Citywide Traffic Improvement Study
City of Oakwood

Hall County, Georgia

Prepared for:

Gainesville-Hall Metropolitan Planning Organization (GHMPO)
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GHMPO

CITY OF OAKWOOD
BUILDING THE FUTURE TOGETHER

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August 2018

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design/construction solutions

ACKNOWLEDGEMENTS

The Oakwood Citywide Traffic Improvement Study was prepared for the City of Oakwood, GA and the Gainesville-Hall Metropolitan Planning Organization (GHMPO).

Funding for the study was provided by GHMPO through Work Program Task #4: System Planning, Sub-element 4.7: Special Transportation Studies.

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Section 1: Introduction

This Citywide Traffic Improvement Study was prepared for the Gainesville-Hall Metropolitan Planning Organization (GHMPO) and the City of Oakwood to evaluate traffic congestion and safety issues at various locations throughout the City. This work was completed as part of the GHMPO's Work Program Task #4: System Planning, Sub-element 4.7: Special Transportation Studies.

1-1 Study Purpose and Objectives

The Study Purpose is to conduct a review of existing conditions to identify and characterize the transportation issues at eighteen strategic locations within the City's roadway network. Based on this initial identification of issues, engineering evaluations and analyses were conducted to identify applicable improvement strategies. These strategies included considerations of geometry, traffic safety, traffic control and traffic operations. The study also identifies the improvement benefits and planning-level costs of capital improvements.

1-2 Study Approach

The Citywide Traffic Improvement Study involved a series of tasks to document existing conditions of the transportation system, identify and characterize existing congestion and safety issues, and to identify potential improvement strategies.

The major elements of the study are as follows:

Initial Document Review: Existing studies and plans were reviewed to identify the context of transportation issues and planned initiatives. This review provided a baseline for understanding the community context and vision for considering potential transportation improvement strategies. The document review included the following:

- Oakwood 2030 Downtown & Commercial Center Transportation Plan
- Existing Traffic Studies:
  Signal Needs Study: SR 53 @ Millside Parkway (*M.R. Acampora*)
- Existing Project Plans:
  McEver Rd @ Flat Creek Rd (*Hall County*)
  UNG Campus Master Plan

Data Collection: Data collection activities for the project involved research and compilation of existing information about the transportation system to document existing conditions and to provide the basis for the technical analyses and development of recommendations. This data compilation included

Geographic Information System (GIS) data (Aerial Imagery, Property and Right-of-Way, 3-Dimensional Contours), available traffic volume data, and current signal timing/phasing plans. Data collection activities also included the compilation of existing crash history data and traffic counts.

Site visits were also conducted to confirm existing physical conditions and environmental resources of the study intersections, and to note features that may contribute to congestion or safety issues. Site visits and video documentation were also conducted to observe traffic operations and queuing characteristics.

Technical Analysis: Various technical analyses and evaluations were conducted to assess the safety and traffic operations considerations of the study intersections. They included traffic operations modeling, signal warrant analysis, and safety.

Traffic Modeling & Analysis: CHA's work on the Oakwood 2030 Master Plan included modeling of many of the intersections identified to be included in this current study using Synchro/SimTraffic software. CHA updated this existing model to incorporate the additional study locations and to update the physical characteristics and traffic control attributes of the system to reflect current conditions. The Synchro/SimTraffic models were used to evaluate traffic operations at the study intersections and to identify relevant performance metrics such as Level of Service, vehicle delay, volume-to-capacity, and queue patterns.

Signal Warrant Analysis: Traffic analysis of key unsignalized intersections considered the operational and safety benefits of providing traffic signal control. This assessment will provide a preliminary opinion on whether the signal warranting criteria might be satisfied based on the available traffic information.

Traffic Safety Evaluation: Crash records were compiled and reviewed for the most recent 3-years of data to identify accident frequencies, accident clusters, severity, crash type and other applicable factors. This data was used to identify safety issues and potential countermeasures.

At-Grade Rail Crossing Evaluation: Safety improvements at the Chamblee Road/Norfolk Southern (NS) Railway at-grade crossing were evaluated based on the recommended best practices of the Federal Highway Administration (FHWA) Railroad-Highway Grade Crossing Handbook, American Railway Engineering and Maintenance of Way Association (AREMA) and NS Railway requirements.

Roadway Geometry: The existing physical conditions at the study intersections were reviewed for consistency with industry design standards and best practices.

Concept Development: Improvement strategies were developed to address the identified safety and/or operational issues. The process considered applicable design standards as well as best practices for context sensitive design and accommodation of a varied range of users ("Complete Streets"), and may include combinations of the following actions or elements:

- Roadway widening or other physical changes to roadway cross section or channelization
- Roundabouts
- Traffic control improvements (signals, signage, pavement markings)
- Improved street network connectivity
- Improved corner radius or roadway alignment

- Access management
- Improved sight distance
- Pedestrian accommodations, including sidewalks, street amenities, crossing improvements.
- Bicycle accommodations, including crossings.

The improvement strategies were developed to a conceptual level based on available aerial mapping. Planning-level cost estimates were also developed for the locations of physical improvements.

1-3 Study Area Description

The study area included eighteen study intersections located throughout the City of Oakwood. These locations are listed below and are shown on

Exhibit 1-1.

Mundy Mill Road (SR 53)

- Atlanta Highway (SR 13)
- Frontage/ Oakwood Roads
- Thurmon Tanner Parkway
- Millside Parkway
- UNG Loop Road
- McEver Road

Thurmon Tanner Parkway

- SR 13 and I-985 SB ramps
- Plainview Road
- Chamblee Road

McEver Road

- Flat Creek Road
- Old Flowery Branch Road

Main Street

- Flat Creek Road / Old Oakwood Road
- McClure Drive

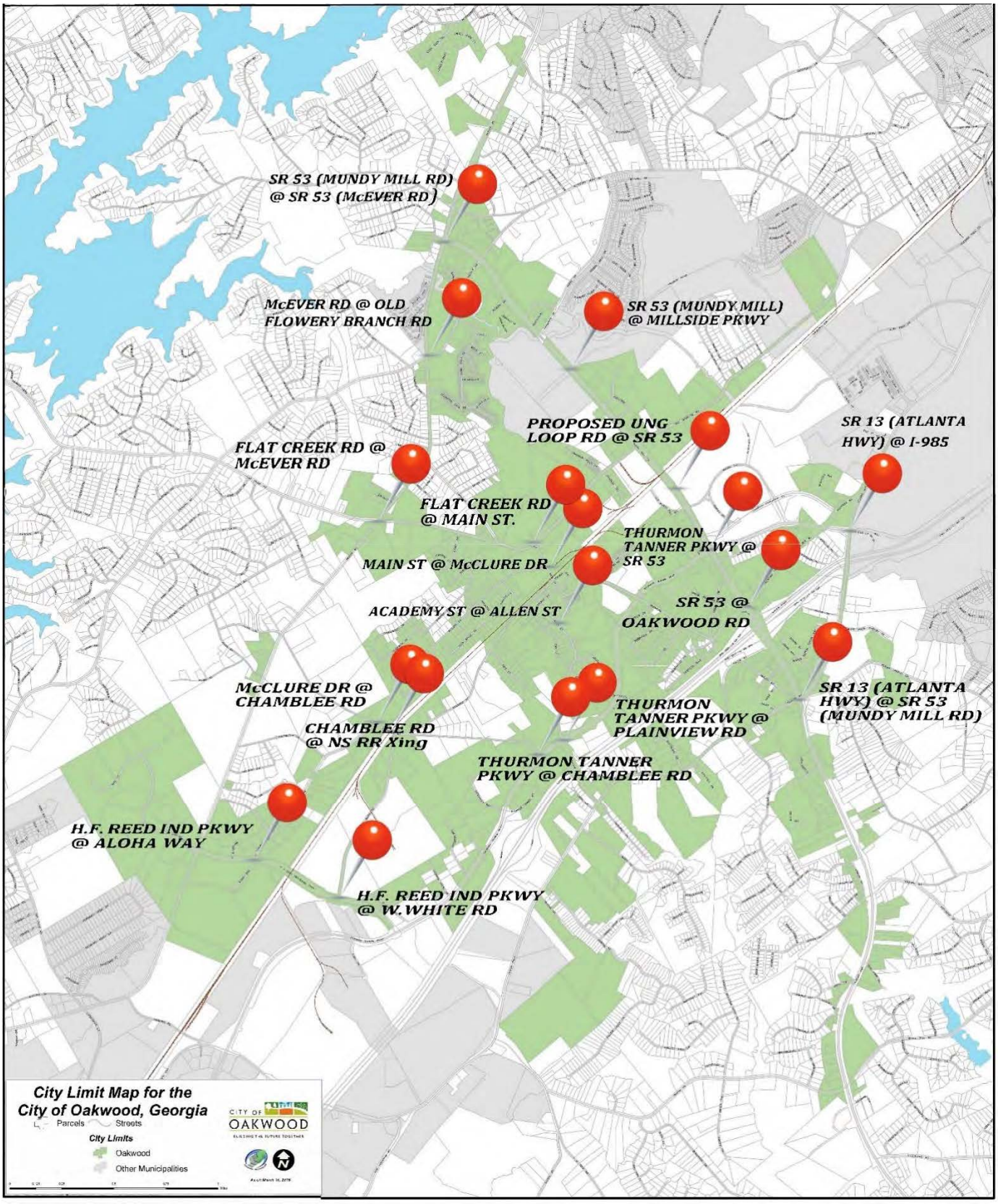
H.F Reed Industrial Parkway

- Aloha Way
- W. White Road

Other Locations

- Allen Street @ Academy Street
- Chamblee Rd Railroad Crossing
- McClure Drive Ext to Chamblee Road

Exhibit 1-1: Study Location Map


SR 53 (MUNDY MILL RD) @ SR 53 (McEVER RD)
McEVER RD @ OLD FLOWERY BRANCH RD
SR 53 (MUNDY MILL) @ MILLSIDE PKWY
PROPOSED UNG LOOP RD @ SR 53
SR 13 (ATLANTA HWY) @ I-985
FLAT CREEK RD @ McEVER RD
FLAT CREEK RD @ MAIN ST.
THURMON TANNER PKWY @ SR 53
MAIN ST @ McCLURE DR
ACADEMY ST @ ALLEN ST
SR 53 @ OAKWOOD RD
McCLURE DR @ CHAMBLEE RD
THURMON TANNER PKWY @ PLAINVIEW RD
SR 13 (ATLANTA HWY) @ SR 53 (MUNDY MILL RD)
CHAMBLEE RD @ NS RR Xing
THURMON TANNER PKWY @ CHAMBLEE RD
H.F. REED IND PKWY @ ALOHA WAY
H.F. REED IND PKWY @ W.WHITE RD
City Limit Map for the City of Oakwood, Georgia
Parcels
Streets
City Limits
Oakwood
Other Municipalities
CITY OF OAKWOOD

Section 2: Public Outreach and Agency Coordination

The study process was coordinated and guided by a Study Advisory Committee (SAC). The SAC consisted of representatives from the GHMPO and the City of Oakwood. The Public Involvement Plan was developed in consultation with the Study Advisory Committee to provide opportunities for public participation and input.

The project is a Technical Study of various traffic-related issues at spot locations throughout the City. These locations have been identified through a variety of input to the City Manager from City staff, stakeholders, and the public, which formed the basis of the RFP request for the study. The results of the study will be used primarily as a tool to identify and prioritize improvements that may be progressed for implementation as a future construction project, at which time there will be additional opportunity for public input during the design process. Because of this context, the Public Engagement Plan for the Citywide Traffic Improvement Study consisted of the following elements

Study Advisory Team Coordination

- Project Kick-off Meeting (occurred January 16, 2018)
- Progress Meetings: anticipate two progress meetings during the study
    - Review preliminary results and considerations of alternatives
    - Review final recommendations and Draft Study documentation
- Correspondence (email and telephone): regular, as needed for general communications and to distribute/review draft and final materials.

Stakeholder Outreach

- Coordination with key stakeholders during the study included:
    - GDOT District 1
    - Hall County
    - University of North Georgia
    - Hall County School District
    - Wal-Mart

Public Presentations

- Two presentations as an agenda item at regularly-scheduled Planning Board meetings.

  Presentation 1: This presentation introduced the project to the public and identified the study locations, study objectives, initial efforts completed, project schedule, and deliverables. This presentation was made on March 19, 2018.

- GHMPO Committees: Presentation of the final report will be made to the GHMPO technical Coordination Committee and to the GHMPO Policy Committee. These meetings are currently scheduled for July 17, 2018 and August 14, 2018, respectively.

Section 3: Data Collection

As noted in Section 1-2, the data collection activities for the project involved research and compilation of existing information, site visits, and included collection of traffic counts and crash history records.

3-1 Traffic Volumes

Traffic volume data was compiled from existing available sources, including the Oakwood 2030 Plan and GDOT online data. Traffic counts were also conducted in 2018 by Southern Traffic Services at the following intersections to provide current information about traffic flow patterns.

- SR 53 (Mundy Mill Road) & SR 53 (McEver Road)
- SR 53 (Mundy Mill Road) & Thurmon Tanner Parkway
- SR 53 (Mundy Mill Road) & Millside Parkway
- SR 13 (Atlanta Highway) & SR 53 (Mundy Mill Road)
- SR 13 (Atlanta Highway & I-985 Southbound Ramps/Thurmon Tanner Parkway
- McEver Road & Flat Creek Road
- McEver Road & Old Flowery Branch Road
- HF Reed Industrial Parkway & Aloha Way
- Main Street & Flat Creek Road/Old Oakwood Road

The traffic count data was collected during the period March 6-8, 2018. The counts were obtained for the weekday AM and PM peak periods from 6-9 am and 3-6 pm. The counts were recorded in 15-minute intervals and included volume and classification information. Pedestrian volumes at the study intersections were also recorded.

Average Daily Traffic (ADT) counts were collected on Chamblee Road in the vicinity of the Norfolk Southern Railroad crossing to identify directional volume, vehicle classification and speed. This data was collected for a 48-hour period March 6-8, 2018.

Video data was collected to provide visual record of the collected data and was also used for additional traffic operations evaluations.

The traffic volume count data is provided in Appendix A. The traffic volume characteristics of each study intersection are described in the respective subsections of Section 4:Technical Analysis.

3-2 Crash History Data

Crash history data was compiled from GDOT's online accident reporting system (GEARS) for selected study locations that were identified in the project scoping as being a traffic safety concern. The crash data was compiled for the 3-year period from January 1, 2015 through Dec 31, 2017 for the following intersections:

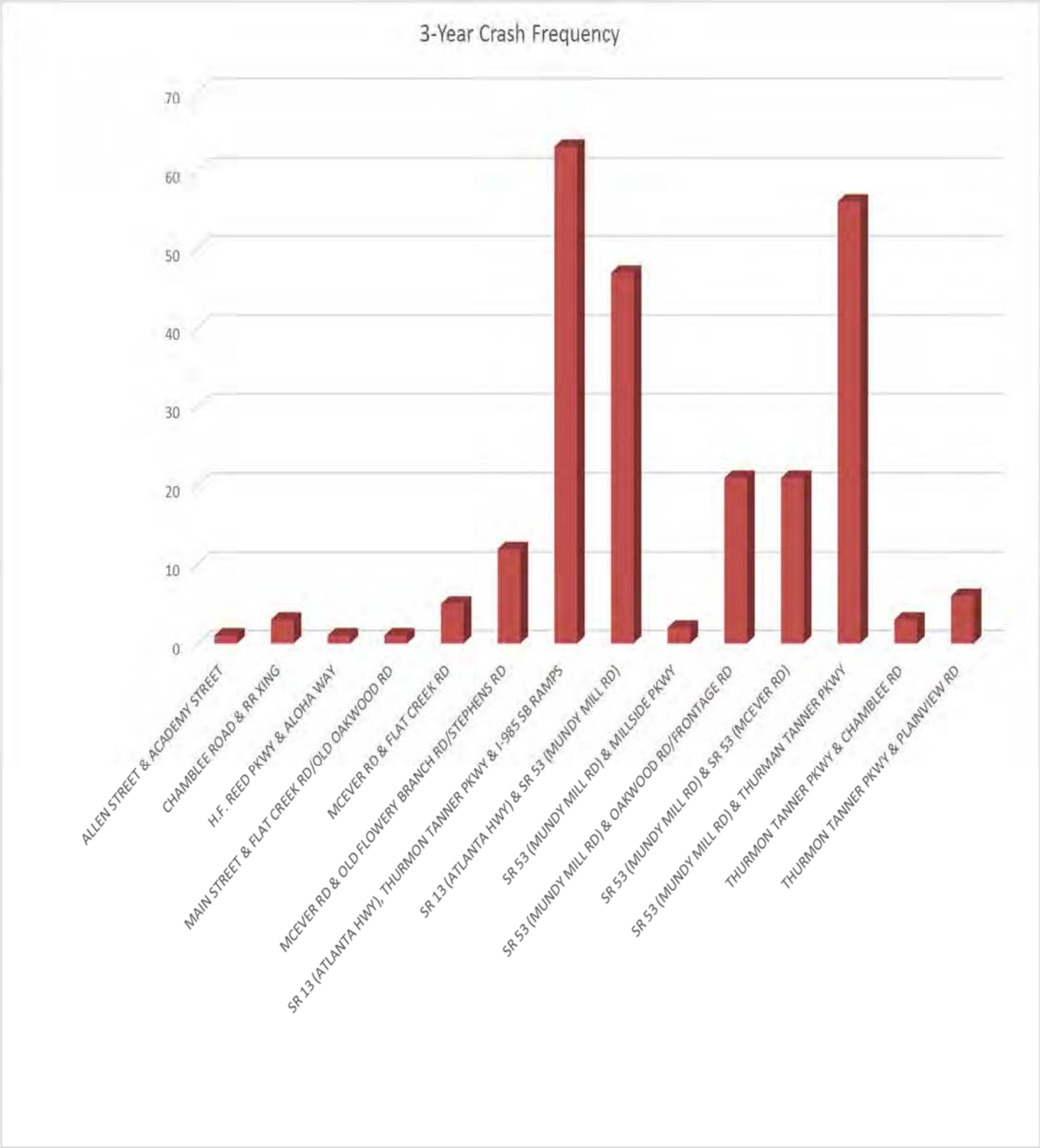
- Allen Street & Academy Street
- H.F. Reed Industrial Parkway & Aloha Way
- Main Street & Flat Creek Road/Old Oakwood Road
- McEver Road & Flat Creek Road
- McEver Road & Old Flowery Branch Road/Stephens Road
- SR 13 (Atlanta Highway) & Thurmon Tanner Parkway/I-985 Southbound Ramps
- SR 13 (Atlanta Highway) & SR 53 (Mundy Mill Road)
- SR 53 (Mundy Mill Road) & Thurmon Tanner Parkway
- SR 53 (Mundy Mill Road) & Millside Parkway
- SR 53 (Mundy Mill Road) & Oakwood Road/Frontage Road
- SR 53 (Mundy Mill Road) & McEver Road
- Thurmon Tanner Parkway & Chamblee Road
- Thurmon Tanner Parkway & Plainview Road

The crash history data is provided in Appendix B. Exhibit 3-1 shows the 3-year crash frequency at each of the study intersections. As shown, the following three intersections have accident frequency that is considerably higher than at the other study locations:

- SR 13 (Atlanta Highway) & Thurmon Tanner Parkway/I-985 Southbound Ramps
- SR 53 (Mundy Mill Road) & Thurmon Tanner Parkway
- SR 13 (Atlanta Highway) & SR 53 (Mundy Mill Road)

The higher crash frequencies at these locations can be explained in part by the higher volumes of traffic that move through the intersections compared to the other study locations. The characteristics of crash severity, crash type and contributing factors are discussed in the respective subsections of Section 4:Technical Analysis. CHA also reached out to the Oakwood City Police Department for input on safety priority locations.

Exhibit 3-1: Crash Frequency



Section 4: Technical Analysis

4-1 Locations with simple geometric issues:

The City of Oakwood assigned seven intersections to be evaluated due to geometric and or operational concerns. The City recognized that particular types of vehicles are experiencing difficulties negotiating the intersections due to deficient geometries and or lack of left turn lanes. Each intersection was examined to verify the stated issues as well as investigating any possible contributing issues. Concept designs have been developed and concept level construction cost estimates have been developed.

Each intersection site was visited, and site investigations were conducted to document existing conditions and any other evidence detailing the difficulties experienced by the traveling public. At all locations, clear evidence these difficulties were documented. Typical evidence was wheel paths onto the shoulders, broken pavement edges, broken sidewalks and or curb and gutter all occurring within the respective turning radii. At each site, the types of vehicles traveling on the roads and the land use of the adjacent and nearby properties was noted. These observations, along with recommendations from the City were used to identify the appropriate design vehicle for each site. Additionally, the site visits were used to note visible utilities and potential environmental resources potentially impacted by any improvements. Verification of environmental resources requires investigations by qualified professionals will be the only way to confirm conditions.

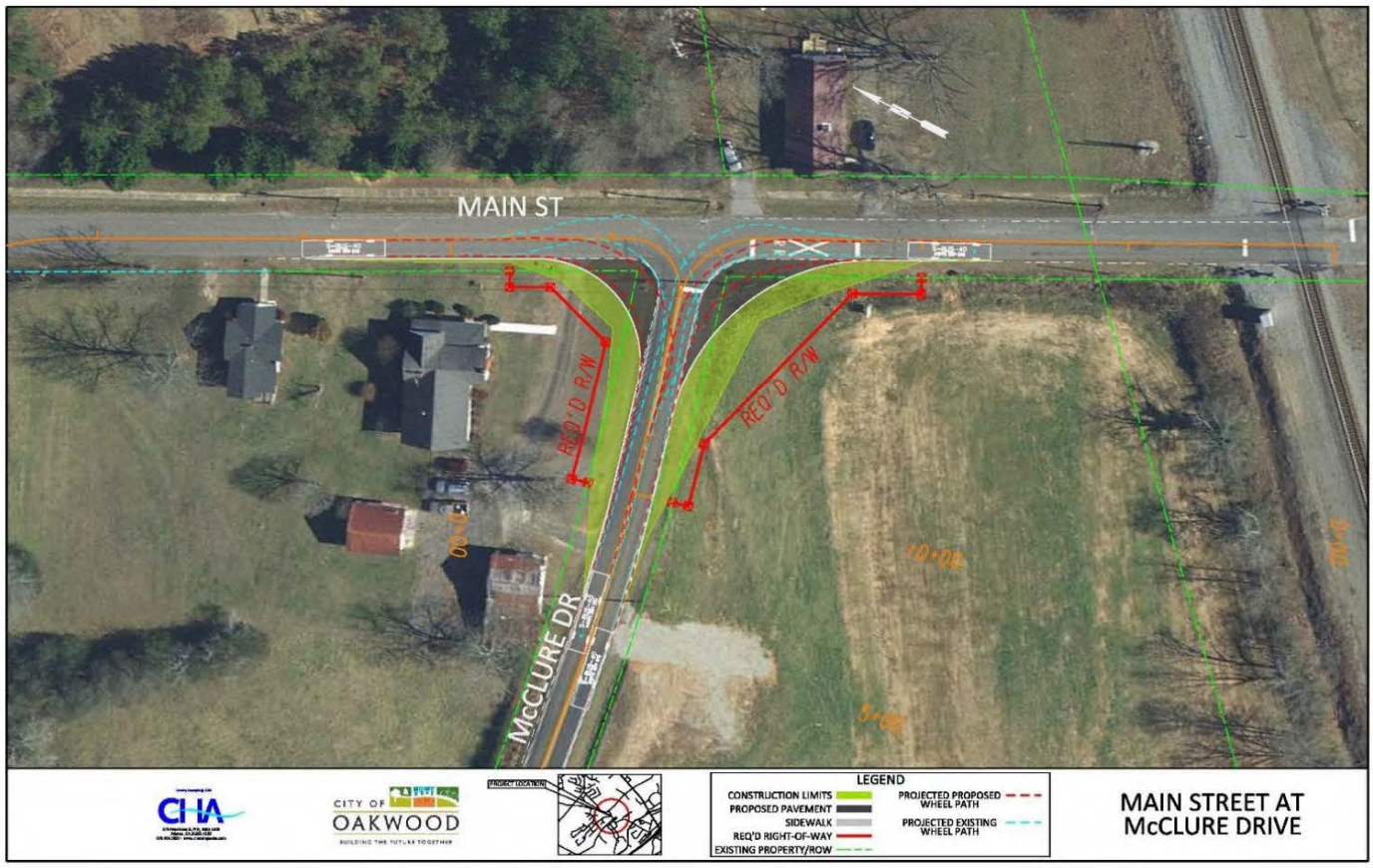
Using provided information from Hall County including aerial imagery, 3-dimensional GIS contours, and GIS right of way and property files inserted into Computer Aided Design (CAD) software, concept level layouts of each site where developed. Using AutoTURN graphic software to establish the specific wheel path dimensions of each of the design vehicles, existing and proposed travel paths were developed to illustrate how vehicles would have to negotiate the turning movements without driving off of the roadway. In each location, the specific design vehicle could not negotiate the turn under existing conditions without either driving off the roadway or having to swing the vehicle out into opposing travel lanes. Wheel paths that did not encroach onto opposing travel lanes were used to develop recommended improvements. Wheel paths are noted on the concept layouts in light blue for exiting conditions and red for proposed conditions.

4-1.1 Main St. @ McClure Drive Radius Improvements

- Issue: Insufficient right turn radii into and from McClure Drive for large vehicles. Evidence of broken asphalt pavement and wheel paths worn into the shoulder within both radii were documented.
- Design Vehicle: S-Bus-40 (school bus). Land use along McClure Dr. is entirely residential suggesting that the school bus is the most common large vehicle driving the road.
- Recommended Improvements: Within the southwest quadrant of the intersection and from the existing edge of pavement, construct a minimum 50 ft. radius turn. In the southeast quadrant of the intersection, construct a minimum 75 ft. radius turn. This construction will require minor grading, the placement of new pavements, minor milling of existing pavements, new drainage structures, roadway striping, resetting of roadway signs, and acquisition of additional right of way. Construction improvements would be done along existing horizontal and vertical alignments. Both overhead and subsurface utilities would be impacted and would require relocations. There were no clear signs of environmental resources in the likely construction zone.

❖ Estimated Construction Costs: $95,000 to $105,000

Exhibit 4-1: Main Street @ McClure Drive

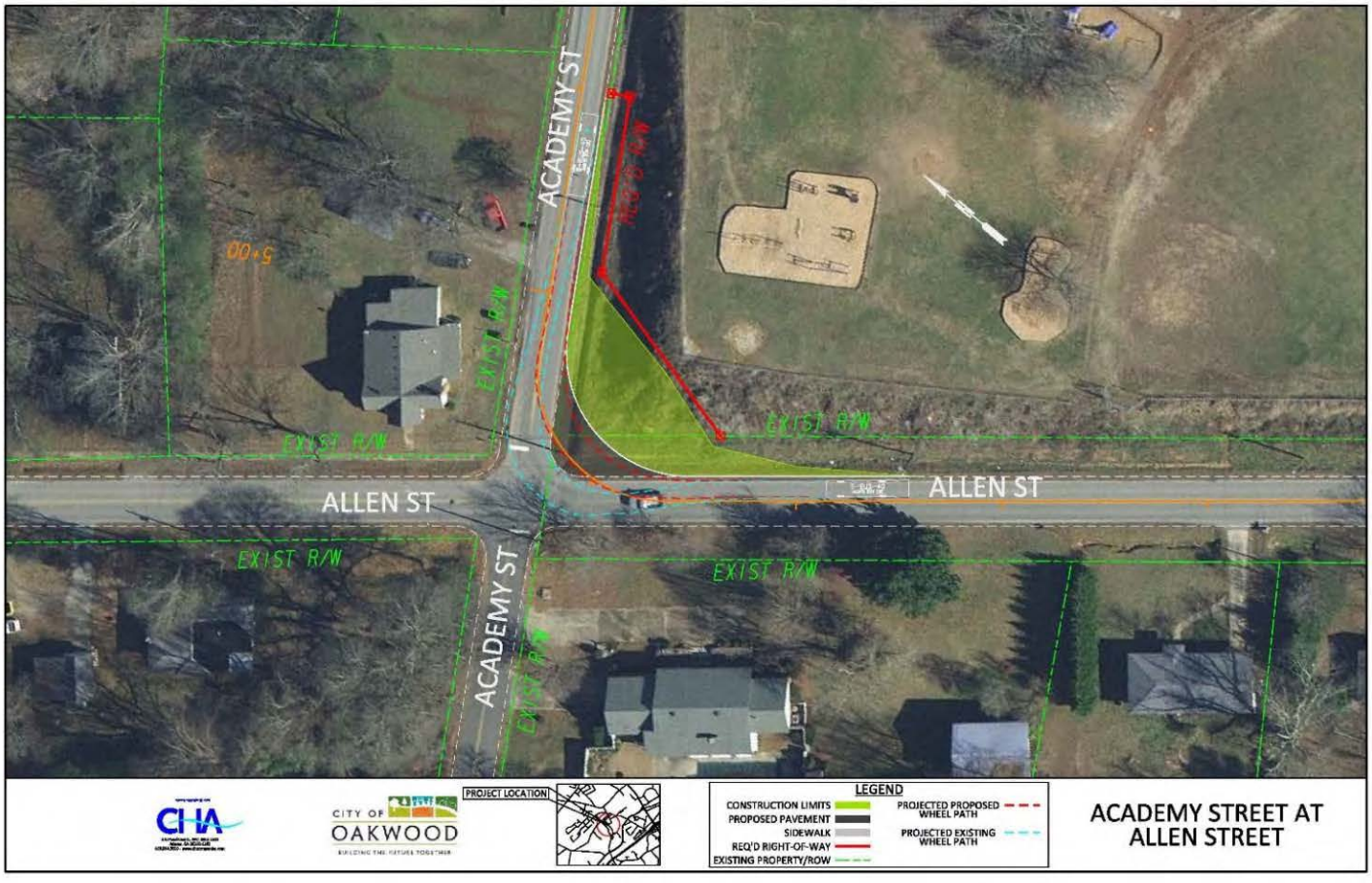


4-1.2 Allen St. @ Academy St. Radius Improvements

- Issue: Insufficient right turn radius from Allen Street onto Academy Street for school buses to negotiate turning movement. Evidence of broken asphalt pavement edge at the turning radius was documented.
- Design Vehicle: S-Bus-40 (school bus) as recommended by the Hall County Board of Education
- Improvement Recommendation: Within the northeast quadrant of the intersection and from the existing edges of pavement, construct a minimum 60 ft. radius. This construction will require placement of new pavements and minor milling of existing pavements, regrading of the adjacent roadway ditches and cut slopes; relocation of at least one utility pole and possible relocations or modifications to underground utilities; extension of the existing stormwater cross pipe; restriping of the pavement markings, resetting of roadway signs and acquisition of additional rights of way onto the Oakwood Elementary School. Construction of the roadway could be done along existing horizontal and vertical alignments. There were no clear signs of environmental resources in the likely construction zone.

❖ Estimated Construction Costs: $85,000 to 95,000

Exhibit 4-2: Allen Street @ Academy Road

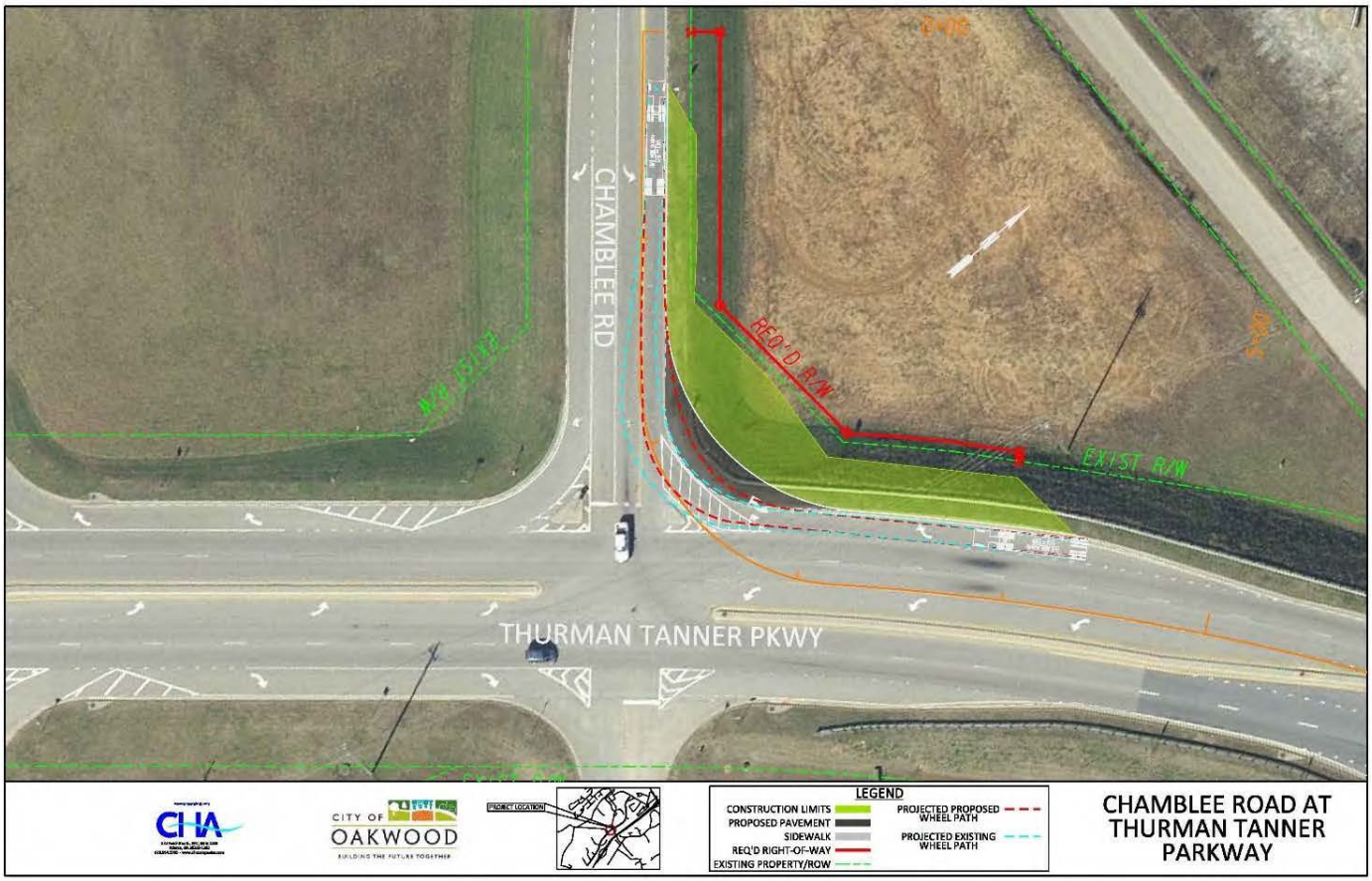


4-1.3 Thurmon Tanner Parkway @ Chamblee Rd Radius Improvements

- Issue: Insufficient right turn radius from Thurmon Tanner Parkway onto Chamblee Road. Evidence of worn wheel paths within the shoulder and on across the curb and gutter was documented.
- Design Vehicle: WB-50 (Large 55 ft. tractor trailer truck). Development along Thurmon Tanner Parkway and nearby local roads is heavily industrial / commercial suggesting that the WB-50 is a the most common large vehicle driving the road. Multiple WB-50 trucks were observed traveling within the corridors.
- Improvement Recommendation: At the northern quadrant of the intersection, replace the existing turning radius with a minimum 100 ft. radius turn. Construction improvements would be done along existing horizontal and vertical alignments. This construction will require additional right of way, placement of new pavements, minor pavement milling, new curb and gutter, placement of new guardrail, new roadway striping and resetting of roadway signs. Multiple existing subsurface utilities will be impacted and will require relocations and or adjustments. There were no clear signs of environmental resources in the likely construction zone.

❖ Estimated Construction Costs: $ 100,000 to $110,000

Exhibit 4-3: Thurmon Tanner Parkway @ Chamblee Road

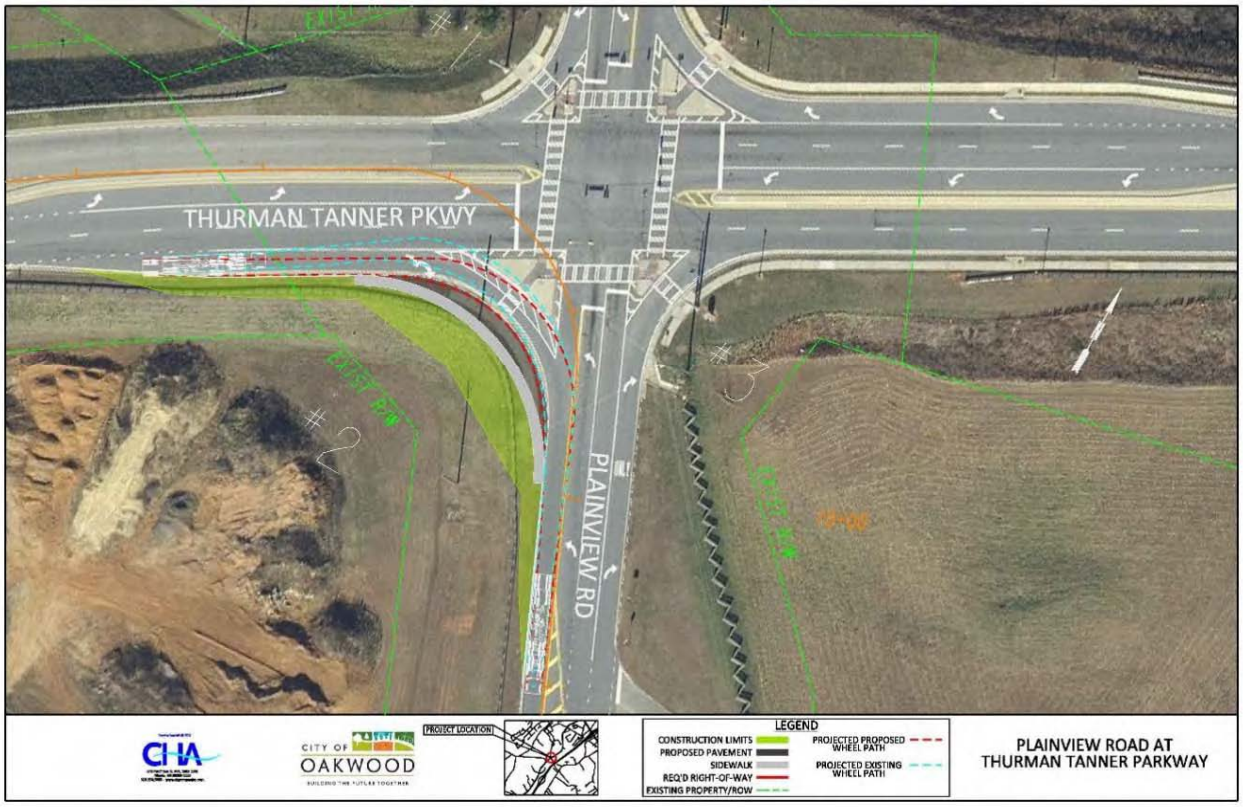


4-1.4 Thurmon Tanner Parkway @ Plainview Rd Radius Improvements

- Issue: Insufficient right turn radius from Thurmon Tanner Parkway onto Plainview Road. Evidence of broken sidewalk, wheel paths within the shoulder and on across the curb and gutter was documented.
- Design Vehicle: WB-50 (Large 55 ft. tractor trailer truck). Development along Thurmon Tanner Parkway and nearby local roads is heavily industrial / commercial suggesting that the WB-50 is a the most common large vehicle driving the road. Multiple WB-50 trucks were observed traveling within the corridors.
- Recommended Improvements: Within the southeast quadrant of the intersection, replace the existing right turn radius with a minimum 100 ft. radius. Construction of the roadway would be done along existing horizontal and vertical alignments. This construction will require minor grading of the shoulders and fill slopes; reconstruction of new curb and gutter and sidewalk, installation of new guardrail, placement of a new traffic signal strain pole, construction of a new catch basin with storm-drain pipe and end section, , minor milling of existing pavements, new pavements, new roadway striping and signing, and new traffic signal conduits and pull boxes. It does not appear that overhead utilities would be impacted by construction. Impacts to subsurface utilities could not be determined. There were no clear signs of environmental resources in the likely construction zone.

❖ Estimated Construction Costs: $ 135,000 to $ 145,000

Exhibit 4-4: Thurmon Tanner Parkway @ Plainview Road

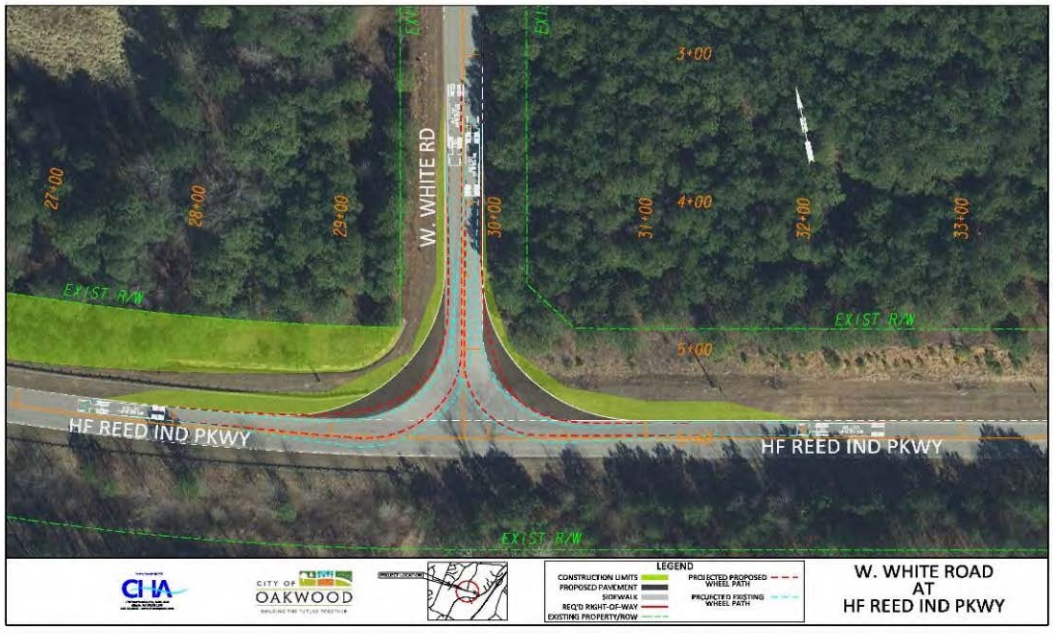


4-1.5 H.F. Reed @ W. White Rd Radius Improvements

- Issue: Insufficient right turn radii into and from W. White Road from H.F. Reed Industrial Parkway. Evidence of worn wheel paths well into the shoulder at both turns was documented. Additional issue determined was the lack of intersection sight distance for large trucks turning left onto H.F. Reed Industrial Parkway. Tree growth within the right of way and behind guardrail reduces sight distance to the west. The minimum required sight distance for this location by large trucks is 760 ft. It is estimated that only 450 ft. to 500 ft. is provided.
- Design Vehicle: WB-50 (Large 55 ft. tractor trailer truck). Development along W. White Road and H.F. Reed Industrial Parkway is mostly industrial / commercial suggesting that the WB-50 is a the most common large vehicle driving the road.
- Improvement Recommendations: Construct a minimum 100 ft. radius at both right turns and clear all trees from the right of way along the north side of H.F. Reed Industrial Parkway to appoint where the minimum 760 ft. of required intersection sight distance is obtained. This construction will require regrading of the shoulders and ditches along both roads, new asphalt pavement, minor milling of existing pavements, extension of an existing storm drain pipe with new end section, new sections of guardrail, resetting of roadway signs, new roadway striping and right of way clearing. Construction of the roadway could be done along existing horizontal and vertical alignments. Both overhead and underground utilities were observed at the location. At least one utility pole will require relocation. It is also recommended that the utility pole located in the northwest quadrant be relocated or removed in order to improve intersection sight distance. There were no clear signs of environmental resources in the likely construction zone.

❖ Estimated Construction Costs: $ 110,000 to 115,000

Exhibit 4-5: H.F. Reed Industrial Parkway @ W. White Road



4-2 Locations needing functional improvements:

4-2.1 Main St. at Flat Creek / Old Oakwood Road

A site investigation was conducted to document existing conditions and traffic movements. The existing intersection is a sign controlled, modified 4-leg intersection. The fourth leg of the intersection serves as a driveway into the First Baptist Church of Oakwood. Left and right turn movements from and to Main St. and Flat Creek Road are separated from the 4-leg intersection and are located within a radius in the southwest quadrant of the intersection. The Church's property is located in both the northwest and northeast quadrants of the intersection, and a United States Post Office is located in the Southeast quadrant. Utilities observed at the site include multiple overhead and subsurface facilities located throughout the project area. During the site visit, it was also observed that large trucks would navigate through the intersection but that it did not appear that truck traffic was significant. Traffic counts conducted at the intersection indicate that trucks and school buses comprise about 3% of the total traffic at the intersection during both the AM and PM peak hours. The traffic models of the intersection do not reflect the congestion that occurs at the intersection. Visual observations show that the non-conventional geometry of the intersection creates conditions where sight lines become obstructed which limits operational efficiency. There are also periods where congestion along Main Street beyond the intersection functional area (and outside the camera field of view) causes congestion because vehicle egress from the intersection becomes blocked. In some cases, vehicles were observed to change their travel direction to avoid the downstream congestion. The video screen shot below shows an example of this congestion.

The City of Oakwood provided direction on their preferred location of the roundabout in the southwest quadrant of the intersection. The City owns this undeveloped parcel of property that is opposite and away from the church and post office developments. The existing terrain in this area is relatively flat which is more suitable for construction.

The proposed roundabout configuration has three legs (Main St., Flat Creek, and Old Oakwood) The driveway to the church would remain at its current location but would tie-into Old Oakwood Road and left turns onto Old Oakwood would no longer be allowed. Drivers would need to travel through the roundabout to travel eastbound on Old Oakwood Road. Traffic flow to the post office would remain as is with entrance into the property occurring off Main St. and exiting out onto Old Oakwood. Access to a residence adjacent to the post office would remain as is.

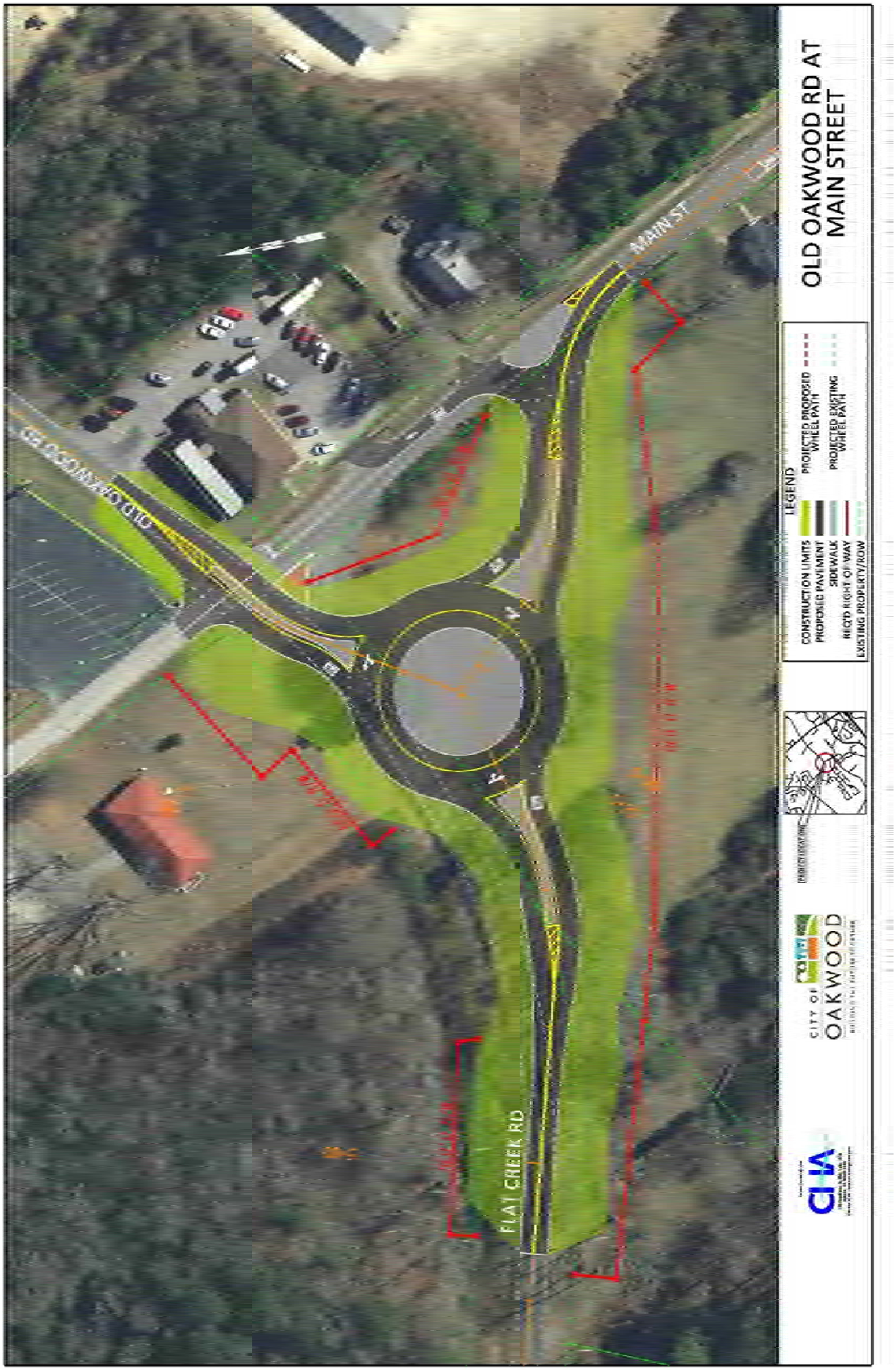
Design Characteristics:

- 25 MPH Speed Design
- 160 ft. outside diameter to accommodate large truck traffic
- 120 ft. diameter truck apron
- 96 ft. inside diameter center island.

The project footprint impacts will require that right of way is acquired from multiple properties, relocation of numerous utilities and the potential need for a retaining wall to avoid encroachment onto Church parking. Based upon site inspections, it was estimated that the proposed construction would not impact any protected water features, historical or archaeological resources. However, verification of these observations through investigations by appropriate professionals will be the only way to confirm these conditions.

❖ Estimated Construction Costs: $ 500,000 to $ 550,000

Exhibit 4-6: Main Street @ Flat Creek and Old Oakwood Roads



4-2.2 Thurmon Tanner Parkway at Sam's Club

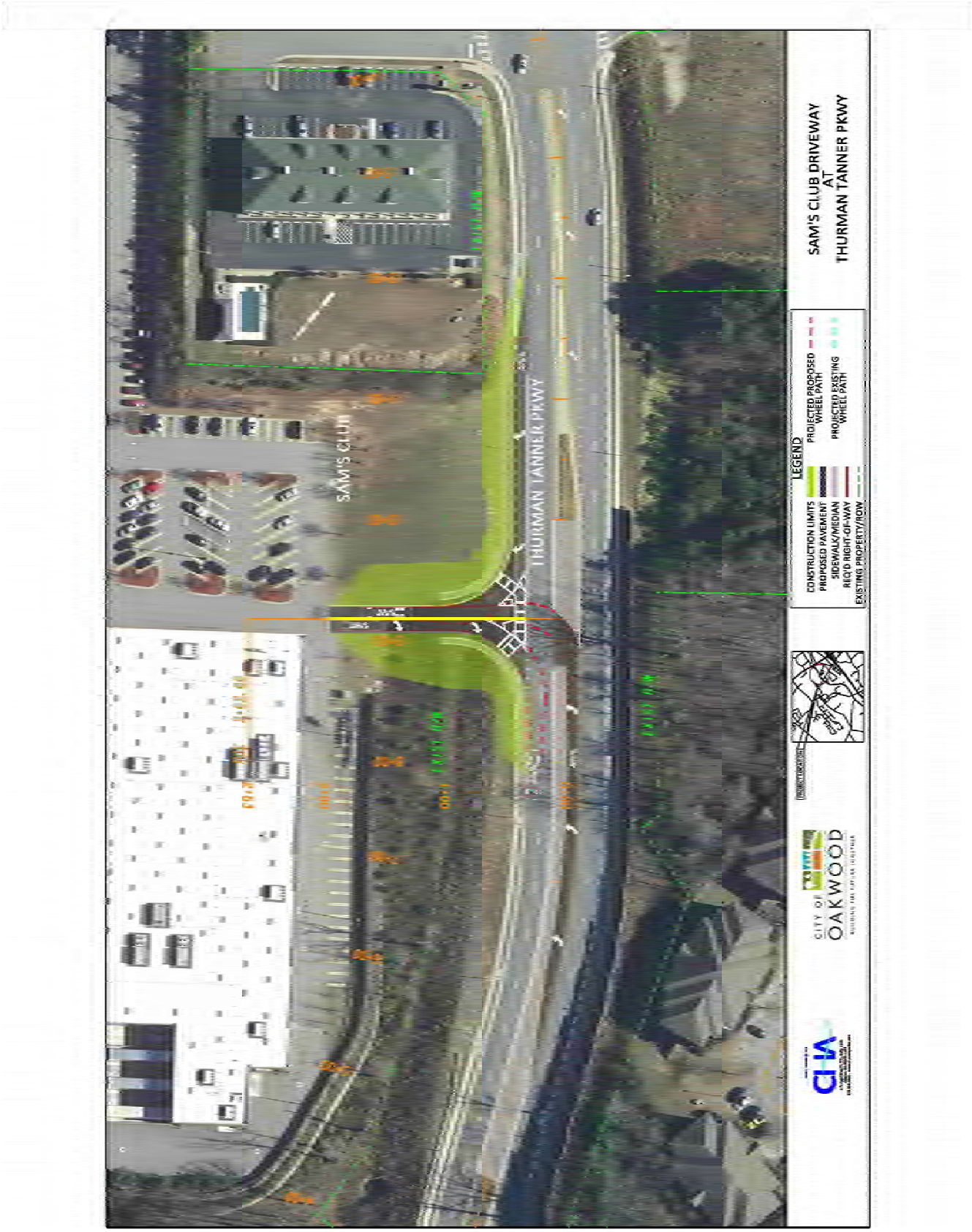
The proposed Restricted Crossing U-Turn (RCUT) intersection on Thurmon Tanner Parkway was advanced to concept development to include the RCUT with left turning vehicle storage, a right turn lane into the Sam's property and the driveway extending up to existing parking. Left-turn traffic volumes on Thurmon Tanner Parkway at SR 53 were used to estimate an approximate volume that might use this RCUT access to the Walmart/Sam's Club retail center. The existing left-turn volume on Thurmon Tanner Parkway ranges from 200-250 vehicles per hour (vph) during peak hours. This left-turn volume includes traffic destined to a variety of institutional, employment and residential destinations northwest of Thurmon Tanner Parkway, in addition to traffic headed for Walmart/Sam's Club. Based on these considerations, it is estimated that the left-turn volume using the RCUT would likely be less than 75 vph. The RCUT was developed considering this left-turn traffic volume projection and considering future traffic volume increases along Thurmon Tanner Parkway. Based on these considerations, the GDOT standard vehicle storage minimum of 250 ft. was determined to be sufficient to accommodate up to 100 left-turn vehicles per hour.

The proposed RCUT, right turn lane, and driveway would be constructed to tie-in to the parking lot of Sam's Club adjacent to the northeast corner of the building and in-line with existing two-way circular traffic flow into the parking lot. The new access into the parking, including the RCUT would be designed using 11 ft. wide lanes that would accommodate the turning movements of a S-Bus-40 or 40 ft long vehicle. The lane width and turning limitations were purposely chosen to discourage use by large delivery vehicles. Those vehicles will continue to use SR 53 as an access. The driveway into the Sam's parking lot and the right turn lane into the driveway would both be approximately 150 ft. long.

Construction of the new access would require grading, clearing and grubbing, new pavements, modifications, additions to the existing roadway drainage system, new curb and gutter with sidewalk, new signing, new roadway striping, and new lighting features. No overhead utilities were present, but it is assumed that there are multiple subsurface utilities that would be impacted. Based upon site inspections, it was estimated that the proposed construction would not impact any protected water features, historical or archaeological resources. However, verification of these observations through investigations by appropriate professionals will be the only way to confirm these conditions.

- Estimated Construction Costs: $ 350,000 to $375,000

Exhibit 4-7: Thurmon Tanner Parkway @ Sam's Club



4-3 Roadway Extension:

4-3.1 McClure Drive Extension

A site investigation was conducted to document existing conditions along the direct proposed route and at the proposed tie-in points. Development along McClure Drive is entirely residential. Development on Chamblee Road at the McBrayer intersection is mixed residential and commercial. The land along the new location route is mostly undeveloped pastureland or residential. The terrain along the route is relatively flat. There are multiple utilities at both tie-in locations.

The proposed route closely follows the current southwesterly direction of McClure Drive with only slight horizontal curves needed to line up with the McBrayer Road / Chamblee Road intersection. The project proposes to remove the existing cul-de-sac on McClure and creating a simple stop sign controlled "T" intersection. Moving southwesterly, the route travels directly through one residential duplex resulting in a displacement. At this location, construction limits do appear to come within close proximity to two other duplex developments on either side of the alignment. From there the route travels over undeveloped land along a southwesterly route to tie-in to Chamblee Road at an approximate 80-degree angle. Beyond the impacts to the residential duplex developments, the project footprint impacts consist of normal grading to construct the roadway and collect stormwater runoff from the road. Utility impacts will be limited to the areas at the project termini.

Design Characteristics:

- 22 ft. wide two-lane rural typical section with rural 6 ft. shoulders
- Design speed of 30 MPH (matching the posted)
- New intersection right turn radii to accommodate a S-Bus-40 set at 60 to 75 ft.

The project footprint impacts will require that right of way is acquired from multiple properties, displacement / relocations of at least one residential development, and relocation or modification of subsurface utilities. Based upon site inspections, it was estimated that the proposed construction would not impact any protected water features, historical or archaeological resources. However, verification of these observations through investigations by appropriate professionals will be the only way to confirm these conditions. Based upon site inspections, it was estimated that the proposed construction would not impact any protected water features, historical or archaeological resources. However, verification of these observations through investigations by appropriate professionals will be the only way to confirm these conditions.

- Estimated Construction Costs: $425,000 to $450,000

Exhibit 4-8: McClure Drive Extension

4-4 Intersection Operations, Safety or Capacity Improvements

The City of Oakwood identified eleven intersections to be evaluated for concerns related to traffic operations, safety, and/or capacity. Each of these locations were studied to confirm existing conditions, and to evaluate the need/benefit of potential improvement strategies. Where applicable, concept designs and concept level construction cost estimates have been developed.

The documentation of existing conditions at these study intersections included traffic counts to record volumes and turning patterns during the weekday AM and PM peak hours, compilation and analysis of crash data, and aerial mapping and field investigations to confirm existing physical features. Traffic operations were analyzed using a Citywide Synchro model developed by CHA to identify vehicle delays, queues and level-of-service (LOS). These models used signal timing/phasing data obtained from GDOT and Hall County Department of Public Works. Video data was also used to support the evaluation of traffic operations in some cases. The traffic model data and performance analysis results are provided in Appendix C.

From this analysis, potential improvements and alternatives were identified where applicable and recommendations developed. These improvements included considerations of geometry, signing and pavement markings, traffic signal warrants, signal phasing/timing optimization, and safety countermeasures.

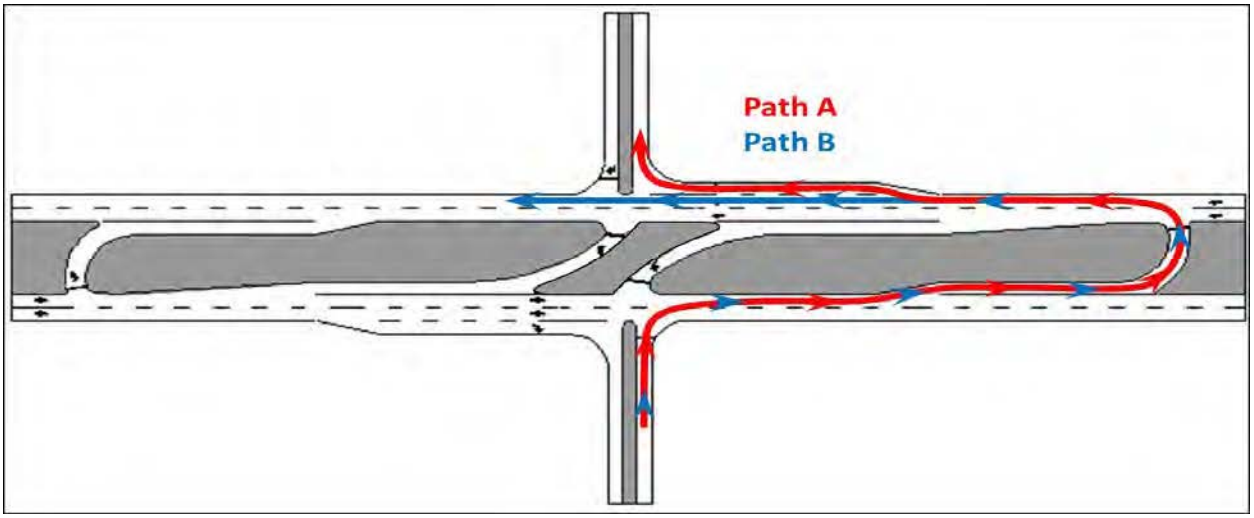
4-4.1 SR 53 (Mundy Mill Road) & Oakwood Road/Frontage Road

The intersection of SR 53 (Mundy Mill Road and Oakwood Road/Frontage Road is currently restricted to right-in/right-out only movement, with a median separation of SR 53 traffic. The focus of study for this location was to consider the potential to reconfigure the intersection to permit left-turn movements from SR 53 onto Oakwood Road and Frontage Road. This concept would be a modified form of a Restrictive Crossing U-Turn (RCUT) intersection, although without provision for the left-turn exit from the side road (i.e. U-turn). The basic concept layout for an RCUT is illustrated on Exhibit 4-10: RCUT Concept.

Exhibit 4-9: SR 53 at Oakwood Road/Frontage Road Study Site

Source: Google Maps, 2018

Exhibit 4-10: RCUT Concept



Source: https://safety.fhwa.dot.gov/intersection/innovative/uturn/

The intersection of SR 53 and Oakwood Road/Frontage Road is located 335 feet northwest of the I-985 Interchange 16 southbound ramps. In the past, full access was provided at this intersection, and the City Police Chief identified that it was changed to the current right-in/ right-out configuration to address congestion and safety issues. The intersection is in an area where the eastbound travel lanes of SR 53 transition from four lanes to six lanes, approaching the signalized I-985 southbound ramp intersection, and is considered to be within the functional area of the signalized intersection. Vehicle queues on SR 53 can extend from the signal past the Oakwood Road/Frontage Road intersection during peak hours.

SR 53 is functionally classified as a Principal Urban Arterial. Access management is an important element of corridor design along this classification of roadway to enhance mobility and improve safety by reducing the areas of vehicle turning conflicts and speed changes. GDOT has established recommended spacing guidelines for the locations of intersections and driveway access along the State's arterial network as part of this access management objective[1]. On urban arterials, the preferred minimum spacing between median openings is 1,000 feet. The location of a potential left-turn access at Oakwood Road/Frontage Road would be less than this standard. Enabling left-turn movements from westbound SR 53 onto Oakwood Road would produce a safety risk because of the interaction with conflicting eastbound traffic queues from the I-985 signal and eastbound vehicles transitioning into the two added eastbound lanes. Westbound traffic intending to turn left onto Oakwood Road would also negatively impact traffic operations and safety because of the deceleration of the left-turn traffic in the same area where westbound through traffic is accelerating away from the I-985 southbound ramp intersection. This speed differential creates the potential for increased rear-end type crashes. Providing an Restrictive Crossing U-Turn (RCUT) Intersection access at Oakwood Road could also induce crossing conflicts of traffic trying to access Oakwood Road from the I-985 southbound exit ramp. For these reasons, the introduction of left-turn access from SR 53 to Oakwood Road/Frontage Road is not recommended.

[1] *Design Policy Manual*, GDOT, April 2018, Revision 5.3, page 7-3

4-4.2 SR 53 (Mundy Mill Road) & Thurmon Tanner Parkway

The primary focuses of study at this intersection involve considerations of the left-turn signal phasing of the traffic signal and the geometry of the southeast-bound intersection approach on SR 53.

The current traffic signal operations provide protected/permitted operation for the left-turn movements on SR 53 and protected-only operation for the left-turns on Thurmon Tanner Parkway. Consideration for changing the signal phasing on SR 53 from protected/permitted to protected-only was requested by the City Police Chief because northwest-bound left-turn drivers reportedly perceive the farthest opposing lane (shared through and right-turn) to be right-turn only.

The left-turn movements on Thurmon Tanner Parkway operate as protected-only because of the dual left-turn lanes. The left-turns on SR 53 are each from a single left-turn lane. Protected/permitted left-turn phasing is GDOT's preferred policy for left-turn phasing with single turn-lane configurations due to the enhanced operational performance/capacity, especially during non-peak periods of the day.[2]

Exhibit 4-11: SR 53 and Thurmon Tanner Parkway Study Site

The current protected/permitted left-turn phasing configuration at this intersection is also consistent with guidelines published by the Transportation Research Board [3].

Overall traffic operations at the intersection are LOS C during both the AM and PM peak hours, but some movements on Thurmon Tanner Parkway operate at LOS E or F. The long delays for these

[2] *GDOT Policy 6785-2 – Left Turn Phasing*, GDOT Office of Traffic Operations, 2017
[3] *NCHRP Report 812: Signal Timing Manual*, 2nd Edition, Transportation Research Board, 2015

movements are primarily associated with the long cycle lengths used to optimize the overall traffic operations. Volume-to-capacity (v/c) ratios show that capacity utilization is less than 75% for all lane groups.

Changing the phasing for SR 53 Eastbound/Westbound left-turns to protected-only will reduce the overall intersection operations from LOS C to LOS D, and the operation of these left-turn movements would change from LOS C to LOS F. Volume-to-capacity (v/c) ratios of the various lane groups show that capacity utilization also increases, with v/c ratios approaching 80%. This analysis illustrates the loss of operational efficiency associated with converting to protected-only phasing.

A review of the crash history indicates that there were 7 crashes over three years involving left-turn movements from SR 53 onto Thurmon Tanner Parkway and opposing through traffic. This frequency of crashes is marginally below the threshold criteria for considering protected-only left-turn phasing per GDOT's phasing policy[4]. Based on these considerations of traffic operations and crash history, it is concluded that the current protected/permitted phasing is appropriate, and no change to the signal phasing is recommended at this time. However, continued monitoring of these conditions is recommended.

The geometric configuration of the southeast-bound travel lanes on SR 53 at Thurmon Tanner Parkway was also reviewed for safety considerations related to the shared through/right-turn lane. This third though lane begins approximately 300 feet in advance of the intersection stop line. There is a small slip ramp with island separating the right-turns at the intersection from this lane, with the lane continuing for through traffic across the intersection. This geometry is different than the treatment of the other right-turn movements at the intersection which are all made from exclusive right-turn lanes. However, this difference does not appear to contribute significantly to the crash experience, as the number of left-turn crashes are the same for both directions.

Traffic operations at the intersection were analyzed for an alternative to reconfigure the southeast-bound approach to convert the curbside lane from shared through/right-turn to right-turn only, thus reducing the number of through lanes to two. These operations analyses show that this change will increase delays for through traffic by 10-15% in both peak hours, but the LOS will continue to be LOS C. However, average vehicle queues in the through lanes will increase by 45% and the 95th percentile design queues will increase by 60-65%. It is also noted that the design queue conditions will be unstable and could be longer than calculated.

Converting the lane use designation of the curbside lane of the southeast-bound approach would change the traffic interactions with the right-in/right-out access to Merchants Way which is about 100 feet from the stop line of SR 53 at Thurmon Tanner Parkway. This change would require traffic exiting Merchants Way to cross the right-turn only lane to access SR 53, introducing a greater conflict area and safety risk.

Converting the lane use of the southeast-bound lanes would also change the dynamics of traffic interactions between through traffic on SR 53 and the right-turn traffic from Thurmon Tanner Parkway. The options to address this change could involve reconstruction of the right-turn lane and island or to use the third lane on SR 53 as a free-flow slip lane from Thurmon Tanner Parkway. Either of these options would require considerations of the safety and sufficiency of merging/weaving distances for the

[4] *GDOT Policy 6785-2 – Left Turn Phasing*, GDOT Office of Traffic Operations, 2017

right-in/right-out access to the Merchants Crossing Shopping Center and at the Mundy Mill Drive signalized intersection.

4-4.3 SR 53 Mundy Mill Road) & UNG Loop Road

The University of North Georgia (UNG) Loop Road is a proposed local road being constructed within the UNG-Gainesville campus as part of their campus master plan. This loop road will provide right-in/right-out access to SR 53 approximately 500 feet northwest of the signalized intersection of SR 53 and Mathis Drive/Old Mundy Mill Road. Mathis Drive is a gateway entrance to the UNG Campus. The focus of study for this location is to evaluate the feasibility for providing left-turn access from SR 53 into the UNG Campus at the Loop Road. This concept would be a modified form of a Restrictive Crossing U-Turn (RCUT) intersection, like the concept described in Section 4-4.1. This evaluation includes assessment of the operational and safety needs/benefits of the enhanced access, and conceptual layout and construction cost.

Exhibit 4-12: SR53 and UNG Loop Road Study Site

The proposed UNG Loop Road is opposite an existing right-in/right-out driveway to Northeast Georgia Physicians Group medical office building. The median barrier separating northwest-bound and southeast-bound traffic is 16 ft +/-.

The southeast-bound left-turn lane on SR 53 at Mathis Drive provides about 280 feet of queue storage and 125-ft +/- bay taper. The beginning of the left-turn bay taper is located about 75 feet from the right-in/right-out access of the medical office bldg. and proposed UNG Loop Road access.

The eastbound left-turn lane from SR 53 to Mathis Drive is opposite double left-turn lanes on the west-bound approach from SR 53 onto Old Mundy Mill Road which is access to Walmart/Sam's Club retail center, other strip retail and Metals USA (and also provides secondary access for the medical office).

A *Traffic & Pedestrian Circulation Study* prepared by Kimley Horn for the UNG Master Plan identified 2017 existing and projected 2024 Design Year traffic volumes on the campus roadways and internal intersections. The entering and exiting traffic volumes on Mathis Drive between SR 53 and Campus Drive are shown in Table 4-1, below.

Table 4-1: Mathis Drive Traffic Volumes

Peak Hour	2017 Existing			2024 DY Projection		
	Enter	Exit	Total	Enter	Exit	Total
AM	367	180	547	403	283	686
Midday	251	359	610	276	438	714
PM	262	517	779	299	646	945

Source: UNG Traffic and Pedestrian Study, Kimley Horn; Figures 2 and 13

A potential benefit of the proposed RCUT left-turn access from SR 53 to the UNG Loop Road is to improve traffic operations at the SR 53/Mathis Drive intersection by reducing the eastbound left-turn volume at the signal. This access would also support the UNG Campus Master Plan objective to reduce traffic volumes along the inner loop road to improve pedestrian and bicycle access and mobility in the campus core. The *UNG Traffic & Pedestrian Circulation Study* did not identify the turning movement patterns at the intersection of Mathis Drive and SR 53, nor did the study identify projections of traffic on the proposed loop road. However, the left-turn volume from SR 53 onto Mathis Drive is estimated to be more than 50% of the entering volume at Mathis Drive since there is a right-in/right-out access to the campus from SR 53 at Landrum Education Center Drive (900 ft SE of Mathis Drive and 350 ft NW of Thurmon Tanner Pkwy intersection), which intercepts right-turn traffic entering the campus from the east.

For purposes of this analysis, the eastbound left-turn volume on SR 53 at Mathis Drive is estimated to be 60% of the entering volume at the Mathis Drive shown in Table 4-1. These estimated eastbound left-turn volumes are shown below.

Table 4-2: Estimated Eastbound Left-turn Volumes into UNG

Peak Hour	2017 Existing	2024 DY
AM	220	240
Midday	150	165
PM	160	180

The available documentation for the UNG Master Plan did not identify the amount of traffic projected to use the new loop road. For the purpose of this study assessment, the potential diversion of left-turn volume from Mathis Drive to the proposed Loop Road RCUT assumed that 60% of the left-turn traffic would divert to the loop road access and the remaining 40% would continue to use the signalized Mathis Drive access to enter the campus. In this scenario, the potential left-turn volume at the Loop Road RCUT would range from 100-150 vehicles per hour (vph) during peak hours in the 2040 design year. The potential advantages and disadvantages of providing the left-turn entering access at the loop road are described below.

Pros:

- Providing the RCUT left-turn access at the loop road could reduce the eastbound left-turn volume at the signalized intersection of SR 53/Mathis Drive. This could improve overall LOS at the signalized intersection by reducing the signal time needed to accommodate these left-turns.
- Reduced traffic volumes on Mathis Drive supports the Campus Master Plan objective to improve the quality of pedestrian and bicyclist mobility and access in the academic core of the campus.
- Although the location of this RCUT is less than the 1,000-foot recommended minimum distance for median openings along SR 53, the left-turn movement would not interact with queued vehicles in the opposing direction, so that the left-turn movement would not be subject to the same safety risks as were identified for the SR 53/Oakwood Road/Frontage Road location.

Cons:

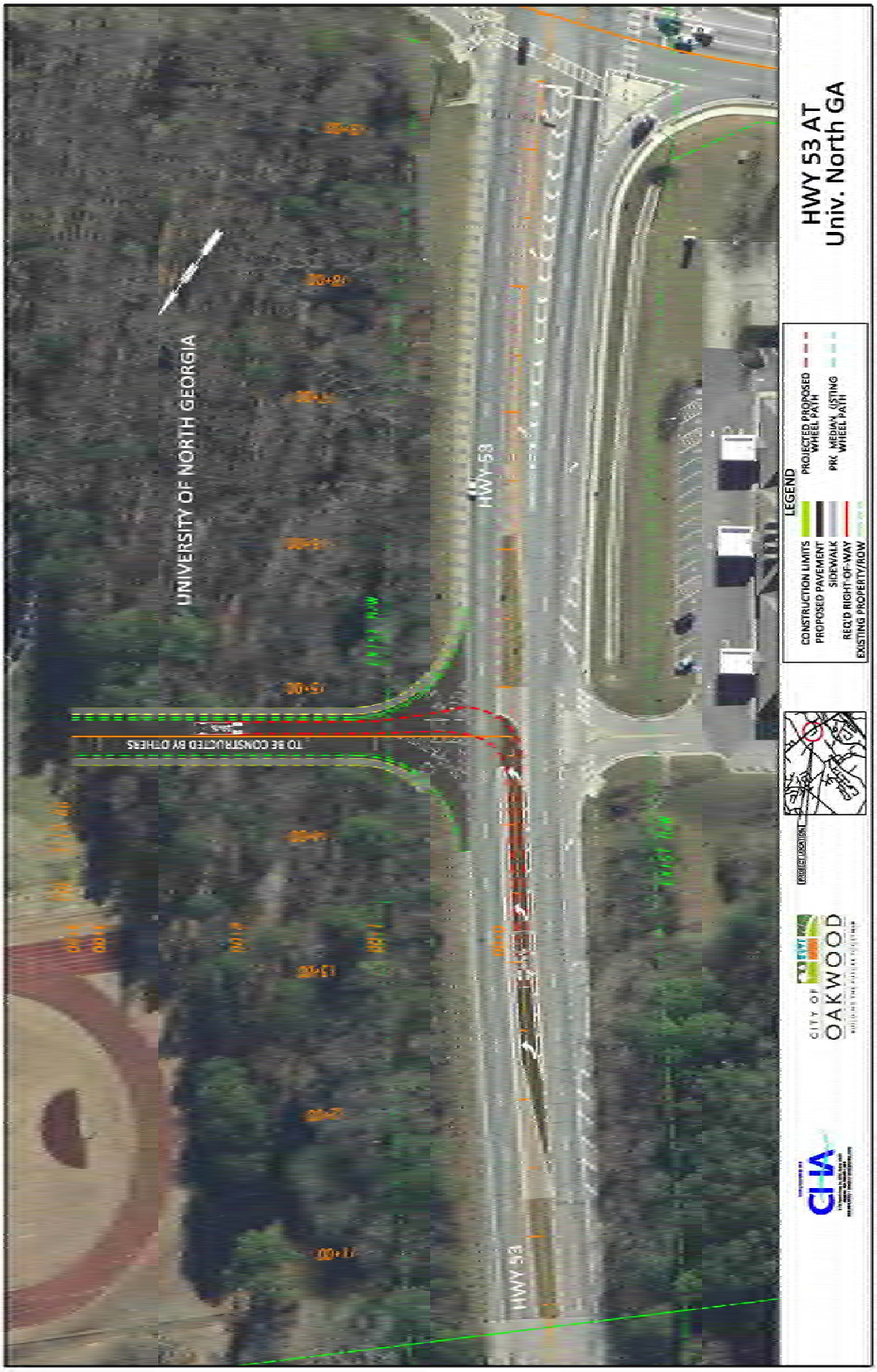
- The RCUT access introduces a new point of uncontrolled turn conflict of left-turn traffic with opposing through traffic.
- The RCUT introduces another location of speed differential associated with decelerating traffic into the RCUT lane, which can increase the risk of rear-end crashes.
- The close proximity of the RCUT intersection to the left-turn lane at Mathis Drive could “trap” left-turn vehicles intending to access the UNG campus at the signal. Signing and pavement markings could be designed to minimize this condition.

Design Concept: The proposed RCUT at the new UNG access Road would be constructed within the existing raised grass median of SR 53. The RCUT would have 12 ft. wide lanes, a minimum 250 ft. of vehicle storage, a 100 ft. taper and be able to accommodate turns from a S-Bus-40. The entrance to the UNG access road would have be modified to accommodate the incoming traffic as it is currently being constructed to be a right-in/right-out. Construction would not impact utilities or environmental resources and would not require additional right of way.

GDOT District 1 Traffic Operations has been consulted with regarding the conceptual design of this left turn opening and have expressed possible consideration of the project.

- ❖ Estimated Construction Costs SR53 at New UNG Access Road: $ 140,000 to $150,000.

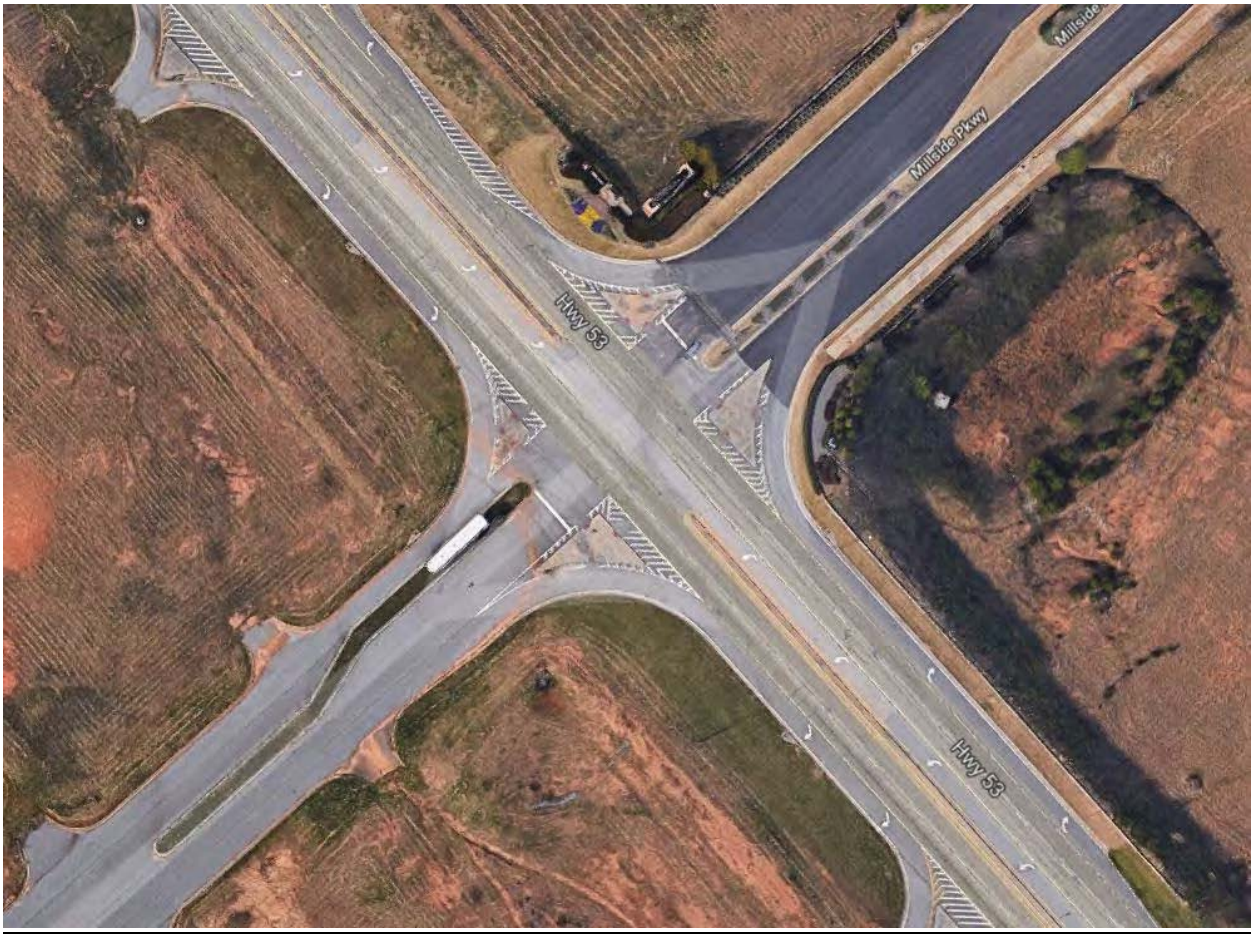
Exhibit 4-13: SR 53 @ UNG Left Turn Access RCUT



4-4.4 SR 53 (Mundy Mill Road) & Millside Parkway

A *Signal Needs Study* was prepared for the intersection of Mundy Mill Road (SR 53) and Millside Parkway in 2016 (using 2015 count data). That study found that the existing conditions in 2015 did not satisfy the minimum warranting criteria for traffic signal control, but that projected development around Millside Parkway will eventually satisfy the warrants. Traffic counts were collected in 2018 to assess the changes in traffic at the intersection and to determine if conditions now meet the warrants.

Exhibit 4-14: SR 53 and Millside Parkway Study Site



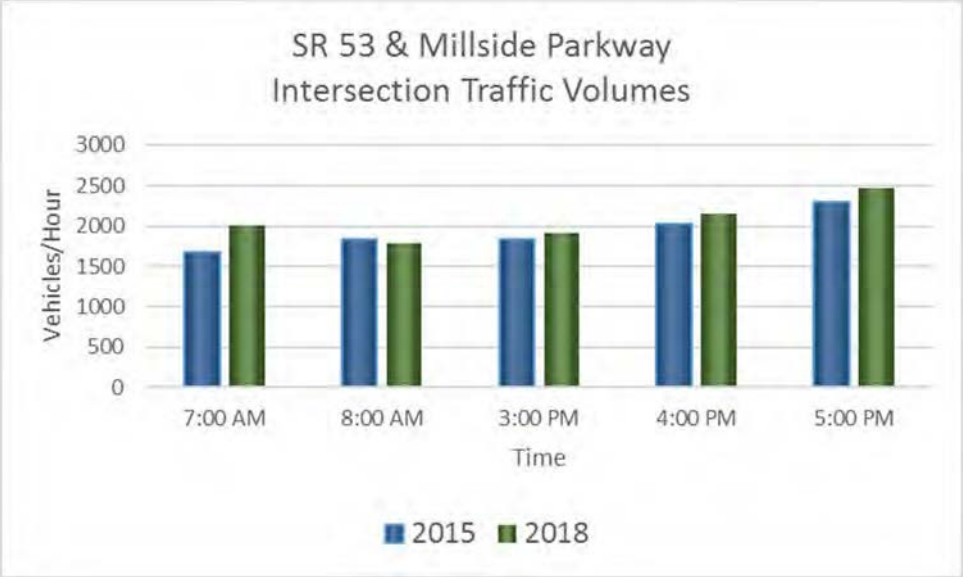
SR 53 is a divided roadway with two through lanes in each direction, and separate left-turn and right-turn lanes at the Millside Parkway intersection. The posted speed limit on SR 53 is 55 mph. Millside Parkway is also a divided roadway with two travel lanes in each direction. The Millside Parkway approach to SR 53 consists of a channelized right-turn only lane that is 'Yield' sign controlled, a through lane and a separate left-turn lane. The through lane is not currently used by traffic because it only accesses a stub road to undeveloped property. The posted speed limit on Millside Parkway is 35 mph.

Traffic Volumes

The updated counts focused on the peak morning and afternoon traffic periods for the screening of the signal warrants. The 2016 *Signal Needs Study* provided 12-hours of count data (from 7 am to 7 pm).

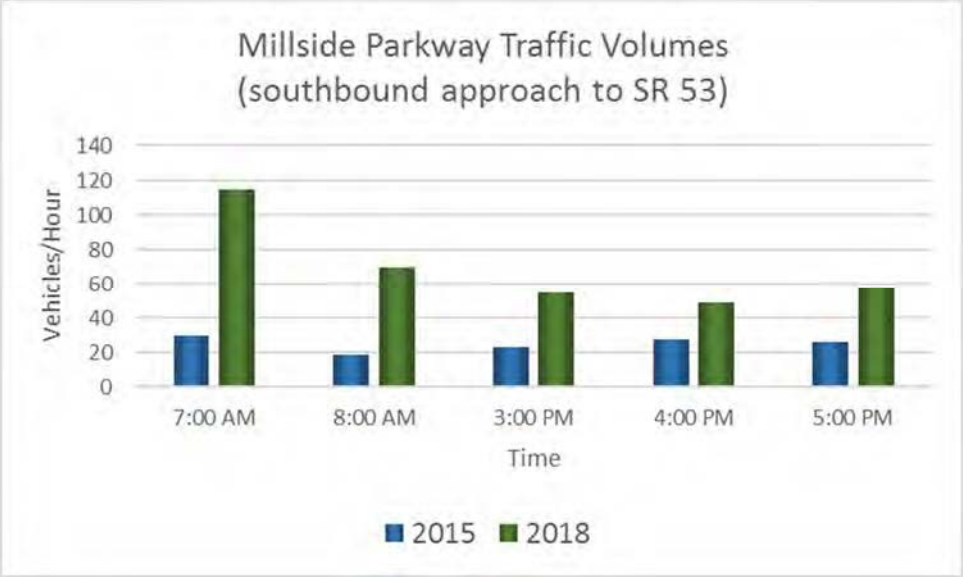
Although 12-hours of data is typically used to establish the eight highest hours of traffic volume for a warrant, the reduced count program was used to provide a comparison of the critical time periods during the AM and PM peak periods. Exhibit 4- shows a comparison of the 2015 and 2018 count data. As shown, the overall intersection volumes have increased by about 20% during the morning peak hour but have remained generally consistent in each of the other morning and afternoon study hours.

Exhibit 4-15: SR 53 & Millside Parkway Intersection Volumes



A key factor of the signal warrant analysis is the amount of traffic entering the intersection from Millside Parkway. As shown in Exhibit 4-, the traffic volumes on Millside Parkway have increased considerably over the past three years. Although the volumes of this approach are still relatively low, they have increased more than 250% during the morning hours, and between 75% and 140% during the afternoon hours.

Exhibit 4-16: Millside Parkway Approach Volumes



Traffic Operations

Delay and Queue analyses were conducted of the SB left-turn lane (the critical lane group for the signal warrant evaluation) to identify the performance characteristics of this Stop-controlled movement. These analyses were based on the same video as was used to record the traffic volumes. This data shows that the average vehicle delay of the Millside Parkway left-turn traffic is 38 seconds per vehicle during the AM peak hour and 47 seconds per vehicle during the PM peak hour. This corresponds to LOS E operations, based on the methods of the Highway Capacity Manual. The range of recorded delay was from 4 seconds to 161 seconds. The measured delay includes control delay, queue delay and delay associated with two-stage gap acceptance.

Maximum observed queues were 7 vehicles in the AM peak hour and 5 vehicles in the PM peak hour. The average queue is 0.93 vehicles in the AM and 0.67 vehicles in the PM. These queue characteristics are shown in Exhibit 4- and Exhibit 4-.

Exhibit 4-17: Millside Parkway Queues - AM Peak Hour

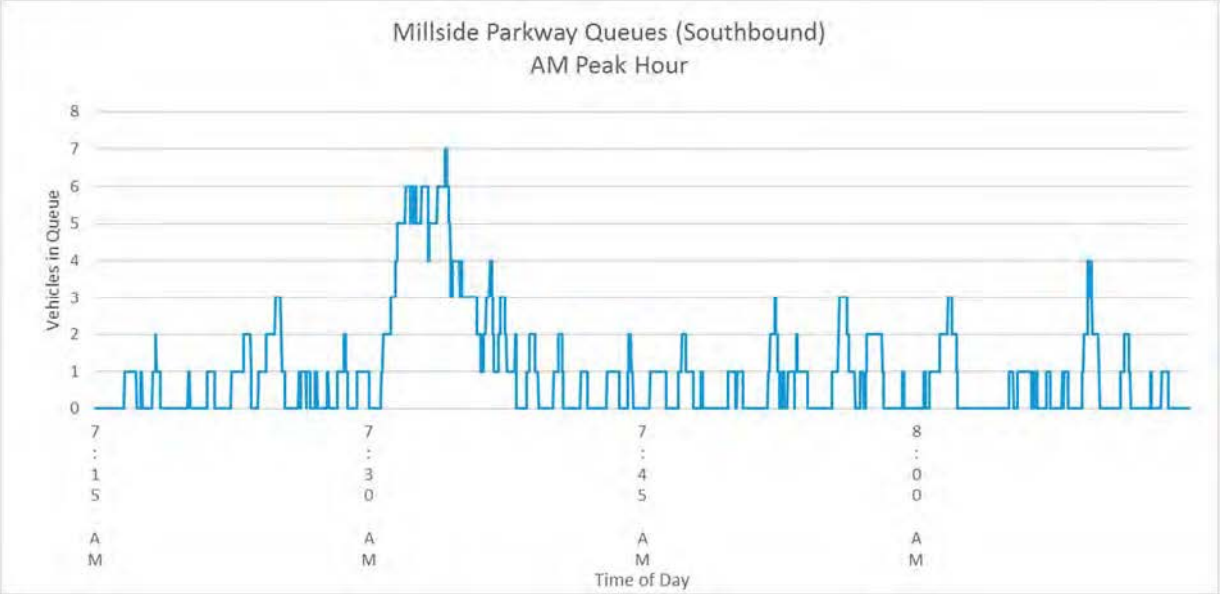
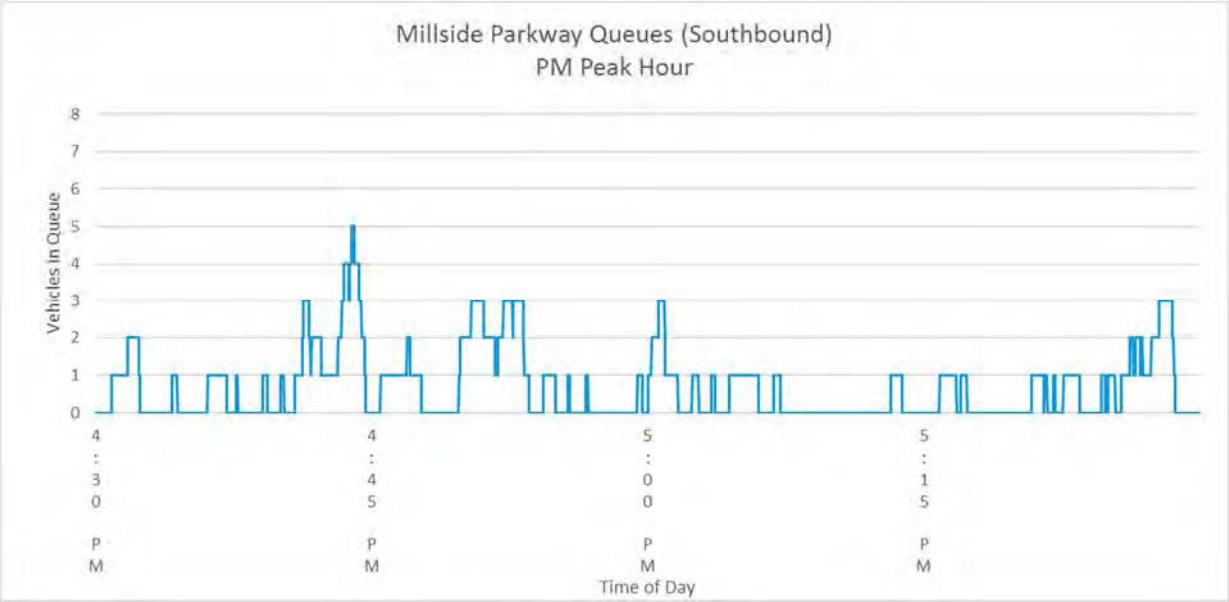


Exhibit 4-18: Millside Parkway Queues - PM Peak Hour



Crash Data

The crash data compiled from GDOT online resource shows that 2 crashes occurred at the intersection over the most recent 3-year period (2015-2017) of available data. This crash history is consistent with the crash patterns reported in the 2016 study. This indicates that the increased traffic on Millside Parkway has not contributed to a change in traffic safety of the intersection.

Signal Warrant Analysis

Traffic conditions at SR 53 and Millside Parkway were evaluated to determine if traffic signal control is warranted, based on the applicable factors described in Chapter 4C-TRAFFIC CONTROL SIGNAL NEEDS STUDY of the U.S. Manual of Uniform Traffic Control Devices, 2009 Edition (including current revisions).

The existing traffic conditions for this intersection were compared to the following signal warrant criteria:

Warrant 1: Eight-Hour Vehicular Volume
Warrant 2: Four-Hour Vehicular Volume
Warrant 3: Peak Hour Vehicular Volume
Warrant 4: Pedestrian Volume
Warrant 5: School Crossing
Warrant 6: Coordinated Signal System
Warrant 7: Crash Experience
Warrant 8: Roadway Network
Warrant 9: Intersection Near a Grade Crossing

The warrant criteria was evaluated in the context of only the left-turning approach volume on Millside Parkway only and considering a single-lane approach because the right-turn movement occurs from a separate 'Yield' control turn lane, and the existing through lane has no volume (because Millside Parkway is a stub to undeveloped property on the south side of Mundy Mill Road). This methodology is consistent with the MUTCD guidance. The technical analysis is provided in Appendix D, and the results of this analysis are summarized below.

Warrant 1: This warrant is intended at locations where a large volume of intersecting traffic is the principal reasons to consider installing a traffic control signal. While the traffic volumes on SR 53 exceed the applicable volume criteria, the volumes on Millside Parkway do not. The collected volume data shows that the 2 hours from 7 am to 9 am meet the criteria but none of the hours in the afternoon peak period (3 pm to 6 pm) meet the criteria. Considerations of traffic volumes for the hours between 9 am and 3 pm were inferred from a comparison of the 12-hour data presented in the 2016 Warrant Study and the 6-hour data collected in 2018. It is concluded from this evaluation that traffic volume on Millside Parkway may also meet the warrant threshold during one or two of the midday hours around the lunch hour. However, these conditions do not meet the 8-hour criteria, and so this warrant is not satisfied.

Warrant 2: This warrant is also intended at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal, but over a four-hour period rather than 8 hours. The analysis of the highest four weekday hours of traffic volume shows that the volumes on SR 53 meet the warrant criteria, but the volumes on Millside Parkway do not. Considerations of estimated midday volumes also indicate that the criteria is not met. This warrant is not satisfied.

Warrant 3: This warrant is intended at locations where for one hour of an average day, the side-street traffic suffers undue delay when entering or crossing the major street. This warrant is intended to be applied only in unusual cases such as office complexes, manufacturing plants, industrial complexes, or high occupancy vehicle facilities that attract or discharge a large number of vehicles over a short time. This warrant is not applicable for this study intersection. Additionally, the analysis of peak hour vehicle delays and queues indicates that conditions do not warrant traffic signal control.

Warrant 4: This warrant is intended for locations where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street. Pedestrian activity at the intersection is negligible. The planned development in this area is not anticipated to significantly change the level of pedestrian activity at the intersection, and pedestrian volumes are expected to remain well below the minimum threshold to satisfy this warrant. This warrant is not satisfied.

Warrant 5: This warrant is intended for locations that are established crossings for school age children. This warrant is not applicable.

Warrant 6: This warrant is intended to maintain progression of traffic movement along a signalized corridor. The intersection is not located within a coordinated signal system. Therefore, this warrant does not apply.

Warrant 7: This warrant is intended where the severity and frequency of certain type accidents that could be remedied by a signal are the principal reason for installing a traffic control signal. The accident data obtained for the period between January 2015 and January 2017 indicate that there were 2 crashes at the intersection in this 3-year period (an equivalent annual rate of 0.67). This crash history does not meet this warrant. This warrant is not satisfied.

Warrant 8: This warrant applies to intersections that are the junctions of two roadways that are part of the principle roadway network for through traffic movements. This warrant is not applicable for the study intersection.

Warrant 9: This warrant is intended for locations where none of the conditions described in the other eight traffic signal warrants are met, but the proximity to the intersection of a grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal. This warrant is not applicable for the study intersection.

The table below summarizes the signal warrant evaluations for existing conditions at the intersection of GA 53 and Millside Parkway. This analysis shows that the existing conditions do not warrant traffic signal control.

Summary of Warrants – Existing Conditions

Warrant	Satisfied?	Hours
1. Eight-Hour	No	3
2. Four-Hour	No	3
3. Peak-Hour	*na*	*na*
4. Pedestrian	No	0
5. School Crossing	*na*	*na*
6. Coordination	*na*	*na*
7. Crash Experience	No	0
8. Network	*na*	*na*
9. Railroad Crossing	na	na

Although none of the signal warrants are currently met, the volumes are very near the threshold values for Warrants 1 and 2. Comparison of the 2015 and 2018 volume data was used to estimate a potential horizon year when these two traffic signal warrants might be expected to be satisfied. As noted before, the volumes on SR 53 already exceed the minimum thresholds for the major street volumes. Our assessment therefore focused on an examination of the current growth trend of volumes on Millside Parkway, and specifically the southbound left-turn movement. This left-turn volume on Millside Parkway has increased at an annual rate of approximately 40%. The current 8th highest hourly volume of this movement is estimated to be 42 vehicles per hour, whereas the applicable threshold criteria for Warrant 1 is 53 vehicles per hour. If the current growth trend continues, it is expected that the 8th highest hour volume will exceed this threshold within the next 12 months, at which time the criteria for both Warrants 1 and 2 will be satisfied.

Because this assessment is based on estimates of existing and future volumes representing the 8th highest hour of the day, it is recommended that conditions continue to be monitored prior to installing a traffic signal at the intersection.

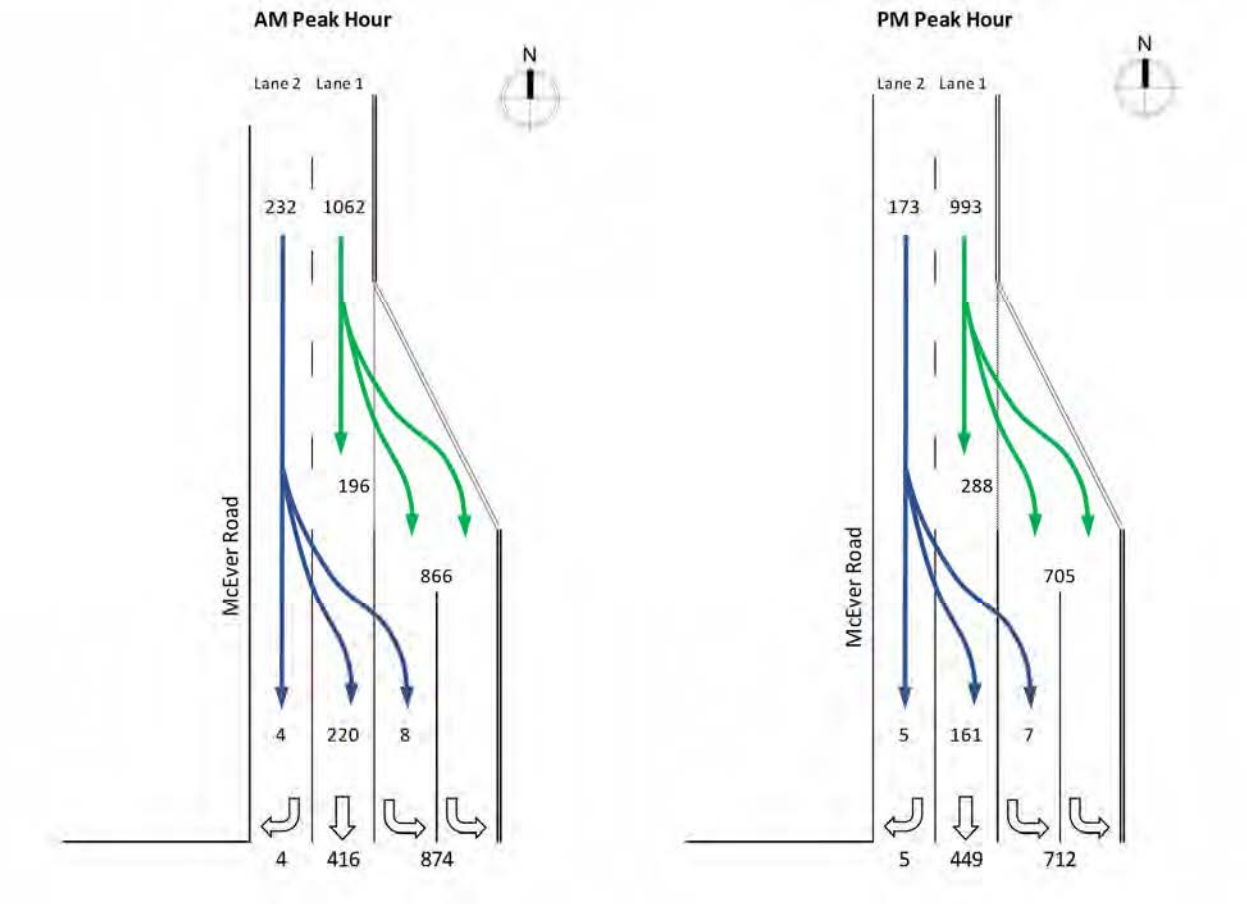
4-4.5 SR 53 (Mundy Mill Road) & McEver Road

The segment of SR 53 (McEver Road) from Mountain View Road to SR 53 (Mundy Mill Road) is approximately 825 feet long, and the southbound travel direction on this segment of McEver Road transitions from two lanes to four lanes to provide two left-turn lanes, a single through lane and a right-turn lane at the SR 53 (Mundy Mill Road) intersection. The southbound left-turn movement from McEver Road to Mundy Mill Road is the predominant traffic movement on this approach, as it is the continuation of SR 53. The transition from two lanes to four lanes begins within 100 feet of Mountain View Road and provides 500 foot of queue storage in the two left-turn lanes. The curb-side lane begins as a through lane for southbound traffic at Mountain View Road but becomes a right-turn lane drop at Mundy Mill Road. The designation of this lane as a right-turn lane begins at the same location as the beginning of the left-turn lanes. This lane configuration requires through traffic departing the Mountain View Road intersection and intending to continue south on McEver Road to change lanes to the left, merging with traffic in the median-side lane that is also continuing to travel south on McEver Road. This lane-shift and merging operation occurs simultaneously while traffic is shifting to enter the double left-turn lanes. These complicated interacting lane changes occur over a short distance and contribute to congestion and safety concerns.

Exhibit 4-19: McEver Road at Mundy Mill Road Study Site

Traffic counts and video recording conducted in March 2018 were used to identify the lane utilization and lane-shifting patterns of the southbound traffic on McEver Road between Mountain View Road and Mundy Mill Road. These volumes are shown on Exhibit 4-.

Exhibit 4-20: McEver Road Southbound Traffic Volumes



As shown on Exhibit 4-, the volume of right-turn traffic is nominal in both peak hours, and most of the curbside traffic (lane 2) is required to make a lane change to continue southbound. This traffic accounts for about 50% of the total southbound through traffic in the AM peak hour and 35% in the PM peak hour, merging with the southbound through traffic that originates in the median-side lane (lane 1). There were also some instances where traffic shifted across two lanes to access the left-turn lane from the curbside lane (8 in the AM and 7 in the PM).

A review of the crash data compiled for this study does not show a significant pattern of crashes associated with the lane shift pattern. Most of the crashes (14 of 21) at the intersection were rear end, six of which were in the southbound direction. There were two sideswipe crashes in the southbound direction. This data indicates that, although the lane shift requirements of the geometry are complex and occurs over a short distance, these conditions have not resulted in a significant safety deficiency.

Traffic operations analysis shows that the intersection generally operates at LOS C during the AM and PM peak hours, although the SB and WB left-turn movements have higher levels of delay and operate at

LOS E. These delays are in part associated with the cycle length of the traffic signal operations and the atypical pattern of the predominant traffic movements (SB Left-turn and WB right-turn) because of the 90^{o} change in direction of SR 53.

Options were explored for improvements to simplify the lane assignment and to reduce the need for lane shift/merging operations. One option considered is to widen McEver Road through the intersection with Mundy Mill Road to allow the curbside lane to be designated as a shared through/left-turn lane and for the lane drop to a single southbound lane to occur south of the intersection. This option was determined to be not feasible due to the large embankment along the west side of the McEver Road, and the impacts to development around the intersection.

Another option that could be pursued would be primarily a restriping and signing project to realign the lane assignments to encourage all southbound through traffic to use the curbside lane. This concept is shown on Exhibit 4-. This concept would also involve signing changes on SR 53 north of Mountain View Road to provide advance directional guidance for SR 53 and McEver Road.

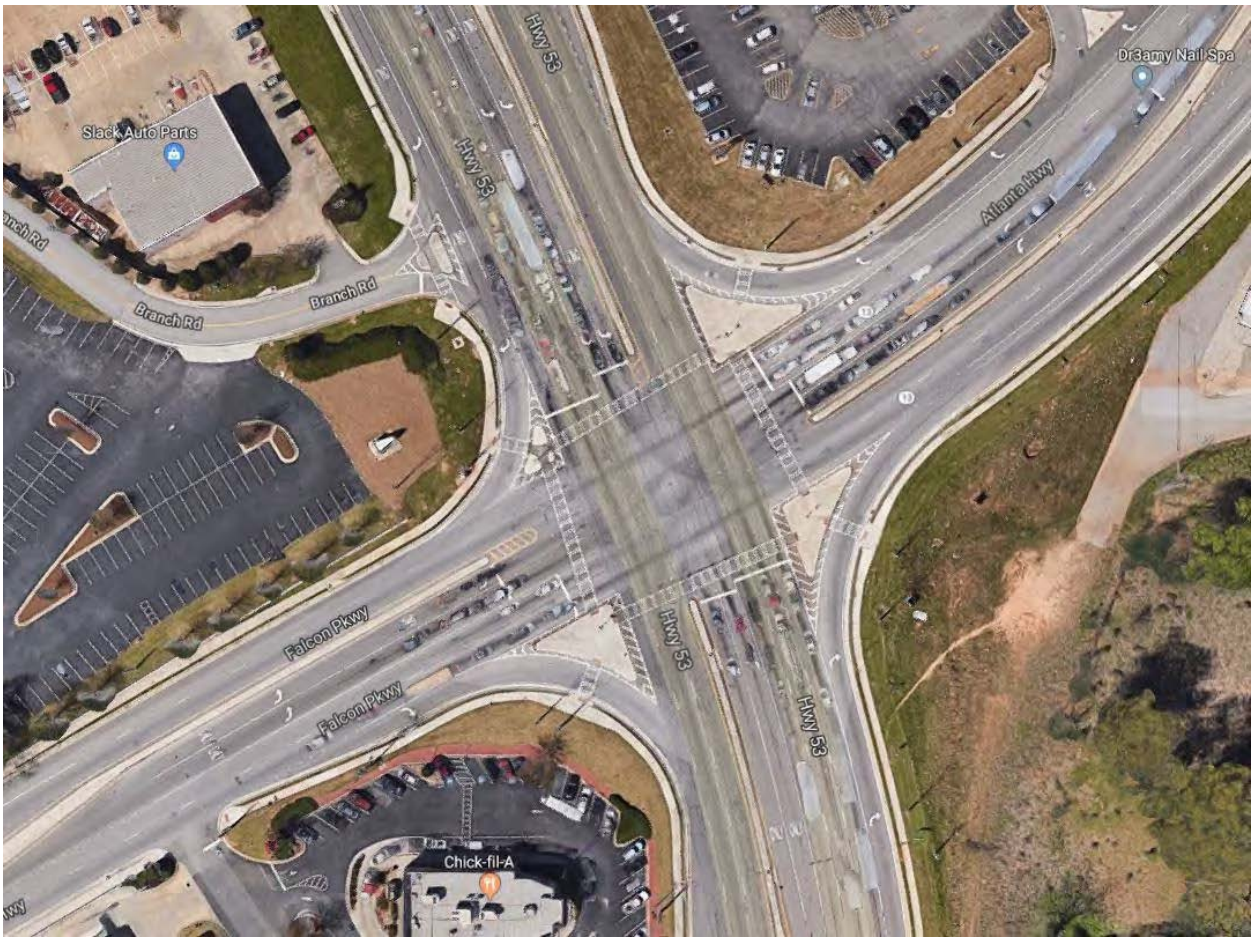
Exhibit 4-21: McEver Road Improvement Concept

4-4.6 SR 13 (Atlanta Highway) & SR 53 (Mundy Mill Road)

Analysis of traffic operations at this intersection show that the overall level of service is LOS D during both the AM and PM peak hours, but many lane groups operate at LOS F. A contributing factor for these operations is the long cycle lengths used to optimize overall operations. Volume-to-capacity (v/c) ratios show that capacity utilization is generally below 80% for all lane groups. There is some additional minor congestion evident along SR 13 associated with the interaction of traffic moving between this intersection and the nearby signalized intersection of SR 13 and Poplar Springs Road, but this congestion is intermittent and does not significantly affect overall mobility.

There is a right-in/right-out access to Chick-fil-A Restaurant located about 150 feet downstream of the right-turn slip ramp from SR 13 (northbound) to SR 53 (eastbound). Observations of traffic operations from 6 am to 9 am showed that there were several periods when traffic accessing the Chick-fil-A backed up onto SR 53. There were eight recorded intervals of varying durations (ranging from 1minute to 6 minutes) where this queue spilled back to the SR 13 right-turn ramp, impeding and in some instances blocking the right-turn movement from SR 13. This queue condition increases traffic delays and creates a safety risk because of the lane-change behavior to by-pass the lane blockage. There were no occurrences of this backup during the observed afternoon study period from 3 pm to 6 pm.

Exhibit 4-22: SR 13 and SR 53 Study Site



There were 47 recorded crashes at the intersection over 3 years. Almost 90% (42) of these were rear-end, and half of these occurred on the southbound approach of SR 13. Although the Chick-fil-A driveway operations noted above presents an increased safety risk at the intersection, the accident records do not show a concentration of crashes attributable to these conditions. However, it is recommended that these conditions continue to be monitored. A potential long-term strategy would be to close the right-in/right-out Chick-fil-A access to SR 53 and direct traffic to use the available right-in/right-out access located another 250 feet along SR 53. This change in access would involve modifications of parking and on-site traffic circulation of the Chick-fil-A site.

The two southbound lanes on SR 13 departing the intersection becomes a right-turn lane drop, requiring through traffic to merge into a single lane. GDOT's recommended standard is to provide at least 1,000 feet to accommodate this merge operation. The existing configuration only provides 300 feet before the curbside lane becomes a dedicated right-turn lane.

Christ Place Church is developing plans to construct a northbound left-turn lane to access their parking lots located on the north side of SR 13, west of the SR 13/SR 53 intersection. GDOT is also currently working with area developers and land owners to develop an access concept to accommodate proposed development activities and to address the long-term access management issues.

A recommended interim strategy is to change the pavement striping and signing along SR 13 to designate the curbside lane as a shared lane for through and right-turn traffic to provide the 1,000 foot transition distance for traffic merging operations.

4-4.7 SR 13 (Atlanta Highway) & Thurmon Tanner Parkway/I-985 Interchange 17 southbound ramps

Overall traffic operations at this intersection are LOS D during the AM peak hour and LOS E during the PM peak hour. Many of the individual lane groups at the intersection have LOS E or F operations. Vehicle queues on the I-985 exit ramp have been observed to extend back to the interstate mainline. GDOT is currently investigating the congestion issues at this location. One of the options being considered is to widen the ramp approach to add another lane for through traffic. The improvement concepts developed for the intersection should consider that lane utilization of traffic on Thurmon Tanner Parkway departing the intersection is not evenly distributed. Only about 20-25% of peak hour traffic uses the left lane because of the primary traffic destination of the UNG Campus.

Exhibit 4-23: SR 13 and Thurmon Tanner Parkway/I-985 Southbound Ramps Study Site

A total of 90 crashes were reported at or near the intersection over the 3-year period. Eighty-five percent of all the crashes at this location occurred during daylight hours. The record data identified that 49 incidents occurred at the intersection, 29 as non-intersection, and the remaining 12 incidents were either off-road, on-shoulder or along the ramps. Many of the reported non-intersection crashes had characteristics which suggest that they may in fact have occurred within the functional area of the intersection (based on review of the reported accident type, vehicle maneuvers, travel direction, traffic control and/or coordinate locations). Based on this review, it is estimated that a total of 63 crashes occurred within the functional area of the intersection. Most of the intersection crashes were rear-end, accounting for approximately 75% of the crashes (47), and 17 of these involved rear-ends of right-turn vehicles. The distribution of rear end crashes by direction are as follows:

Roadway	Approach Direction	Number of Rear-end Crashes (Straight)	Number of Rear-end Crashes (Right-turn)
SR 13	Northbound Southbound	8 5	1 5
Thurmon Tanner Parkway	Eastbound	8	11
I-985 Southbound Exit Ramp	Westbound	10	0

The crash record data provides only limited information about the factors contributing to these crashes. Potential factors that may contribute to rear-end crash types typically include unexpected geometry/lane changes, restricted sight distance, congestion/unexpected stops, aggressive driving, and distracted driving. GDOT's study to identify improvement concepts to reduce congestion can contribute to a reduction in the frequency of rear-end type crashes because of improved traffic flow. Modification of the right-turn slip ramps designs may also be considered to improve driver sight lines of oncoming traffic.

Four of the intersection crashes involved vehicles turning left from SR 13 onto Thurmon Tanner Parkway or the I-985 Southbound Ramp. This frequency of crashes is below the threshold criteria for considering protected-only left-turn phasing per GDOT's phasing policy[5]. It is concluded that the current protected/permitted phasing is appropriate, and no change to the signal phasing is recommended at this time.

4-4.8 McEver Road & Flat Creek Road

Hall County developed preliminary plans for reconstruction of this intersection. These plans included capacity enhancements to provide left-turn lanes on all approaches, right-turn slip lanes on Flat Creek Road, and traffic signal control improvements with protected/permitted phasing for McEver Road left-turns. The improvements also included access management features to reconfigure the driveway accesses to adjacent commercial properties. These improvements were not advanced to final design and have not been constructed. The focus of the evaluation for this study is to evaluate the need/benefit of these or other improvements to address current traffic and safety conditions at this intersection.

Exhibit 4-24: McEver Road and Flat Creek Road Study Site

[5] *GDOT Policy 6785-2 – Left Turn Phasing*, GDOT Office of Traffic Operations, 2017

Per GDOT Design Policy Manual, left-turn lanes are beneficial when turn volumes are significant. Capacity analysis is typically the governing basis for establishing the need and benefit of turn lanes. HCM guidance for providing a left-turn lane at signalized intersections is when left-turn volumes exceed 100 vph and/or when a protected left-turn phase is needed for operations.

Traffic counts at the intersection show that the volumes of turn movements are low (30 vph or less) except for the WB left-turn from Flat Creek onto McEver (97 AM; 72 PM) and the NB right-turn movement (102 AM; 88 PM), which is made from an exclusive right-turn Lane.

The overall intersection operations are LOS B during both peak hours, indicating good levels of mobility. The signal timings are programmed to provide longer green time for traffic movement on McEver Road since this roadway has a higher functional priority. Operations are LOS B on McEver Road and LOS C on Flat Creek Road. These analyses do not indicate a congestion issue related to the current shared left-through lane geometry. Video of the AM peak hour conditions was reviewed to confirm the operations associated with the left-turns from the shared lanes. This review showed that there were occasions where the NB/SB vehicle queues were not fully-served in the phase when vehicles arrived, but this was not a persistent recurring congestion issue and these queue conditions were not typically caused by delay from left-turn vehicles; so providing NB/SB left-turn lanes on McEver Road would not significantly improve operations.

WB left-turn movements on Flat Creek Road were observed to produce a residual queue due to left-turn impedance in approximately 25% of the cycles during the peak hour (14 cycles), where the queues that formed during the red period were not completely serviced during the green phase. However, in all these cases, the residual queues were serviced in the following green phase along with all of the new arrivals. This level of peak hour congestion/delay is not significant and is not indicative of a capacity deficiency at the intersection.

The capacity analysis shows that LOS is consistent with typical design objectives (LOS C or better) with the existing signal phasing and timing, and that there is not a need to provide protected left-turn phases. Although the WB left-turn volume on Flat Creek Road is near the volume threshold to consider providing a separate lane, the analysis of existing operations shows that the lane is not needed and would provide only limited benefit.

There were 5 crashes at the intersection over 3 years: one was an EB/WB crash involving a left-turn vehicle and opposing through vehicle. The other crashes were rear end and involved traffic traveling straight. This data does not indicate a need/benefit of providing left-turn lanes or other geometric improvements for safety reasons.

4-4.9 McEver Road & Old Flowery Branch Road/Stephens Road

The focus of study at this intersection was to evaluate the need/benefit of geometric and/or traffic signal improvements to address operations or safety issues.

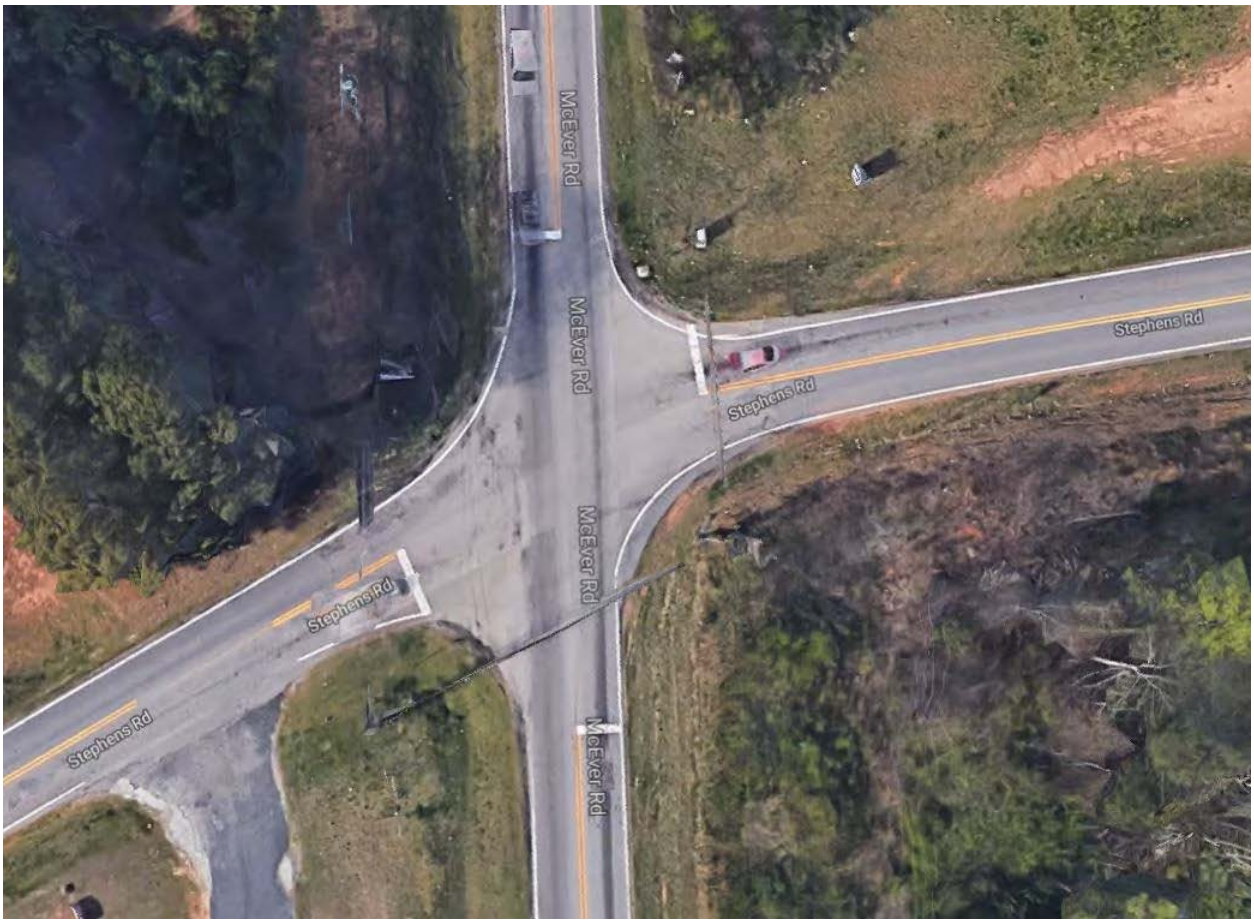
The traffic volumes at this intersection show low volumes of left-turn turning traffic from McEver Road (15 vph or less). These volumes do not require consideration for providing left-turn lanes. The left-turn traffic volumes on Stephens Road and Old Flowery Branch Road are 85 vph EB and 95 vph WB in the AM peak hour. In the PM peak hour the left-turn volumes are 50 vph EB and 85 vph WB. The volumes of

through traffic that oppose these left-turns are typically low (115 vph or less) so that there is not significant delay associated with these conditions.

The overall intersection operations are LOS B during both peak hours, indicating good levels of mobility. The signal timings are programmed to provide longer green time for traffic movement on McEver Road since this roadway has a higher functional priority. Operations are LOS B on McEver Road, and LOS C on Stephens Road and Old Flowery Branch Road.

The capacity analysis shows that LOS is consistent with typical design objectives (LOS C or better) with the existing signal phasing and timing, and that there is not a need to provide protected left-turn phases.

Exhibit 4-25: McEver Road and Old Flowery Branch Road/Stephens Road Study Site



There were 12 crashes at the intersection over 3 years. One of these was an EB/WB crash involving a left-turn vehicle and opposing through vehicle. Four were rear-end crashes and involved traffic traveling straight. There are no patterns or clusters of crashes at this location indicating a need/benefit of providing left-turn lanes or other geometric improvements for safety reasons.

4-4.10 H.F. Reed Industrial Parkway & Aloha Way

Traffic volumes were evaluated using the methodologies of NCHRP Report 457[6] to identify the need/benefit of providing left-turn lanes on H.F. Reed at Aloha Way. These analyses considered the traffic volume patterns, turning patterns and vehicle classification characteristics. These evaluations were performed using current existing data, and do no reflect future conditions that may be different as a result of the completion of the H.F. Reed Industrial Parkway at I-985 New Interchange.

Traffic operations analysis shows that the LOS for the Stop-controlled approaches are LOS A-B, with average delay of less than 15 seconds per vehicle. This study site is located in a light-industrial/ manufacturing zone. The traffic count data shows that trucks volumes during the AM and PM peak hours are low, and account for about 2% of the volume on HF Reed Industrial Parkway during these peak times. The truck volume turning left from HF Reed Industrial Parkway onto Aloha Way are also low during peak hours: AM: 4 single-unit trucks in the AM peak hour and 1 tractor-trailer in the PM peak hour. However, the truck percentage over the entire 6-hour data collection program shows that trucks comprise about 15% of the total volume of left-turns

The left-turn warrant analysis for providing a left-turn lane on HF Reed Industrial Parkway applied the criteria in NCHRP Report 457 for two scenarios: using the standard calibration factors for typical traffic conditions and also with adjustment of these factors to reflect the higher overall percentage of trucks during the day. The calibration factor adjustments were based on data published in NCHRP Report 505[7].

The results of these analyses are provided in Appendix E and show that the criteria for providing a left-turn lane on HF Reed Industrial Parkway at Aloha Way are not satisfied under either scenario for either peak hour.

A review of the crash data shows that there was only one crash at the intersection in 3 years, which was an angle crash where the driver on Aloha Way failed to yield to the vehicle traveling straight (eastbound) on HF Reed Industrial Parkway.

This review of traffic operations, crash history and warranting criteria indicates that left-turn lanes are not required at this time on HF Reed Industrial Parkway at this intersection.

Further considerations of any improvements to this intersection factoring in the potential effects of the new interchange at I-985 should be investigated as they facilitate the need to construct left turn lanes and evaluate intersection control. A conceptual layout and construction cost estimate was prepared for possible future installation of left turn lanes constructed to GDOT minimum design standards for a 45 MPH road.

Conceptual improvements include: Construction of left turn lanes on H.F. Reed Industrial Parkway and M. Stringer Road symmetric to the existing roadway using 250 ft, long storage lengths with 100 ft. tapers; reconstruction all intersection right turn radii to accommodate the WB-50 truck; and reconstruct existing curb and gutter with sidewalk. This construction will require the acquisition of additional rights of way, grading, new pavements, milling, expansion of and modification to drainage structures, new guardrail, and new roadway striping and signing. Construction of the improvements will be done along existing horizontal and vertical alignments and should not extend to the east on H.F. Reed Industrial

[6] NCHRP Report 457 Evaluating Intersection Improvements: An Engineering Study Guide; Transportation Research Board, 2001
[7] NCHRP Report 505 Review of Truck Characteristics as Factors in Roadway Design, Transportation Research Board, 2003 (pg 49-52)

Parkway as to impact the existing bridge over Norfolk Southern Railroad. Numerous utilities were documented within the likely project footprint. It is anticipated that both the overhead and subsurface utilities will require relocation and or modification to resolve impacts associated with the project. There were no clear signs of environmental resources in the likely construction zone.

- Estimated Construction Costs: $ 550,000 to $600,000

Exhibit 4-26: H.F. Reed Industrial Parkway @ Aloha Way / M. Stringer Rd Concept


ALOHA WAY AT
HF REED IND PKWY
LEGEND
CONSTRUCTION LIMITS
PROPOSED PAVEMENT
SIDEWALK
REVD RIGHT-OF-WAY
EXISTING PROPERTY/ROW
PROJECTED PROPOSED WHEEL PATH
PROJECTED EXISTING WHEEL PATH
PROJECT LOCATION
CITY OF OAKWOOD

4-4.11 Chamblee Road Railroad Crossing

The existing at-grade highway-railroad crossing on Chamblee Road was evaluated for conformance with recommended traffic control standards and safety improvements. This evaluation was based on the recommended best practices of the FHWA Railroad-Highway Grade Crossing Handbook, AREMA and NS Railway requirements and the Manual of Uniform Traffic Control Devices.

The following recommendations have been identified based on a field review of the existing conditions.

SIGNING

- **W10-1 Advanced Warning Sign – 36" Diameter**
  - 2 Locations – minimum of 175' on each approach along Chamblee Road
- **W10-4 Grade Crossing and Intersection Advanced Warning Sign – 36" x 36"**
  - 1 Location – on W. White Road approximately 100' back from the stop bar

STRIPING

- **RR Symbol Marking**
  - 2 Locations – placed with the W10-1 signs along Chamblee Road
- **Stop Bar**
  - 2 Locations – placed across travel way a minimum of 8' back from existing Signal Mast
- **Center Line Striping**
  - 1 Location – Placed from end of RR symbol to end of RR symbol

BRUSH CUTTING

- Thinning & Trimming of trees and brush as needed near the crossing within the ROW to improve sight distance

❖ Estimated Construction Costs (Minimum Recommendations): $ 25,000 to $30,000

ADDITIONAL RECOMMENDED SAFETY UPGRADES TO CONSIDER

- Repave and regrade the roadway approaches at the grade crossing
- Schedule a rail diagnostic meeting to consider additional modifications at the grade crossing
  - Replace the existing Railroad Crossbuck Signs on Signal Mast (R15-1) – 9" x 48"
  - Replace existing LED Lights on the Signal Mast with new 12" LED Lights
  - Upgrade existing asphalt crossing surface with a Precast Concrete surface

Section 5: Summary

The Citywide Traffic Improvement Study identifies a range of improvements to address traffic operations and safety issues at various locations within the City of Oakwood, GA.

These improvements include geometric and traffic control improvements. The following is a summary of the identified improvements:

SR 53 & Oakwood Rd/Frontage Road: no geometric or traffic control changes

SR 53 & Thurmon Tanner Parkway: no geometric or signal phasing changes at this time; continue monitoring

SR 53 & UNG Loop Road: construct RCUT access to allow left-turn access to the UNG Campus from SR 53. Coordinate with GDOT regarding the availability of Quick Response Funds to construct the project.

SR 53 & Millside Parkway: traffic signal warrants not met at this time, but may be met within 1 year if prevailing growth pattern continues

SR 53 & McEver Road: signing and striping improvements to better organize traffic flow on southbound approach. Coordination with GDOT in the development of a more detailed concept.

SR 13 & Thurmon Tanner Parkway/I-985 Southbound Ramps: no changes to left-turn signal phasing; Support GDOT effort to address capacity enhancement; Modify right-turn slip ramp geometry to improve sight-lines

SR 13 & SR 53: modify signing and striping on southbound departure lanes to convert right-turn only lane to shared through/right-turn to maintain a 1,000-ft. transition lane for traffic merge; Monitor congestion at Chick-fil-A access and coordinate with GDT for potential access closure

McEver Road & Flat Creek Road: no changes recommended at this time.

McEver Road and Stephens Road/Old Flowery Branch Road: no changes recommended at this time.

HF Reed Industrial Parkway and Aloha Way: no changes recommended at this time. Monitoring of H.F. Reed Industrial Parkway traffic and congestion at this site as the I-985 Interchange opens and traffic patterns adjust.

Chamblee Road RR Crossing: signing/striping improvements and Right of Way clearing as recommended; Long term crossing upgrade (roadway regrading and paving)

Thurmon Tanner Parkway at Sam's Club Left Turn RCUT: the recommendation is to construct the project as proposed. Consideration of combining this project with the other projects requiring geometric improvements if funding is not provided by private sources.

Main St. at Flat Creek and Old Oakwood Roads Roundabout: the recommendation is to not construct the roundabout because conditions do not warrant it. Investigations of the intersection should be revisited as growth and development of the surrounding area change to create greater traffic and congestion.

McClure Drive Extension: the recommendation for this project is to proceed ahead as shown in the concept report as a stand-alone project. Because of the anticipated displacement and demolition of the residential complex within the project alignment, it is recommended that the City conduct separate environmental investigations of the structures to verify that no toxic materials such as lead based paint or asbestos exists. Any abatement and demolition efforts to remove the structure would be done separate of the design and roadway construction efforts. The project itself is simple and should progress quickly once land surveys and environmental screenings are completed. It is not anticipated that there will be any environmental issues.

Intersections with Simple Geometric Issues: the recommendation is to construct the intersections as noted in the concepts. It is advised to combine as many of the intersections together as possible in both design efforts and when letting to construction to get the maximum cost savings when compared to addressing each site individually.