Rd or vehicles turning left from Lear Nagle Rd onto the access drives (Figure 19).

Crashes at the drives resulted in a higher injury rate than the main signalized intersection at Lorain Rd/Lear Nagle Rd, and the queueing produced by vehicles waiting to turn in/out creates operational inefficiency that impact the signal at Lear Nagle Rd/Lorain Rd. The number of crashes at the drives approaching the intersection contributed to this segment of Lear Nagle Rd appearing on ODOT's HSIP Priority List for 2024.

Figure 19 - Multiple Vehicles (Circled) Waiting to Turn On/Off Lear Nagle Rd at Sheetz/McDonald's Drives

Access management is an **FHWA Proven Safety Countermeasure** that reduces conflict points at unsignalized driveway intersections and **directly addresses the primary crash types occurring at the Sheetz/McDonald's driveways**. Access management can come in multiple forms, from very short-term vertical delineators or bollards such as Qwick-Kurb, to longer term solutions including reconstruction of the driveways to physically prohibit left turn exits (Right-In, Right Out), and/or construction of a raised median to prohibit movements.

While there are notable safety benefits to access management, there are several drawbacks to access management if it is done as a standalone improvement. Most notably, restricting left turns in or out of both drives would restrict access to the Sheetz/North Ridgeville Kinder Care/Taco Bell properties from all vehicles approaching from the north on Lear Nagle Rd, and all vehicles attempting to exit southbound with an eastbound destination including I-480. Destinations to the west, such as the Ohio Turnpike and SR 10 could be accessed through the local roadway network, but this may be impractical or infeasible especially for fuel delivery at the Sheetz gas station.

Access management in heavily developed areas is most effective when combined with longer term solutions that maintain access to all drives via movement redistributions at nearby intersections. This can be done by allowing U-Turns at intersections, or by converting intersections on the ends of access managed segments with roundabouts, which can accommodate U-Turn movements as part of their normal operation. Ensuring access is maintained also reduces the potential impacts to adjacent businesses following modifications to driveways and the roadway network.

4.4 Lorain Rd Corridor

The Lorain Rd Corridor extends from the North Ridgeville city limits on the east end to Victory Ln on the west end, passing through the I-480 interchange and Lear Nagle Rd/Cook Rd. Woolpert explored various alternatives to improve operations on Lorain Rd, especially during the AM and PM peak periods. Woolpert also accounted for projected growth, by growing present day (2025) volumes to 2050 volumes using NOACA growth rates.

4.4.1 Medium Term Improvement: I-480 EB Entrance Ramp Improvements

One of the highest demand movements along the entire corridor is the Lorain Rd eastbound right turn onto I-480 EB. This movement is served by a single exclusive right turn lane at the I-480 EB signalized ramp terminal intersection. In the existing condition, this movement is provided an exclusive arrow phase and an overlap phase with the northbound left turn movement off the ramp onto Lorain Rd westbound.

The movement is oversaturated, with a Volume to Capacity (V/C) ratio of 1.38 during the AM peak period. The existing single eastbound right turn lane also creates an upstream lane imbalance at Lear Nagle Rd, where most vehicles choose the rightmost left turn lane because that lane becomes the Lorain Rd eastbound right turn lane onto I-480. This lane imbalance results in available capacity on Lear Nagle Rd and Lorain Rd going unused, which furthers the operational issues along the corridor.

Woolpert explored medium-term alternatives to the I-480 EB ramp terminal intersection to add capacity for the eastbound right turn movement onto the interstate, and to reduce the likelihood of lane imbalances on Lorain and Lear Nagle Rd by adjusting lane use and lane alignment. While outside the scope of this study, improvements which change physical geometrics at an interstate interchange ramp are subject to Interchange Modification Study (IMS) requirements by ODOT. Figure 20 shows the proposed improvement to the eastbound ramp terminal intersection.

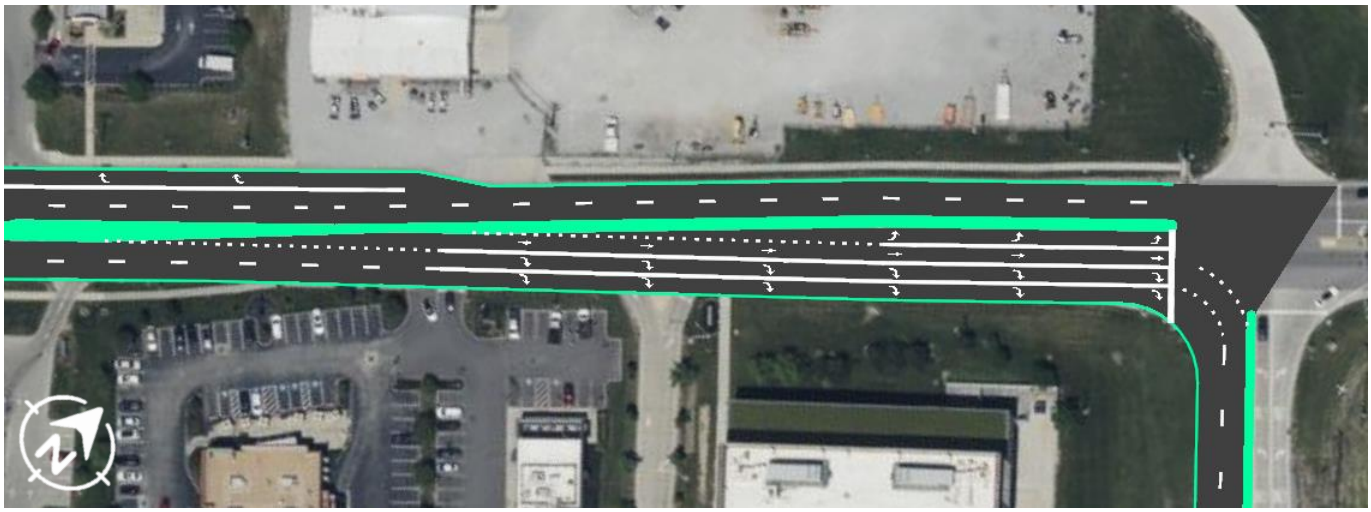


Figure 20 - Medium Term Alternative at Lorain Rd and I-480 EB Ramp

The proposed improvement would add a second eastbound right turn lane and widen the ramp to accommodate two entrance lanes before reducing down to a single lane entrance ramp prior to joining I-480 eastbound. The eastbound right turn lanes would form from the existing Lorain Rd thru lanes to reduce lane imbalance. The thru and left turn lanes would become add lanes to the left of the eastbound right turn lanes.

Capacity analysis indicates that this alternative would improve operations in the 2025 AM peak period but make no significant improvement in the 2025 PM peak period. Further, because this improvement assumes no changes at Lorain Rd and Lear Nagle Rd, the benefits in the 2050 analysis period are limited due to capacity constraints at upstream intersections such as Lorain Rd/Lear Nagle Rd, and Lear Nagle Rd/Chestnut Ridge Rd.

4.4.2 CAP-X Analysis

With growth in the study area anticipated to reach 0.5%-1.0%/year over the next 25 years, a long-term approach to improvements is warranted. Additional growth will push the primary study intersection further over capacity and create capacity issues to both up and downstream intersections.

Woolpert used FHWA's Capacity Analysis Planning for Junctions (CAP-X) tool to explore various alternatives for the Lorain Rd/Lear Nagle Rd intersection to address significant queueing and corridor congestion in both the present and future condition. The CAP-X tool takes volume information and conducts a high-level analysis of various intersection configurations, including both conventional and alternative intersection designs.

Based on existing movement patterns, the CAP-X tool determined the following intersection configurations warrant further exploration:

- Conventional Configuration with Widening
- Displaced Left Turn
- Quadrant Road
- Restricted Crossing U-Turn (RCUT)

Conventional Widening, and a Displaced Left Turn Intersection would result in significant impacts to adjacent properties, likely requiring total takes at the Sheetz gas station due to the existing difference in vertical geometry between the property and the intersection. Significant impacts would likely be expected at the Hurricane Laserwash and BP properties, including a possible total take at the BP due to the location of the gas station tanks.

For **conventional widening**, an additional northbound lane would be required on Lear Nagle Rd, and the westbound right turn lane would either be converted to dual right turn lanes operating as protected only, or as a single continuous right turn lane that does not stop at the intersection. While the westbound continuous right turn alternative provides the greatest operational benefits, it presents potential safety concerns for pedestrian movements at the intersection as it would eliminate the signal-controlled pedestrian movement in favor of a "yield to pedestrians" condition. A dual westbound right turn would likely operate as protected only, limiting its benefits. Alternatively, a "No Turn on Red except Curb Lane" could be implemented to increase efficiency.

For the **Displaced Left Turn** (CFI), a partial CFI would be sufficient (similar in configuration to Figure 21), with southbound left turns being displaced along with the paired westbound right turn movement. Note the size of this intersection, and the additional signals and crossovers within the intersection. The CFI functions in part by separating left turn movements from the primary intersection and operating the movements from separate signals to allow left turn and thru movements to operate simultaneously (NCDOT CFI Video Link). **CFIs are very efficient**, especially where left turn demand is high.

Their primary drawback is their physical size, which increases impacts and significantly increases crosswalk lengths for pedestrians. For this reason, CFIs are commonly seen in exurban or newly developing suburban use cases, as opposed to already developed locations.

Figure 21 - Example of Displaced Left Turn Intersection: Austin Blvd at SR 741, Miamisburg OH

A **Quadrant Road** would have similar benefits to a CFI, in part by separating left turn movements and operating them separately from thru movements. Quadrant roads are specifically designed to address high demand left turn movements and paired left/right demand pairs (VDOT Quadrant Road Video Link). A quadrant road would require a new alignment to facilitate the southbound left/westbound right turn movement at the Lorain Rd/Lear Nagle Rd intersection.

This alignment currently exists as a commercial roadway connecting the Taco Bell to Lorain Rd (westbound only) and Lear Nagle Rd; however, this alignment is only 28 ft wide at its narrowest point, which would only accommodate a two-lane section, vs the three to four lane section required to accommodate future traffic. Alternative alignments would likely require total takes of the North Ridgeville KinderCare/Taco Bell, and potential impacts to the Leppo Rents property.

Using the commercial drive alignment would require new signals at the Sheetz/McDonalds and Sheets/Taco Bell drives, which would be coordinated with the main signal (Figure 22), and would likely impact both the Sheetz and Taco Bell properties including potential driveway consolidation/relocation. Additionally, a new signal at Sheetz/Taco Bell would create access constraints on the Dunkin Donuts property south of Lorain Rd, likely requiring a driveway consolidation.

Like CFIs, quadrant roads are very efficient and are designed to facilitate heavy turning movement pairs. Quadrant roads are most effective when the quadrant road itself does not have driveways. In the case of the study area, this would require a totally new alignment and require significant right of way and or property impacts.

Figure 22 - Conceptual Layout of Low-Impact Quadrant Road at Primary Study Intersection

4.4.3 Long Term Improvement: Restricted Crossing U-Turn (RCUT)

Neither the conventional widening, CFI, or quadrant road alternatives can achieve an acceptable LOS in the 2050 analysis period without significant physical property or right of way constraints. With the joint goals of improving vehicle operations, improving safety, and minimizing impacts to property and right of way, a Restricted Crossing U-Turn (RCUT) presents a viable alternative. An RCUT intersection is an **FHWA Proven Safety Countermeasure** that can reduce injury crashes at signalized intersections by upwards of 20% while improving overall intersection efficiency. Like a CFI, an RCUT aims to redistribute movements and reduce the number of signal phases necessary to increase green time and reduce delay.

In an RCUT, all movements off the side street (Lear Nagle Rd) are converted to right turns. Vehicles intending to proceed left or thru are then directed to a downstream signal where they make a U-Turn movement followed by a subsequent movement to their intended destination. This intersection configuration converts a single eight-phase signal into three two-phase signals that operate in a coordinated fashion to significantly reduce overall vehicle delay (VDOT RCUT Video Link). An example of an RCUT intersection in Beavercreek Township, OH is shown in Figure 23.

Figure 23 - Example of an RCUT Intersection: US 35 at S Orchard Ln, Beavercreek Township OH

By simplifying signal operation, an RCUT can process more turning movements than a conventional intersection without increasing overall vehicle delay. At the main signalized intersection, Lorain Rd left turn movements can operate simultaneously with right turn movements from Lear Nagle Rd/Cook Rd, increasing green time for major movements and reducing delay.

As shown in the figure, U-Turn movements at an RCUT typically occur at a dedicated U-turn bulb approximately 600-800 ft from the main intersection. The U-turn bulb is the most physically impactful part of an RCUT intersection given the size required to accommodate large vehicles such as WB-62 trucks. Figure 24 presents what a compact RCUT would look like if implemented with U-Turn bulbs on the Lorain Rd Corridor.

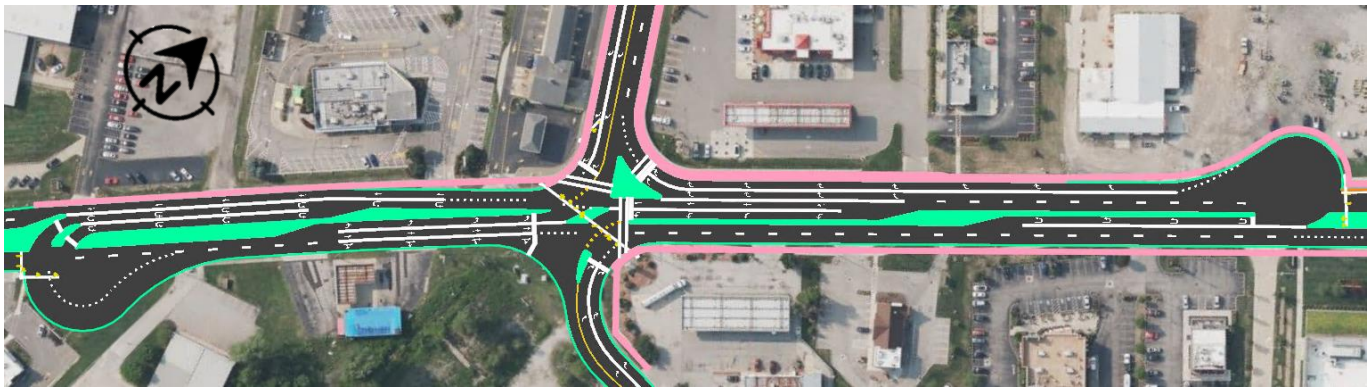


Figure 24 - Proposed RCUT at Lorain Rd and Lear Nagle Rd

As shown in Figure 23, RCUT intersections typically have a central island median through the length of the RCUT to assist with lane alignment and lane continuity along with dedicated left turn and U-turn lanes. In the case of Lorain Rd, there is a small existing median to the east of the primary study intersection, and no median to the west. Some widening of the roadway would be necessary to introduce a median to accommodate left turn and U-turn lanes for an RCUT along Lorain Rd, but the widening impacts would be significantly less than what would be required for other alternative intersection designs such as a CFI.

Note that the Lear Nagle Rd southbound approach has been converted to two right turn lanes. On Cook Rd, the existing left turn lane has been converted to a second right turn lane. A dual westbound right turn lane is provided on Lorain Rd, converting the westbound approach from dual thru lanes to a single thru lane. A single westbound thru lane is necessary to avoid widening that may impact the Sheetz gas station property.

4.4.4 Long Term Improvement: Restricted Crossing U-Turn with Roundabouts

An RCUT presents a viable solution for both capacity and safety in the 2025 and 2050 analysis periods but has significant physical impacts in the form of U-Turn bulbs on each end of the intersection. Woolpert examined potential alternatives to leverage the benefits of an RCUT while minimizing potential impacts to property and right of way. Utilizing **roundabouts** as U-Turn locations presents multiple benefits including better intersection capacity, improved safety, minimized impacts, and the potential to introduce corridor access management.

Woolpert developed an RCUT alternative (Figure 25) with roundabouts on each end, one at Victory Ln and another at the I-480 EB ramp terminal intersection. Analysis of 2050 volumes indicates that a 2x2 multi-lane roundabout will be necessary at Victory Ln and at the I-480 EB ramp terminal intersection. As part of the analysis, Woolpert incorporated a 2x2 multi-lane roundabout at the I-480 westbound ramp to accommodate future exit ramp queue lengths that are expected to spill back off the ramp onto the mainline by 2050. While multi-lane roundabouts present challenges from both a design and vehicle operation perspective, anticipated 2050 volumes exceed the commonly accepted thresholds for single-lane roundabouts by a significant margin. **A full-size conceptual graphic of the proposed RCUT with roundabouts is presented in Appendix I.**

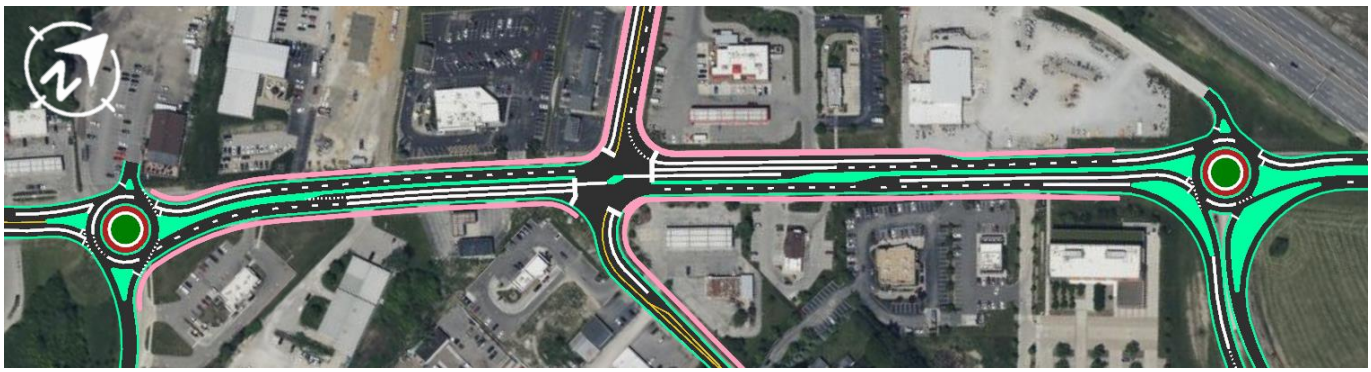


Figure 25 - Conceptual RCUT with Roundabouts on Lorain Rd at Lear Nagle Rd

From a capacity perspective, an RCUT produces significant reductions in overall vehicle delay by reducing the number of signal phases required to service the intersection. The existing Lorain Rd/Lear Nagle Rd intersection operates as an 8-phase signal with several dedicated left turn phases and one protected only left turn phase. The proposed RCUT would operate as a two-phase signal on a significantly shorter cycle length, meaning that more green time can be allocated to more vehicles over the same period vs. the existing signal, improving overall traffic flow.

Roundabout intersections on both ends of the RCUT provide convenient locations for U-Turn movements. The Lear Nagle Rd southbound left turn would be converted to a southbound right followed by a westbound U-Turn at the roundabout at Lorain Rd/Victory Ln. Accounting for future growth, this is the most critical movement from a capacity perspective. Based on current traffic volumes, a single westbound U-Turn Lane is sufficient for this movement, however, a second U-Turn Lane is required if full 2050 projected are met. Therefore, a roundabout at Lorain Rd and Victory Ln should be designed to accommodate two westbound U-Turn lanes but may be striped for one until such point that capacity dictates both lanes are necessary.

Woolpert evaluated LOS at both the signalized central intersection, and all three proposed Lorain Rd roundabouts. Per the HCM, roundabouts follow unsignalized LOS criteria, as shown in Table 3 on Page 15. Table 8 presents LOS results for the central signalized intersection, with roundabout LOS shown in Table 9, both for the 2025 AM/PM and 2050 AM/PM peak periods. For this analysis, a two-lane westbound U-Turn was assumed in both the 2025/2050 analyses at Lorain Rd/ Victory Ln.

Table 8 - RCUT LOS Results for the Signalized Central Intersection

RCUT Signalized		2025 AM Peak		2050 AM Peak		2025 PM Peak		2050 PM Peak	
Intersection/Movement		LOS	Delay s/veh	LOS	Delay s/veh	LOS	Delay s/veh	LOS	Delay s/veh
Lorain Rd at Lear Nagle Rd	NB	B	14.6	B	15.2	B	11.1	B	11.5
	SB	C	21.1	C	21.9	B	16.4	B	18.5
	WB	A	9.2	A	9.2	B	10.9	B	13.3
	EB	B	18.7	C	22.8	B	13.9	B	15.8
	Overall	B	17.0	B	18.7	B	13.0	B	14.9

Table 9 - RCUT LOS Results for the Proposed Multi-Lane Roundabout Intersections

RCUT/Roundabout Unsignalized		2025 AM Peak		2050 AM Peak		2025 PM Peak		2050 PM Peak	
Intersection/Movement		LOS	Delay s/veh	LOS	Delay s/veh	LOS	Delay s/veh	LOS	Delay s/veh
Lorain Rd at Victory Ln (2x2 RAB)	Overall LOS	A	8.7	B	10.6	A	7.4	B	10.0
Lorain Rd at I-480 EB Ramps (2x2 RAB)	Overall LOS	A	3.4	A	3.8	A	4.7	A	6.1
Lorain Rd at I-480 WB Ramps (2x2 RAB)	Overall LOS	A	4.1	A	4.2	A	6.7	A	8.3

LOS results for the RCUT indicate significant delay reductions across all peak periods and all analyses timeframes vs. the existing signalized condition. While the total distance traveled is greater for movements from Lear Nagle to I-480, **reductions in signal control delay result in no increase to total travel time**. For the movement from I-480 to Lear Nagle, reductions in control delay result in travel time reductions of close to 50% in the PM peak period. This is the primary benefit of unconventional intersection designs such as RCUTs, where the unique geometry unlocks improved traffic operations and increased intersection safety. Capacity analysis results for the RCUT alternative with roundabouts is presented in **Appendix J**.

From a safety perspective, a traditional RCUT reduces intersection conflict points from 32 to 14. Crossing conflict points, which carry the highest potential for serious injury, are reduced by 87.5% from 16 to 2, directly addressing angle and right/left turn crashes at the intersection (Figure 26). Roundabouts also significantly reduce conflict points, removing all crossing conflict points and reducing total conflict points by 33% (T-intersections) or 75% (four-leg intersections) (Figure 27). Overall, the three roundabouts and signalized RCUT intersection would reduce the number of conflict points on Lorain Rd from 105 to 36 and reduce the number of high severity crossing conflict points from 48 to 2.

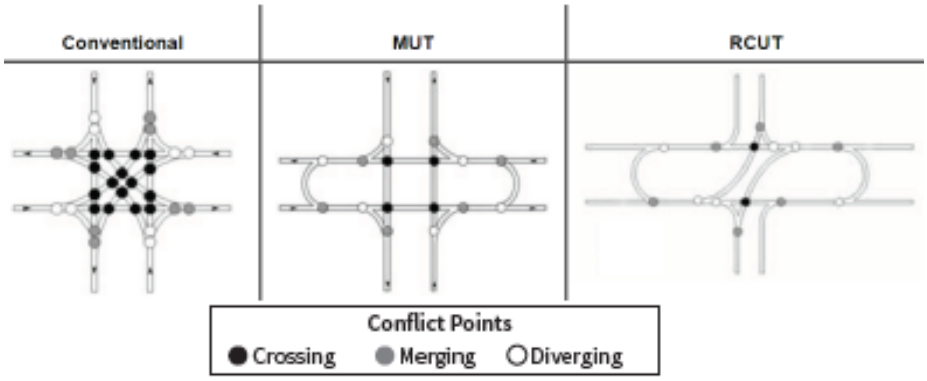


Figure 26 - Comparison of Conflict Points between Conventional Intersections and RCUTs (FHWA)

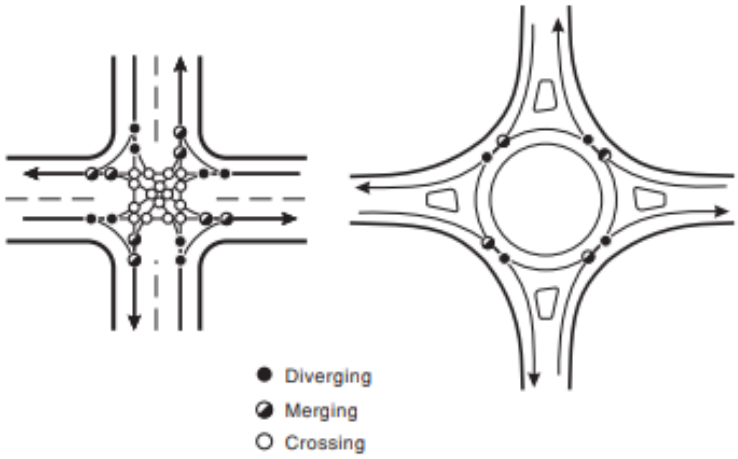


Figure 27 - Comparison of Conflict Points between Conventional Intersections and Roundabouts (FHWA)

By placing the roundabouts at existing intersections, **the need for significant right of way and property impacts is minimized**. Multi-lane roundabouts are traditionally larger, but recent advances in roundabout design have resulted in multi-lane roundabout footprints becoming more compact, with the added benefit of using roundabout geometry to slow approaching vehicles to safer entry speeds and improving roundabout safety. Woolpert located proposed roundabouts to minimize right of way impacts without compromising roundabout design.

Additionally, Woolpert optimized roundabout location to minimize or eliminate any impact to physical structures. Existing utilities will likely require relocation or burial as part of the proposed roundabout design, along with new lighting for approach and circulatory roadways.

Access management is a major consideration with any corridor improvement project. The RCUT alternative with roundabouts presents an opportunity to introduce access management and reduce the number of left turns across Lorain Rd between intersections. Utilizing the roundabouts as U-Turn locations, access to businesses is maintained from all directions, with a minimum of additional travel time for vehicles but with a significant increase in safety as additional crossing conflict points are removed from the roadway network.

The approach of using roundabouts and median access management has been used successfully by local communities, including the City of Green, OH, which is currently transforming the heavily congested Massillon Rd corridor from conventional intersections to multi-lane roundabout intersections with access management between the roundabouts (Figure 28).

Figure 28 - Use of Roundabouts and Access Management in a Mixed Suburban Context (City of Green, OH)

4.5 Lear Nagle Corridor

Operations on the Lear Nagle Rd corridor between Lorain Rd and Chestnut Ridge Rd directly impact the Lorain Rd/Lear Nagle Rd intersection. Woolpert examined the corridor as part of the development of the long-term alternatives at Lorain Rd/Lear Nagle Rd and determined the following alternatives warrant further consideration.

4.5.1 Short Term Improvement: Complete Cypress Ave Connection

The City of North Ridgeville will extend Cypress Ave from its current termination point to Lorain Rd immediately east of the North Ridgeville/North Olmsted border on the Lorain County/Cuyahoga County line. The future intersection will be signalized, and the signal will be owned and maintained by the City of North Ridgeville. The City anticipates construction of this extension and intersection to be completed in 2025.

When completed, Cypress Ave will provide an additional connection between Lear Nagle Rd and the I-480 interchange, allowing vehicles to bypass the Lorain Rd/Lear Nagle Rd intersection. While similar in geometry to a quadrant road, the Cypress Ave connection is not a true quadrant road due to its distance from the primary study intersection, and the several signalized intersections between them (Figure 29). There is a potential that some vehicles that would typically turn left off I-480 westbound may instead turn right to take Cypress Ave as a shortcut to Lear Nagle Rd, bypassing Lorain at Lear Nagle. The percentage of vehicles that may choose this routing is difficult to estimate and may ultimately be a function of how well the stop-controlled intersection at Cypress Ave and Lear Nagle Rd operates.

Woolpert explored how a redistribution of approximately 30% of Lear Nagle Rd to/from Lorain Rd traffic would impact the overall study area. Specifically, Woolpert modeled a signal at the future Cypress Ave/Lorain Rd intersection and coordinated it with adjacent Lorain Rd signals. Woolpert also modeled the existing Two-Way Stop Controlled (TWSC) intersection at Cypress Ave and Lear Nagle Rd. A value of 30% is a conservative estimate based on the additional distance added by the Cypress Ave extension, and the tendency of commuter populations to rely on travel apps which prioritize shortest time and distance for route choice.

Just 30% traffic redistribution to Cypress Ave significantly improves traffic operations along Lorain Rd and at the Lorain Rd/Lear Nagle Rd intersection **but creates significant congestion and a failing LOS at the TWSC intersection of Lear Nagle Rd and Cypress Rd in the PM period**, limiting the potential benefits provided by the Cypress Ave extension assuming no changes are made at Cypress Ave and Lear Nagle Rd.

Figure 29 - Cypress Ave Extension (Construction in 2025)

4.5.2 Medium Term Improvement: Cypress Ave Roundabout

With the completion of the Cypress Ave connection to Lorain Rd occurring in 2025, improvements at the Cypress Ave/Lear Nagle Rd intersection may be warranted as volumes on Cypress Ave increase. Initial analysis of the Cypress Ave intersection indicated that the existing stop-controlled intersection would fail from an LOS perspective due to a lack of gaps on Lear Nagle Rd for turning vehicles to/from Cypress Ave.

While signalization may be warranted with future volumes, the proximity to Chestnut Ridge Rd (approximately 750 ft) and Lorain Rd (approximately 1,200 ft) would create operational challenges in the form of spillback queueing and poor signal coordination. With over 20,000 vehicles per day using Lear Nagle Rd between Chestnut Ridge Rd and Lorain Ave, any additional delay produced by existing or proposed signals would risk creating momentary gridlock conditions along the corridor.

In the 2025 analysis period, a single lane roundabout is sufficient to process AM and PM peak period demand, but projected growth along Lear Nagle Rd over the 25-year analysis period suggest a multi-lane roundabout with two lane entry on Lear Nagle Rd will be necessary prior to 2050. Because a multi-lane roundabout would necessitate the widening of Lear Nagle Rd, a phased approach to a roundabout ay Cypress Ave is warranted. **As such, any single lane roundabout at Cypress Ave should be designed for quick conversion a to multi-lane by designing the roundabout to a multi-lane diameter, but only striping for single-lane operation until demand warrants multi-lane striping.**

Woolpert evaluated LOS for both a single-lane (1x1) and multi-lane (2x1) roundabout at the Cypress Ave intersection. Given no existing development and no existing movements on Cypress Ave, Woolpert assigned an assumed number of vehicles to each peak period analysis (approximately 100-150 per period) as simulated traffic. Future development may generate additional trips, which would may increase delays beyond what is presented below in Table 10.

Table 10 - LOS Results for Various Roundabout Configurations at Cypress Ave

RCUT/Roundabout Unsignalized		2025 AM Peak		2050 AM Peak		2025 PM Peak		2050 PM Peak	
Intersection/Movement		LOS	Delay s/veh	LOS	Delay s/veh	LOS	Delay s/veh	LOS	Delay s/veh
Lear Nagle Rd at Cypress Ave (1x1 RAB)	Overall LOS	A	3.1	A	4.4	**A***	**8.6**	**C***	**18.4**
Lear Nagle Rd at Cypress Ave (2x1 RAB)	Overall LOS	A	1.5	A	1.6	A	2.5	A	2.6

**Indicates failing movements on one or more approaches to the roundabout.*

A single-lane roundabout experiences failing movements in both the 2025 and 2050 PM peak period. There are no failing movements when a 2x1 roundabout (single lane entry Cypress, dual lane entry Lear Nagle) is implemented. A significant component of congestion at this roundabout in the PM peak period is due to spillback interaction from the Chestnut Ridge Rd intersection. During the period where Chestnut Ridge Rd is signalized, spillback queueing into a roundabout at Cypress Ave is possible, especially during the PM peak period. Spillback queueing from Chestnut Ridge Rd is present in the existing condition given high northbound demand and may get worse as demand increases with regional growth.

4.5.3 Long Term Improvement: Chestnut Ridge Rd Roundabout

The existing signalized intersection at Chestnut Ridge Rd processes vehicles well considering the nearly 20,000 AADT along Lear Nagle Rd through the intersection. In addition, and much like Lorain Rd at Lear Nagle Rd, there is a growing right turn/left turn paired movement, specifically the eastbound Chestnut Ridge Rd right turn and northbound Lear Nagle Rd left turn. Most of this traffic originates on Bainbridge Rd from central North Ridgeville and points east such as SR 83 (Avon-Belden Rd) as a short cut from SR 83 to I-480, bypassing SR 10.

As volumes continue to grow, the three-lane section along Lear Nagle Rd will likely become oversaturated. Woolpert evaluated a roundabout as an alternative to a signalized intersection in the long-term at Chestnut Ridge Rd. As shown previously, a signalized intersection without widening fails in the 2050 PM peak period, so Woolpert assumed the signalized alternative would involve widening to Lear Nagle Rd. Even with widening, a signalized alternative would struggle to process heavy northbound left turn movements in the 2050 PM peak.

NOACA growth rates suggest AADTs could approach 25,000 on Lear Nagle Rd by 2050, which exceeds the common threshold for three-lane sections by a wide margin. As such, physical improvements may be necessary to this corridor should projected growth be realized.

To accommodate future growth, Woolpert evaluated a 2x1 roundabout, with dual lane entry on the northbound approach (northbound left and northbound thru/right) and single lane entry on all other approaches. Woolpert also evaluated a 2x2 roundabout, with dual lane entry on Lear Nagle Rd (requiring widening Lear Nagle Rd to a four-lane section), dual lane entry from Chestnut Ridge Rd (using existing the dual lane approaches) and single lane exit onto Chestnut Ridge Rd. **Both roundabout alternatives assume widening on Lear Nagle Rd to a four-lane section to accommodate future growth.** Table 11 presents LOS results for both roundabout configurations.

LOS results show that the 2x1 hybrid alternative struggles in the opening year 2025 PM peak period, and fails in the 2050 PM peak period, primarily due to heavy northbound left demand. The 2x2 roundabout alternative operates at an acceptable level of service in both peaks across both analysis years, but has failing movements in the 2050 PM peak period, including a failing westbound approach on Chestnut Ridge Rd.

Table 11 - LOS Results for Various Roundabout Configurations at Chestnut Ridge Rd

RCUT/Roundabout Unsignalized		2025 AM Peak		2050 AM Peak		2025 PM Peak		2050 PM Peak	
Intersection/Movement		LOS	Delay s/veh	LOS	Delay s/veh	LOS	Delay s/veh	LOS	Delay s/veh
Lear Nagle Rd at Chestnut Ridge Rd (2x1 Hybrid RAB)	Overall LOS	A	5.1	A	7.0	E*	44.4	F*	67.3
Lear Nagle Rd at Chestnut Ridge Rd (2x2 RAB)	Overall LOS	A	4.9	A	6.0	A	9.9	D*	31.9

**Indicates failing movements on one or more approaches to the roundabout.*

Proposed growth along Lear Nagle Rd approaching Lorain Rd warrants exploration of capacity improvements to ensure that improvements at Lorain Rd do not just transfer congestion upstream towards Cypress/Chestnut Ridge. Roundabouts process turning traffic more efficiently than signalized intersections, but with volumes approaching 25,000+ vehicles per day, multi-lane roundabouts will likely be necessary by the 2050 analysis period to accommodate growth and to prevent spillback queueing from Chestnut Ridge Rd upstream into Cypress Avenue. Figure 30 presents a conceptual layout of multi-lane roundabouts at Cypress Ave and Chestnut Ridge Rd, along with associated widening of Lear Nagle Rd between the pair of roundabouts.

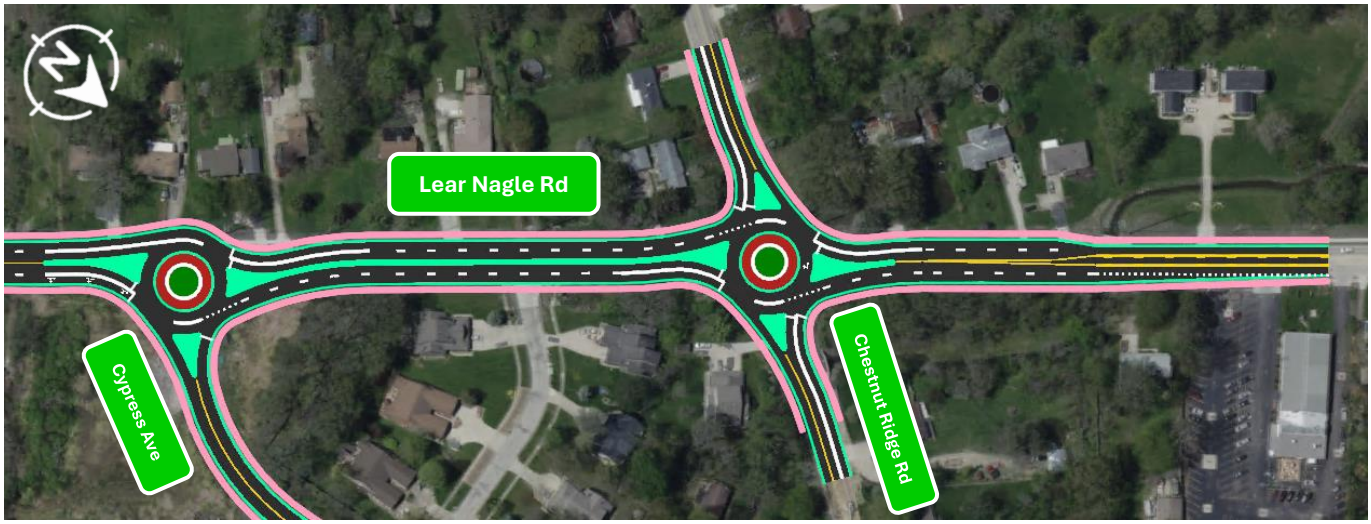


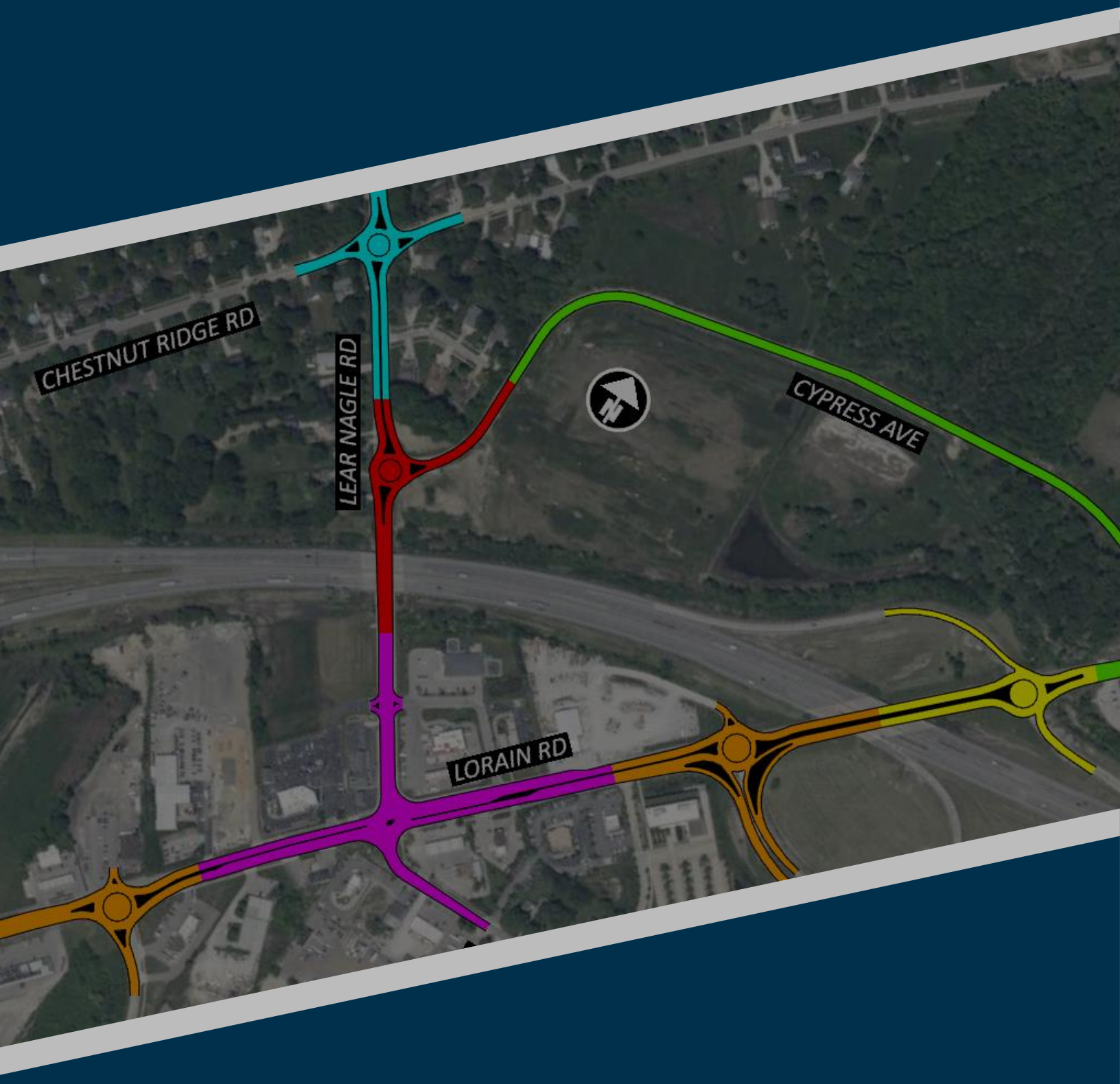
Figure 30 - Multi-Lane Roundabouts at Cypress Ave and Chestnut Ridge Rd

A full-size conceptual graphic of the Cypress Ave/Chestnut Ridge Rd roundabouts is presented in **Appendix K**. Capacity analysis results for all roundabout analyses is presented in **Appendix L.**

4.6 Alternatives Evaluation Matrix

Table 12 - Alternatives Evaluation Matrix for Lorain Rd at Lear Nagle Rd

Improvement	Benefits	Drawbacks	Costs/Impacts
Lorain Rd at Lear Nagle Rd			
Conventional Widening	• Driver familiarity	• Limited operational benefits • Requires widening to both Lorain and Lear Nagle • Widening would need to extend into I-480 interchange • Would directly impact multiple gas station properties	• $$$ • Significant RoW Impacts • Multiple Property Takes
Quadrant Road	• Common strategy for heavy paired left turn/right turn movement • Very efficient for left turn operations at congested intersections	• Existing alignment is not wide enough to meet capacity requirements • Using existing commercial drive as quadrant road would impact businesses • Significant potential for grid lock conditions	• $$ • Moderate RoW Impacts
Displaced Left Turn/CFI	• Very efficient for left turn operations at congested intersections • Multiple signalization strategies available based on dominant movements and future growth	• Would require entire parcels of right of way in multiple intersection quadrants • Necessary footprint likely exceeds available land area • Would directly impact multiple gas station properties	• $$$$$ • Extreme RoW Impacts • Multiple Property Takes
Restricted Crossing U-Turn (RCUT)	• FHWA Proven Safety Countermeasure • Increases efficiency for all movements by reducing signal phases • Promotes access management	• U-Turn bulbs would cause moderate right of way and property impacts • U-Turn bulbs adjacent to signals/intersections may not be most efficient	• $$$$$ • Moderate RoW Impacts • Possible Property Takes
RCUT with Roundabouts	• All the benefits of an RCUT, combined with optimized roundabouts at existing intersections • Increases efficiency for all movements by reducing signal phases • Promotes access management • Fewer right of way impacts than traditional RCUT by using roundabouts as U-Turn locations	• Increases travel time minimally vs. conventional RCUT • Additional growth beyond NOACA projection may oversaturate roundabout U-Turns in future condition	• $$$$ • Limited RoW Impacts



CHAPTER 5

Recommended Alternatives

Lorain at Lear Nagle Traffic Study

5 Recommended Alternatives

Woolpert developed short- and long-term alternatives to address existing crash patterns and to address congestion and poor traffic operations. Based on a detailed evaluation of alternatives, including safety, capacity, impacts, and costs Woolpert recommends the following alternatives:

Short Term Alternatives

- Optimize signal timing for AM and PM peak period to account for present day demand, and monitor changing vehicle demand for continuous optimization in the short term

Lorain Rd Corridor:

- Convert the existing Lorain Rd/Lear Nagle Rd signalized intersection to a Restricted Crossing U-Turn (RCUT) intersection with roundabout U-Turns at Victory Ln and the I-480 EB Ramp
- Conduct an Interchange Modification Study for the proposed multi-lane roundabout at the I-480 EB ramp and a multi-lane roundabout at the I-480 WB ramp

Lear Nagle Rd Corridor:

- Construct a multi-lane roundabout at Lear Nagle Rd and Cypress Ave striped for single-lane operation in the opening year, but capable of facilitating quick conversion to multi-lane operation once volume demand reaches multi-lane threshold
- Convert existing Sheets/McDonalds driveways from full access to Right-In, Right-Out only following completion of Lorain Rd RCUT and Cypress Ave Roundabout
- Construct a multi-lane roundabout at Lear Nagle Rd and Chestnut Ridge Rd
- Widen Lear Nagle Rd from three lanes to four lanes between Chestnut Ridge Rd and Lorain Rd with a raised median installed between Cypress Ave and Chestnut Ridge Rd

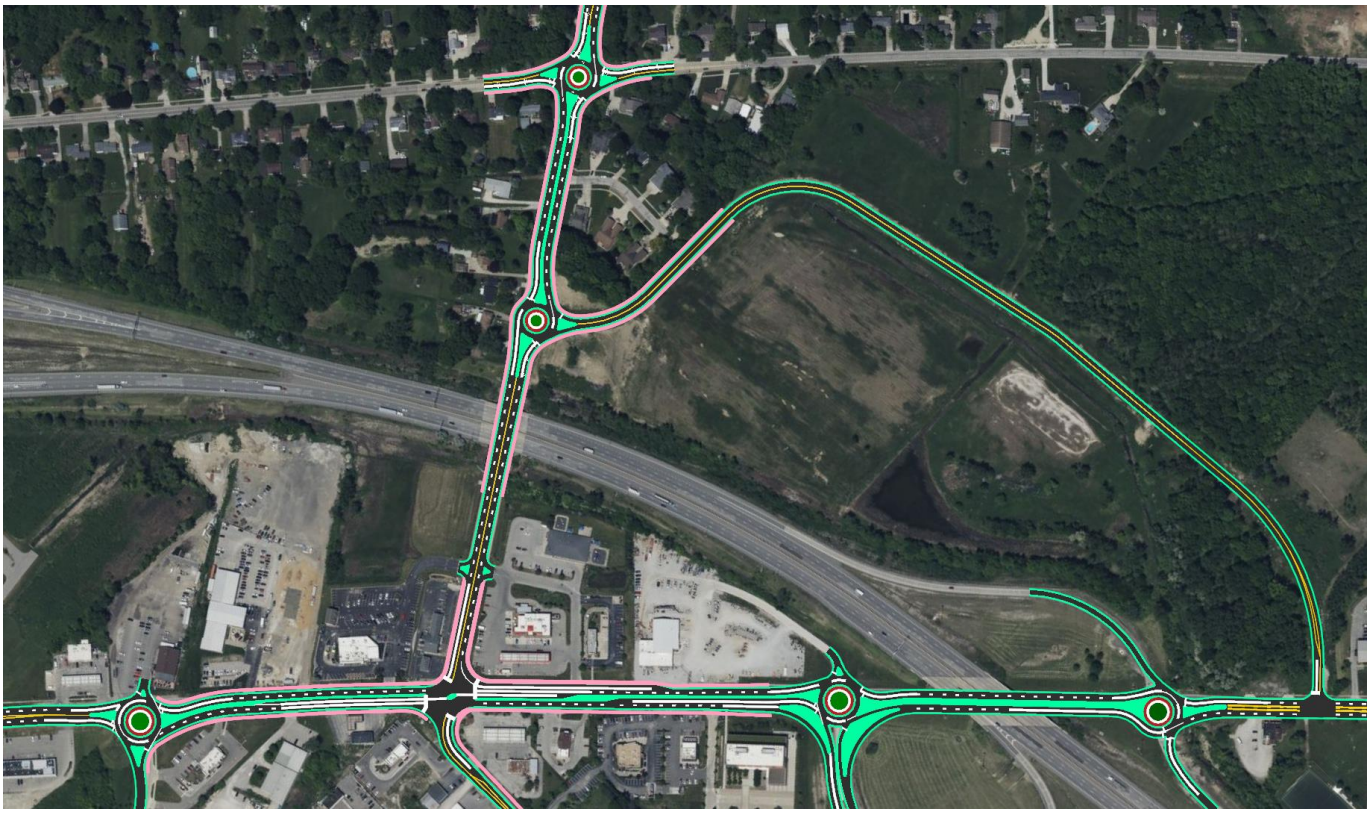


Figure 31 – Long-Term Future View of Study Area

5.1 Phased Implementation

Woolpert recommends implementing the recommended alternatives over an extended period to allow for both construction duration, maintenance of traffic, and continued evaluation of evolving traffic demand flows. Woolpert recommends the following project construction phasing, shown below and in Figure 32 (also see **Appendix M**):

- Phase 0: Complete Cypress Ave Connection to Lorain Rd **(Green)**
- Phase 1: Construct Cypress Ave Roundabout **(Red)**
- Phase 2A: Construct Victory Ln and I-480 EB Ramp Roundabouts **(Orange)**
- Phase 2B: Construct I-480 WB Ramp Roundabouts **(Yellow)**
- Phase 2C: Convert Lorain Rd/Lear Nagle Rd from Full Movements to RCUT Movements Only, and complete Sheetz/McDonalds Drive Access Management **(Purple)**
- Phase 3: Construct Chestnut Ridge Rd Roundabout and Widen Lear Nagle Rd from Three Lanes to Four **(Blue)**

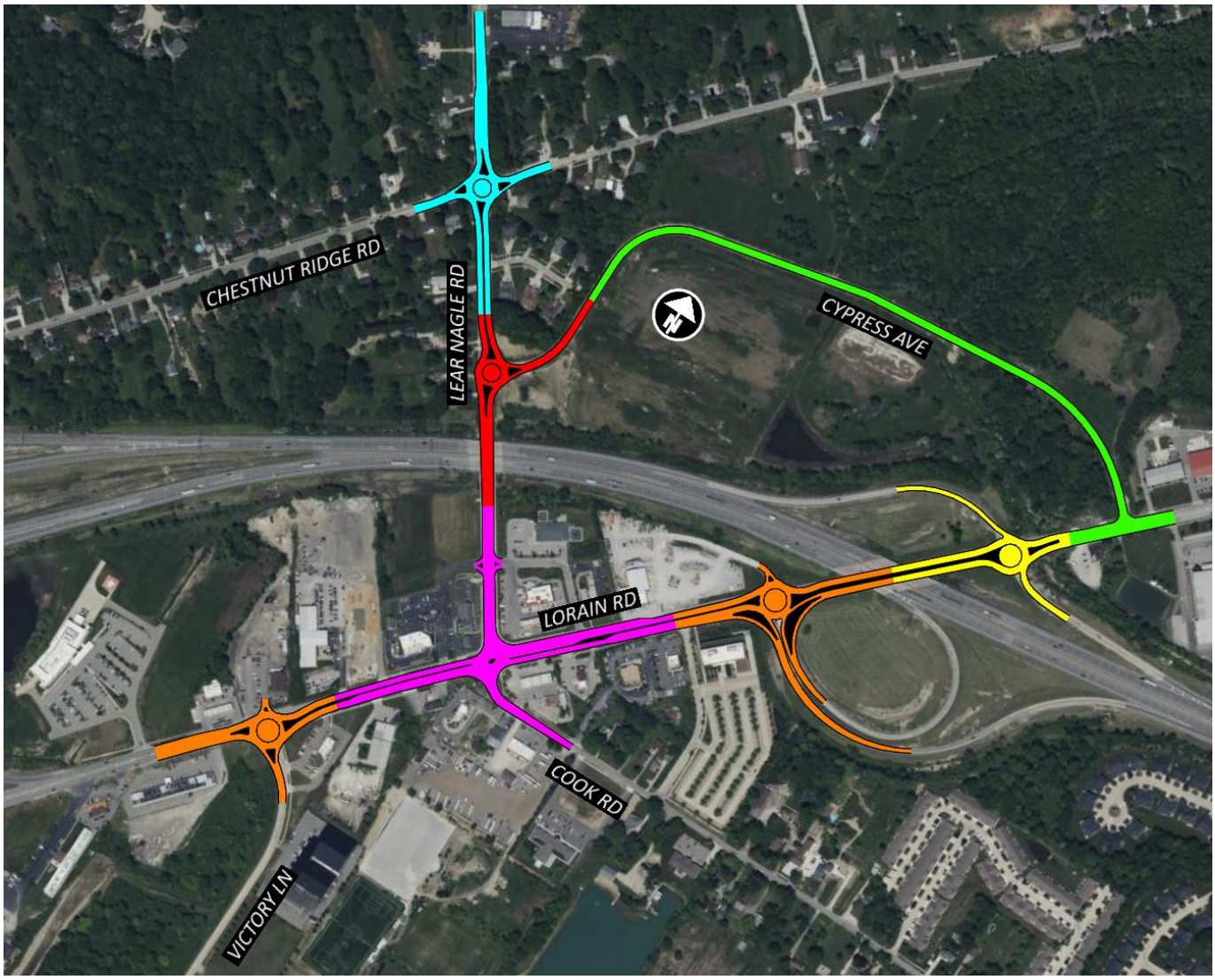


Figure 32 - Phased Implementation Strategy for Study Area

Phase 0 will be constructed by the City of North Ridgeville in 2025. It is included in Figure 32 and in the project list for illustrative purposes only. Project phases 1, 2, and 3 each have independent utility, but provide the greatest operational benefit when all three are built. Woolpert recommends a sequential phasing as noted above, starting with Phase 1, but also notes that the operational need to construct Phase 3, a roundabout at Lear Nagle Rd and Chestnut Ridge Rd, may occur during or even before the completion of Phase 2. The primary factor for improvements at Chestnut Ridge Rd will be vehicle demand growth, which is expected to increase on Chestnut Ridge Rd at a faster pace than on Lear Nagle Rd, per NOACA 2050 growth estimates. For cost estimating purposes, Woolpert assumed construction on Phase 3 occurring along side Phase 2A.

5.2 Project Costs

Woolpert developed high level preliminary cost estimates by evaluating primary cost drivers for each project phase. ODOT's Summary of Contracts Awarded, bid item data, and inflation calculation methodologies were used to produce each estimate. **Cost estimates assume fully reconstructed pavement, and major cost drivers including new walk, curb ramps where required, signal work, and new lighting.** Throughout the project, existing pavement may be in good enough condition to fully or partially reuse with an overlay which would significantly reduce project costs. Utility relocation and right of way are not included in the estimate due to the highly variable nature of these costs over a 10+ year horizon, but a 30% contingency has been added to each project phase. Table 13 presents cost estimates by phase and overall:

Table 13 - High Level Conceptual Cost Estimates

Project Phase	Construction Year	Preliminary Cost Estimate
Phase 1 – Cypress Roundabout	2030	$4.3 Million
Phase 2A – RCUT Roundabouts	2031	$10.5 Million
Phase 2B – I-480 WB Roundabout	2032	$3.9 Million
Phase 2C – RCUT Improvement	2033-2034	$10.6 million
Phase 3 – Chestnut Ridge Roundabout	2031	$4.9 Million
Total Project	***2030-2034***	***$34.2 Million***

Complete cost estimates are presented in **Appendix N**.

5.3 Project Funding

With the size and scope of the proposed improvements, and the regional importance of the study intersection and connection to I-480/SR 10/Ohio Turnpike, funding for the project will likely come from local, regional, state and federal partners. With a primarily congestion related crash pattern and a low frequency of high severity crashes, sources beyond ODOT Safety Funding will be necessary. Woolpert has identified several potential funding sources and funding partners that would be ideal matches for a project of this importance and magnitude, including:

- ODOT Transportation Review Advisory Council (TRAC)
- ODOT Safety Funding
- NOACA Congestion Mitigation and Air Quality (CMAQ)
- NOACA Surface Transportation Block Grant (STBG) Program
- Ohio Public Works Commission (OPWC) State Capital Improvement Program (SCIP)
- OPWC Local Transportation Improvement Program (LTIP)
- ODOT Jobs & Commerce Economic Development (JCED) Funding
- ODOT Transportation Improvement District (TID) via Lorain County TID
- County Engineers Association of Ohio (CEAO)

Table 14 presents a breakdown of funding sources, eligibility, and how they may apply to the proposed improvements:

Table 14 - Table of Potential Funding Partners and Funding Program Details

Source	Eligibility	Competitive?	Applicable Project Phase	Funding Available	Local Match/ Contribution
ODOT TRAC	Projects over $12 Million that improve capacity or reduce congestion.	Yes	Phase 2A Phase 2B Phase 2C	$$$$$	Yes
ODOT Safety	Safety focused projects with over 30% injury crashes (formal, large projects) or low-cost improvements (abbreviated, less than 30% injury)	Yes	All Phases	$$$	Yes
NOACA CMAQ	Projects that reduce congestion and improve air quality.	Yes	All Phases	$$$$	Yes
NOACA STBG	Wide range of projects	Yes	All Phases	$$$	Yes
OPWC SCIP	Roadway improvement projects	Yes	All Phases	$$	Yes (grants) No (for Loans)
OPWC LTIP	Roadway improvement projects	Yes	All Phases	$$	No
ODOT JCED	Projects that promote economic development, job creation, and job retention	Yes	All Phases	$	Yes
ODOT TID	Projects that promote economic development, job creation, and job retention	Yes	All Phases	$	Yes
CEAO CSTP/HSIP	Projects on County Roads	Yes	Phase 3	$$	Yes

A combination of funding sources including the sources above will likely be necessary to implement the long term proposed improvements. Because the project is split into phases with independent utility, multiple funding "packages" can be constructed from various sources over time to complete each Project Phase. The City of North Ridgeville will likely need to complete an Interchange Modification Study (IMS) conducted with the cooperation of ODOT District 3 and NOACA as part of the project development process for Project Phase 2.