

Union County

2021 Critical Intersection Design and Cost Estimation Project (Phase II)

June 2021

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Acronyms and Definitions

AADT	Annual Average Daily Traffic: Average 24-hour traffic volume on a given section of roadway for a full 365-day year, divided by 365
AASHTO	American Association of State Highway and Transportation Officials: Standards setting body which publishes specifications, test protocols, and guidelines that are used in highway design and construction
CMAQ	Congestion Mitigation and Air Quality: Program that provides funds for projects and activities that reduce congestion and improve air quality
CRTPO	Charlotte Regional Transportation Planning Organization: Designated MPO for all of Iredell and Mecklenburg counties and the majority of Union County (see MPO)
HSIP	Highway Safety Improvement Program: National program aimed at significantly reducing traffic fatalities and injuries on all public roads
LOS	Level of Service: A qualitative assessment of a road's operating condition, generally described using a scale of A (little congestion) to F (severe congestion)
MPO	Metropolitan Planning Organization: Federally designated agency required for Urbanized Areas with populations larger than 50,000; primary function is to carry out the transportation planning process among the member jurisdictions within its established planning area boundary
MRM	Metrolina Regional Model: Forecasts future year demand on existing and planned transportation facilities using anticipated land use, demographic information, and travel patterns unique to the region
MTP	Metropolitan Transportation Plan: A long-range planning document that identifies transportation deficiencies, policies, strategies, and projects over a 20-year planning horizon
Spot Safety	Spot Safety is an NCDOT program (under Highway Safety Improvement Program) that is used to develop smaller improvement projects to address safety, potential safety, and operational issues.
STIP	Statewide Transportation Improvement Program: A state's capital improvement program that sets forth the transportation projects that will be funded over a minimum four-year period
STBG-DA	Surface Transportation Block Grant-Direct Attributable: A program that provides flexible funding that may be used by States and localities for projects across all modes of transportation; project must be Federal-aid eligible and are subject to federal compliance
TAP	Transportation Alternatives Program: A funding source for bicycle, pedestrian, and "alternative" transportation projects

Purpose

The Union County 2021 Critical Intersection Design and Cost Estimation Project (Phase II) is a continuation of ongoing efforts by Union County to identify, prioritize, and develop design concepts and cost estimates for intersections throughout the County that pose congestion and/or safety concerns. It supplements major widening projects that typically take longer to receive approval and funding and serves as a solution to remedy identified issues at select intersections throughout the County.

In 2019, through a partnership between Union County, its municipalities, and the North Carolina Department of Transportation (NCDOT), 15 intersections were identified due to a combination of congestion and safety issues that require improvements to the existing roadways. Of the 15 intersections identified in the 2019 Critical Intersection Analysis, six intersections were previously evaluated as part of Phase I and an additional five intersections were selected to move forward to conceptual design in Phase II (**Figure 1**). This Study Workbook addresses the process, analysis, and recommendations for the five intersections included in Phase II.

The results of this study and next steps identified in the implementation plan are intended to position these intersection projects to compete for funding when it becomes available through the Charlotte Regional Transportation Planning Organization (CRTPO) and NCDOT, including discretionary and safety funds.

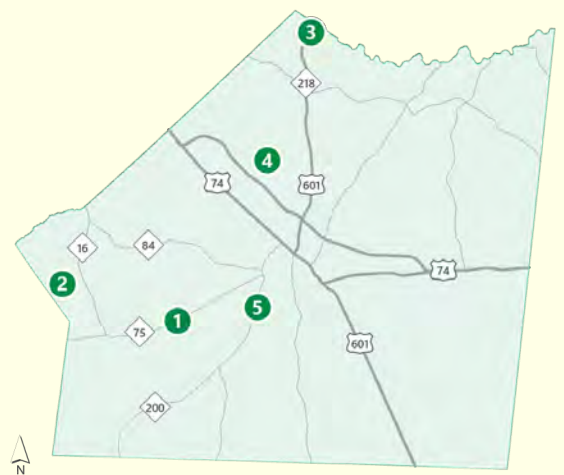
These ongoing intersection analysis studies are a proactive approach to establish designs and cost estimates that are mutually agreed upon by the NCDOT, municipality, and County in order to facilitate fast responses to grant solicitations.

Process

The study process involved evaluating existing conditions for each location and conducting a traffic engineering and safety analysis in order to develop two alternative design concepts for each intersection. Stakeholder input was a substantial component of this study which contributed to decision-making at key milestones throughout the process and assisted with coordination efforts to gain consensus on the preferred alternatives. Coordination with an Advisory Committee to review design ideas ensured that the potential improvements being considered were consistent with the respective municipality's vision and other projects being planned for the area. NCDOT concurrence with the preferred alternatives and cost estimates was also critical to ensure support for future funding applications and potential project administration. Public feedback was gathered before defining a preferred alternative and accompanying cost estimate for each concept. The preferred alternatives were presented for approval to each respective municipal board and the Union County Board of Commissioners in May 2021.

Figure 1: Study Intersections

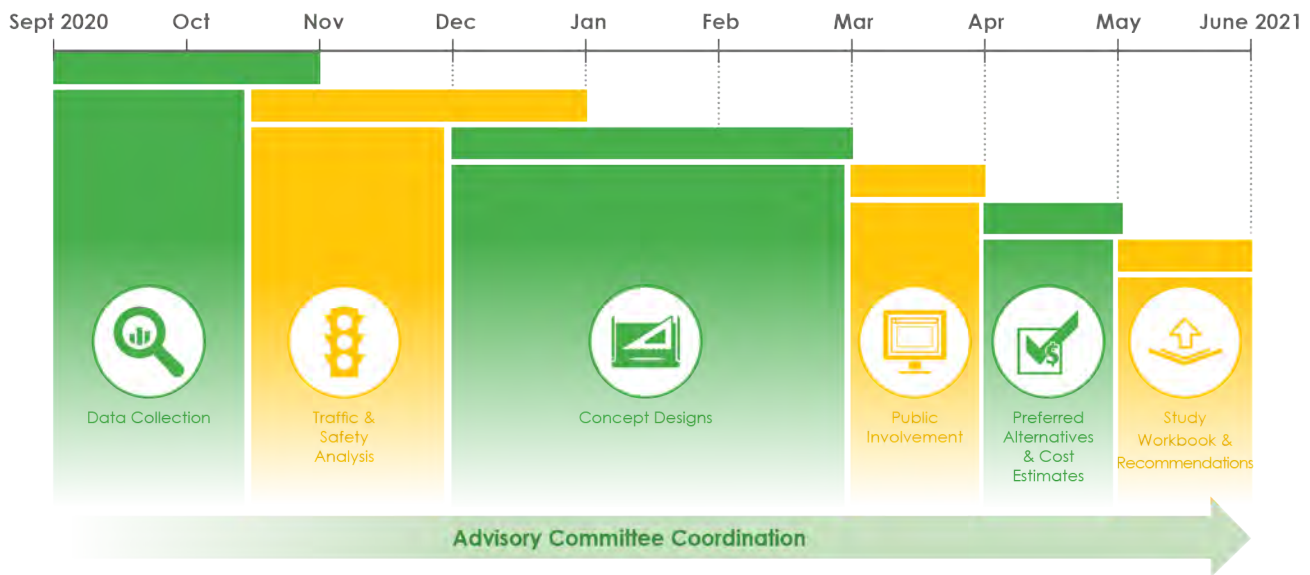
1. **NC 75 at Potter Road, Mineral Springs**
2. **Bonds Grove Church Road at Waxhaw-Marvin Road, Marvin**
3. **US 601 at Brief Road, Fairview**
4. **Poplin Road at Unionville-Indian Trail Road, Monroe**
5. **NC 200 at Plyler Mill Road, Unincorporated Union County**



Each component of the study process, findings, and recommendations are documented in this Study Workbook. It also includes funding and coordination activities to move these projects forward. In addition, a one-page Project Sheet was produced, serving as a summary document for each preferred design alternative. The Project Sheets are included in the Findings and Recommendations section.

The planning, analysis, and collaboration efforts that led to the design concepts, cost estimates, and implementation plan contained in this Study Workbook lasted approximately seven months, starting in October 2020, and concluding in June 2021. Specific tasks and significant milestones of this process are shown in **Figure 2**.

Figure 2: Project Schedule and Milestones



The following pages provide an overview of the steps, processes and coordination required to assess each intersection, determine alternatives, and develop recommendations. Following the overview of the study processes are individual Findings and Recommendations sections for each of the five intersections that provide intersection specific details and results related to each element of the study process.

Data Collection

One of the initial steps in the study process was to gather data about existing conditions and identify design deficiencies and potential design considerations for each intersection.

Due to COVID-19 impacts on travel patterns, new traffic counts could not be collected for Phase II. Instead, peak hour volumes were developed at the

five study intersections using historic traffic count data, StreetLight Data, and growth rates. StreetLight collects data from smartphone apps and Navigation-GPS which can be translated into usable traffic data.¹

The project team also conducted field visits alongside municipality representatives and NCDOT staff to review existing conditions, potential improvements, other projects and area developments, and to determine the municipality's vision for their respective intersection.

¹ Refer to the Traffic Operations Analysis memo for more comprehensive details regarding the StreetLight Data

Traffic and Safety Analyses

Traffic and safety analyses were conducted for each of the five study intersections. Detailed analysis results are documented in the Traffic Operations Analysis memo (March 2021), which can be found in **Appendix A** and brief summaries are provided in the Findings and Recommendations sections.

The traffic operations analysis was performed for the following scenarios for each of the study intersections:

- 2019 Existing Conditions
- 2035 No-Build Conditions
- 2035 Build Conditions

Volume Development

Intersection turning movement counts were developed for the Bonds Grove Church Road at Waxhaw-Marvin Road and Poplin Road at Unionville-Indian Trail Road intersections using previously collected data from other projects.² The 2019 Existing Conditions AM and PM peak hour volumes for these intersections were developed using the sum of the highest four consecutive 15-minute volumes for each peak period.

For the remaining three intersections, Existing Conditions AM and PM peak hour volumes were developed using StreetLight Data from all Tuesdays, Wednesdays, and Thursdays in March, April, September, and October 2019 for the hours of 7:00 to 8:00 AM and 5:00 to 6:00 PM. Data was manipulated within the StreetLight InSight platform and calibrated against historical NCDOT AADT data to develop volumes.

The growth rate used to project the future year 2035 peak hour volumes was developed using output from the Metrolina Regional Model (MRM20v1.0) and in coordination with Union County, NCDOT Division 10, and the municipality in which the intersection is located. The MRM volumes were not directly used in the traffic analysis. Instead, the selected growth rate was applied to the peak hour turning movement volume to determine future year 2035 peak hour volumes. The 2035 No-Build and Build scenarios were

analyzed using the same future year 2035 peak hour volumes.

Concept Designs

Two design alternatives were prepared for each of the five intersections, based on the evaluation of existing conditions, traffic and safety analyses, and Advisory Committee input. Development of the concept designs followed NCDOT Roadway Design Guidelines and were performed at a conceptual design level, which included lane configurations, and multimodal accommodations.

The design process maintained American Association of State Highway and Transportation Officials (AASHTO) minimum design standards, including the determination if design exceptions would be needed. Specific deficiencies have been identified for each location, along with design improvements to address those concerns. Existing constraints associated with each intersection influenced geometric design considerations, such as roundabout location and asymmetrical versus symmetrical widening. The design improvements, including length and number of turn lanes and roundabout configurations, were determined based on the traffic analyses. A build conditions analysis was performed to evaluate the benefits and impacts of the proposed improvements for each design alternative.

Following the development of design concepts for each study intersection, the Advisory Committee was consulted to review the proposed improvements and provide feedback, including review by NCDOT to ensure consistency with other projects that are already underway (or anticipated to be constructed in the near-term). The concept design alternatives, accompanying analysis results, and benefits versus impacts assessments were made available for public comment before a preferred alternative was selected.

² Traffic Count Date – Bonds Grove Church Road at Waxhaw-Marvin Road (5/29/2019), Poplin Road at Unionville-Indian Trail Road (3/21/2019).

Capacity Analysis Methodology and Results

All capacity analyses were performed in accordance with the NCDOT Congestion Management Capacity Analysis Guidelines (July 1, 2015). Intersection capacity and queue analysis of the stop-controlled and signalized intersections was performed using Synchro/SimTraffic software.

Roundabouts were analyzed using Sidra. A flow-scale analysis was performed to determine the final year the roundabout would operate with a volume to capacity (v/c) ratio under 0.85.³ The flow-scale analysis is shown as a percentage of the design year 2035 traffic volumes.

The overall intersection average delay and percent reduction in delay shown in the design information table within the concept design figures are based on a weighted average of the AM and PM peak hour delay. Overall intersection delay was presented for one-way and two-way stop-control intersections in order to provide a comparison with all-way stop-control, roundabout, and signal control intersections.

Crash Analysis

A crash analysis was conducted to evaluate historical crash patterns at the study intersections and determine potential improvements that would provide reductions in crashes. In addition to reviewing the historical crash patterns, crash reduction factors⁴ were gathered for the proposed intersection improvements.

Stakeholder Coordination

Collaboration with stakeholders was an important component of the study and was accomplished by establishing an Advisory Committee comprised of local municipal, Union County, CRTPO, and NCDOT staff. The Advisory Committee, whose membership is displayed in **Table 1**, participated in each aspect of the study process, providing insight and guidance on analysis results and design concepts, assisting with public outreach efforts, and contributing to decision

making. NCDOT Division 10 staff provided recommendations on state requirements since the roads affected by this study are owned and maintained by the State.

Table 1: Advisory Committee Membership

Member	Agency
Bjorn Hansen	Union County
Ed Humphries	Fairview
Rohit Ammanamanchi	Marvin
Vicky Brooks	Mineral Springs
Sarah McAllister	Monroe
Theo Ghitea	Waxhaw
Agustin Rodriguez	CRTPO
Sean Epperson	NCDOT
Stuart Basham	NCDOT
Travis Preslar	NCDOT

This study allowed for substantial input from the jurisdiction in which each respective intersection is located, with Union County serving as a supporting partner and facilitator of the process. The coordinated effort with CRTPO and NCDOT and commitment by the municipalities to participate in the process led to intersection design enhancements that meet the needs of the community while also contributing to a higher probability of local funds being allocated to implement the project improvements.

The Advisory Committee met six times throughout the study process, including participating in a field visit on November 13, 2020 to gather information about each intersection, and assisting with scheduling and presenting information to the various municipal boards to request approval of the preferred design alternatives. Meeting summaries from each of the Advisory Committee meetings can be found in **Appendix B**.

Public Involvement

³ As the v/c ratio exceeds 0.85, traffic flow through a roundabout typically becomes unstable and operations deteriorate quickly, which leads to excessive delay and queuing.

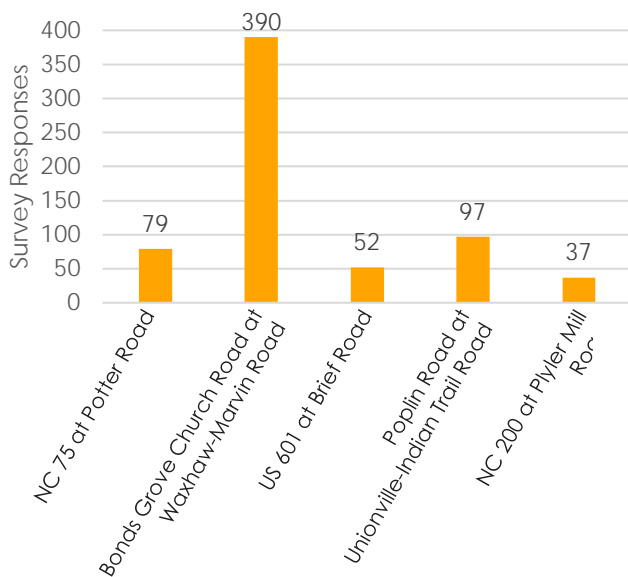
⁴ A crash reduction factor (CRF) is the percent decrease in the number of crashes that may be obtained by implementing a given countermeasure. The CRFs for this study were obtained from NCDOT's *North Carolina Project Development Crash Reduction Factor Information* (revised July 2020) and NCDOT's *Safest Feasible Intersection Design (SaFID)* (courtesy of Joe Hummer, revised October 2019).

Public engagement was an important element of the study process and was used to solicit community input on the design concepts for each intersection, which stakeholders and decision makers considered prior to selecting a preferred alternative. Online engagement options were the primary source of public feedback with some in-person outreach for one intersection.

Following the development of two design concepts per intersection, an interactive webpage was developed for each location using ArcGIS StoryMaps. The interface allowed users to review and compare the two proposed design concepts at each intersection, including features such as anticipated congestion and crash reductions, neighborhood benefits and impacts, and estimated costs.

The StoryMaps were posted to the Union County website and a survey was included with each respective intersection page providing residents the opportunity to leave comments and select their preferred design concept. A total of 655 responses were received from March 8 through April 4, 2021. Total responses are detailed in **Figure 3** below.

Figure 3: Public Input Responses



As a result of continued COVID restrictions and the positive response to online engagement methods, no in-person public meetings were held. However, due to slightly lower response rates for the US 601 at Brief Road intersection, members of the project team dispersed additional information to patrons of Hot Mess Burger restaurant on April 30, 2021 and links to online materials were sent out to the staff of Fairview Elementary School. These efforts resulted in a roughly 25% increase in total responses for this intersection.

An overview of the public input received for each intersection is included in the Findings and Recommendations section. **Appendix C** contains additional documentation, including a comprehensive list of comments received from the public involvement activities conducted for this study.

Preferred Alternatives

One of the primary purposes of this study is to identify a preferred design alternative for each intersection that can be used to apply for funding to construct the determined improvements. Two concept designs were developed for each intersection based on an evaluation of existing conditions, results from the traffic and safety analyses, and stakeholder feedback. The alternative design concepts were then made available for public input. Stakeholder feedback from the municipal Advisory Committee representative, the County, and NCDOT, as well as the responses received from the public all weighed into the selection of preferred alternatives and recommendations presented in the Study Workbook.

A final step to establish consensus on the preferred design alternatives was to present the concepts for each of the five intersections to each respective municipal board as well as the Union County Board of Commissioners for approval (see **Table 13**).⁵

⁵ Preferred alternative overviews provided in *Findings and Recommendations* and full concept designs provided in **Appendix D**.

Cost Estimates

For each of the concept design alternatives, a conceptual cost estimate was prepared. The NCDOT cost estimating methodology was utilized during the development of the construction cost estimates since all the roadways affected by this study are maintained by the State. Contingencies were applied based on CRTPO Discretionary Funds Policy Guide⁶. All cost estimates were prepared using fiscal year (FY) 2020 dollars based on NCDOT 2020 bid results and NCDOT Cost Per Mile Cost Estimating Spreadsheet (2020).⁷

Construction cost estimates were created for the alternatives using a cost per mile table provided by the NCDOT cost estimating group, which is typically used for determining costs for long range transportation plans. The cost per mile table suggests costs for project types, such as adding a turn lane.

Right-of-way estimates were produced by researching the Union County tax parcel values and applying a cost per acre calculation according to the anticipated right-of-way needs for each proposed design improvement. To figure out the right-of-way needs, the existing contours were reviewed to determine the existing terrain. The Advisory Committee indicated its preference to be conservative when calculating the right-of-way costs. NCDOT supported this approach and to establish a 100% right-of-way contingency cost and add \$5,000 for the appraisal of each parcel. In the event this adjusted value was less than \$10,000, a minimum of \$10,000 per impacted parcel was used. This contingency covers not only the settlement values for the properties, but also the costs to acquire land and administrative fees. Conceptual utility estimates were provided for each intersection by the NCDOT Division 10 Division Utility Agent.

Contingencies have also been applied to the construction estimates based on the Discretionary Funds Policy Guide from CRTPO. 20% of the construction cost was added as a contingency for Construction Engineering Inspections (CEI) and 40% of the combined Construction/CEI contingency was used to determine the entire construction phase cost.

25% of the construction cost was added for Preliminary Engineering/Design and 40% of this cost was used as a Preliminary Engineering contingency. An additional 40% of the total right-of-way cost was used as a right-of-way and utilities contingency.

A Local Match is required for projects funded with federal discretionary funds, which is a potential funding source for these intersection projects; therefore, the minimum 20% local match amount was calculated to inform municipalities and Union County about this potential funding requirement.

Findings and Recommendations

Based on the previously described process, this section of the Study Workbook is organized by intersection location and contains relevant elements of each process component for each respective intersection, including:

- Existing Conditions
- Design Deficiencies
- Design Considerations
- Related Projects
- Traffic and Safety Analysis Results
- Concept Designs
- Public Involvement Results
- Preferred Alternative
- Cost Estimate

In addition, summary Project Sheets are included at the end of the Study Workbook, to serve as a quick reference to pertinent information regarding each preferred design alternative.

⁶ CRTPO Discretionary Funds Policy Guide (Revised August 2020) - <https://www.crtpo.org/crtpo-discretionary-projects>

⁷ Cost estimate overviews provided in *Findings and Recommendations* and detailed cost estimates provided in **Appendix E**.

NC 75 at Potter Road



Existing Conditions:

The intersection is located in downtown Mineral Springs, south of the CSX railroad. The intersection is currently signalized without turn lanes.

A gas station and church office are located on either side of Potter Road on the south side of NC 75. The north side of NC 75 is occupied by a commercial building/strip center and barbershop. All land uses have direct access to NC 75 and Potter Road adjacent to the main intersection.

Design Deficiencies:

- No turn lanes present and the high traffic volumes on southbound Potter Road result in queueing across the railroad tracks
- Multiple full access driveways in close proximity to the intersection
- Minimal pedestrian accommodations

Design Considerations:

- Limited space and substantial right-of-way constraints due to commercial development in close proximity to the intersection
- Railroad crossing approximately 200 feet north of intersection
- Underground water, sewer, gas, and overhead utilities present at intersection
- Strong desire to enhance the pedestrian friendly downtown area

Concept Designs:

The two design concepts developed for this intersection include:

- **Alternative 1 – Turn Lane Improvements**
Construct right and left-turn lanes from Potter Road to NC 75, left-turn lanes from NC 75 to Potter Road, and concrete medians to control driveway access near the intersection to improve traffic operations and safety. This option will also add marked crosswalks and sidewalks to improve pedestrian connectivity and safety.
- **Alternative 2 – Roundabout**
Convert the existing signalized intersection to a roundabout with sidewalks and marked crosswalks. The roundabout includes left and right-turn lanes traveling eastbound on NC 75, a right-turn lane traveling westbound on NC 75, and right-turn lanes traveling in both directions on Potter Road.

Realign Old Waxhaw-Monroe Road to improve the approach angle, realign the Kangaroo Express driveway to increase distance from the roundabout, and add an exclusive left-turn lane from southbound Potter Road to Old Waxhaw-Monroe Road and northbound Potter Road to the Kangaroo Express.

Figure 4 displays Alternative 1 and an overview of the design features associated with that concept design and **Figure 5** provides the same information for Alternative 2. Additional information on the concept designs is included in the Traffic and Safety Analysis Results.

Figure 4: NC 75 at Potter Road Alternative 1 Concept Design



Design Information
Improve traffic flow and safety
Add marked crosswalks and sidewalks to improve pedestrian connectivity and safety
Install concrete medians to control driveway access near the intersection
No alignment modifications to Old Waxhaw-Monroe Road at Potter Road
Potentially reduce total crashes by 12% and injury crashes by 8%
Average peak hour vehicle delay of 45 seconds in 2035 (reduction of 56%)
Approximate Project Cost of \$5,590,000*

*See **Appendix E** for full cost estimate details

Map Notes
1. Add 500' left-turn lane from NC 75 to Potter Rd
2. Concrete medians to control driveway access near intersection to improve safety
3. Marked crosswalks improve pedestrian safety
4. Add 100' right-turn lane from Potter Rd to NC 75
5. Add 100' left-turn lane from Potter Rd to NC 75
6. Building would be acquired due to impacts from roadway construction
7. Building would be acquired due to impacts from roadway construction
8. New 5' sidewalk to provide improved connectivity and safety for pedestrians
9. Add 400' left-turn lane from NC 75 to Potter Rd
10. Add 260' right-turn lane from Potter Rd to NC 75
11. Add 300' left-turn lane from Potter Rd to NC 75

*See **Appendix D** (Preferred Alternative Design Concepts) for full design details

Figure 5: NC 75 at Potter Road Alternative 2 Concept Design



Design Information
Improve traffic flow and safety
Add marked crosswalks and sidewalks to improve pedestrian connectivity and safety
Install concrete medians to control driveway access near the intersection
Reduce speeds and improve safety at Old Waxhaw-Monroe Road at Potter Road by redirecting left-turn movement from Old Waxhaw-Monroe Road and adding left-turn lanes on Potter Road
Potentially reduce total crashes by 40% and injury crashes by 55%
Average peak hour vehicle delay of 20 seconds in 2035 (reduction of 80%)
Approximate Project Cost of \$10,320,000*

*See **Appendix E** for full cost estimate details

Map Notes
1. Add 375' left-turn lane from NC 75 to Potter Road
2. Add 225' right-turn lane from NC 75 to Potter Road
3. Marked crosswalks to improve pedestrian safety
4. Roundabout design improves traffic flow and safety
5. Add 75' right-turn lane from Potter Road to NC 75
6. Building would be acquired due to impacts from roadway construction
7. Building would be acquired due to impacts from roadway construction
8. New 5' sidewalk to provide improved connectivity and safety for pedestrians
9. Add 325' right-turn lane from NC 75 to Potter Road
10. Add 50' right-turn lane from Potter Road to NC 75
11. Add 75' left-turn lane from Potter Road to Old Waxhaw-Monroe Road
12. Kangaroo Express driveway realigned to increase distance from roundabout to improve safety
13. Old Waxhaw-Monroe Road realigned to improve approach angle
14. Add 100' left-turn lane from Potter Road to Kangaroo Express

*See **Appendix D** for full design details

Traffic and Safety Analysis Results:

The capacity analysis results indicate that the intersection operations for both the AM and PM peak hour would degrade from its existing LOS C down to LOS F in the 2035 No Build-scenario, indicating the intersection would be over capacity. In order to evaluate future 2035 conditions, a 2.5% annual growth rate was used.

Build Concept 1 proposes the addition of an exclusive left-turn lane on all four intersection approaches as well as an exclusive right-turn lane on both Potter Road approaches. Build Concept 1 would improve the overall intersection operations to LOS D in both the 2035 AM and PM peak hours. Some of the intersection movements would operate at LOS E or LOS F in the AM and PM peak hours, which although not desirable, would be a substantial improvement compared to the No-Build Conditions. The vehicle queue on the southbound Potter Road approach would continue to extend past the railroad crossing in both the AM and PM peak hours.

Build Concept 2 proposes the conversion of the existing signalized intersection into a roundabout. Build Concept 2 would improve the overall intersection operations in 2035 to LOS C in both the AM and PM peak hours. The intersection queue would be approximately half as long as Build Concept 1 but would extend across the railroad crossing in the AM and PM peak hours. The flow-scale analysis determined that the roundabout would be able to accommodate 2035 projected volumes, operating with a v/c ratio under 0.85 at 94% of the 2035 AM peak hour volumes and 103% of the PM peak hour volumes.

Table 2 presents the AM and PM peak hour LOS, delay, and v/c ratio for the overall intersection for the 2019 Existing Conditions and 2035 No-Build and Build Concepts. Additional details including lane configuration, LOS and peak hour volumes are available for each scenario in **Appendix A**.

Table 2: NC 75 at Potter Road Intersection Analysis Results

Scenario	AM Peak Hour			PM Peak Hour		
	LOS	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c
2019 Existing [Signal]	C	28.1	0.88	C	22.8	0.82
2035 No-Build [Signal]	F	115.6	1.30	F	85.0	1.21
2035 Build Concept 1 [Signal]	D	51.1	0.96	D	37.4	0.81
2035 Build Concept 2 [Roundabout]	C	23.2	0.93	C	16.1	0.80

Crash Analysis

Crash data collected over a five-year period from August 1, 2015 through July 31, 2020 indicated 28 crashes occurred at the NC 75 at Potter Road intersection. The resultant crash rate at this intersection is 144.58 crashes per 100 million vehicles entered, which is below the statewide average crash rate for rural two-lane NC routes of 181.59. None of the crashes at this intersection were fatal or involved pedestrians. Approximately half of all crashes were angle/left-turn/sideswipe collisions, approximately 35% were rear-end collisions and the remaining 15% were attributed to fixed object collisions or other factors. Build Concept 2 (Roundabout) would likely reduce total crashes substantially more than Build Concept 1, with a 40% reduction versus 12%, respectively.

Public Involvement Results:

Figure 6 indicates where people live who provided feedback about this intersection, while Figure 7 displays which alternative is preferred by those who responded.

Figure 6: NC 75 at Potter Road Location of Responder Residence

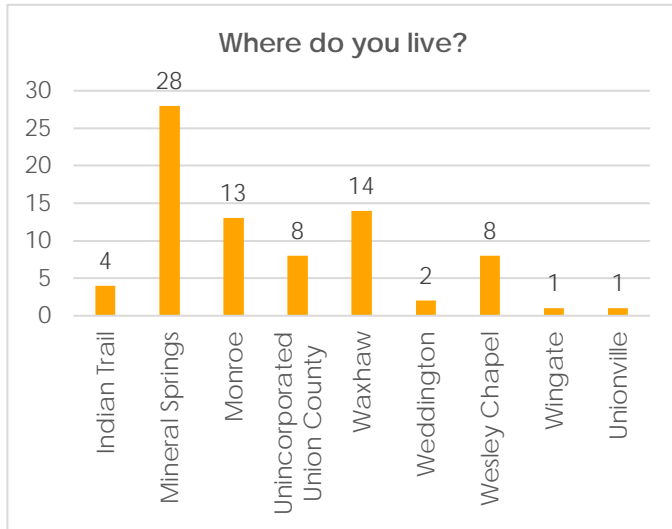
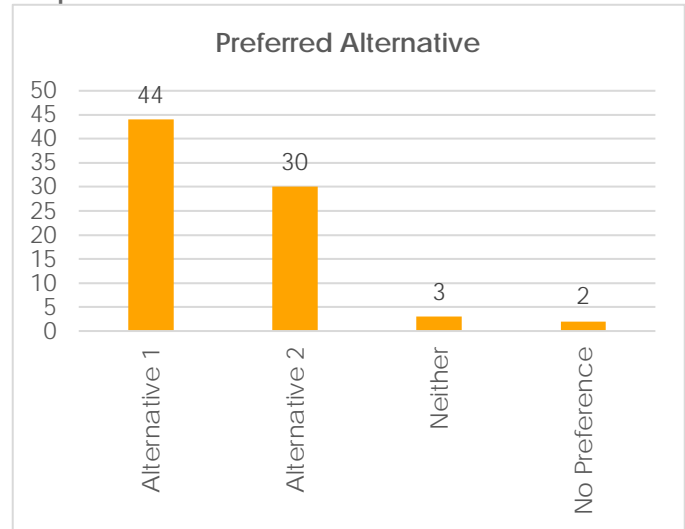


Figure 7: NC 75 at Potter Road Preferred Alternative Responses



A total of 79 responses were received for this intersection. Residents noted the lower project cost and reduced impacts to businesses as a benefit for Alternative 1, but expressed concern that the improvements may not be enough to reduce queueing across the railroad tracks. Alternative 2 was liked for its safety improvements and improved traffic flow, but disliked due to its greater impacts on the surrounding businesses and lower compatibility with the downtown area.

Preferred Alternative:

Alternative 1, Turn Lane Improvements, was selected by the Mineral Springs Town Council on May 13, 2021 as the preferred alternative for this location for the following reasons:

- Addresses traffic issues without extensive right-of-way acquisition, whereas Alternative 2 is less compatible with the local vision of the downtown area.
- Lower project cost results in a more feasible project, especially considering the local match criteria

Cost Estimate:

The cost estimate for the preferred design alternative for this intersection is provided in **Table 3**.

Table 3: NC 75 at Potter Road Preferred Alternative Cost Estimate

Activity	Cost Estimate
Preliminary Engineering/Design (25% of Construction Cost)	\$ 497,000
PE Contingency (40%)	\$ 199,000
Total PE Phase	\$ 700,000
Right-of-Way Cost	\$ 447,000
Utility Cost (Power & Gas Relocation)	\$ 649,000
ROW & Utilities Contingency (40%)	\$ 439,000
Total ROW Phase	\$ 1,540,000
Construction Cost	\$ 1,988,000
Construction Inspection (20% of Construction Cost)	\$ 398,000
Construction + CEI Contingency (40%)	\$ 955,000
Total Construction Phase	\$ 3,350,000
Project Total	\$ 5,590,000
Local Match (Min. 20% if applicable)	\$ 1,120,000

*See **Appendix E** for full cost estimate details

Emissions Analysis

An emissions analysis was performed for the preferred alternative of the NC 75 at Potter Road intersection. These calculations are needed to apply for Congestion Mitigation and Air Quality (CMAQ) funding, which would be an eligible source at this location.

The emissions analysis was completed using the vehicle delay from the 2019 and 2035 No-Build and Build traffic analysis results and pollutant reduction factors from NCDOT’s spreadsheets and US Environmental Protection Agency’s (EPA) Motor Vehicle Emissions Simulator (MOVES). The 2019 Build analysis results, which were not included in the Traffic Operations Analysis Memo as they are only used as part of the emissions analysis, are included in **Appendix A**.

Alternative 1 would result in a 42% reduction in total emissions in 2019 and a 56% reduction in 2035. The daily emissions before improvements, after improvements proposed as part of the preferred alternative, and resultant reduction in the four pollutants measured as part of the emissions analysis are shown in **Table 4**.

Table 4: NC 75 at Potter Road Alternative 1 (Traffic) Daily Emissions (kg)

Pollutants	Year 2019			Year 2035		
	Before	After	Reduction	Before	After	Reduction
Oxides of Nitrogen (NOx)	1.16 kg	0.67 kg	0.49 kg	4.64 kg	2.05 kg	2.60 kg
Volatile Organic Compound (VOC)	3.46 kg	2.00 kg	1.45 kg	13.88 kg	6.12 kg	7.76 kg
Carbon Monoxide (CO)	18.76 kg	10.87 kg	7.89 kg	75.29 kg	33.22 kg	42.07 kg
Particulate Matter (PM2.5)	0.04 kg	0.02 kg	0.01 kg	0.14 kg	0.06 kg	0.08 kg

Bonds Grove Church Road at Waxhaw-Marvin Road



Existing Conditions:

This T-intersection is currently stop-controlled on the eastern leg of Waxhaw-Marvin Road and is located in Marvin. Waxhaw-Marvin Road connects Waxhaw to Marvin and the Ballantyne area and is often used to bypass Providence Road.

The intersection is located in a sharp horizontal curve which creates limited sight distance for vehicles traveling west on Waxhaw-Marvin Road to turn left to stay on Waxhaw-Marvin Road. Three schools are located just west of the intersection, including a high school that attracts less experienced drivers during peak hours.

Design Deficiencies:

- Limited sight distance for vehicles approaching intersection
- Skewed intersection creates challenges for stop-controlled traffic along westbound Waxhaw-Marvin Road
- Existing through movement is not the heaviest traffic movement

Design Considerations:

- Multiple schools in the surrounding area
- Gas, water, and sewer lines present along Waxhaw-Marvin Road
- Village Greenway Master Plan calls for a greenway along Waxhaw-Marvin Road

Concept Designs:

The two design concepts developed for this intersection include:

- **Alternative 1 – Signalized Intersection**
Replace the stop-controlled intersection with a signalized intersection with left-turn lanes on the southbound and eastbound approaches to improve traffic flow. The alignment of Bonds Grove Church Road would be shifted to improve the sight distance and approach angle. Waxhaw-Marvin Road would become the through movement to better accommodate the heaviest traffic movements through the intersection. Add multi-use path along the south side of Waxhaw-Marvin Road.
- **Alternative 2 – Roundabout**
Replace the stop-controlled intersection with a roundabout with right-turn lanes added on the southbound and eastbound approaches. The alignment of Bonds Grove Church Road would be shifted to improve the approach angle. Add multi-use path along the south side of Waxhaw-Marvin Road.

Figure 8 displays Alternative 1 and an overview of the design features associated with that concept design and **Figure 9** provides the same information for Alternative 2. Additional information about the concept designs is included in the Traffic and Safety Analysis Results.

Figure 8: Bonds Grove Church Road at Waxhaw-Marvin Road Alternative 1 Concept Design



Design Information
Realign Bonds Grove Church Road to improve sight distance, approach angle, and safety
Accommodate future Waxhaw-Marvin Road greenway project
Improve traffic flow and safety
Add left turn lanes on the southbound and eastbound approaches
Shift intersection to create through movement on Waxhaw-Marvin Road to accommodate heaviest traffic movements
Potentially reduce total crashes by 27% and injury crashes by 30%
Average peak hour vehicle delay of 20 seconds in 2035 (reduction of 88%)
Approximate Project Cost of \$3,640,000*

*See **Appendix E** for full cost estimate details

Map Notes
1. Multi-use path part of future Waxhaw-Marvin Rd greenway
2. Add 475' left-turn lane from Waxhaw-Marvin Rd to Bonds Grove Church Rd
3. Shift intersection to make Waxhaw-Marvin Rd the through movement to better accommodate the heaviest traffic volumes
4. Existing pavement to be removed after construction
5. Add 325' left-turn lane from Bonds Grove Church Rd to Waxhaw-Marvin Rd
6. Shift current intersection alignment to improve approach angle, sight distance, and safety for drivers

*See **Appendix D** for full design details

Figure 9: Bonds Grove Church Road at Waxhaw-Marvin Road Alternative 2 Concept Design



Design Information
Realign Bonds Grove Church Road to improve sight distance, approach angle, and safety
Accommodate future Waxhaw-Marvin Road greenway project
Improve traffic flow and safety
Add right turn lanes on the southbound and eastbound approaches
Shift intersection to create through movement on Waxhaw-Marvin Road to accommodate heaviest traffic movements
Potentially reduce total crashes by 50% and injury crashes by 78%
Average peak hour vehicle delay of 13 seconds in 2035 (reduction of 92%)
Approximate Project Cost of \$5,360,000*

*See **Appendix E** for full cost estimate details

Map Notes
1. Multi-use path part of future Waxhaw-Marvin Rd greenway
2. Add 275' right-turn lane for heaviest volume movement
3. Roundabout design improves traffic flow and safety
4. Existing pavement to be removed after construction
5. Add 300' right-turn lane from Bonds Grove Church Rd to Waxhaw-Marvin Rd
6. Shift current intersection alignment to improve approach angle, sight distance, and safety for drivers

*See **Appendix D** for full design details

Traffic and Safety Analysis Results:

The worst movement, which is the stop-controlled Waxhaw-Marvin Road approach, currently operates at LOS F in the AM peak hour and LOS D in the PM peak hour. The 2035 No-Build Conditions analysis indicates this movement would continue to operate at LOS F in the AM peak hour and degrade to LOS F in the PM peak hour. In order to evaluate future 2035 conditions, a 2.0% annual growth rate was used.

Build Concept 1 proposes the conversion of the existing one-way stop-controlled intersection into a signalized intersection and realignment to make the movement continuing along Waxhaw-Marvin Road as the through movement. This concept would also include the addition of an exclusive left-turn lane on the southbound Bonds Grove Church Road and eastbound Waxhaw-Marvin Road approaches. Build Concept 1 would improve the overall intersection operations in 2035 to LOS C in the AM peak hour and LOS A in the PM peak hour.

Build Concept 2 proposes the conversion of the existing intersection into a single lane roundabout with an exclusive left-turn lane and right-turn lane along the southbound Bonds Grove Church Road approach and exclusive right-turn lane and through lane along the eastbound Waxhaw-Marvin Road approach. Build Concept 2 would improve the overall intersection operations in 2035 to LOS C in the AM peak hour and LOS B in the PM peak hour. The flow-scale analysis determined that the roundabout would be able to accommodate 2035 project volumes, operating with a v/c ratio under 0.85 at 101% of the 2035 AM peak hour volumes and 110% of the PM peak hour volumes.

Table 5 presents the AM and PM peak hour LOS, delay, and v/c ratio for the overall intersection or poorest performing approach for one-way stop-control intersections for the 2019 Existing Conditions and 2035 No-Build and Build Concepts. Additional details including lane configuration, LOS and peak hour volumes are available for each scenario in **Appendix A**.

Table 5: Bonds Grove Church Road at Waxhaw-Marvin Road Intersection Analysis Results

Scenario	Approach	AM Peak Hour			PM Peak Hour		
		LOS	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c
2019 Existing [One-Way Stop-Control]	Waxhaw-Marvin Road Stop-Controlled Movement	F	201.9	1.35	D	34.6	0.71
2035 No-Build [One-Way Stop-Control]	Waxhaw-Marvin Road Stop-Controlled Movement	F	682.2	2.43	F	203.4	1.32
2035 Build Concept 1 [Signal]	Overall	C	31.9	0.93	A	8.7	0.58
2035 Build Concept 2 [Roundabout]	Overall	C	15.8	0.83	B	10.5	0.76

Crash Analysis

Crash data collected over a five-year period from August 1, 2015 through July 31, 2020 indicated 23 crashes occurred at the Bonds Grove Church Road at Waxhaw-Marvin Road intersection. The resultant crash rate at this intersection is 122.22 crashes per 100 million vehicles entered, which is below the statewide average crash rate for rural two-lane secondary routes of 235.81. None of the crashes at this intersection were fatal or involved pedestrians. Approximately one third of crashes can be attributed to each of the following: rear end, angle/left-turn/right-turn/sideswipe, and ran off road/fixed object/other. Build Concept 2 would likely reduce crashes by 50% while Build Concept 1 would likely reduce crashes by 27%.

Public Involvement Results:

Figure 10 indicates where people live who provided feedback about this intersection, while Figure 11 displays which alternative is preferred by those who responded.

Figure 10: Bonds Grove Church Road at Waxhaw-Marvin Road Location of Responder Residence

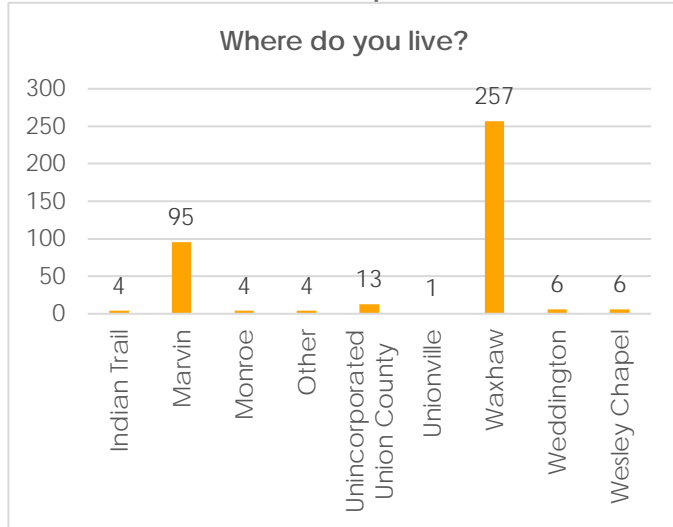
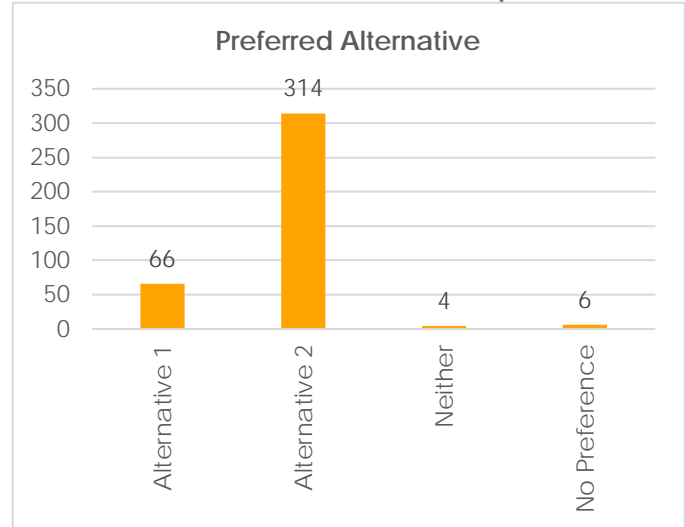


Figure 11: Bonds Grove Church Road at Waxhaw-Marvin Road Preferred Alternative Responses



A total of 390 responses were received for this intersection with 80% indicating Alternative 2 as their desired alternative. Residents noted the improved safety as a benefit for both alternatives in addition to the lower costs for Alternative 1 and improved traffic flow and aesthetics for Alternative 2.

While favored, residents expressed concern that inexperienced drivers may have challenges with the roundabout and added that blind spots are currently present at the intersection and a large number of accidents occur as a result. Overall, safety appeared to be the most notable concern for survey respondents.

Preferred Alternative:

Alternative 2, Roundabout, was selected by the Village of Marvin Council on May 11, 2021 as the preferred alternative for this location for the following reasons:

- Improved safety and greater potential for crash reduction.
- Improved compatibility with future bicycle and pedestrian accommodations.

Cost Estimate:

The cost estimates for both design alternatives for this intersection are provided in **Table 6**.

Table 6: Bonds Grove Church Road at Waxhaw-Marvin Road Preferred Alternative Cost Estimate

Activity	Cost Estimate
Preliminary Engineering/Design (25% of Construction Cost)	\$ 629,000
PE Contingency (40%)	\$ 252,000
Total PE Phase	\$ 890,000
Right-of-Way Cost	\$ 80,000
Utility Cost (Power & Gas Relocation)	\$ 161,000
ROW & Utilities Contingency (40%)	\$ 97,000
Total ROW Phase	\$ 340,000
Construction Cost	\$ 2,513,000
Construction Inspection (20% of Construction Cost)	\$ 503,000
Construction + CEI Contingency (40%)	\$ 1,207,000
Total Construction Phase	\$ 4,230,000
Project Total	\$ 5,460,000
Local Match (Min. 20% if applicable)	\$ 1,092,000

*See **Appendix E** for full cost estimate details

US 601 at Brief Road



Existing Conditions:

The US 601 at Brief Road intersection is an existing two-way stop-controlled intersection in the Town of Fairview. Development in the immediate area is minimal but there are multiple driveways in close proximity to the intersection.

This intersection is being analyzed predominantly due to safety concerns, but peak hour congestion and delay issues are also present, particularly for vehicles traveling eastbound on Brief Road. The existing concrete medians along the Brief Road approaches indicate improvements may have been previously constructed in an attempt to increase driver awareness of the stop condition.

Design Deficiencies:

- No turn lanes

Design Considerations:

- Heavy truck traffic along US 601
- Drivers tend to treat US 601 as a high-speed corridor resulting in safety issues for the Brief Road approaches
- Three developments were proposed along US 601 south of the intersection but later withdrawn demonstrating development pressures in the area
- Traffic volumes do not meet signal warrants

Related Projects:

- **NCDOT Safety Improvements**
This intersection was awarded funding to add rumble strips and advanced signing to improve safety at this intersection.

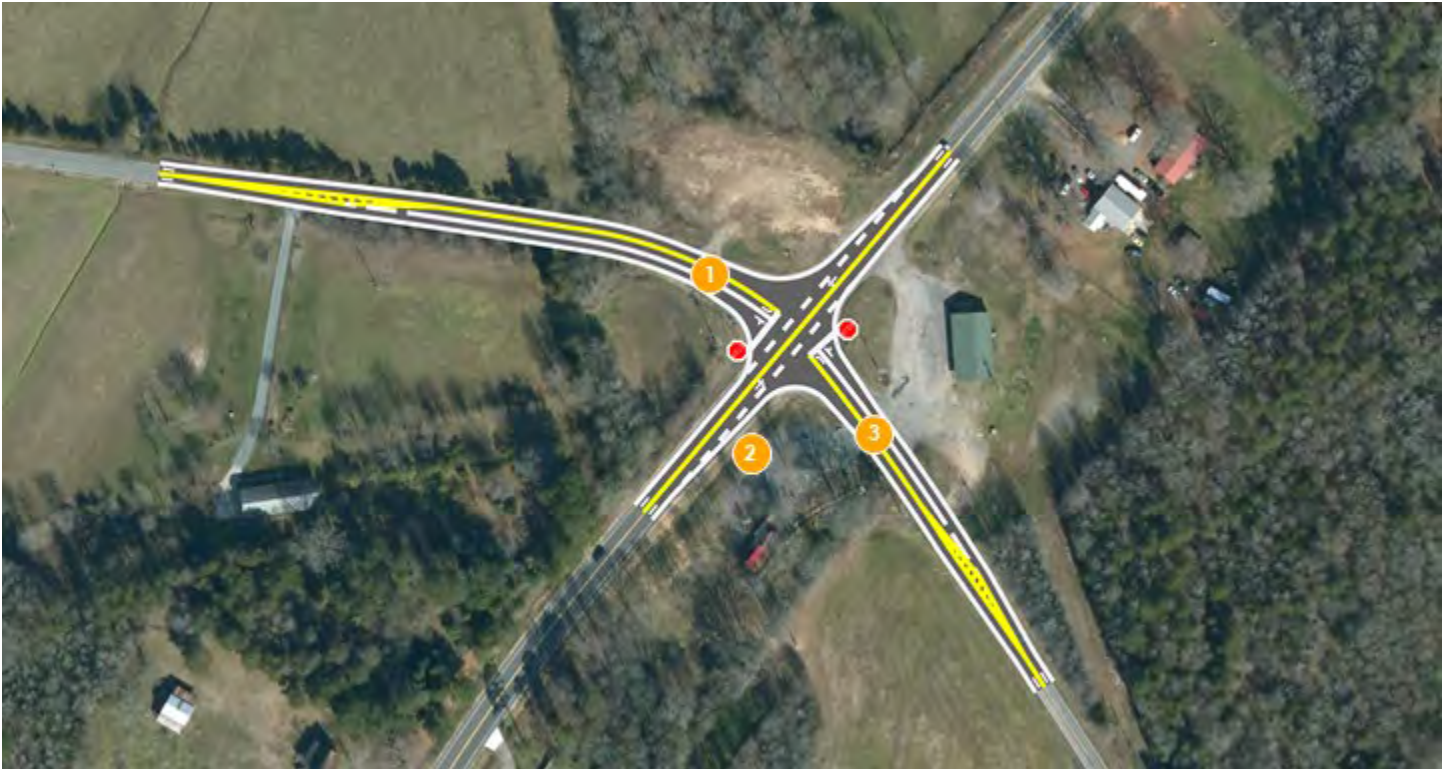
Concept Designs:

The two design concepts developed for this intersection include:

- **Alternative 1 – Turn Lane Improvements**
Add left-turn lanes along both Brief Road approaches, along with warning signs in advance of the intersection at all approaches.
- **Alternative 2 – Roundabout**
Convert the intersection to a single-lane roundabout.

Figure 12 displays Alternative 1 and an overview of the design features associated with that concept design and **Figure 13** provides the same information for Alternative 2. Additional information about the concept designs is included in the Traffic and Safety Analysis Results.

Figure 12: US 601 at Brief Road Alternative 1 Concept Design



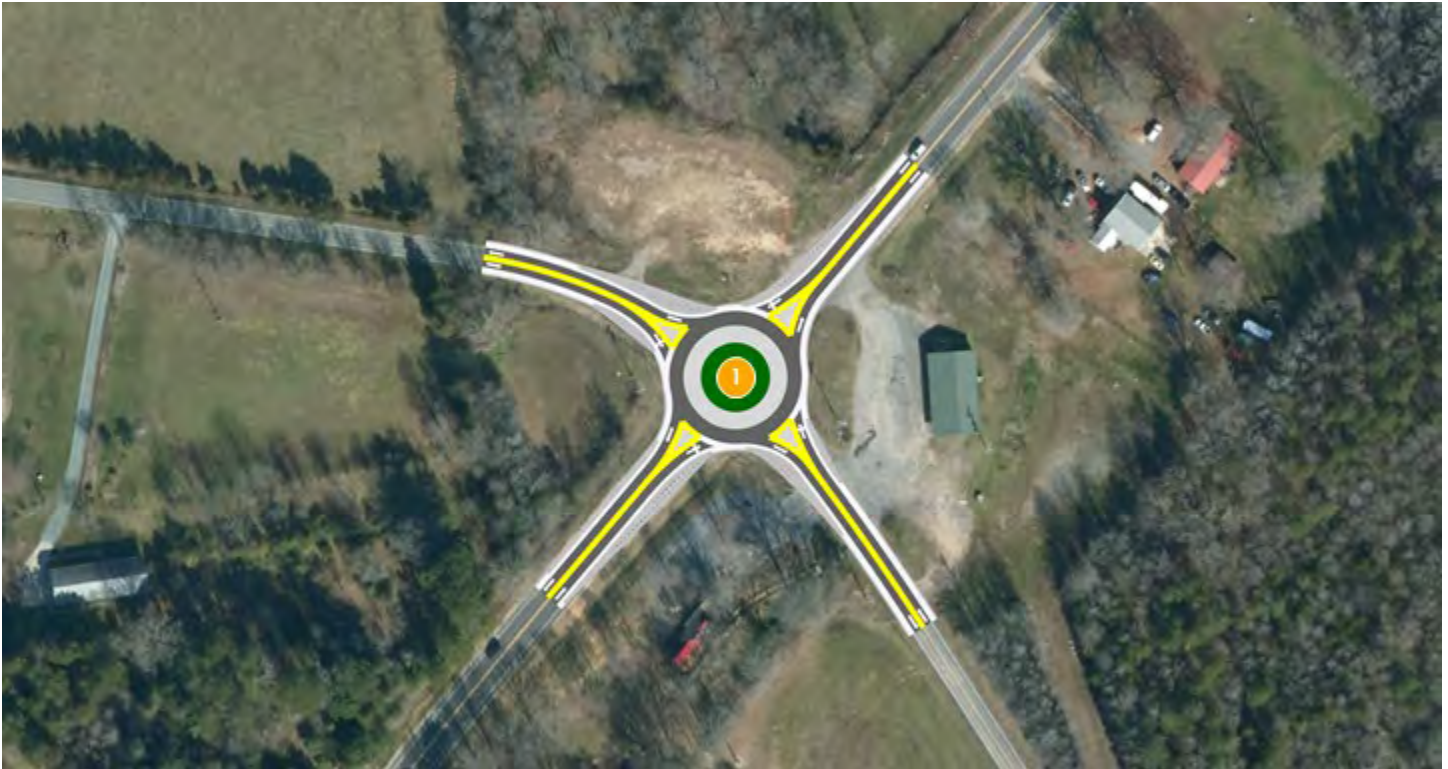
Design Information
Add left-turn lanes for Brief Road approaches to reduce vehicle delay
Negligible reduction in total and injury crashes
Average peak hour vehicle delay of 74 seconds in 2035 (reduction of 45%)
Approximate Project Cost of \$920,000*

*See **Appendix E** for full cost estimate details

Map Notes
1. Add 375' left-turn lane from Brief Rd to US 601
2. Add advanced intersection warning signs on all intersection approaches to improve safety
3. Add 200' left-turn lane from Brief Rd to US 601

*See **Appendix D** for full design details

Figure 13: US 601 at Brief Road Alternative 2 Concept Design



Design Information

Roundabout design helps to reduce speeds through intersection and increases safety for vehicles turning from Brief Road approaches
Potentially reduce total crashes by 50% and injury crashes by 79%
Average peak hour vehicle delay of 14 seconds in 2035 (reduction of 89%)
Approximate Project Cost of \$2,950,000*

*See **Appendix E** for full cost estimate details

Map Notes

1. Roundabout design improves traffic flow and safety

*See **Appendix D** for full design details

Traffic and Safety Analysis Results:

The worst movement currently operates at LOS F in both the AM and PM peak hours. The 2035 No-Build Conditions analysis indicates the worst movement would continue to operate at LOS F in both the AM and PM peak hours with the stop-controlled eastbound shared left-through-right-turn movement from Brief Road experiencing delays of over 25 minutes in the PM peak hour. In order to evaluate future 2035 conditions, a 2.0% annual growth rate was used.

Build Concept 1 keeps the intersection as two-way stop-controlled and proposes the addition of an exclusive left-turn lane on each of the Brief Road approaches. Build Concept 1 would reduce the delay for the stop-controlled movements but would still have movements that operate at LOS F. Left-turn lanes along US 601 are not proposed because left turning volumes on US 601 are relatively low and the addition of left-turn lanes along US 601 would increase the number of lanes vehicles turning left or moving through from the Brief Road approaches would have to cross, which may exacerbate safety issues.

Build Concept 2 proposes the conversion of the existing intersection to a single lane roundabout. Build Concept 2 would improve the overall intersection operations in 2035 to LOS B in the AM peak hour and LOS C in the PM peak hour. The flow-scale analysis determined that the roundabout would be able to accommodate 2035 projected volumes, operating with a v/c ratio under 0.85 at 118% of the 2035 AM peak hour volumes and 98% of the PM peak hour volumes.

Table 7 presents the AM and PM peak hour LOS, delay, and v/c ratio for the overall intersection or poorest performing approach for two-way stop-controlled intersections for the 2019 Existing Conditions and 2035 No-Build and Build Concepts. Additional details including lane configuration, LOS and peak hour volumes are available for each scenario in **Appendix A**.

Table 7: US 601 at Brief Road Intersection Analysis Results

Scenario	Approach	AM Peak Hour			PM Peak Hour		
		LOS	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c
2019 Existing [Two-Way Stop-Control]	Brief Road Stop-Controlled Movement	F	56.0	0.71	F	249.2	1.34
2035 No-Build [Two-Way Stop-Control]	Brief Road Stop-Controlled Movement	F	469.4	1.81	F	1,524.8	4.09
2035 Build Concept 1 [Two-Way Stop-Control]	Brief Road Stop-Controlled Movement	F	331.6	1.35	F	1,256.8	3.42
2035 Build Concept 2 [Roundabout]	Overall	B	11.2	0.71	C	17.2	0.86

Crash Analysis

Crash data collected over a five-year period from August 1, 2015 through July 31, 2020 indicated 23 crashes occurred at the US 601 at Brief Road intersection. The resultant crash rate at this intersection is 132.52 crashes per 100 million vehicles entered, which is below the statewide average crash rate for rural two-lane US routes of 153.47. None of the crashes at this intersection were fatal or involved pedestrians. Approximately 75% of the crashes at the intersection were angle/left-turn/right-turn collisions, 15% rear-end and 10% fixed object. Build Concept 1 would likely have no impact on crash rates while Build Concept 2 would likely result in a 50% reduction in crashes.

Public Involvement Results:

Figure 14 indicates where people live who provided feedback about this intersection, while Figure 15 displays which alternative is preferred by those who responded.

Figure 14: US 601 at Brief Road Location of Responder Residence

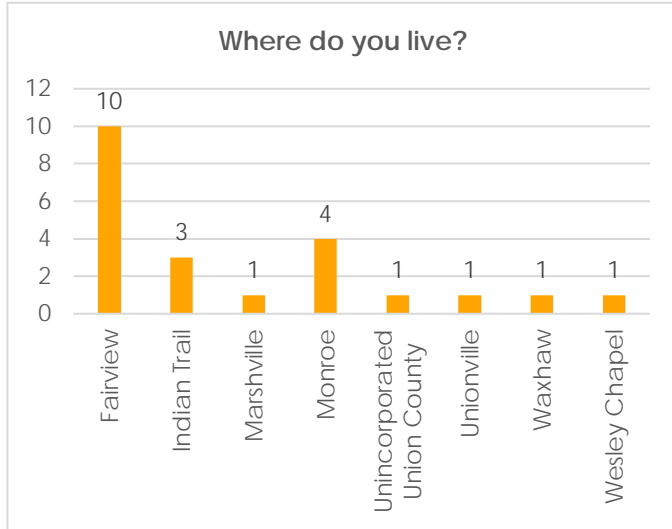
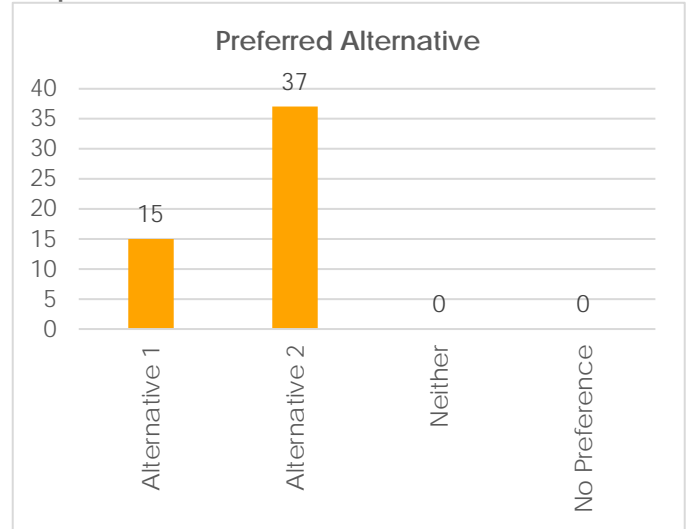


Figure 15: US 601 at Brief Road Preferred Alternative Responses



A total of 52 responses were received for this intersection. Residents liked the fact that Alternative 1 keeps traffic moving uninterrupted along US 601 and disliked the speed reducing aspect of the roundabout. Other residents expressed concerns for Alternative 1 that turn-lane sight-distance would be inadequate for cars turning onto US 601. Alternative 2 was desired predominantly due to safety reasons and residents noted it would likely be a better long-term solution. Similar feedback was received during in-person outreach at Hot Mess Burgers on April 1, 2021.

Preferred Alternative:

Alternative 2, Roundabout, was selected by the Fairview Town Council on May 11, 2021 as the preferred alternative for this location for the following reasons:

- Improved safety and potential for substantial crash reduction.
- Improved level of service and long-term viability of roundabout improvements.

Cost Estimate:

The cost estimates for the preferred design alternative for this intersection is provided in **Table 8**.

Table 8: US 601 at Brief Road Preferred Alternative Cost Estimates

Activity	Cost Estimate
Preliminary Engineering/Design (25% of Construction Cost)	\$ 305,000
PE Contingency (40%)	\$ 122,000
Total PE Phase	\$ 430,000
Right-of-Way Cost	\$ 40,000
Utility Cost (Power & Gas Relocation)	\$ 203,000
ROW & Utilities Contingency (40%)	\$ 97,000
Total ROW Phase	\$ 340,000
Construction Cost	\$ 1,217,000
Construction Inspection (20% of Construction Cost)	\$ 244,000
Construction + CEI Contingency (40%)	\$ 585,000
Total Construction Phase	\$ 2,050,000
Project Total	\$ 2,820,000
Local Match (Min. 20% if applicable)	\$ 564,000

*See **Appendix E** for full cost estimate details

Poplin Road at Unionville-Indian Trail Road



Existing Conditions:

The Poplin Road at Unionville-Indian Trail Road intersection in northern Monroe is a two-way stop-controlled intersection with left-turn lanes on all approaches. The intersection is surrounded on three sides by the Glendalough subdivision. This intersection is being analyzed in response to safety concerns, including a severe injury crash and a fatal crash in 2017 and another fatal crash in 2020. The crash rate at this intersection exceeds the statewide crash rate for similar roadways.

There is pedestrian activity in the area, with the neighborhood clubhouse located south of the intersection. While sidewalks exist in the area, no crosswalks or other accommodations are present to bring driver awareness to pedestrians entering the intersection. Additionally, the existing turn lanes increase the distance pedestrians are required to travel to cross at the intersection.

Design Deficiencies:

- Horizontal and vertical sight distance issues along Unionville-Indian Trail Road due to vegetation and vertical curvature of roadway
- Minimal pedestrian accommodations

Design Considerations:

- Safety problems with lack of stop-control along Unionville-Indian Trail Road
- Development under construction along Unionville-Indian Trail Road east of the intersection
- Traffic volumes do not meet signal warrants

Related Projects:

- **NCDOT Division 10 Spot Safety Improvements**
This intersection was awarded funding through the Spot Safety program in April 2021 to convert the two-way stop into an all-way stop-controlled intersection.

Concept Designs:

The two design concepts developed for this intersection include:

- **Alternative 1 – Four-Way Stop**
Add stop signs to the Unionville-Indian Trail Road approaches, build and improve existing sidewalk curb ramps, and add marked crosswalks.
- **Alternative 2 – Roundabout**
Convert the existing intersection to a single-lane roundabout with marked crosswalks and new sidewalk curb ramps.

Figure 16 displays Alternative 1 and an overview of the design features associated with that concept design and **Figure 17** provides the same information for Alternative 2. Additional information about the concept designs is included in the Traffic and Safety Analysis Results.

Figure 16: Poplin Road at Unionville-Indian Trail Road Alternative 1 Concept Design



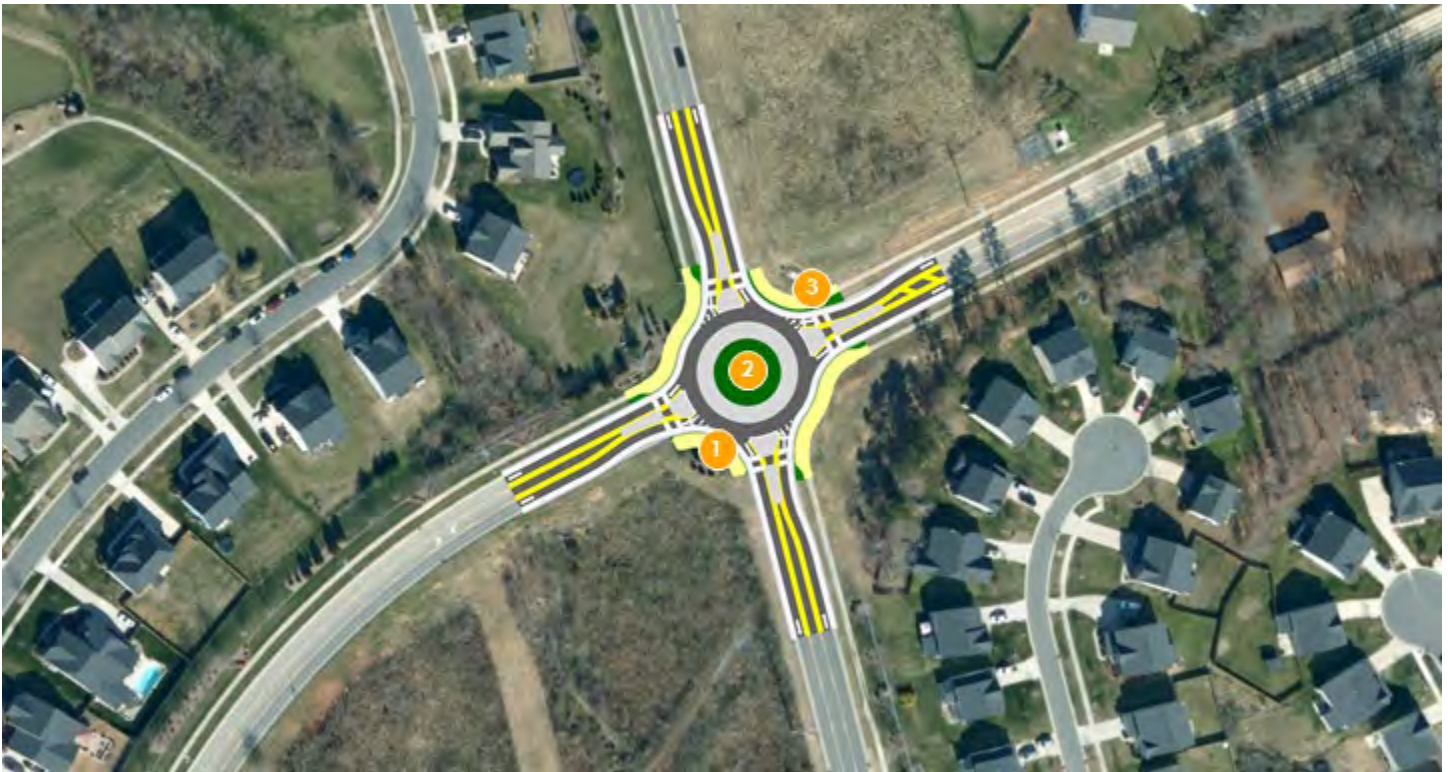
Design Information
Improve traffic safety
Add marked crosswalks to improve pedestrian safety
Rebuild and improve existing sidewalk curb ramps
Add stop signs to the Unionville-Indian Trail Road approaches to create a four-way stop
Potentially reduce total crashes by 70% and injury crashes by 72%
Average peak hour vehicle delay of 25 seconds in 2035
Approximate Project cost of \$170,000*

*See **Appendix E** for full cost estimate details

Map Notes
1. Marked crosswalks improve pedestrian safety
2. Rebuild and improve existing sidewalk curb ramps
3. Add stop signs to Unionville-Indian Trail Rd approaches to create a four-way stop and improve safety

*See **Appendix D** for full design details

Figure 17: Poplin Road at Unionville-Indian Trail Road Alternative 2 Concept Design



Design Information
Improve traffic safety
Add marked crosswalks to improve pedestrian safety
Rebuild and improve existing sidewalk curb ramps
Roundabout design helps to reduce speeds through intersection
Potentially reduce total crashes by 50% and injury crashes by 78%
Average peak hour vehicle delay of 7 seconds in 2035
Approximate Project cost of \$2,700,000*

*See **Appendix E** for full cost estimate details

Map Notes
1. Marked crosswalks improve pedestrian safety
2. Roundabout design improves traffic flow and safety
3. Rebuild and improve existing sidewalk curb ramps

*See **Appendix D** for full design details

Traffic and Safety Analysis Results:

The worst movement currently operates at LOS C in the AM peak hour and LOS B in the PM peak hour. The 2035 No-Build Conditions analysis indicates the worst movement would degrade to LOS E in the AM peak hour and LOS C in the PM peak hour. In order to evaluate future 2035 conditions, a 2.5% annual growth rate was used.

Build Concept 1 proposes the conversion of the existing two-way stop-controlled intersection to an all-way stop-controlled intersection with no changes to the lane configuration. Build Concept 1 would improve the overall intersection operations in 2035 to LOS D in the AM peak hour and LOS B in the PM peak hour.

Build Concept 2 proposes the conversion of the existing two-way stop-controlled intersection into a single lane roundabout. Build Concept 2 would improve the overall intersection operations in 2035 to LOS A in both the AM and PM peak hours. The flow-scale analysis determined that the roundabout would be able to accommodate 2035 projected volumes operating with a v/c ratio under 0.85 at 159% of the 2035 AM peak hour volumes and 225% of the PM peak hour volumes.

Table 9 presents the AM and PM peak hour LOS, delay, and v/c ratio for the overall intersection or poorest performing approach for two-way stop-controlled intersections for the 2019 Existing Conditions and 2035 No-Build and Build Concepts. Additional details including lane configuration, LOS and peak hour volumes are available for each scenario in **Appendix A**.

Table 9: Poplin Road at Unionville-Indian Trail Road Intersection Analysis Results

Scenario	Approach	AM Peak Hour			PM Peak Hour		
		LOS	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c
2019 Existing [Two-Way Stop-Control]	Poplin Road Stop-Controlled Movement	C	22.0	0.08	B	14.9	0.04
2035 No-Build [Two-Way Stop-Control]	Poplin Road Stop-Controlled Movement	E	46.8	0.22	C	21.4	0.09
2035 Build Concept 1 [All-Way Stop-Control]	Overall	D	33.0	0.95	B	13.3	0.59
2035 Build Concept 2 [Roundabout]	Overall	A	7.3	0.50	A	5.4	0.33

Crash Analysis

Crash data collected over a five-year period from August 1, 2015 through July 31, 2020 indicated 41 crashes occurred at the Poplin Road at Unionville-Indian Trail Road intersection. The resultant crash rate at this intersection is 284.07 crashes per 100 million vehicles entered, which is above the statewide average crash rate for urban two-lane secondary routes of 268.84. There was one fatal crash and one pedestrian involved crash at this intersection during this period. Approximately 90% of the crashes at the intersection were angle collisions and remaining crashes were split evenly between left-turn/sideswipe and other. Both Concepts would likely have a substantial impact on crash rates with Build Concept 1 resulting in a 70% reduction and Build Concept 2 resulting in a 50% reduction on total crashes.

Public Involvement Results:

Figure 18 indicates where people live who provided feedback about this intersection, while Figure 19 displays which alternative is preferred by those who responded.

Figure 18: Poplin Road and Unionville-Indian Trail Road Location of Responder Residence

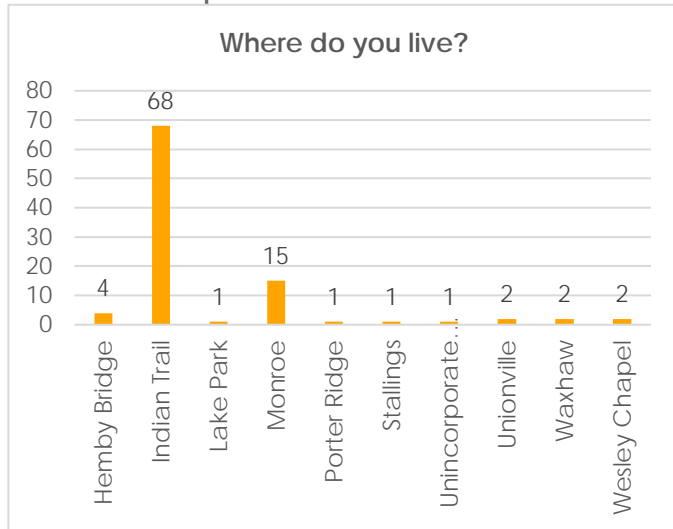
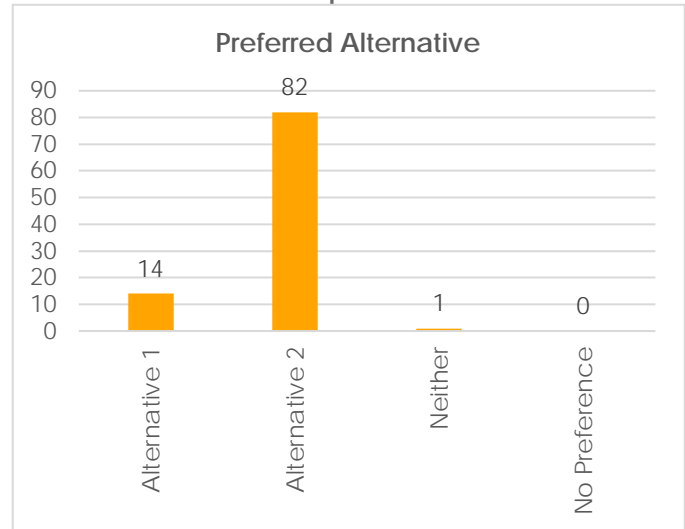


Figure 19: Poplin Road and Unionville-Indian Trail Road Preferred Alternative Responses



A total of 97 responses were received for this intersection. For Alternative 1, the comments indicated lower construction costs as a benefit along with improved safety, although some residents felt the all-way stop would not be as effective as a roundabout. Residents noted that in addition to the aesthetic value of a roundabout, Alternative 2 provides better traffic flow while calming traffic and improving safety.

Residents generally expressed concerns with high speeds in the area, driver familiarity with roundabouts, and lack of stopping at stop signs.

Preferred Alternative:

In light of the recent plans to improve this intersection as a Spot Safety project, the Monroe City Council selected Alternative 2, Roundabout, as the ultimate preferred option for this intersection on May 11, 2021. This decision was made dependent on how well the all-way stop addresses current safety issues and handles future traffic growth. Alternative 2 was preferred at this location for the following reasons:

- Potential for even further improvements to safety and greater reduction in potential conflict points.
- Greater ability to handle future traffic volumes and provide adequate level of service.

Overall, the consensus was to monitor the intersection to ensure the improvements funded through Spot Safety will reasonably address existing safety concerns. As traffic continues to increase, additional analysis at the intersection will be necessary to ensure acceptable levels of service are being met.

Cost Estimate:

The cost estimates for the preferred design alternative for this intersection are provided in **Table 10**.

Table 10: Poplin Road at Unionville-Indian Trail Road Preferred Alternative Cost Estimate

Activity	Cost Estimate
Preliminary Engineering/Design (25% of Construction Cost)	\$ 313,000
PE Contingency (40%)	\$ 126,000
Total PE Phase	\$ 440,000
Right-of-Way Cost	\$ 50,000
Utility Cost (Gas Relocation)	\$ 56,000
ROW & Utilities Contingency (40%)	\$ 43,000
Total ROW Phase	\$ 150,000
Construction Cost	\$ 1,252,000
Construction Inspection (20% of Construction Cost)	\$ 251,000
Construction + CEI Contingency (40%)	\$ 602,000
Total Construction Phase	\$ 2,110,000
Project Total	\$ 2,700,000
Local Match (Min. 20% if applicable)	\$ 540,000

*See **Appendix E** for full cost estimate details

NC 200 at Plyler Mill Road



Existing Conditions:

This intersection is currently a stop-controlled intersection on the Plyler Mill Road approach without turn lanes in unincorporated Union County. Plyler Mill Road continues to South Carolina and services a large rural area. Plyler Mill Road intersects NC 200 at a skewed approach and there are multiple residential driveways in close proximity to the intersection.

Design Deficiencies:

- No left-turn lane for westbound NC 200 resulting in rear-end crashes
- No turn lanes on Plyler Mill Road approach

Design Considerations:

- 300-home development is proposed along Helms Shortcut Road, approximately ½ mile south of the intersection
- Gasline present along east side of NC 200
- Quadruple 10' x 13' reinforced concrete box culvert crosses underneath NC 200 approximately 200 feet north of the intersection
- Multiple driveways in close proximity to the intersection

Concept Designs:

The two design concepts developed for this intersection include:

- **Alternative 1 – Turn Lane Improvements**
Add a right-turn lane on Plyler Mill Road and a southbound left-turn lane on NC 200. Extend the existing culvert east of the intersection to accommodate the proposed NC 200 southbound left-turn lane. Realign Plyler Mill Road to improve the approach angle.
- **Alternative 2 – Roundabout**
Convert the existing intersection to a single-lane roundabout and realign Plyler Mill Road to improve the approach angle.

Figure 20 displays Alternative 1 and an overview of the design features associated with that concept design and **Figure 21** provides the same information for Alternative 2. Additional information about the concept designs is included in the Traffic and Safety Analysis Results.

Figure 20: NC 200 at Plyler Mill Road Alternative 1 Concept Design



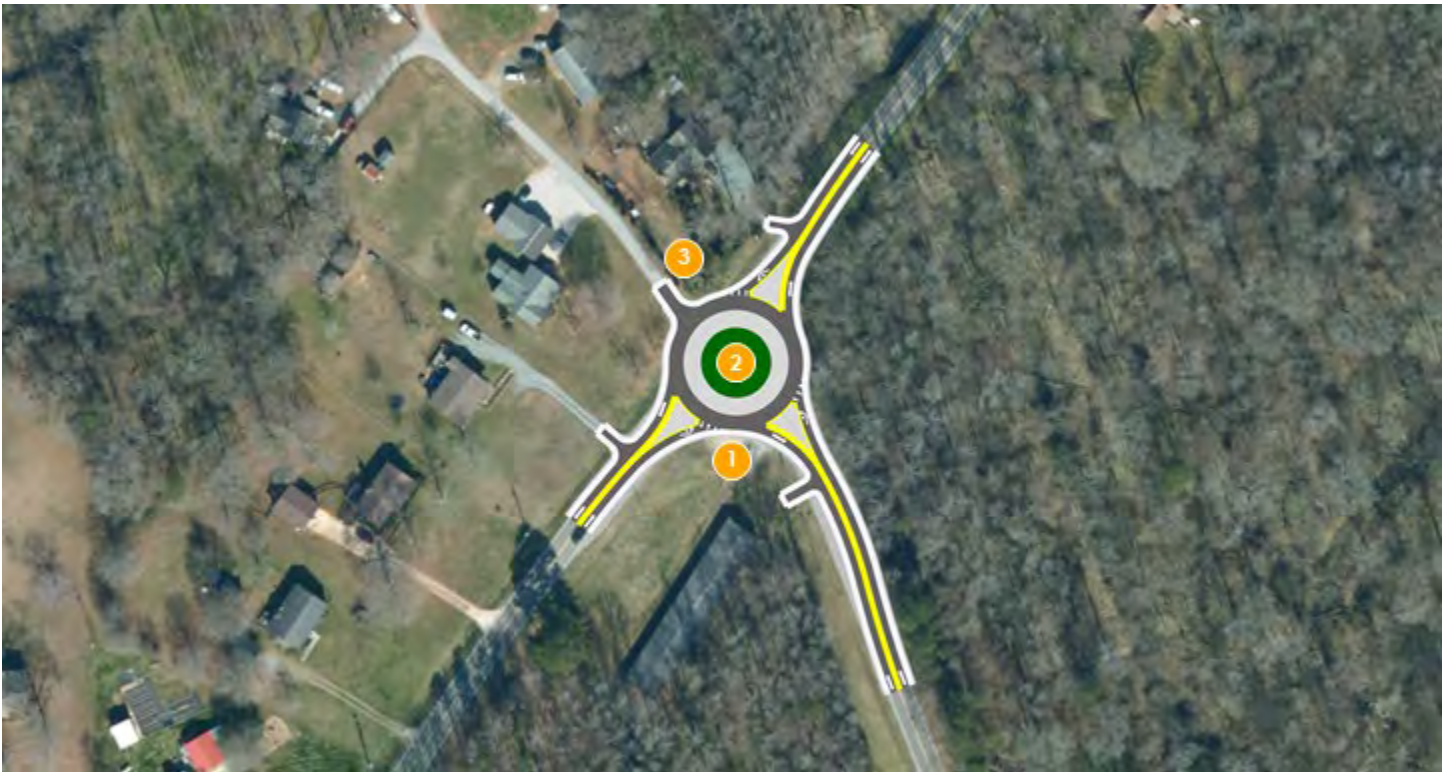
Design Information
Shift alignment to improve approach angle and safety
Improve traffic flow
Maintain driveway access for local residents
Add right-turn lane from Plyler Mill Road to NC 200 and add left-turn lane from NC 200 to Plyler Mill Road
Potentially reduce total crashes by 44% and injury crashes by 47%
Average peak hour vehicle delay of 8 seconds in 2035 (reduction of 64%)
Approximate Project cost of \$2,380,000*

*See **Appendix E** for full cost estimate details

Map Notes
1. Add 225' right-turn lane from Plyler Mill Rd to NC 200
2. Shift current intersection alignment to improve approach angle and safety for drivers
3. Add 500' left-turn lane from NC 200 to Plyler Mill Rd
4. Guardrail to protect vehicles crossing culvert
5. Extend existing box culvert to accommodate wider road

*See **Appendix D** for full design details

Figure 21: NC 200 at Plyler Mill Road Alternative 2 Concept Design



Design Information
Shift alignment to improve approach angle and safety
Improve traffic flow
Maintain driveway access for local residents
Roundabout design helps to reduce speeds through intersection
Potentially reduce total crashes by 50% and injury crashes by 78%
Average peak hour vehicle delay of 14 seconds in 2035 (reduction of 37%)
Approximate Project cost of \$2,870,000*

*See **Appendix E** for full cost estimate details

Map Notes
1. Shift current intersection alignment to improve approach angle and safety for drivers
2. Roundabout design improves traffic flow and safety
3. Maintain driveway access for local residents

*See **Appendix D** for full design details

Traffic and Safety Analysis Results:

The worst movement currently operates at LOS E and LOS D in the AM and PM peak hours, respectively. The 2035 No-Build Conditions analysis indicates the worst movement would degrade in operations to LOS F in both the AM and PM peak hours with the stop-controlled westbound shared left-right-turn movement from Plyler Mill Road experiencing delays of over two minutes in the AM peak hour. In order to evaluate future 2035 conditions, a 1.0% annual growth rate was used.

Build Concept 1 keeps the intersection as one-way stop-controlled and proposes the addition of an exclusive left-turn lane on the southbound NC 200 approach and an exclusive right-turn lane on the westbound Plyler Mill Road approach. Build Concept 1 would improve the worst movement operations in 2035 to LOS E in the AM peak hour but the PM peak hour would remain LOS F.

Build Concept 2 proposes the conversion of the existing one-way stop-controlled intersection into a single lane roundabout. Build Concept 2 would improve the overall intersection operations in 2035 to LOS B in both the AM and PM peak hours. The flow-scale analysis determined that the roundabout would be able to accommodate 2035 projected volumes operating with a v/c ratio under 0.85 at 116% of both the 2035 AM and PM peak hour volumes.

Table 11 presents the AM and PM peak hour LOS, delay, and v/c ratio for the overall intersection or poorest performing approach for one-way stop-controlled intersections for the 2019 Existing Conditions and 2035 No-Build and Build Concepts. Additional details including lane configuration, LOS and peak hour volumes are available for each scenario in **Appendix A**.

Table 11: NC 200 and Plyler Mill Road Intersection Analysis Results

Scenario	Approach	AM Peak Hour			PM Peak Hour		
		LOS	Delay (sec/veh)	v/c	LOS	Delay (sec/veh)	v/c
2019 Existing [One-Way Stop-Control]	Plyler Mill Road Stop Controlled Movement	E	44.6	0.83	D	30.9	0.53
2035 No-Build [One-Way Stop-Control]	Plyler Mill Road Stop Controlled Movement	F	122.8	1.13	F	83.0	0.88
2035 Build Concept 1 (One-Way Stop-Control)	Plyler Mill Road Stop Controlled Movement	E	38.0	0.76	F	86.3	0.57
2035 Build Concept 2 [Roundabout]	Overall	B	11.7	0.64	B	11.1	0.72

Crash Analysis

Crash data collected over a five-year period from July 1, 2015 through June 30, 2020 indicated 17 crashes occurred at the NC 200 at Plyler Mill Road intersection. The resultant crash rate at this intersection is 83.83 crashes per 100 million vehicles entered, which is below the statewide average crash rate for rural NC two-lane routes of 181.59. None of the crashes at this intersection were fatal or involved pedestrians. Approximately 85% of the crashes at the intersection were rear-end, 10% left-turn/right-turn, and 5% other. Build Concept 1 and Build Concept 2 would likely result in similar reductions to total crashes with 44% and 50%, respectively.

Public Involvement Results:

Figure 22 indicates where people live who provided feedback about this intersection, while Figure 23 displays which alternative is preferred by those who responded.

Figure 22: NC 200 at Plyler Mill Road Location of Responder Residence

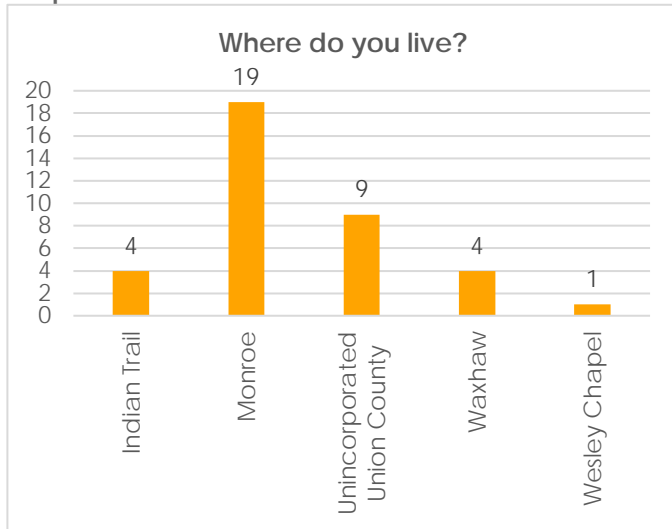
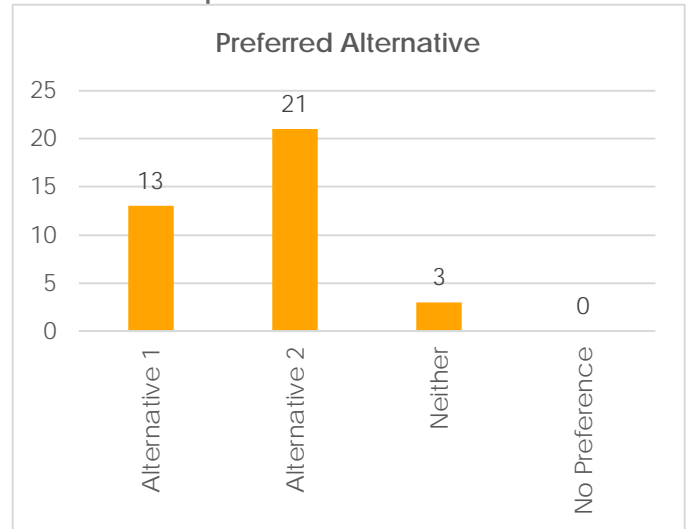


Figure 23: NC 200 at Plyler Mill Road Preferred Alternative Responses



A total of 37 responses were received for this intersection. The comments for Alternative 1 indicated a preference towards reduced project cost and the uninterrupted flow of traffic along NC 200. Alternative 2 was favored mainly for its traffic calming affects and safety improvements. Some comments noted that Alternative 2 seemed like an overdesign for the area.

Preferred Alternative:

Alternative 2, Roundabout, was selected by the Union County Board of Commissioners on May 17, 2021 as the preferred alternative for this location for the following reasons:

- Greatest potential for crash reduction
- Better option to accommodate future traffic volumes anticipated from development in the area

Cost Estimate:

The cost estimates for the preferred design alternative for this intersection is provided in **Table 12**.

Table 12: NC 200 at Plyler Mill Road Preferred Alternative Cost Estimate

Activity	Cost Estimate
Preliminary Engineering/Design (25% of Construction Cost)	\$ 298,000
PE Contingency (40%)	\$ 120,000
Total PE Phase	\$ 420,000
Right-of-Way Phase	
Right-of-Way Cost	\$ 60,000
Utility Cost (Power & Gas Relocation)	\$ 251,000
ROW & Utilities Contingency (40%)	\$ 125,000
Total ROW Phase	\$ 440,000
Construction Phase	
Construction Cost	\$ 1,191,000
Construction Inspection (20% of Construction Cost)	\$ 239,000
Construction + CEI Contingency (40%)	\$ 572,000
Total Construction Phase	\$ 2,010,000
Project Total	\$ 2,870,000
Local Match (Min. 20% if applicable)	\$ 574,000

*See **Appendix E** for full cost estimate details

Implementation Strategies

As a result of Phase II of the Union County Critical Intersection Program, five intersections with safety and/or congestion issues have undergone additional analysis, coordination, and received public input in order to develop preferred design concepts and cost estimates.

The intent for selecting preferred alternatives and cost estimates now is to facilitate community consensus, obtain the necessary approvals and position these intersections to compete well for available funding so they can be programmed for construction in the near term.

The following steps have been identified as actions to implement the design concepts for the critical intersections defined in this Study Workbook:

- Approvals of Municipal Boards
- Identify Potential Funding Sources and Submit Application(s)
- Ongoing Coordination

The remainder of this section [of the Study Workbook] provides an overview of each of these items.

Approvals of Local Government Boards

The preferred alternatives documented in this Study Workbook have been presented to each respective municipal board and the Union County Board of Commissioners for approval, as shown in **Table 13**, in order to be formally recognized as priority projects. This will allow them to be submitted for funding consideration as soon as eligible funds become available (typically through a formal call for projects).

Table 13: Municipal Board Actions

Board Meeting	Date	Action
Mineral Springs Town Council	May 13, 2021	Approved Alternative 1, Turn Lane Improvements, as the preferred design concept for NC 75 at Potter Road
Village of Marvin Council	May 11, 2021	Approved Alternative 2, Roundabout, as the preferred design concept for Bonds Grove Church Road at Waxhaw-Marvin Road
Fairview Town Council	May 11, 2021	Approved Alternative 2, Roundabout, as the preferred design concept for US 601 at Brief Road
Monroe City Council	May 11, 2021	Approved Alternative 2, Roundabout, as the preferred design concept for Poplin Road at Unionville-Indian Trail Road
Union County Board of Commissioners	May 17, 2021	Approved Alternative 2, Roundabout, as the preferred design concept for NC 200 at Plyler Mill Road and supported municipal decisions at the other critical intersections

Additional approvals could be required, depending on the funding source. For example, a request for allocation of federal discretionary funds through CRTPO would require approval from the CRTPO Board.

Potential Funding Sources

These types of intersection projects are typically more costly than is feasible for a small municipality to pay for on its own, but do not rise to the level of competing for funding in a long-range plan such as the Metropolitan Transportation Plan (MTP), which means other funding is necessary to implement these improvements.

Funding that is typically available for these types of projects comes from one of the following three sources:

- Federal funding allocated through the CRTPO planning process
- Federal and State safety and discretionary funding allocated by NCDOT
- Local funding provided by the municipality or County in which a project is located

In many instances, funding for a single project comes from multiple sources (i.e., federal funds through the CRTPO, matched with local funds).

Federal discretionary funding is available through CRTPO, the designated Metropolitan Planning Organization (MPO) for the area. CRTPO has policies in place to solicit projects and allocate funds. A Project Oversight Committee (POC), established by CRTPO, monitors and recommends the allocation of federal discretionary funds, including the following:

- Surface Transportation Block Grant-Direct Attributable (STBG-DA)
- Congestion Mitigation and Air Quality (CMAQ)
- Transportation Alternatives Program (TAP)

Certain funding types have specific requirements, such as CMAQ, which is available for projects that demonstrate improvements to air quality through reduced congestion and increased multimodal transportation options. Other funding sources can be used on a wide variety of transportation improvement projects, such as the STBG-DA funds.

CRTPO adopted a Discretionary Projects Policy in 2019, to establish a consistent and efficient process to allocate these various funds. A key component of the policy is that CRTPO will issue an annual call for projects to consider how available discretionary funds

will be programmed. The policy also includes an application and evaluation process for eligible project submissions.

There are also processes and procedures in place to select, prioritize, and award funding for various types of transportation projects through NCDOT. The following funding sources are particularly relevant to these types of intersection projects:

- Spot Safety funds
- Highway Safety Improvement Program (HSIP) funds
- High Impact/Low-Cost Funds
- Small Construction Funds

To be considered for these funds, request should be made to the NCDOT Division 10 Engineer. The Division Engineer and staff can evaluate the type of improvement being done and the types of funds that best fit the project and the issues the project addresses (i.e. safety or capacity).

Local funding usually supplements federal or state funding or is provided as a required match.

Ongoing Coordination

[Charlotte Regional Transportation Planning Organization:](#)

In order to utilize the funds available through CRTPO for the intersections presented in this Study Workbook, it is important that the respective municipalities monitor calls for projects and use the data included in this study to apply for eligible funds. The CRTPO Technical Coordinating Committee (TCC) and policy Board are responsible for recommending and approving funding allocations for eligible projects. The CRTPO Project Oversight Committee (POC) reviews the project applications for discretionary funds before they are recommended and approved for funding by the TCC and policy Board. Participating in the CRTPO planning process, attending TCC and policy Board meetings, and coordinating with CRTPO staff will give municipalities a greater understanding of the types of funding available, how funding is applied to specific projects, and deadlines/requirements for submitting eligible projects to CRTPO for funding consideration.

North Carolina Department of Transportation

Continued coordination with various Divisions/units within NCDOT to vet the alternatives presented in this study and gain consensus on project elements that are preferred and have the most potential to gain funding will help maintain momentum and provide a better understanding of when potential funding could be available to implement the improvements. Primary coordination will be with the Division 10 Office, mostly with the Division Planning Engineer and Division Traffic Engineer. Through these individuals and with their feedback, further outreach can be made to various Divisions, most notably the Rail Division and the Transportation Mobility and Safety Division (TMSD).

Insight and consensus from TMSD on the mitigation of identified safety and capacity issues can lead to the consideration of federal and state funding dedicated to safety and mobility. Projects typically compete for

these funds statewide and funds are allocated on a "worst first" basis.

With insight from the Rail Division, access can be gained to CSX for their review and comment on the proposed design elements of each alternative at NC 75 and Potter Road. This is extremely important from rail crossing design, operations, and safety perspectives, but also as the rail right-of-way is immediately adjacent to the road right-of-way in this area. Any widening, relocation of sidewalk, curb and gutter, or drainage outfall extensions on the north side of the intersection could impact existing CSX right-of-way. In addition, the Rail Division manages some state and federal funds to improve rail crossing conditions and safety.

Project Sheets

NC 75 at Potter Road, Mineral Springs

Bonds Grove Church Road at Waxhaw-Marvin Road, Marvin

US 601 at Brief Road, Fairview

Poplin Road at Unionville-Indian Trail Road, Monroe

NC 200 at Plyler Mill Road, Unincorporated Union County

Preferred Alternative – Turn Lane Improvements



Design Deficiencies

- No turn lanes present and the high traffic volumes on southbound Potter Road result in queueing across railroad tracks
- Multiple full access driveways in close proximity to the intersection
- Minimal pedestrian accommodations

Design Considerations

- Limited space and substantial right-of-way constraints due to commercial development in close proximity to the intersection
- Railroad crossing approximately 200 feet north of intersection
- Underground water, sewer, gas, and overhead utilities present at intersection
- Strong desire to maintain a walkable and pedestrian friendly downtown area

Proposed Design Improvements

- Construct right and left-turn lanes from Potter Road to NC 75 and left-turn lanes from NC 75 to Potter Road
- Implement access management measures
- Construct crosswalks and sidewalks

Cost

Preliminary Engineering	\$0.7 M
Right-of-Way	\$1.54 M
Construction	\$3.35 M
TOTAL	\$5.59 M
Local Match (Min. 20%)	\$1.1 M

NOTE: Project cost estimated based on FY 2020 dollars and may need to be modified for future year funding opportunities

Jurisdiction	Existing Conditions	Turn Lane(s)
Mineral Springs	Signalized Intersection	No

Analysis Results

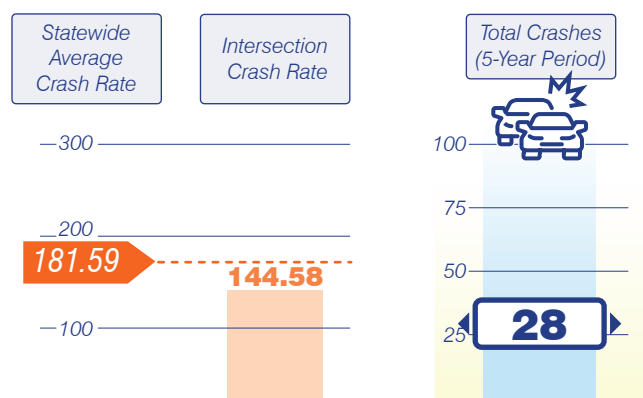
Congestion

	LOS	Delay (sec/veh)	V/C
2019	C	26	0.88
2035 No-Build	F	101	1.30
2035 Build	D	45	0.96

Reduction of Delay (2035 Build vs. No-Build) 56%

Congestion data based on weighted average of the AM and PM peak hour delay for comparison purposes.

Safety



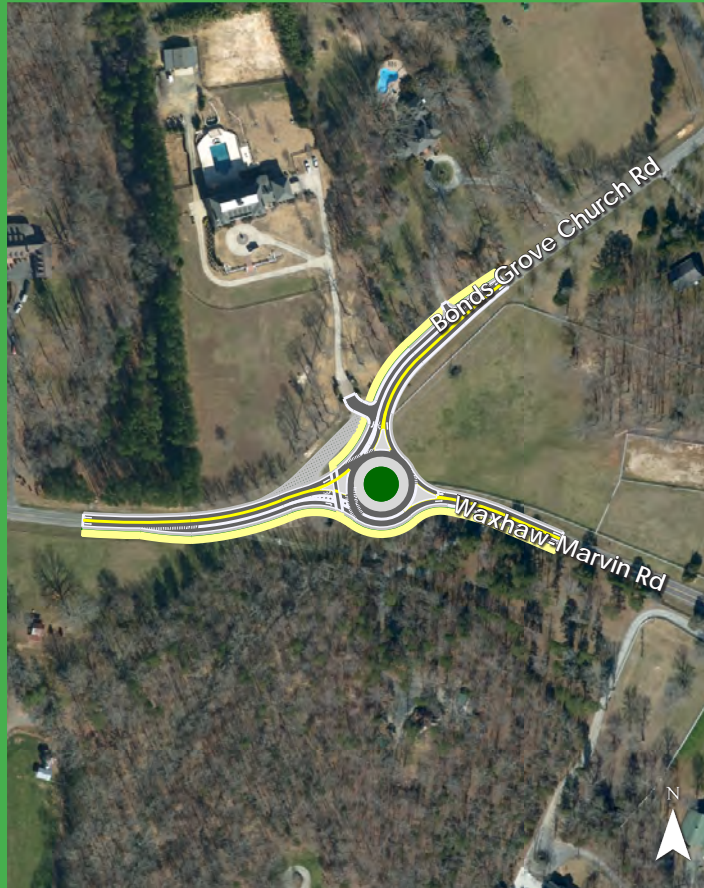
Reduction in Total Crashes (Estimated with preferred alternative) 12%

Crash data from 8/1/2015 through 7/31/2020

Daily Emissions Reduction

Year	CO	VOC	NOx	PM2.5	Reduction in Total Emissions	42% 56%	2019 2035
2019	7.89 kg	1.45 kg	0.49 kg	0.01 kg			
2035	42.07 kg	7.76 kg	2.60 kg	0.08 kg			

Preferred Alternative – Roundabout



Design Deficiencies

- Limited sight distance for vehicles approaching intersection
- Skewed intersection creates challenges for stop-controlled traffic along westbound Waxhaw-Marvin Road
- Existing through movement is not the heaviest traffic movement

Design Considerations

- Multiple schools in the surrounding area
- Gas, water, and sewer lines present along Waxhaw-Marvin Road
- Town Greenway Master Plan calls for a greenway along Waxhaw-Marvin Road

Proposed Design Improvements

- Construct roundabout with right-turn lanes on southbound and eastbound approaches
- Realign intersection to improve approach angle
- Add multi-use path along the south side of Waxhaw-Marvin

Cost

Preliminary Engineering	\$0.89 M
Right-of-Way	\$0.34 M
Construction	\$4.23 M
TOTAL	\$5.46 M
Local Match (Min. 20%)	\$1.09 M

NOTE: Project cost estimated based on FY 2020 dollars and may need to be modified for future year funding opportunities

Jurisdiction	Existing Conditions	Turn Lane(s)
Marvin	One-Way Stop-Controlled	No

Analysis Results

Congestion

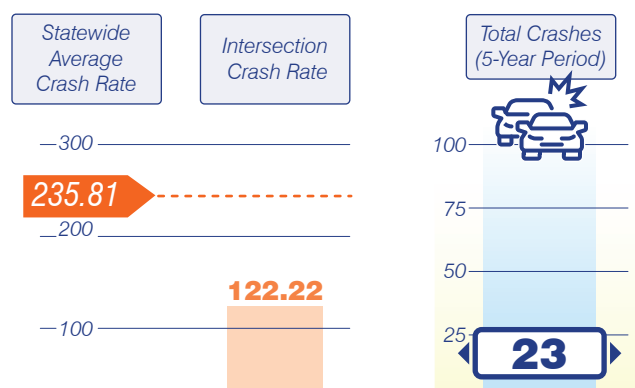
	LOS	Delay (sec/veh)	V/C
2019	E	45	1.35
2035 No-Build	F	161	2.43
2035 Build	B	13	0.83

Reduction of Delay
(2035 Build vs. No-Build)

92%

Congestion data based on weighted average of the AM and PM peak hour delay for comparison purposes.

Safety

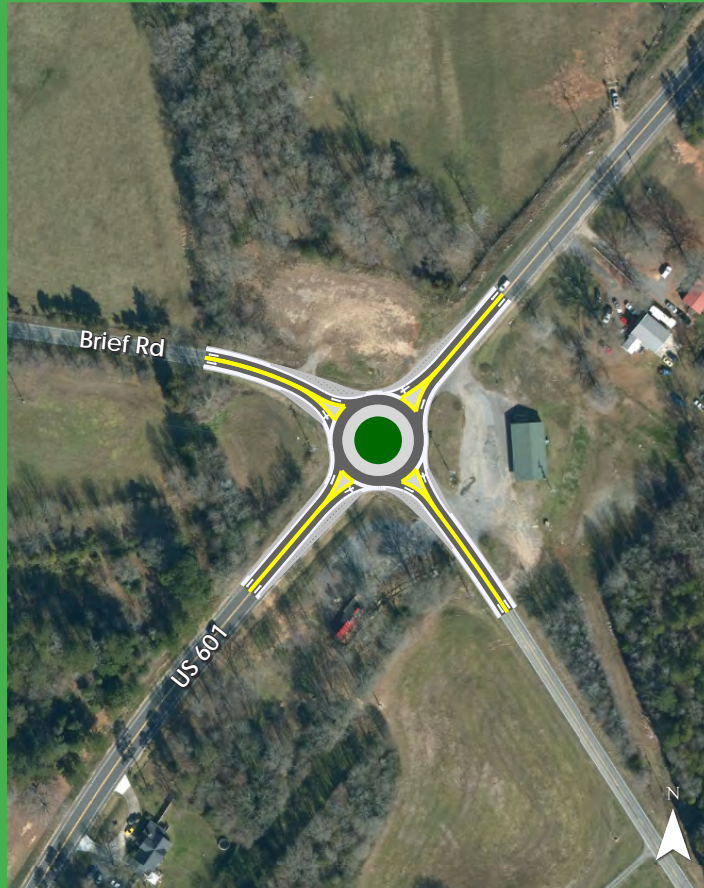


Reduction in Total Crashes
(Estimated with preferred alternative)

50%

Crash data from 8/1/2015 through 7/31/2020

Preferred Alternative – Roundabout



Design Deficiencies

- No turn lanes

Design Considerations

- Heavy truck traffic along US 601
- Drivers tend to treat US 601 as a high-speed corridor resulting in safety issues for the Brief Road approaches
- Three developments proposed along US 601 south of the intersection
- Traffic volumes do not meet signal warrants

Proposed Design Improvements

- Convert intersection to a single-lane roundabout

Cost

Preliminary Engineering	\$0.43 M
Right-of-Way	\$0.34 M
Construction	\$2.05 M
TOTAL	\$2.82 M
Local Match (Min. 20%)	\$0.56 M

Jurisdiction	Existing Conditions	Turn Lane(s)
Fairview	Two-Way Stop-Controlled	No

NOTE: Project cost estimated based on FY 2020 dollars and may need to be modified for future year funding opportunities

Analysis Results

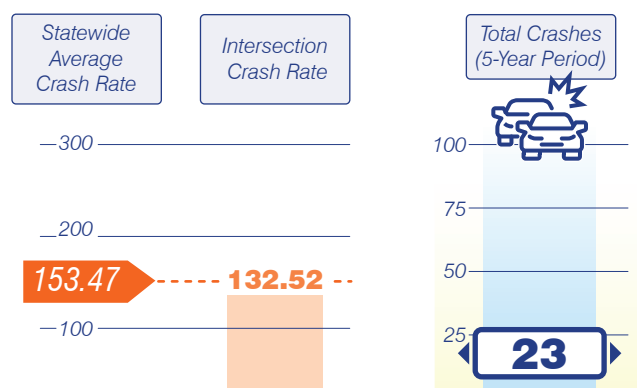
Congestion

	LOS	Delay (sec/veh)	V/C
2019	C	22	1.34
2035 No-Build	F	134	4.09
2035 Build	B	14	0.86

Reduction of Delay
(2035 Build vs. No-Build) **89%**

Congestion data based on weighted average of the AM and PM peak hour delay for comparison purposes.

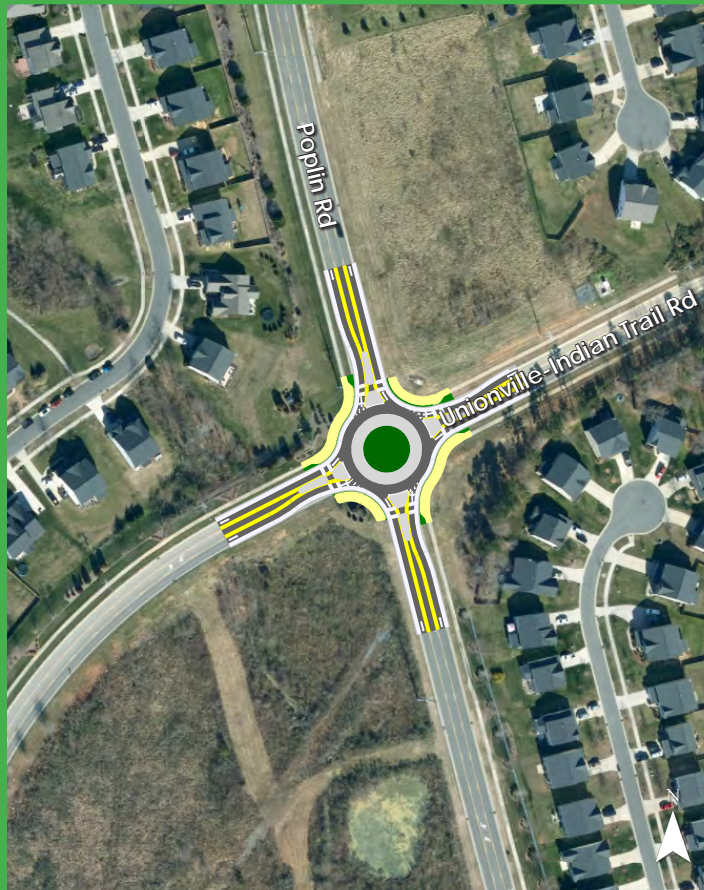
Safety



Reduction in Total Crashes
(Estimated with preferred alternative) **50%**

Crash data from 8/1/2015 through 7/31/2020

Preferred Alternative – Roundabout



Design Deficiencies

- Horizontal and vertical sight distance issues along Unionville-Indian Trail Road due to vegetation and vertical curvature of roadway
- Minimal pedestrian accommodations

Design Considerations

- Safety problems with lack of stop-control along Unionville-Indian Trail Road
- Development under construction along Unionville-Indian Trail Road east of the intersection
- Traffic volumes do not meet signal warrants

Proposed Design Improvements

- Convert intersection to a single-lane roundabout
- Construct crosswalks and new sidewalk curb ramps

Cost

Preliminary Engineering	\$0.44 M
Right-of-Way	\$0.15 M
Construction	\$2.11 M
TOTAL	\$2.70 M
Local Match (Min. 20%)	\$0.54 M

Jurisdiction	Existing Conditions	Turn Lane(s)
Monroe	Two-Way Stop-Controlled	Yes

NOTE: Project cost estimated based on FY 2020 dollars and may need to be modified for future year funding opportunities

Analysis Results

Congestion

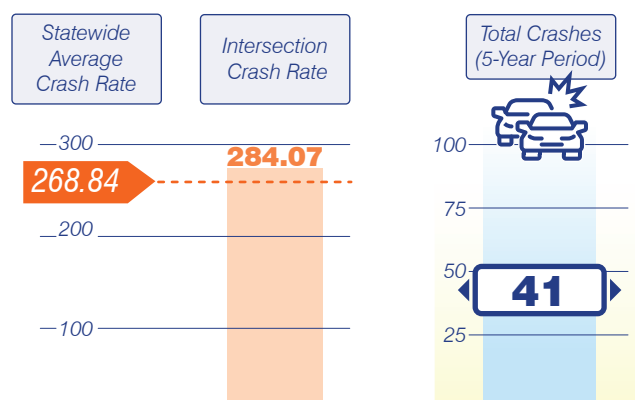
	LOS	Delay (sec/veh)	V/C
2019	A	4	0.08
2035 No-Build	A	6	0.22
2035 Build	A	7	0.50

Reduction of Delay
(2035 Build vs. No-Build)

+17%

Congestion data based on weighted average of the AM and PM peak hour delay for comparison purposes.

Safety

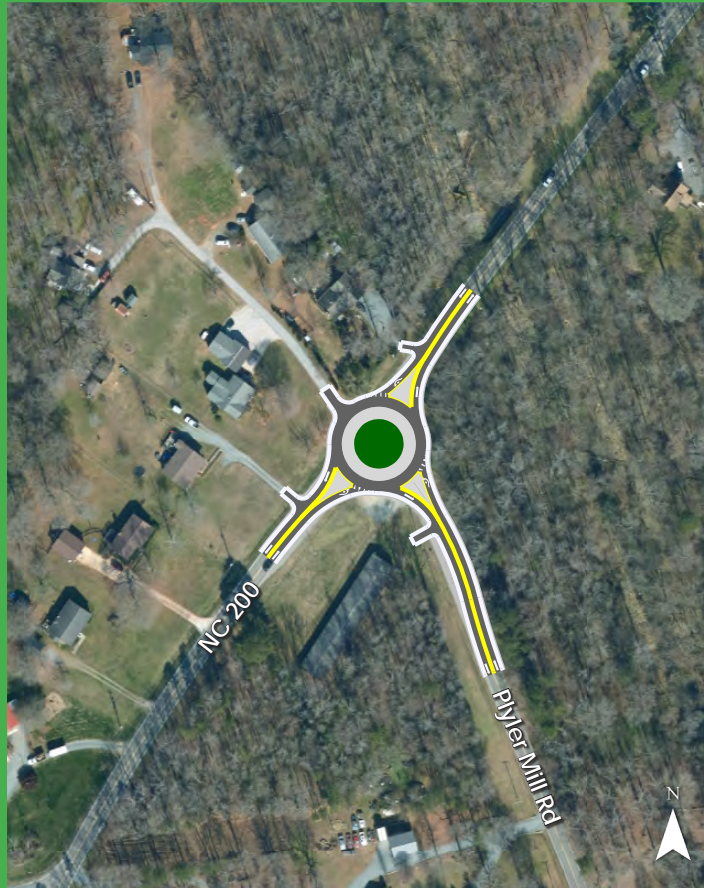


Reduction in Total Crashes
(Estimated with preferred alternative)

50%

Crash data from 8/1/2015 through 7/31/2020

Preferred Alternative – Roundabout



Design Deficiencies

- No left-turn lane for westbound NC 200 resulting in rear-end crashes
- No turn lanes on Plyler Mill Road approach

Design Considerations

- 300-home development is proposed along Helms Shortcut Road, approximately ½ mile south of the intersection
- Gas line present along east side of NC 200
- Quadruple 10' x 13' reinforced concrete box culvert crosses underneath NC 200 approximately 200 feet north of the intersection
- Multiple driveways in close proximity to the intersection

Proposed Design Improvements

- Convert intersection to a single-lane roundabout
- Realign Plyler Mill Road to improve the approach angle

Cost

Preliminary Engineering	\$0.42 M
Right-of-Way	\$0.44 M
Construction	\$2.01 M
TOTAL	\$2.87 M
Local Match (Min. 20%)	\$0.57 M

Jurisdiction	Existing Conditions	Turn Lane(s)
Unincorporated	One-Way Stop-Controlled	No

NOTE: Project cost estimated based on FY 2020 dollars and may need to be modified for future year funding opportunities

Analysis Results

Congestion

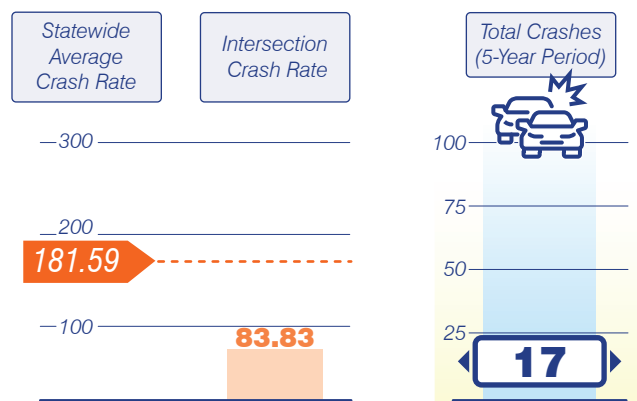


Year	LOS	Delay (sec/veh)	V/C
2019	A	9	0.83
2035 No-Build	C	23	1.13
2035 Build	B	14	0.72

Reduction of Delay
(2035 Build vs. No-Build) **37%**

Congestion data based on weighted average of the AM and PM peak hour delay for comparison purposes.

Safety



Reduction in Total Crashes
(Estimated with preferred alternative) **50%**

Crash data from 7/1/2015 through 6/30/2020



Union County

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