Access Management Manual

September 2022

ALABAMA DEPARTMENT OF TRANSPORTATION

ALABAMA DEPARTMENT OF TRANSPORTATION

ACCESS MANAGEMENT MANUAL

SEPTEMBER 2022

Prepared by:

Sain Associates, Inc.
Skipper Consulting, Inc.

Editors:

Jim Meads, P.E.
Darrell Skipper, P.E.
Jeff Stephenson, P.E., P.T.O.E.
Charles Cochran, P.E., P.T.O.E.

Technical steering committee:

Bryan Orange, P.E.
Eric Bertolotti, P.E.
Andrew Harry, P.E.
Kerry NeSmith, P.E.
Steve Walker, P.E.
Johnny Johnson
Matt Johnson, P.E.
Stuart Manson, P.E.
Taylor Stoudenmire, P.E.
Robert Prescott
Angela Lambert, P.E.
Stephen Blair
Brian Aaron, P.E.
Ken Cush, P.E.
Scott Moseley
Philip Shamburger

CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

1 Introduction

1.1 Purpose

The purpose of the Alabama Department of Transportation (ALDOT) *Access Management Manual* is to set out guidelines for managing access to and from state roads and highways.

Goals of access management include:

- protecting the health, safety, and welfare of the public
- maintaining the highway rights-of-way
- preserving the functional level of state roads and highways while meeting the needs of the motoring public

1.2 Authority

This *Access Management Manual* is authorized by § 23-1-40 of the Code of Alabama 1975. The access management guidelines contained in this Manual are applicable to all classes of state highways.

Local agencies (municipalities, counties, etc.) that handle access permitting for non-state roadways within their jurisdiction are encouraged to develop their own access management guidelines. They can also adopt the guidelines contained in this Manual. Since local jurisdictions have authority to implement subdivision and zoning regulations, local agencies also can apply a host of access management techniques: shared access, cross access, lot width requirements, driveway throat length, internal street circulation, and general thoroughfare planning. It is through a cooperative relationship between ALDOT and local agencies that the safety and operational benefits of access management can be fully realized on all roads in Alabama.

1.3 Limitations

The materials in this Manual are current at the time of publishing. ALDOT will update this Manual as needed to reflect changing practices and new design guidelines. It is the responsibility of the applicant to check the ALDOT website periodically for updates to this Manual. ALDOT recommends that the designer check for updates prior to each new permit application.

1.4 Organization

The organization of the ALDOT *Access Management Manual* is described in the following text.

Chapter 1 introduces the Manual.

Chapter 2 is a general discussion of the principles of access management. It describes the concepts on which access management is based and presents benefits of proper access management.

Chapter 3 describes the current ALDOT requirements for a traffic impact study.

Chapter 4 presents the ALDOT access design guidelines.

1.5 Definitions, Abbreviations and Acronyms

For the purposes of this Manual, the following definitions will apply:

1. AASHTO: American Association of State Highway and Transportation Officials.

2. Acceleration Lane: a speed-change lane, including tapered area, to enable a vehicle entering the traffic stream to accelerate to a speed where it can merge with traffic safely.

3. Access Connection: any driveway, approach, connecting street, road, or highway that connects to a state highway.

4. Access Point: the location of the intersection of a highway, street, road, driveway, or approach with a state highway.

5. ADT: the two-way average traffic volume counted over a period, two days or greater, but less than one year, and divided by the number of days that traffic was counted.

6. ALDOT: Alabama Department of Transportation.

7. Applicant: entity requesting the permit.

8. Area: one of ten (10) divisions of the Department comprised of three to six Districts.

9. Auxiliary Lane: the portion of the roadway adjoining the traveled way for speed change, turning, weaving, truck climbing, maneuvering of entering and leaving traffic, and other purposes supplementary to through-traffic movement.

10. Connection: the intersection of a public roadway and a private driveway or other public roadway.

11. Corner Clearance: the distance between an intersection and the nearest unsignalized access connection.

12. Curb Line: the line, whether curbing exists or not, that is the outer edge of the paved portion of a highway.

13. Deceleration Lane: a speed-change lane, including the tapered areas, that allows vehicles exiting the through traffic lanes to slow or stop before turning from the highway.

14. District: One of forty-one (41) local offices representing the Departmental interests within one- to three-county divisions.

15. District Administrator: senior Departmental officer of a District.

16. Divided Highway: a highway with opposing traffic movements physically separated by medians, concrete barrier rails, raised traffic islands, or pavement markings. Due to conflicting traffic movements a two way left turn lane does not establish a divided highway.

17. Driveway (also referred to as a Turnout): an access point to a public road from a private, publicly owned, and/or commercial facility.

18. Frontage Road (also referred to as a Service Road): any public street or road providing service and access from areas adjacent to a freeway or highway.

19. Functional Classification: a classification system that identifies a public roadway according to its purpose and hierarchy in the local or statewide highway system.

20. Highway: entire width between the boundary lines of every way publicly maintained when any part thereof is open to the use of the public for purposes of vehicular travel.

21. Horizon Year: future year in which traffic generated by a proposed development is projected to impact traffic operations on adjacent roads. Refers to the timeframe for projection of future traffic conditions to be analyzed as part of a traffic impact study.

22. Interchange: a facility where grade separates intersecting roadways and provides directional ramps for movements between the roadways. The grade separation structure and ramps are part of the interchange.

23. ITE: Institute of Transportation Engineers.

24. Intersection: the location where two or more roadways meet at grade.

25. Lane: the portion of a roadway for the movement of a single line of vehicles and which does not include the gutter or shoulder of the roadway.

26. Maintenance Bureau: final approval authority for all permits in the state except for those approved in the District or Region/Area.

27. Median: the portion of a highway separating opposing traffic flows except two way left turn lanes.

28. MPH: a rate of speed expressed in miles per hour.

29. MPO: Metropolitan Planning Organization.

30. MUTCD: Manual on Uniform Traffic Control Devices issued by the Federal Highway Administration (FHWA)

31. Permit: form submitted by the Applicant requesting to perform work on ALDOT right-of-way.

32. Professional Engineer: individual who has been granted a certificate of registration to practice an engineering discipline by the Alabama Board of Professional Engineers and Land Surveyors based on professional education and practical experience

33. Ramp: all types, arrangements, and sizes of turning roadways that connect two or more legs at an interchange. The geometry of the connecting road usually involves some curvature and a grade.

34. Region: one of five (5) divisions of the Department comprised of two Areas.

35. Region Engineer: senior Departmental officer of a Region.

36. Roadway: area between the outermost limits of the right-of-way.

37. Right-of-way or ROW: limits of property owned by ALDOT.

38. Signal Spacing: the distance (measured from center of intersection to center of intersection) between signalized intersections along a roadway.

39. Special and Standard Highway Drawings: collection of ALDOT standard plans for construction of structures within the ROW, most current edition.

40. Standard Specifications for Highway Construction: collection of ALDOT standard specifications for materials and procedures used within the right-of-way, most current edition.

41. State Highway: any road, street, or highway that is on the state highway system and to which a current state route number has been assigned.

42. Traveled Way: the portion of the highway available to the through movement of traffic. It does not include shoulders, sidewalks, gutters, medians, or auxiliary lanes.

43. Truck: every motor vehicle designed, used, or maintained primarily for the transportation of property. For specific vehicle configurations and dimensions for design purposes, refer to AASHTO's *A Policy on Geometric Design of Highways and Streets*.

1.6 Types of Permits Associated with Access Management

ALDOT issues three types of permits in conjunction with proposed development and access to state roads and highways. These are turnout permits, permits for median crossovers, and permits for installation of traffic signals.

1.6.1 Turnout Permits

Turnouts (also referred to as driveways) are access points to public roads from private, publicly owned, and commercial facilities. Since turnouts affect drainage and safety characteristics of the highway, a permit is required so that the location and construction methods are acceptable. A complete description of turnout permits and application procedures is provided in the ALDOT *Permit Manual*.

1.6.2 Median Crossover Permits

A complete description of median crossover permits and application procedures is provided in the ALDOT *Permit Manual*.

1.6.3 Traffic Signal Installation Permits

Traffic signals are to be installed only when justified by an engineering analysis to include the satisfaction of one or more traffic safety warrants and only after other reasonable alternatives have been considered. The satisfaction of a warrant does not imply that a traffic signal is required. A complete description of the traffic signal warrant procedure is provided in the ALDOT *Traffic Signal Timing and Design Manual*.

1.7 PERMIT REVIEW PROCESS

When a permit application is submitted to ALDOT for consideration, the review/approval process includes up to three levels of internal review within ALDOT. At each review level, the permit application is evaluated for, among other things, safety, proper traffic function, and adherence to ALDOT guidelines. A description of the permit review process can be found in the ALDOT *Permit Manual*.

1.8 EXCEPTIONS / VARIATIONS

For special circumstances where it is infeasible to meet the minimum access management criteria set out in the Manual, the applicant should submit a detailed description and explanation of variation to the Department. The statement should address the constraining site conditions to which the application applies. Proposed variations will be evaluated according to the following criteria (including but not limited to):

- Denial of the requested variations will result in loss of reasonable access to the site.
- The requested variations are reasonably necessary for the convenience and welfare of the public.
- All reasonable alternatives that meet access requirements have been evaluated and determined to be infeasible.
- Reasonable alternative access cannot be provided.
- The variations will not result in any violations of the pedestrian accessibility in accordance with relevant ALDOT-accepted guidelines.

The applicant must submit written justification for the requested variation including any associated traffic impact studies deemed applicable by the applicant or as required by the Department. Restrictions and conditions on the scope of the permit will be imposed as required to keep potential hazards to a minimum. The permit may contain specific terms and conditions providing for the expiration of the variation if in the future the grounds for the variation no longer exist.

1.9 DEPARTMENT CONTACTS

A list of Region, Area, and District contacts can be found in Appendix B.

2 PRINCIPLES OF ACCESS MANAGEMENT

2.1 ACCESS MANAGEMENT DEFINED

Access management involves balancing the two competing functions of roadways – providing mobility for through traffic and providing accessibility to property. The mobility function is defined as the provision of capacity for through traffic traveling along a roadway from point to point. The accessibility function of a roadway is defined as the provision of ingress and egress for adjacent property. The most basic example of the accessibility function is a driveway. A roadway can be very good at either of these functions, but it cannot perform both functions optimally at the same time. For example, a roadway lined with commercial driveways provides maximum access to adjacent businesses, but traffic entering and exiting these businesses creates congestion and driver frustration and significantly decreases the mobility function of the roadway.

In simple terms, access management is a tool that provides safe and efficient traffic mobility while allowing reasonable accessibility to adjacent property. The key concept behind good access management is the application of proper roadway design principles and traffic engineering practices. Application of these principles and practices results in carefully planning, designing, and operating roadways, access connections, and the interaction among them. For example:

- Drivers searching for the access connection to a particular destination may hesitate, become distracted, slow down, and/or make abrupt lane changes.
- Once the access connection is located, a poorly designed driveway (e.g., a small turning radius) may cause further uncertainty for drivers and cause them to turn from the main roadway at an excessively slow speed, creating delays and potentially unsafe conditions on the main roadway.
- Poor parking lot designs may require a car to wait for a preceding vehicle to park, creating a queue of vehicles that extends into the main roadway.

Drivers should be able to see their destinations early, easily maneuver their vehicles to the exit, and quickly and safely leave the roadway. Drivers making left turns also must wait for a gap in the opposing traffic flow. Once off the main roadway, vehicles should be able to move toward the center of the parking area to prevent backups. These and other driver-friendly elements can be provided through good roadway design, appropriate traffic control devices, and good access management practices.

2.2 FUNCTIONAL CLASSIFICATION

An important means of managing a roadway system is to maintain a clear understanding of how each roadway or individual segment of roadway is intended to function. This understanding is generally developed and maintained by having a functional classification system. ALDOT maintains a functional classification system with twelve types of roadways. Maps depicting the functional classification of Alabama's roadways can be found on the ALDOT website at the HFC Maps[1] page.

In addition to roadway type, ALDOT differentiates between urban and rural roadways to further classify the expected functionality of a given roadway. The twelve functional classifications used by ALDOT are listed Table 2-1.

[1] https://www.dot.state.al.us/maps/HFCMaps.html

Table 2-1: ALDOT Functional Classifications

Urban Roadways	Rural Roadways
Urban Interstate	Rural Interstate
Freeway	Rural Principal Arterial
Urban Principal Arterial	Rural Minor Arterials
Urban Minor Arterial	Rural Major Collector
Collector	Rural Minor Collector
Urban Local	Rural Local

Functional classification is important in the context of access management because of the expected speed ranges on different types of roadways and whether they are in urban or rural areas. As explained in Chapter 4, the operational differences between roadways with lower speeds and those with higher speeds affect access management criteria (e.g., driveway spacing, turn lane requirements). For this reason, it is important to understand what type of roadway is being considered for access, so the correct access requirements are used. Principal arterials, whether urban or rural, typically have higher speed limits. In some cases, it is reasonable to expect that rural minor arterials may also exhibit higher speeds. Urban minor arterials, collector roadways, and local roadways typically exhibit lower speeds. As such the access management criteria for lower speed ranges in Chapter 4 would be expected to apply. As always, engineering judgment and knowledge of local conditions should be considered by ALDOT on a case-by-case basis.

The overall speed on the roadway correlates to how the roadway is expected to function. Higher-speed roadways provide mobility between different areas, regions, cities, etc., whereas lower speed roadways are intended to provide access to adjacent roadside development (business, residencies, schools, etc.). The concepts of accessibility and mobility are described further in Section 2.3.

2.3 Accessibility vs. Mobility

Proper access management requires that a roadway be planned, designed, and operated to provide the balance of accessibility and mobility appropriate for its functional classification. Figure 2-1 shows the relationship between the provision of mobility and accessibility and the ALDOT functional classification system.

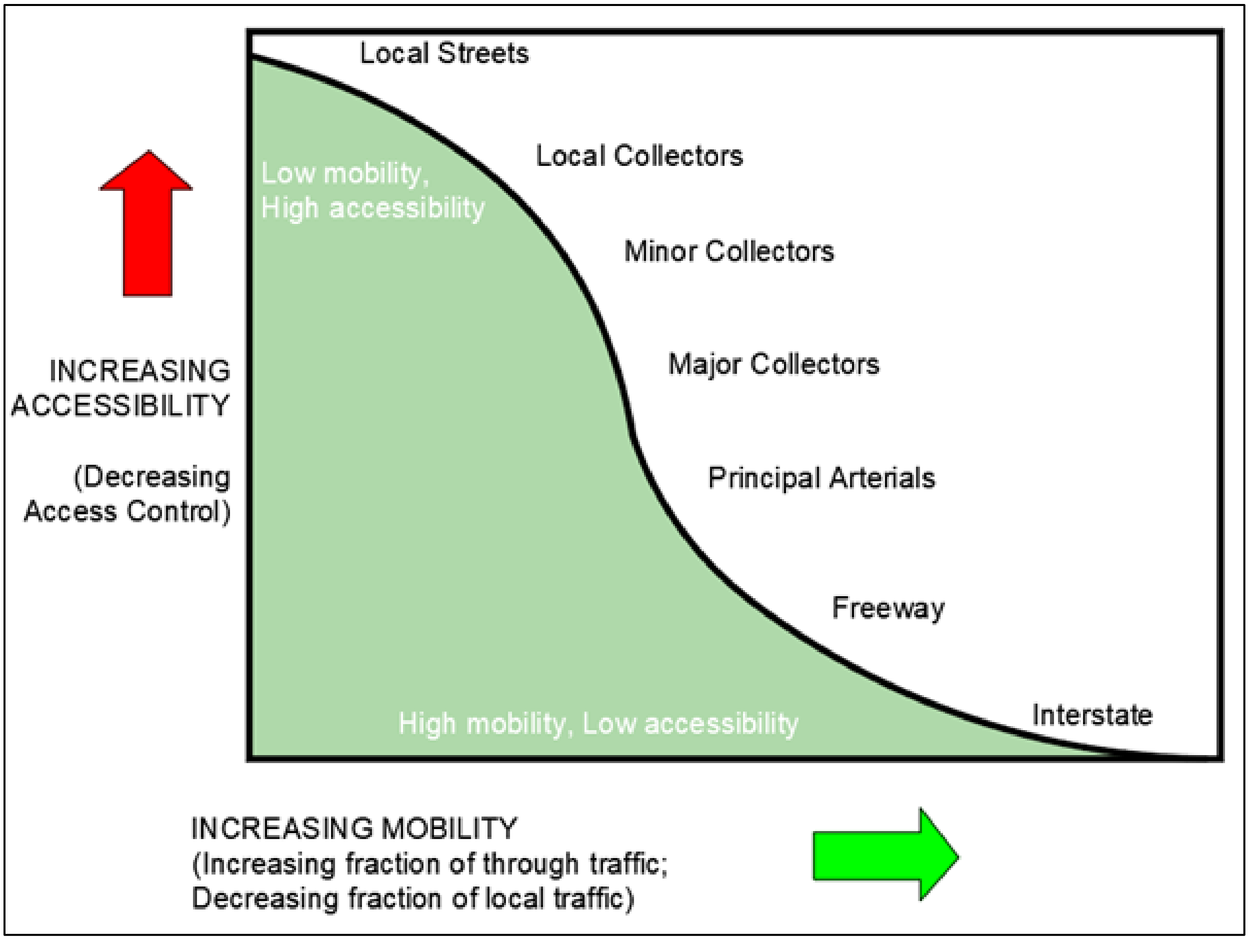


Figure 2-1: Relationship Between Accessibility/Mobility and ALDOT Functional Classification System

Allowing roadways to operate according to their functional classification increases efficiency and enhances safety for all roadway users.

2.4 Reasonable Access

Reasonable access is defined as access that is generally considered a matter of physical necessity for use of the property, not a matter of convenience or competitiveness in the marketplace. If alternate access locations and routes are available and do not significantly impair access to the property, the criteria for reasonable access are generally considered satisfied. Circuity of route and off-site turning movements en route to the site are not factors that should be used when determining reasonable access.

2.5 Safety Benefits of Access Management

In addition to increasing efficiency, proper access management increases safety for all roadway users. Numerous traffic engineering studies have shown that access management reduces conflicts and, therefore, crashes.

Access management makes it safer for the motoring public to enter and exit property adjacent to the roadway. Proper access management balances site access needs with the need to provide safe and efficient traffic operations for all roadway users by specifying acceptable spacing and combinations of access connections for a given property. Specific guidelines for design of proper access management in Alabama are presented in Chapter 4 of this Manual.

The increase in safety is attributable to the reduction of traffic conflicts resulting from properly managing access to and from a roadway. Traffic conflict points occur where vehicle paths cross, merge, or weave. Connections along roadways are where traffic conflict points occur. Traffic conflicts cause one or more drivers to take evasive action to avoid a collision. Crossing movements have the potential for high-speed impacts and are referred to as “major” conflicts.

Safety Benefits of Corridor Access Management:

5-23%

Reduction in total crashes along 2-lane rural roads

25-31%

Reduction in crashes along urban/suburban arterials

Source: FHWA

Different types of connections result in different levels of traffic conflicts. The number of conflict points is a function of the number of legs at an intersection and the number of allowed traffic movements. Three-legged intersections have 9 conflict points (Figure 2-2), while four-legged intersections have 32 conflict points (Figure 2-3) if all possible movements are allowed.

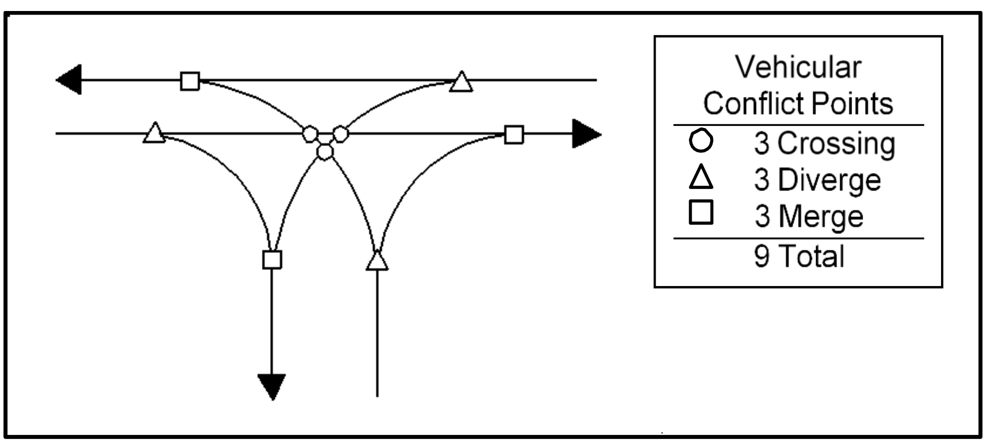


Figure 2-2: Traffic Conflicts at Three-legged Intersection

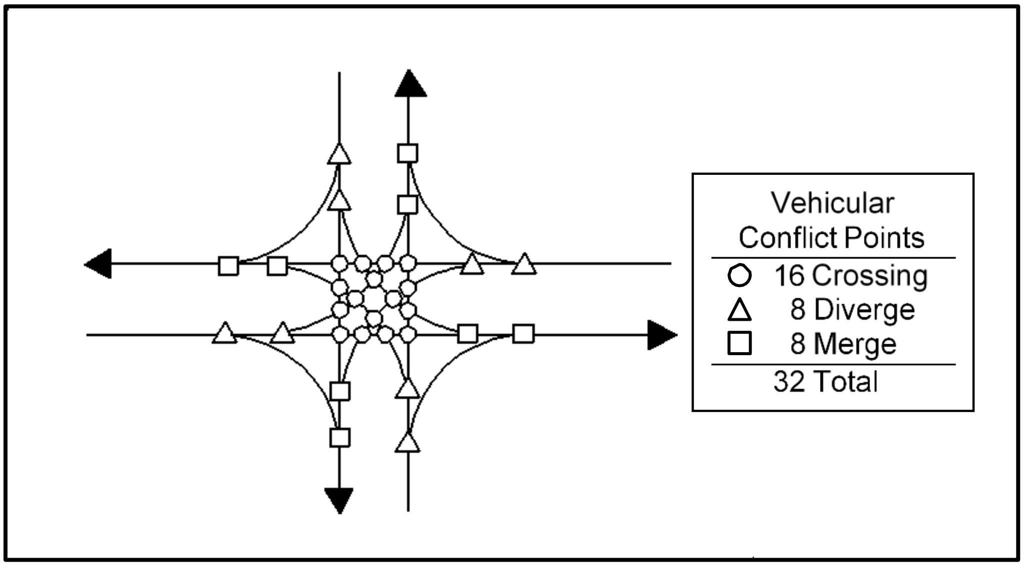


Figure 2-3: Traffic Conflicts at Four-legged Intersection

Access management increases safety by reducing the occurrence of traffic conflicts. As shown in Figure 2-2, a three-legged intersection exhibits 9 conflict points. Installing a non-traversable median at a driveway to prevent vehicles from turning left out of the driveway reduces the potential traffic conflicts to 5 as shown in Figure 2-4. Installing a non-traversable median to provide right-in/right-out (RIRO) access at a driveway reduces the potential traffic conflicts to 2 as shown in Figure 2-5.

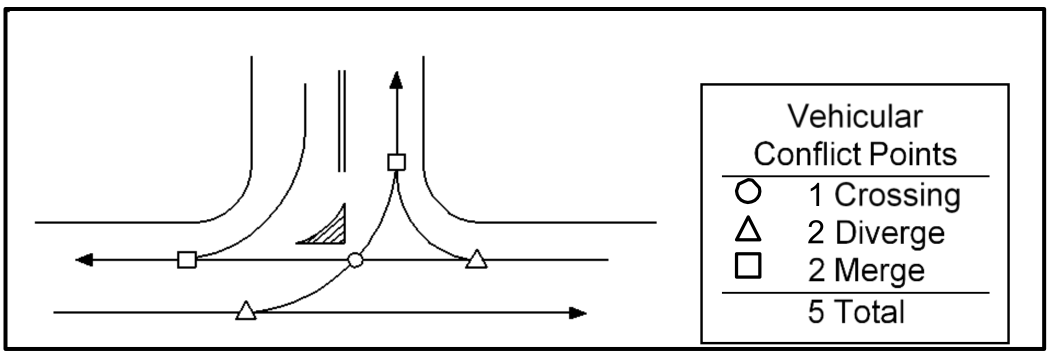


Figure 2-4: Traffic Conflicts at Three-legged Intersection with a Non-traversable Median

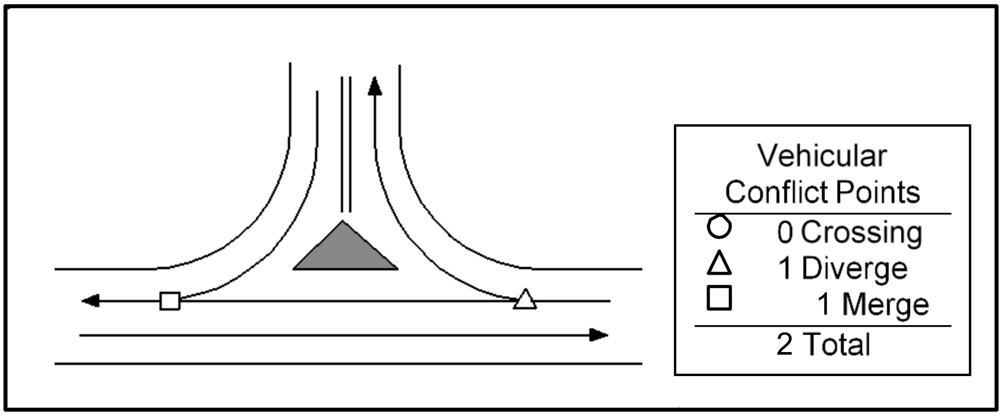


Figure 2-5: Traffic Conflicts at a RIRO Three-legged Intersection

In addition to the configuration of individual driveways, traffic conflicts are also affected by the location and spacing of access connections. It is well documented that closely spaced intersections and access connections increase the complexity of the driving task. When access connections are too closely spaced, drivers must navigate complex traffic situations where other vehicles may be entering or exiting the roadway to and from many directions at once. Reducing this level of complexity creates safer driving conditions for all roadway users. Proper access management can be used to reduce the complexity of driving by requiring:

- minimum spacing between successive access connections,
- minimum spacing between successive median openings,
- minimum spacing between access connections and adjacent intersections, and
- maximum number of access connections for a given length of property frontage.

2.6 Other Benefits of Access Management

In addition to increasing safety, access management has been shown to have the following positive effects:

- Roadway capacity and, therefore, useful life is preserved.
- Travel times and congestion are reduced.
- The need for new roadways and widening projects is reduced resulting in fewer work zones.
- Access to properties is improved.

It has been documented that good access management positively impacts the viability of commercial development and property values. These positive effects are derived from the fact that proper access management makes it easier for the motoring public to enter and exit property adjacent to the roadway.

2.7 Economic Impacts of Access Management

The economic impacts of applying access management principles to a roadway corridor are of concern to both the local business owners as well as the local governmental agencies. Many business owners become concerned when access to a roadway corridor is modified from existing configurations that have been in place prior to a roadway access management project. Economic studies have been completed in many different areas of the United States after the deployment of access management strategies, and the following are a few typical conclusions from those studies:

- Median projects have little overall adverse impact on business activity.[2]
- Most business types reported increases in the number of daily customers and gross sales.
- Destination businesses (grocery stores, restaurants, specialty retail) are less impacted by roadway corridor access management.[3]
- Business owners' perceptions of impacts related to the implementation of access management strategies tended to be more negative than the impacts actually turned out to be.[4]

ALDOT policies and procedures when developing a roadway project with access management include public information meetings to discuss the proposed changes with the public and business owners. This

---

[2] *Economic Impacts of Access Management, Center for Urban Transportation Research, University of South Florida, 2000.*

[3] *Economic Effects of Restricting Left Turns, National Cooperative Highway Research Program, Research Results Digest, No. 231, 1998*

is an opportunity for the public to see the proposed plan and provide input into the final development of access management related plans.

2.8 Access Management Strategies

2.8.1 Corridor Access Management Plans

Proactively developing a corridor access management plan is beneficial for coordinating land development and transportation decisions along ALDOT roadway segments. These plans help to guide roadway design and access permitting decisions. The development of a corridor access management plan should be a collaborative effort that could include ALDOT, local governments, MPOs, regional planning agencies, representatives of key local stakeholders and interest groups, and consultants.

2.8.2 Reconfiguration of Driveways

One of the most utilized access management techniques is the consolidation/reconfiguration of existing driveways along a roadway. In many locations existing driveways have been constructed in less-than-ideal locations. Existing driveways should be closely examined whenever an existing property redevelops or when ALDOT or a local agency plans a roadway project. There are many ways driveways can be addressed and the conditions vary by location. The following are strategies on how to address driveways along an existing roadway:

- Identify locations with two or more driveways and determine if there is the opportunity to close/remove the driveway.
- Identify adjacent land uses where driveways are spaced such that two driveways could be consolidated to one joint-use driveway.
- Identify locations where driveways cannot be closed, but traffic movements could be reduced. One such example would be the conversion of a full access to a limited access such as a right-in/right-out.
- Identify locations between land uses where cross-access could be provided off ALDOT right-of-way that would result in the reduction of a driveway and increased access for the properties.

Figure 2-6 shows a portion of a typical access management plan for an existing state highway.

Figure 2-6: Sample Access Management Plan Showing Reconfigured Driveways

In this approximately 900’ section along the roadway there were 15 full access driveways. The access management plan recommends driveway closures, reconfigurations, and consolidations resulting in only 5 driveways.

2.8.3 Installation of Medians

The installation of medians along multilane roadways represents one of the most effective access management strategies. The installation of medians along a roadway converts left turns from side streets to right turns and routes them to median openings in strategic locations where they can be accommodated as left turns or U-turns.

The safety benefits of median improvements have been the subject of numerous studies. Raised medians can be anticipated to reduce crashes by over 40 percent in urban areas and over 60 percent in rural areas. Raised medians also have been proven to enhance pedestrian safety by reducing pedestrian-involved crashes. ALDOT has applied this access management strategy in many locations across the state, which has resulted in improved traffic flow and reduced travel time and crashes. Figure 2-7 and Figure 2-8 illustrate the before and after conditions of a location in Alabama where ALDOT installed a median with signalized U-turns along an existing five-lane roadway.

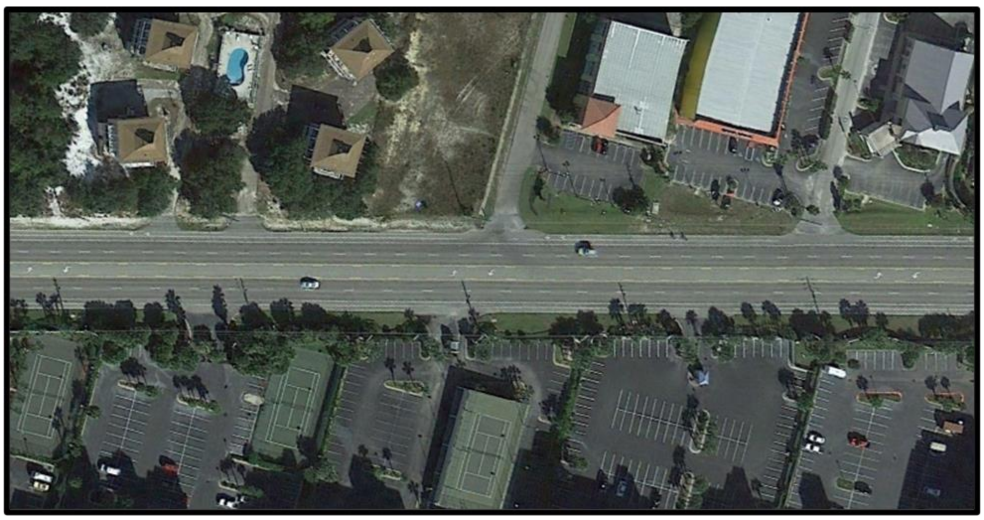


Figure 2-7: Alabama Highway 182 in Orange Beach, Alabama Before Access Management

Figure 2-8: Alabama Highway 182 in Orange Beach, Alabama After Access Management

2.8.4 Alternative Intersection Design

Today's traffic and safety problems are more complex and complicated than ever. Conventional intersection designs are sometimes found to be insufficient to mitigate traffic safety and congestion issues. Consequently, many engineers are investigating and implementing innovative treatments to improve mobility for roadway users. Alternative intersection and interchange designs may offer additional benefits compared to conventional at-grade intersections and grade-separated diamond interchanges.

ALDOT is currently developing an Intersection Control Evaluation (ICE) policy that will provide a data-driven, performance-based framework to screen intersection alternatives.

The following alternative intersection designs should be considered where traditional intersection designs cannot solve traffic congestion, safety, or access management issues.

2.8.4.1 Restricted Crossing U-turn

The restricted crossing U-turn (RCUT) intersection is also known as a superstreet intersection, a J-turn intersection, or synchronized street intersection. The RCUT intersection differs from a conventional intersection by eliminating the left turn and through movements from cross street approaches. To accommodate these movements, the RCUT intersection requires drivers to turn right onto the main road and then make a U-turn maneuver at a one-way median opening at least 400' after the intersection.

At the main street approaches, the left turns are typically accommodated similarly to left turns at conventional intersections. In some cases, such as rural unsignalized RCUT intersection designs, left turn movements from the main street could also be removed. RCUT intersections can have either three or four legs. In the case of a four-legged RCUT intersection, there are two U-turn crossovers, and minor street left turn and through movements are not allowed to be made directly at the intersection. There are two basic types of RCUT intersections considered for use in Alabama:

- Signalized – A signalized RCUT intersection can provide favorable progression along an urban or suburban corridor. RCUT intersection signals typically require only 2 phases, which can minimize the lost time at the intersection. Signalized RCUT intersections are able to accommodate pedestrians and adjacent access driveways.
- Stop-controlled – A stop-controlled RCUT intersection is sometimes used as a safety treatment at an isolated intersection on a four-lane divided arterial in a rural area. There are known safety benefits for this type of RCUT intersection. In some cases, a stop controlled RCUT intersection is later converted to a signalized RCUT intersection as traffic volumes increase.

Installing an RCUT intersection provides both traffic operational and safety benefits if applied to the appropriate location. Figure 2-9 illustrates a typical RCUT intersection and Figure 2-10 illustrates the crossing movement paths.

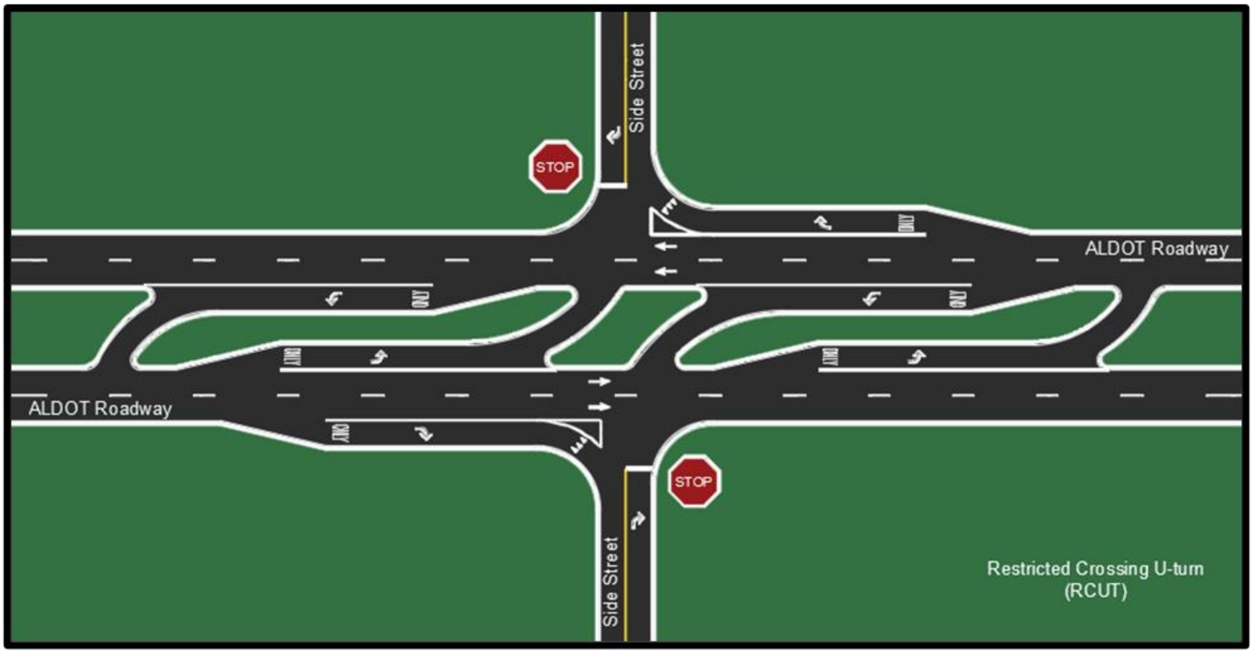


Figure 2-9: Sample Restricted Crossing U-turn Intersection (RCUT)

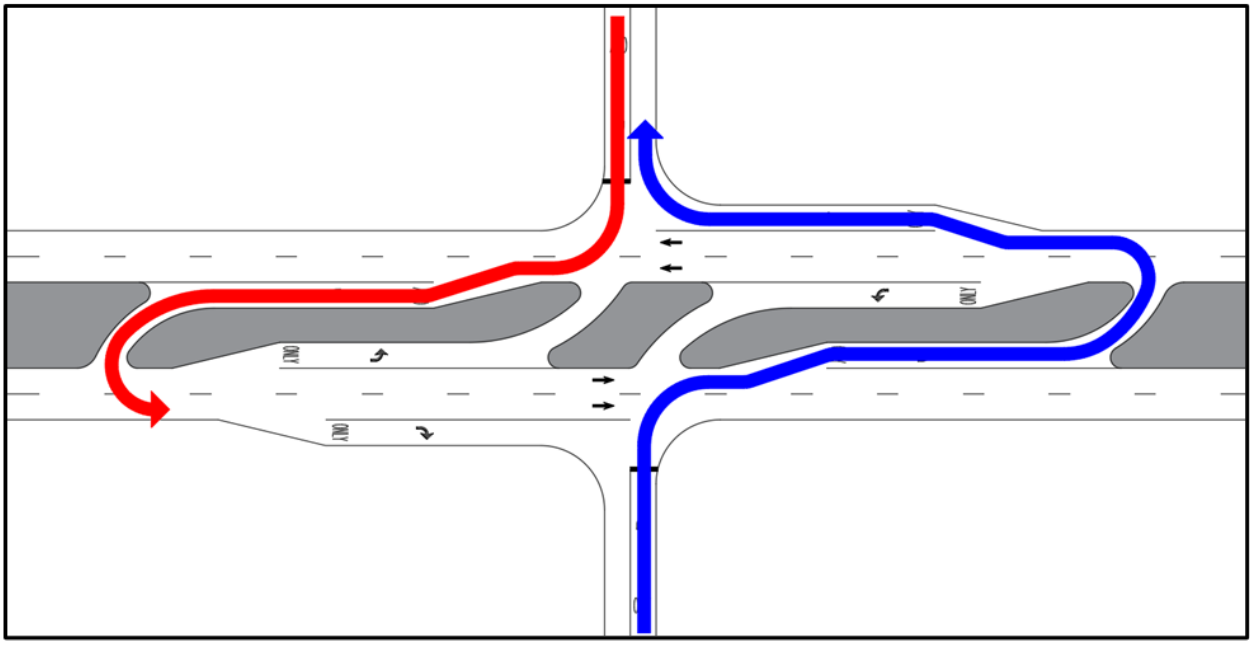


Figure 2-10: Cross Traffic Movements at a Restricted Crossing U-turn Intersection (RCUT)

2.8.4.2 Continuous Green T-Intersection

The continuous green T-intersection is also known as the "Alabama T" intersection configuration. The continuous green T-intersections are characterized by a channelized left turn movement from the minor street approach onto the mainline (major street), along with a continuous mainline through movement that occurs at the same time. The continuously moving through lanes are not controlled by a traffic signal phase, while the other intersection movements are controlled by a three-phase signal. The through lanes on the mainline that have continuous flow typically contain a green through arrow signal indicator to inform drivers that they do not have to stop. The continuous through lanes are often separated from the left turn and merge lanes with delineators, curbed islands, pavement markings, or other separations. Figure 2-11 below illustrates a typical intersection configuration of this type.

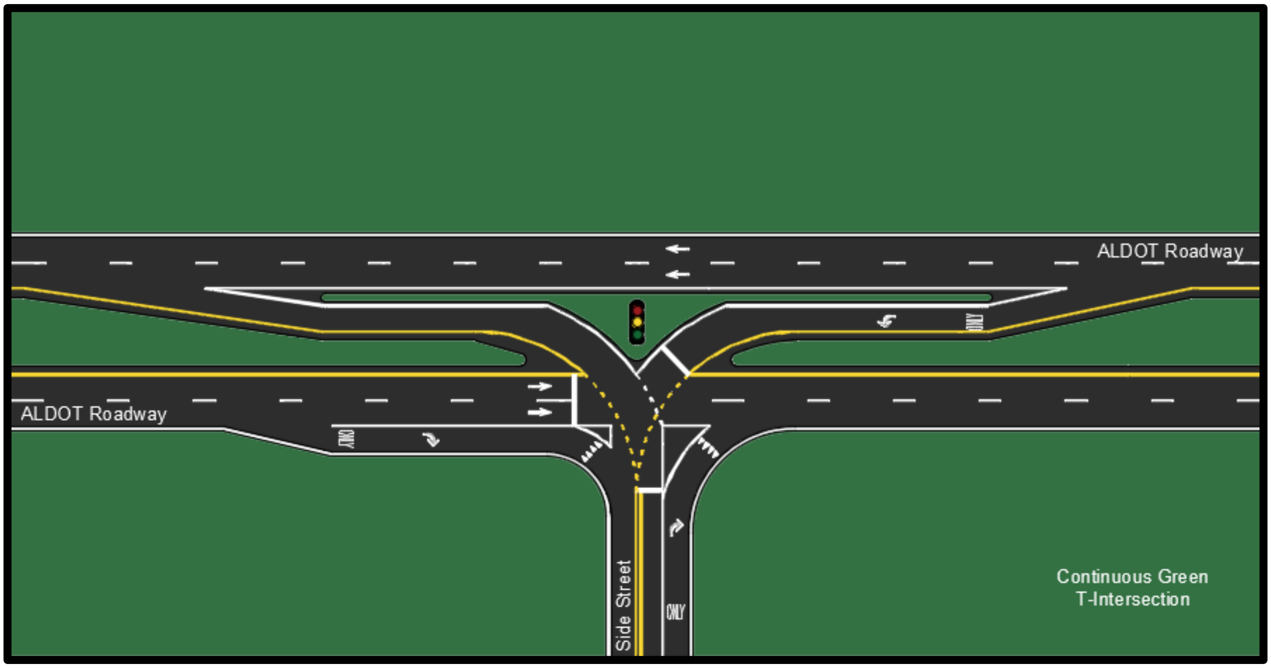


Figure 2-11: Sample Continuous Green T-Intersection

The continuous green T-intersection configuration has been successfully deployed/constructed at various locations on state highways in Alabama.

2.8.4.3 Median U-Turn Intersection

The median U-turn intersection is an intersection design that is similar to the restricted crossing U-turn (RCUT). Median U-turn intersections are commonly referred to as "Michigan left turn intersections." The primary difference between the median U-turn intersection and the RCUT intersection is the prohibition of cross traffic movements from the side streets. Typically, a median U-turn intersection is signalized with signalized U-turn movements. The U-turn intersection locations are typically designed to be located as far from the primary intersection as practical with the minimum distance being 600'. Figure 2-12 illustrates a typical median U-turn intersection.

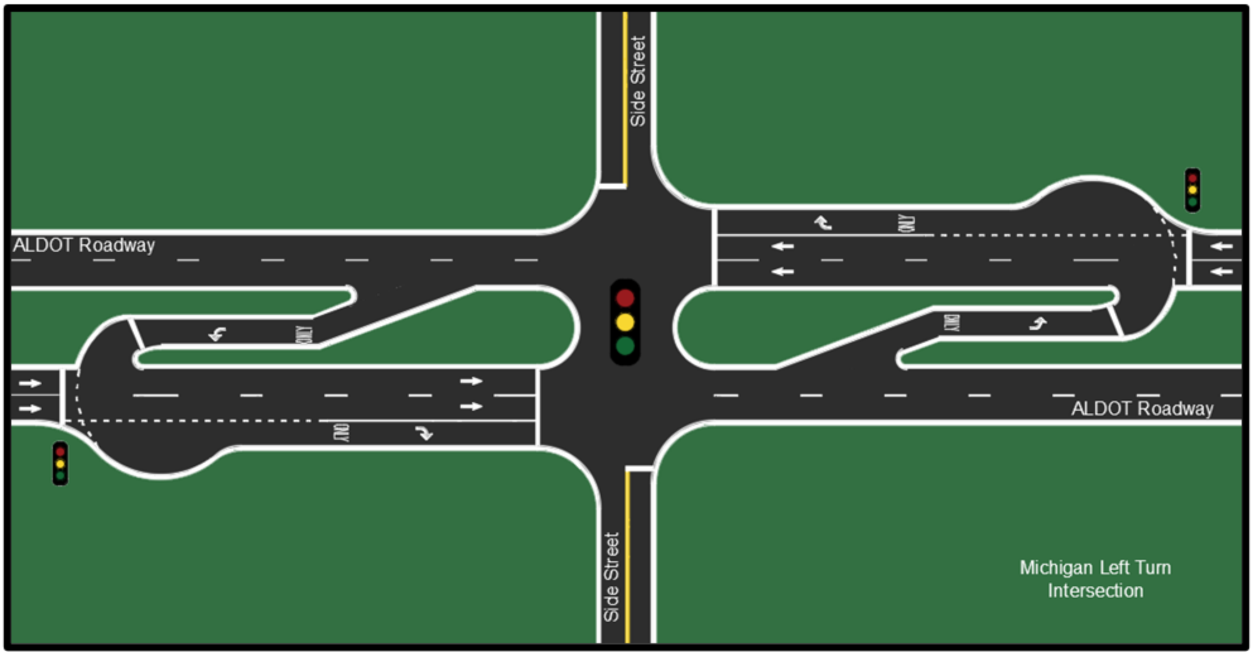


Figure 2-12: Sample Median U-turn Intersection

Median U-turn intersections have been deployed along roadways corridors within Alabama and have provided successful results.

2.8.4.4 Roundabout

Roundabouts represent a potential solution for intersections with many conflict points. Though not appropriate for all situations, roundabouts reduce vehicle movements across traffic. The location and design of roundabouts on ALDOT roadways is discussed in the *ALDOT Roundabout Planning, Design, and Operations Manual*[4]. This publication describes the safety and capacity benefits for roundabouts as well as specific design characteristics and requirements. Figure 2-13 illustrates a typical roundabout intersection.

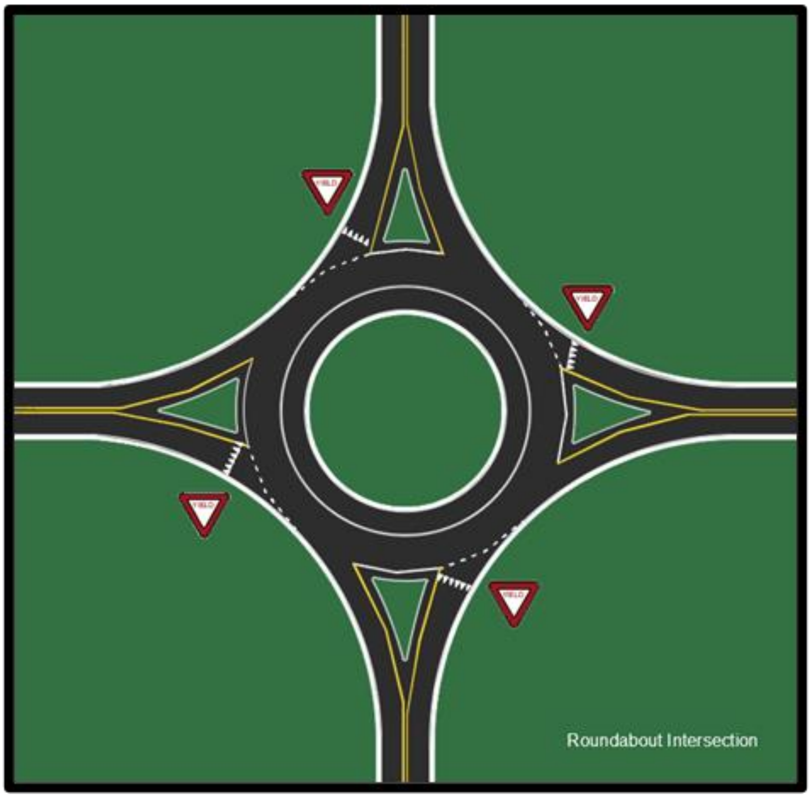


Figure 2-13: Sample Roundabout Intersection

[4] https://www.dot.state.al.us/publications/Design/pdf/TrafficSafetyOp/RoundaboutPlanningDesignOpManual.pdf

3 TRAFFIC IMPACT STUDY REQUIREMENTS

This chapter covers requirements for traffic impact studies for proposed developments/conditions that may impact traffic operations on the state-maintained roadway network.

3.1 GENERAL INFORMATION

Traffic impact studies (TIS) are often required by ALDOT to adequately assess the impact of a proposed change in conditions which may affect traffic operations on the existing and/or planned highway system. The objectives for a traffic impact study are to:

- identify the traffic and operational impacts a proposed development and/or project may have on the highway system; and,
- determine any improvements to the highway system needed for mitigation of traffic, safety, and operational impacts associated with a proposed development and/or project.

The TIS is the responsibility of the applicant and should be prepared and sealed by an engineer licensed in Alabama who has expertise in traffic impact studies and transportation planning. The following process should be followed when completing a TIS:

- The applicant and their traffic engineering consultant should contact the appropriate ALDOT District Administrator to determine the need for a scoping meeting and/or conference call to discuss the TIS requirements.
- The applicant's traffic engineering consultant should proceed and complete the TIS upon completion of the project scoping meeting.
- The applicant should submit the TIS to the appropriate ALDOT District Administrator, unless otherwise instructed by ALDOT personnel.

Upon receipt of a TIS, ALDOT will review the study data (sources, methods, and findings) and will respond with written comments.

ALDOT reserves the right to seek additional information or clarification on the TIS or commission its own independent study or review. ALDOT must approve the TIS before a permit application will be approved.

3.2 WHEN IS A TRAFFIC IMPACT STUDY REQUIRED?

A TIS is encouraged for any development requiring an access permit along any state highway. A TIS may not be required for developments whose trip generation estimates are less than 100 total (inbound plus outbound) peak hour vehicle trips.

For developments that generate more than 100 total (inbound plus outbound) peak hour vehicle trips, a TIS is required unless indicated otherwise by the ALDOT Engineer.

Table 3-1 provides land use density thresholds for typical development types that have trip generation rates greater than 100 vehicles per hour (VPH) that may serve as a quick reference for the engineer/applicant.

Table 3-1: Traffic Impact Study Land Use & Density Thresholds

Land Use	Density (>100 trips/hour)
Residential	
Single-Family Detached Housing	101 Dwelling Units
Single-Family Attached Housing	174 Dwelling Units
Multifamily Housing (Low-Rise)	184 Dwelling Units
Lodging	
Hotel	173 Rooms
Motel	277 Rooms
Office	
General Office Building	54,000 sf Gross Floor Area
Medical/Dental Office	25,000 sf Gross Floor Area
Retail/Service	
Shopping Center/Plaza/Strip Retail	14,000 sf Gross Floor Area
Supermarket	8,000 sf Gross Floor Area
Fast Casual Restaurant	6,000 sf Gross Floor Area
Fast-Food Restaurant with Drive-Through	2,000 sf Gross Floor Area
Convenience Store(2-4k sf)/Gas Station	6 Fueling Positions
Institutional	
Day Care Center	9,000 sf Gross Floor Area
Elementary School	135 Students
Middle/Junior High School	149 Students
High School	90 Students
Industrial	
Manufacturing	130,000 sf Gross Floor Area
Warehousing	550,000 sf Gross Floor Area
Industrial Park	290,000 sf Gross Floor Area

The following are conditions where ALDOT personnel may require traffic impact studies regardless of development density:

- Impact to state highway system – Developments that do not directly access the state highway system but will impact the traffic conditions on the existing highway system.
- Change in land use and/or development density – A change in the land use and/or development density of a property accessing a previously permitted connection point.
- Update to previous TIS – Previous TIS that is more than two (2) years old when construction commences on the permitted access point(s) should be updated. ALDOT may waive this requirement if it can be demonstrated that the conclusions of the original TIS are valid for current conditions.
- Deficient conditions – If in the opinion of ALDOT personnel significant operational deficiencies and/or safety concerns exist or would be created as a result of traffic expected to be generated by a development.
- Currently congested areas – Developers/property owners who are proposing developments along congested corridors are strongly recommended to contact ALDOT to discuss TIS requirements and limits.

- Access management guidelines – If in the opinion of ALDOT personnel further analysis is necessary to review a proposed change to the highway system.

3.3 Key Traffic Impact Study Requirements

3.3.1 Traffic Impact Study Scoping Meeting

Applicants and their traffic engineering consultant should have a scoping meeting or, at a minimum, a conference call to discuss TIS requirements with ALDOT prior to commencing the study effort. Items that should be discussed include:

- the extent of the proposed projects (including initial, intermediate, and final phases);
- definition of the study area;
- directional distribution of traffic;
- critical analysis requirements;
- development horizon year;
- crash history (safety audit may be required);
- the existence of any corridor-specific access management plans;
- opportunities to implement recommendations from previously conducted safety audits; and
- any other information relevant to the project and TIS.

3.3.2 Conformity with Corridor-Specific Access Management Plans

There are ALDOT roadways in various locations around the state of Alabama that have an existing adopted corridor-specific access management plan. The adopted access management plan is available at the local ALDOT Area or Region office. The traffic consultant should review the access management plan (where applicable) and consider the recommendations included in the corridor access management plan as the basis for access locations when completing the TIS. Any requested changes to the existing corridor access management plan should be addressed in the TIS with the justification to support the requested changes.

3.3.3 Traffic Impact Study Project Study Area Requirements

The study area of the project should be determined by the type of development and the nature of adjacent roadways and intersections. ALDOT has developed criteria to follow when determining the study area for all traffic impact studies. Table 3-2 illustrates the required study area selection criteria.

Table 3-2: ALDOT Criteria to Determine Traffic Impact Study Area Requirements

Development Land Use Type	Required Study Area for Traffic Impact Study
Sample Small Commercial Developments (Outparcel/Small Tract)	
Fast-food restaurant	Proposed connection point -&- All intersections (signalized or unsignalized) within 1,000 ft of the site property boundaries except minor driveways
Convenience store (with or without gas pumps)	
Any small single tract development generating 200 or fewer trips during any peak hour	
Sample Moderate Developments (Commercial, Industrial, & Residential)	
Shopping center or commercial/industrial (<70,000 ft^2 floor space)	Proposed connection point(s) -&- All signalized intersections within ¼ mile and all un-signalized intersections within ¼ mile of the site property boundaries
Residential developments generating fewer than 500 trips during any peak hour	
Any development generating between 200 and 500 trips during any peak hour	
Sample Large Developments (Commercial, Industrial, & Residential)	
Shopping center or commercial/industrial (>70,000 ft^2 floor space)	Proposed connection point(s) -&- All signalized and un-signalized intersections within ½ mile of the site property boundaries
Residential developments generating 500 trips or more during any peak hour	
Any development generating more than 500 trips during any peak hour	

Note: Any proposed development that has access points within ½ mile of an interchange ramp should include all ramp intersections as a part of the required study area.

ALDOT reserves the right to require additional intersections (beyond those outlined in Table 3-2) and any access driveways within the applicable study area boundary to be studied as a part of the TIS. If it is expected that the traffic impact will extend into another governing agency's jurisdiction, the developer and ALDOT should also coordinate with the adjacent authority.

3.3.4 Traffic Data Collection Requirements

The traffic data collection efforts for the study should be consistent with the level of analysis required. The following data should be collected when completing a TIS:

1. Hourly approach counts – A minimum of 24 continuous hours of approach counts for the ALDOT roadways within the study area will be required.
    - The counts should be for the same time period, for the same day, for each roadway.
    - These should be taken on a typical weekday (preferably on a Tuesday, Wednesday, or Thursday), unaffected by holidays or special events.
    - For proposed intersections, roadway counts should be taken at the proposed intersection location.
    - **These counts should be displayed as a summary of the approach counts for each approach, and the raw count information should be included in the study's appendices.**

2. Peak hour turning movements – At a minimum, AM and PM peak hour turning movement count summaries should be included for each approach of each existing study intersection.
    - Typical peak hour counts should be done from 7:00AM–9:00AM and 4:00PM–6:00PM on Tuesday, Wednesday, or Thursday unless otherwise specified by ALDOT personnel based on known traffic conditions.
    - It is preferable to have these counts taken on the same day as the approach counts, but turning movement counts from a different typical day comparable to the approach counts are acceptable as long as they are collected within two weeks of the approach counts.
    - These counts should be normalized with the approach counts, or vice-versa, so that a proper comparison can be made. Justification for the way these counts are normalized should be provided.
    - Different peak hour counts, other than the AM and PM, may need to be considered depending on the prevailing traffic conditions such as peak flows during lunch hours, school hours, industry working hours, etc.
    - **Raw counts should be included in the study's appendices.**
3. Traffic distribution summary – Current traffic distribution for the location and posted speeds of all roadways within the area of the proposed development should be determined. A speed study may be required by ALDOT to validate realistic speeds along critical roadways.
4. Age of traffic data – Traffic data for existing conditions analyses should not be over 24 months old. Any previously conducted traffic counts should be approved by ALDOT for application to the TIS.

Additional data required to provide calibration of traffic simulation models should also be collected for all analysis periods as necessary. The additional data that may be required includes information such as vehicle queues for existing intersections, traffic speed data, traffic gaps or headway data, and any other data that may be deemed important by ALDOT personnel to further calibrate traffic analyses included in the study.

3.3.5 Required Analysis Scenarios

The TIS should examine the existing conditions, as well as conditions within the study area before and after the proposed development for the anticipated year of opening. The before and after conditions should be termed the "No Build" and "Build" conditions. Analysis should be completed to a degree sufficient to document the operational impacts of the proposed development and access plan. The following are the minimum required analysis scenarios:

1. Existing conditions – The existing conditions scenario represents traffic conditions that are present at the time the TIS is completed. The existing conditions analysis should include existing traffic volumes and traffic control. The existing conditions should be used to calibrate and validate the analysis model.
2. Future "No Build" – The "No Build" condition should include existing traffic volumes, background traffic growth, and any planned and funded infrastructure improvements within the study area.
3. Future "Build" – The "Build" condition should include "No Build" traffic volumes plus site-generated traffic and any access improvements proposed with the development.

Considering the nature of certain types of developments, it is understood that not all developments are completed/built out and occupied at the same time. Therefore, "Build" traffic conditions for developments with multiple construction phases should be evaluated for future time periods after opening day. Also, the proposed development may be constructed within a short time frame from when the TIS is completed. For short time frames, such as a year from the publish date of the TIS, ALDOT personnel may choose to waive the requirement for the "No Build" scenario. Table 3-3 sets out the required analysis parameters (horizon years, study periods) for different types and scales of proposed developments.

Table 3-3: Required Traffic Impact Study Analysis Parameters for Different Development Types

Development Type	Horizon Years/ Required Analysis Scenarios
Single Phase Construction (1-year or less completion)	Existing Conditions, Future "Build"
Single Phase Construction (>1-year completion)	Existing Conditions, Future "No Build," Future "Build"
Multiple Phase Construction – Small to Moderate Developments	Existing Conditions, Future "No Build," Future "Build" for key phases[1]
Multiple Phase Construction – Large Developments (As defined in Table 3-1)	Existing Conditions, Future "No Build," Future "Build" for key phases[1]

1. Applicant should address the required analysis of development phases with ALDOT personnel as a part of the TIS scoping meeting.

ALDOT reserves the right to require additional analysis scenarios beyond those included in the table above.

3.3.6 Background Traffic Growth Requirements

Background traffic growth should be considered for all proposed developments when the completion date occurs over 24 months from the time the existing traffic data is collected. The existing traffic data may need to be adjusted based on the projected traffic growth rates for the area before the site-generated traffic is added.

To develop background traffic growth rates, the following methodologies are considered acceptable:

1. Historical traffic growth – This method utilizes historical traffic growth trends and applies a linear regression model to predict future traffic growth rates. Historical traffic volumes for use in this methodology can be found on the ALDOT Traffic Monitoring website[5].
2. Travel demand model – In urbanized areas where travel demand models are available, traffic growth should be calculated using travel demand model software (if available). The applicant should contact ALDOT Local Transportation Bureau for the latest software requirements and accepted methodology at the time of the TIS.

Justification for the projected traffic growth methodology should be included in the report appendices. In cases where the TIS completion is delayed for more than a year from the date of data collection, ALDOT reserves the right to require the applicant to conduct follow-up traffic data collection in spot locations. If ALDOT is not satisfied with this, then a full data collection as described previously should be conducted.

3.3.7 Trip Generation Requirements

Trips to be generated by proposed and future developments should be calculated using trip generation estimates. The typical source for trip generation data is the current version of the ITE *Trip Generation*

[5] https://aldotgis.dot.state.al.us/TDMPublic/

Manual. The ITE *Trip Generation Manual* provides data in terms of trip rates (average, maximum, and minimum), fitted curve equations (i.e., regression equations) and data plots. The ITE *Trip Generation Handbook* provides guidelines for when to use each source of data for estimating the trip generation characteristics of a land use.

The applicant should use the trip generation rates or regression equations published in the latest edition of the ITE *Trip Generation Manual* to estimate site traffic. Exceptions to this include times when an individual trip generation study for the proposed development exists or when there is trip generation data available for an individual company/entity within the proposed development. In cases where ITE trip generation data is very limited or unavailable, it may be appropriate to use trip generation rates available via one or more of the following sources:

- local data for comparable developments
- other published references such as the ITE Journal
- trip generation studies conducted at sites comparable to the proposed development[6]

The trip generation data obtained should be from "Peak Hour of Adjacent Street Traffic" for the applicable peak hours. Any deviation from this data should be adequately justified. These generated traffic volumes should be for the development only. Adjacent roadway traffic would only be considered and combined with generated volumes for use in the capacity analysis.

The type of trips to be generated by a proposed development typically include new trips, pass-by trips, and internal/mixed-use trips. The following is a summary of each trip type:

- New trips are the trips new to the study area and are derived from the trip generation rates.
- Pass-by trips are existing trips in the study area that are diverted to the development. Pass-by trips are derived from trip generation rates and applied based upon guidance in the ITE *Trip Generation Handbook*.
- Internal/mixed-use trips are trips internal to the development. Internal/mixed-use trips are derived from information presented in the ITE *Trip Generation Handbook*. The applicant should contact ALDOT to determine appropriate internal/mixed-use rates for applicable developments.

The TIS should document all sources used to determine the trip generation for each land use. If the source is from something other than the ITE *Trip Generation Manual*, the applicant should provide, in writing, justification as to their suitability for the proposed development. The outcome of the entire traffic analysis can often depend solely on the question of appropriate trip generation rates; thus, any use of non-ITE rates should be approved by ALDOT prior to submission.

[6] *Trip Generation studies for unique land uses should be considered by ALDOT for the purposes of traffic impact studies. Prior to submission to ALDOT, the applicant must provide details of the land use and a detailed description of the analysis method used to develop the trip generation estimates. ALDOT must approve any trip generation studies prior to submission as a part of the TIS.*

3.3.8 Traffic Capacity Analysis Requirements

The purpose of the capacity/level of service (LOS) analysis is to show the relationship between traffic operations and roadway geometrics, assess needs, and identify alternatives for further consideration. Intersection delay is the basis for determining the LOS, which ranges from LOS A to LOS F. Generally, LOS C is considered desirable, while LOS D is considered acceptable during peak hours of traffic flow. LOS E and LOS F are typically considered unacceptable. If a proposed development reduces a LOS for an intersection or approach from acceptable to unacceptable, then improvements should be considered that will mitigate the additional delay and return the intersection or approach to an acceptable LOS.

An intersection capacity analysis of peak hour traffic conditions (as determined during scoping discussions with ALDOT) should be included for each study area intersection. The capacity analysis should conform to the type of intersection it is (signalized or unsignalized). The procedures, methods, and techniques recommended in the *Highway Capacity Manual* (HCM) should be the basis for the intersection capacity analysis. The Applicant should contact ALDOT to determine the appropriate release of the *Highway Capacity Manual* to be referenced in the analysis efforts.

The applicant should use the latest versions of ALDOT-approved software packages to conduct the intersection capacity analysis. Software packages approved for use include HCS, Synchro, Sidra, and VISSIM/VISTRO. For studies that require a traffic signal system analysis, Synchro should be used unless otherwise approved by ALDOT. For roadway corridors/study areas that operate at or above capacity, ALDOT may require VISSIM modeling analysis to be completed as an additional analysis. A complete analysis summary from an ALDOT-approved traffic analysis methodology should be included in the study's appendices. For all analyses, the scenario tested, and both the input and output data should be clearly labeled.

3.3.9 Traffic Signal Warrant Analysis Requirements

For locations where traffic signalization is requested or considered, a traffic signal warrant analysis is required. The signal warrant analysis should conform to current ALDOT guidelines for traffic signal warrants, including approach count requirements, turning movement counts, and right turn reduction (where applicable). The TIS should include any supporting data for the justification of any warrants met. **The completed ALDOT warrant analysis worksheet for each intersection should be included in the study's appendices.**

Average daily traffic (ADT) counts (without hourly approaches) should not be used, nor will they be accepted, for the justification of traffic control signal installation.

A description of ALDOT traffic signal warrant analysis procedures is provided in the latest edition of the *ALDOT Traffic Signal Timing and Design Manual*[7]. The "Warrant Analysis Worksheet" is posted on ALDOT's website under Maintenance Bureau Publications. All 5 pages of this worksheet should be included for each intersection. Reports generated by analysis software are acceptable provided they show the status of all warrants and applicable data verifying a satisfied warrant.

[7] https://www.dot.state.al.us/publications/Design/pdf/TrafficDesign/TrafficSignalManual.pdf

3.4 Traffic Impact Study Report Formatting

3.4.1 Traffic Impact Study Contents

Specific requirements for each TIS will vary depending on site location and type of development. A typical traffic impact study should contain the information in Figure 3-1.

1. Preface
2. Introduction & Overview
    - Overview of Development
    - Analysis Scenarios
3. Existing Traffic Conditions
    - Project Study Area
    - Existing Geometric Data
    - Existing Traffic Data
    - Existing Traffic Conditions Analysis
4. Future “No Build” Traffic Conditions (as applicable)
    - Future Roadway Improvements
    - Background Traffic Growth
    - Future “No Build” Traffic Volumes
    - Future “No Build” Traffic Conditions Analysis
5. Future “Build” Traffic Conditions
    - Description of Proposed Development
    - Trip Generation Estimates
    - Site-Generated Traffic Distribution
    - Future “Build” Traffic Volumes
    - Traffic Signal Warrant Analysis (as applicable)
    - Future “Build” Traffic Conditions Analysis
6. Conclusions/Recommendations
7. Appendices
    - Proposed Site Layout
    - Signal Timing Sheets (as applicable)
    - Traffic Count Data
    - Existing Capacity Analysis
    - Signal Warrant Analysis (as applicable)
    - Future “No Build” Capacity Analysis (as applicable)
    - Future “Build” Capacity Analysis

Figure 3-1: Typical Traffic Impact Study Outline

Figure 3-1 shows a recommended table of contents for a typical TIS with suggested headings and subheadings. The following sections provide details and guidance for each of the sections of the recommended TIS.

3.4.2 Preface

Title/cover page – The report title page should include:

1. Title of the report – States the type of study (TIS, etc.).
2. Development name – Lists the name of the development and the general location of the development (city/town and county located in).
3. Date – The month and year the study/report was created.
4. Prepared for – Name of the firm, entity, or development that the report was prepared for, if applicable.

5. Prepared by – Name of the firm or entity that produced the report, to include address and phone number, and the seal and signature of the engineer of record.
6. Table of contents – At a minimum, should include a listing of the main sections of the study and appendices. Should a “List of Tables” and/or “List of Figures” be included, they should precede the “Appendices” listing.

3.4.3 Introduction and Overview

This section contains an overview of the purpose and a summary of results for the study. The following items should be included in this section:

1. Vicinity map – This is a map of the general area. This map should clearly show:
    - the project/development location in relation to the nearest town/city and the major roadways in and around the development area
    - where the affected and/or proposed intersections are located with enough detail to locate the intersection(s) and the surrounding, affected roadways/intersections
2. Project description – This is a brief project description describing why this study was required, to include:
    - the location, type, and size of the development
    - roadways adjacent to the development
    - the anticipated completion date and/or a schedule of phase completion dates
    - the location of any proposed access driveways within the study area, giving distances from known/existing intersections
    - a more detailed map/aerial photo showing the areas of concern (as applicable)
3. Resources – This is a list of resources used for the study, to include applicable editions or revisions. This should also include a list of any programs used in the analysis, along with their versions.
4. Additional information – This should list the supporting agencies and what data were supplied by them along with all other information sources used in the generation of the study. All other background information about the location and project that has not been previously addressed and is required for clarity should be included in this section.

3.4.4 Existing Traffic Conditions

This section should be used to present the current/existing conditions at the development site and the surrounding areas. This should include, but is not limited to, the following:

1. Project study area – This section should include a description of the project study area as determined in Section 3.3.2. The project study area should be listed along with study intersections and roadways. This information can be provided by description or graphically.
2. Existing geometric data – This includes a detailed geometric layout of the required study area roadways and intersections. The following should be included where applicable:
    - number of lanes and/or approach lanes
    - lane and/or approach lane usage (left only, thru/left combined, etc.)
    - lane width
    - turn lane length (full width lane and taper)
    - sight distance limitations
    - posted speed limits
    - existing traffic control measures

- any other roadway or intersection details that might be pertinent to the study/analysis (driveways, median crossovers, etc.)

3. Existing traffic data – This section should include a summary of traffic count data collected for the project. Guidelines included in Section 3.3.3 should be followed on all traffic data collection. The existing traffic count data should be clearly presented in graphical and/or tabular format.
4. Existing traffic conditions analysis – This section outlines the methods and results of the required traffic analysis for existing conditions. Analysis should be performed for each required peak period for each existing study intersection. Refer to Table 3-1 for guidance on which intersections are to be analyzed. The results of the analyses must be included in this section in tabular format. The results must include at a minimum the level of service (LOS) and delay for each intersection approach. Further information such as LOS, queues, and delay for individual movements may be required at the discretion of ALDOT.

3.4.5 Future "No Build" Traffic Conditions

This section should be used to present the future traffic conditions projected to be present at the time of the buildout of the development. Pertinent information to be included in this section includes:

1. Future planned roadway improvements – This section should include an outline of any planned or programmed roadway improvements that would impact traffic conditions within the study area. The applicant should provide as many details as available. Key details include the scope of planned improvements, the location of planned improvements, the anticipated completion date of planned improvements, the status of construction, and the funding status and sources of projects (project sponsors) that are planned but not under construction.
2. Background traffic growth – This section outlines the background traffic growth calculated for the required analysis scenarios. The methods outlined in Section 3.3.5 should be used to develop background traffic growth. The section should provide details of how background traffic growth rates are calculated and should clearly show the background traffic growth rate used and the supporting data to accompany it.
3. Future "No Build" traffic volumes – This section should include details on the methods used to determine future "No Build" traffic volumes. Traffic volumes must be provided in graphical format clearly denoting the time period (AM peak, PM peak, etc.), analysis scenario (Future Buildout, Future Build Phase 1, etc.), and the location of study intersections.

3.4.6 Future "Build" Traffic Conditions

This section should be used to present the future traffic conditions projected to be present at the time of the final buildout of the development with development traffic in place. Pertinent information to be included in this section includes:

1. Description of proposed development – This section should include the proposed development plan and should outline any analysis scenarios tested as a result of multiple construction phases.
2. Trip generation estimates – This section outlines the trip generation estimates calculated for the proposed development. The methods outlined in Section 3.3.6 should be used to develop trip generation estimates. The section should provide details of how trip generation estimates are calculated and should show the trip generation estimates in tabular format.
3. Site-generated traffic distribution – This section should include the direction of approach for site-generated traffic. The applicant should show the direction of approach for site-generated traffic, the driveway distribution of site-generated traffic (for developments with multiple driveways), and the traffic distributed to study intersections and roadways. This information should be

presented graphically. See Figure 3-2 and Figure 3-3 for sample figures of site-generated traffic distribution.

4. Future "Build" traffic volumes – This section should include details on the methods used to determine future traffic volumes. Traffic volumes must be provided in graphical format clearly denoting the time period (AM peak, PM peak, etc.), analysis scenario (Future Buildout, Future Build Phase 1, etc.), and the location of study intersections.
5. Traffic signal warrant analysis (as applicable) – This section outlines the methods and results of any traffic signal warrants conducted for the proposed development. The methods outlined in Section 3.3.8 should be used to complete the traffic signal warrant analysis. Results of the traffic signal warrant analysis must be included in tabular format. Hourly traffic volumes used for signal warrant purposes may be included in this section or may be placed in a report appendix. Any right turn reduction calculations applied must be clearly discussed and included in this section.
6. Future "Build" traffic conditions analysis – This section outlines the methods and results of the required traffic analysis for future conditions. Refer to Section 3.3.8 for traffic signal warrant analysis requirements. Analysis should be performed for each peak period for each intersection in the development, around the development, and impacted by the development. Refer to Table 3-1 guidance on which intersections are to be analyzed. The results of the analyses must be included in this section in tabular format. The results must include at a minimum the level of service (LOS) and delay for each intersection approach. Further information such as LOS, queues, and delay for individual movements may be required at the discretion of ALDOT.

3.4.7 Conclusions/Recommendations

This section should contain a summary of the conclusions and recommendations in the development study area, to include a detailed description of the proposed site modifications with a justification for each. Detailed descriptions of improvement recommendations should provide as much information as possible and at a minimum should be consistent with the level of detail provided in the description of existing geometric conditions and traffic control measures outlined in Section 3.2. A graphical representation of improvement recommendations is recommended for providing additional detail.

The satisfaction of a traffic signal warrant or warrants does not in itself justify the installation of a traffic control signal, as outlined in the *MUTCD*. Signal justification should be based on geometric limitations, safety concerns, capacity analysis, and all other requirements set out in the ALDOT *Traffic Signal Timing and Design Manual*.

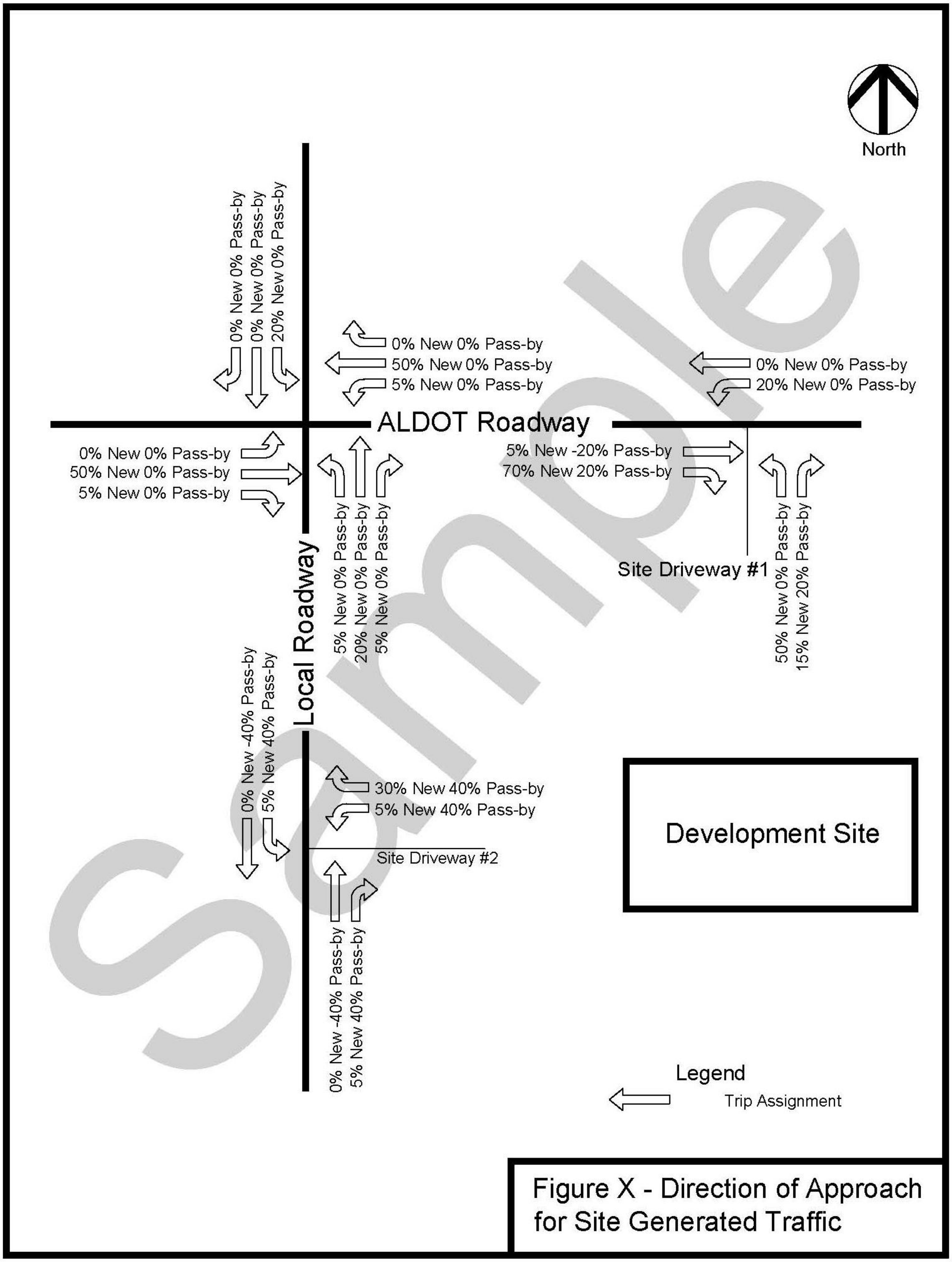


Figure 3-2: Suggested Trip Distribution Figure

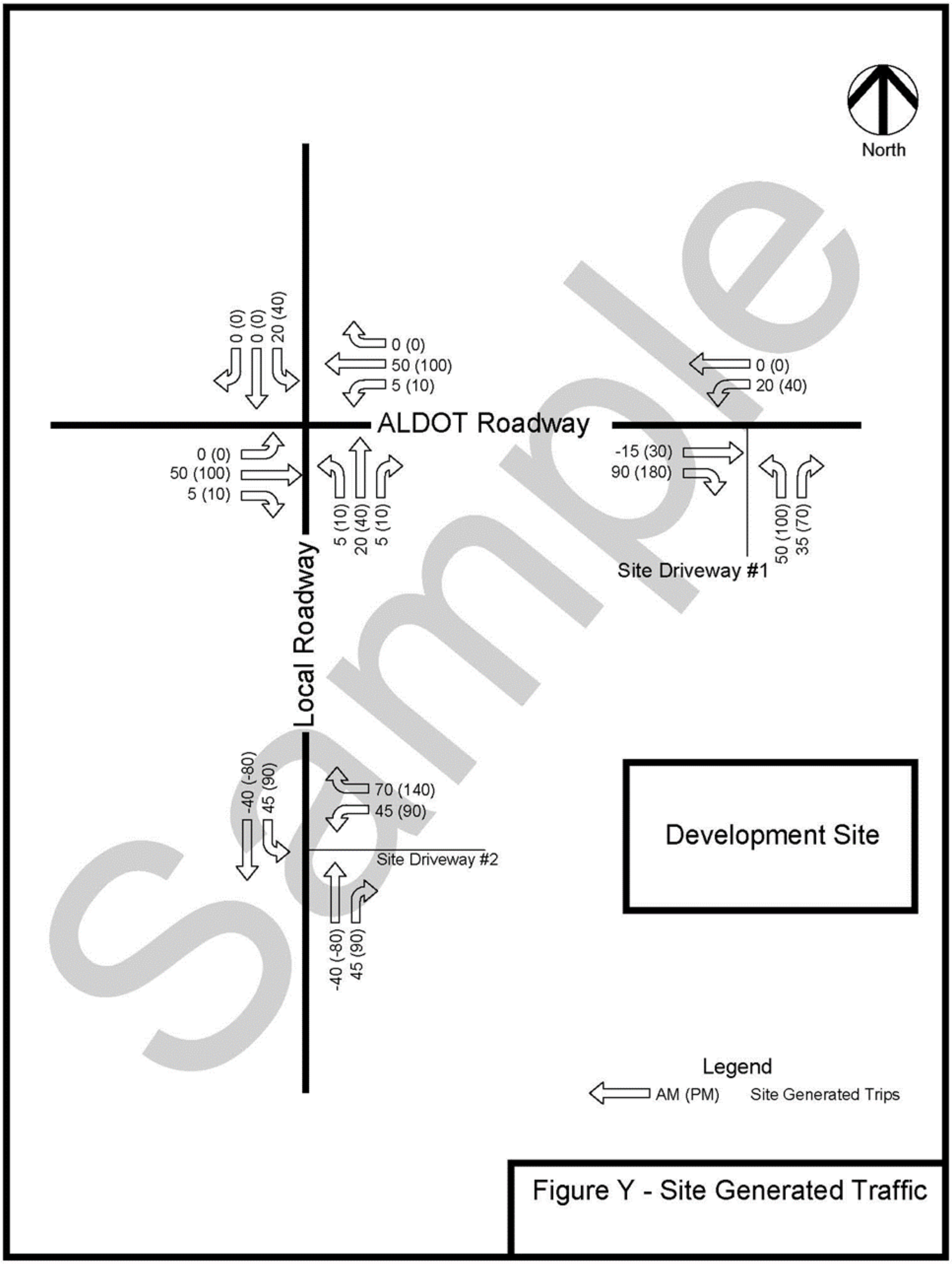


Figure 3-3: Suggested Trip Assignment Figure

3.4.8 Appendices

This section should include any supporting data not listed previously in the study, copies of analysis printouts, raw data counts, etc. This is the minimum information that should be contained in the appendices. Any other pertinent information to include in the appendices should be added logically based on where it is covered in the body of the TIS. Should there be no information for a given appendix, the area should be indicated with a page stating that there is no information for this appendix.

The following is the required order of the appendices area:

1. Proposed site layout – A detailed proposed site layout to include all impacted intersections and roadways.
2. Signal timing sheets (as applicable) – Timing plan sheets for each existing signalized intersection in required study area (refer to Table 3-1). Should include timing plans for peak hour (where applicable).
3. Traffic count data – Raw data section for the existing traffic data for each roadway/intersection impacted by the development.
4. Existing capacity analysis – Capacity analysis printouts for each existing intersection/approach impacted by the development. Should show the current LOS for the intersection/approach. Should be based on existing geometric and traffic control conditions.
5. Signal warrant analysis (as applicable) – Warrant analysis for each intersection proposed for signalization and intersections within the study area (refer to Table 3-1) projected to operate below an acceptable LOS as a result of the proposed development. This should either be the five-page form from the ALDOT *Traffic Signal Timing and Design Manual* or computer printouts of the analysis.
6. Future capacity analysis – Capacity analysis printouts for each current intersection/approach impacted by the development and each proposed intersection based on the proposed/future traffic for each intersection/approach. Analysis should show the projected LOS for the intersection/approach.

A traffic impact study checklist and report outline are both provided in Appendix C.

4 ACCESS DESIGN

4.1 CONNECTION TYPES

A roadway connection is defined as the intersection of a public roadway and a private driveway or another public roadway. As discussed in Chapter 2, connection points create opportunities for traffic conflicts and crashes. For this reason, it is good access management practice to allow no more connections than necessary to provide an appropriate level of accessibility to and from the roadway network.

ALDOT defines two types of connections on its roadway network: full access and directional access. Both connection types are appropriate for different locations within the roadway network and serve different accessibility purposes. The connection types are described in the following sections.

4.1.1 Full Access Connections

Full access connections refer to intersections that allow all turning movements. Examples include the following:

- major road intersecting a major road
- minor road intersecting a major road
- interchange ramp intersecting a major road
- driveway to a commercial business or residence intersecting a major road

These connections can be signalized or unsignalized. Full access connections are shown in Figure 4-1.

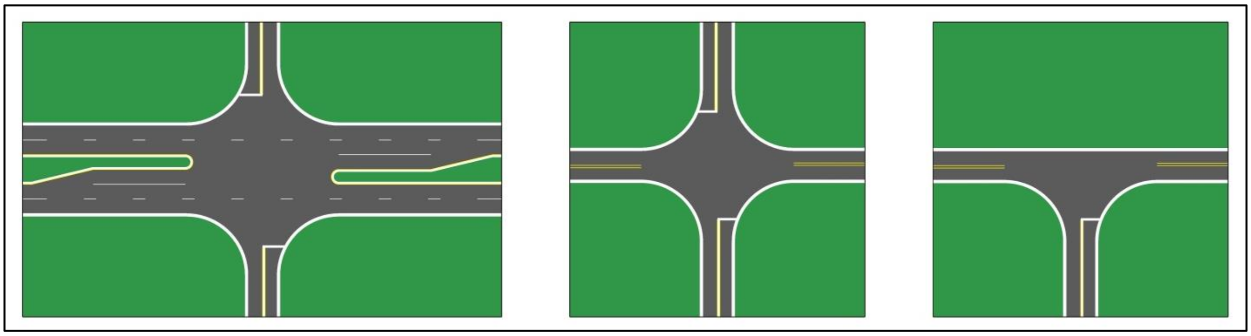


Figure 4-1: Full Access Connections

4.1.2 Directional Access Connections

Directional access connections are generally used to provide access to and from commercial and industrial land uses, but can also be used at major intersections, minor intersections, or interchanges. As shown in Chapter 2, directional connections provide access to and from the roadway with less impact on traffic safety and efficiency when compared to full access connections.

Directional access connections commonly refer to:

- right-in access drives
- right-out access drives
- right-in/right-out access drives
- left-in/right-in/right-out access drives

Like full access connections, directional connections can also be signalized or unsignalized. Figure 4-2 presents graphical examples of different types of directional connections.

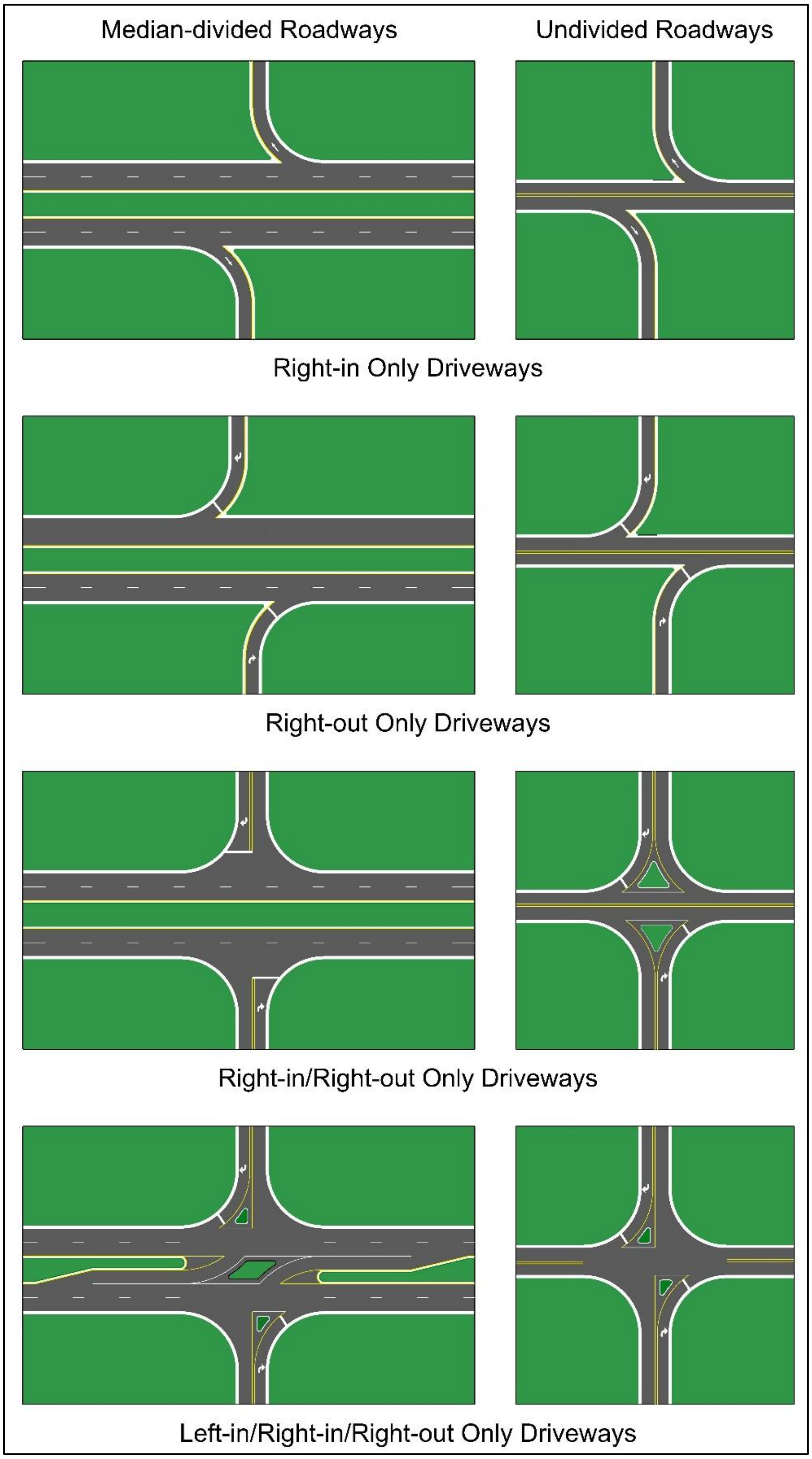


Figure 4-2: Directional Connections

4.2 MEDIANS

Medians are the portion of a highway separating opposing traffic flows. Medians can be raised, depressed, or flush with the traveled way, as well as traversable or non-traversable.

4.2.1 Traversable Median

Traversable medians do not physically discourage or prevent vehicles from entering upon or crossing over it. The two-way left turn lane (TWLTL) is the most well-known type of traversable median.

4.2.2 Non-Traversable Median

Non-traversable medians separate traffic traveling in opposite directions and physically prevent crossing or turning movements. Non-traversable medians can include raised curb or depressed medians. They can be either grass-covered or hard-surface filled. Non-traversable medians are an effective access management tool to help restrict vehicles crossings at prohibited locations.

4.2.3 Median Openings

Median-divided roadways provide median openings to allow for crossing the opposing traffic lanes to access adjacent property, turn to and from public roadways, and to make a U-turn. Median openings should be strategically located to provide appropriate access to adjacent property and roadways while protecting the capacity and traffic operations of the mainline roadway. Figure 4-3 illustrates a few median examples. Spacing criteria for median openings are provided in the following section.

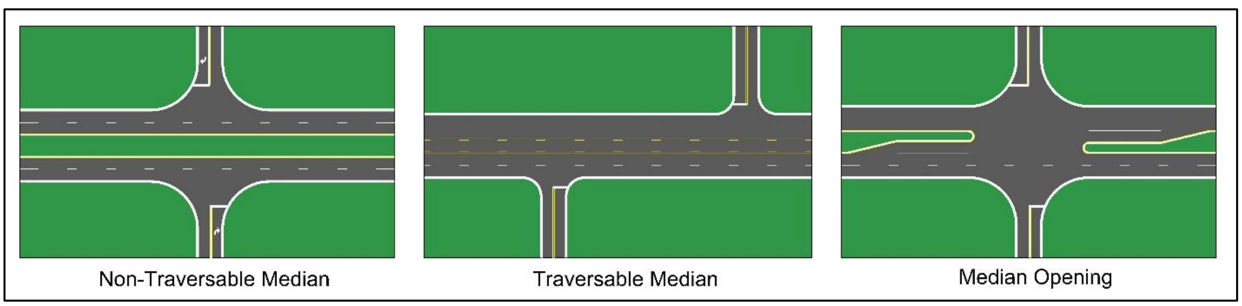


Figure 4-3: Medians

4.3 SPACING CRITERIA

4.3.1 Commercial/Industrial Driveway Spacing Requirements

The minimum driveway spacing criteria are based on the posted speed limit, intersection control, median presence, and access type. However, there are certain special conditions that may require further examination to determine acceptable property access. Commercial/industrial driveways often present challenges to spacing criteria based on the amount of roadway frontage and the size of the parcels. Therefore, the size and type of access required should be considered.

As routes redevelop, there will be a desire by developers to have multiple driveways for certain land uses. The authorization of multiple driveways will be considered based on the amount of continuous parcel frontage. ALDOT will consider additional driveways only for parcels with frontage exceeding 660', subject to the roadway cross-section and median opening locations. Driveways with no corresponding median opening should be limited to directional connections. Median consolidation may be required in conjunction with granting driveway access.

The spacing requirements for full accesses for commercial/industrial driveways are summarized in Table 4-1. If the spacing criteria for a full access cannot be met, then a directional access should be considered.

The spacing requirements for directional accesses are summarized in Table 4-2. The spacing for both types of accesses should be measured from edge of traveled way to edge of traveled way, as shown in Figure 4-4. There will be cases where the minimum spacing criteria for either type of access is not feasible. Those cases should be discussed with ALDOT staff.

A connection spacing example is provided in Figure 4-5. This example demonstrates the hierarchy of full and directional accesses. If more than one access is desired for a site, any full accesses should be located first, and then the directional accesses should be located.

Table 4-1: Minimum Spacing Criteria – Full Access

Access Category	Posted Speed (MPH)	Minimum Spacing (ft)*		
		Signalized	Unsignalized	
			Divided	Undivided
Commercial/Industrial Driveway	<45	1,000	660	450
	45 - 50	1,320	1,320	660
	≥55	2,640	1,320	1,320

*These spacing requirements may not be feasible for some locations. If this spacing cannot be provided, then further analysis may be needed to demonstrate that there will still be acceptable traffic operations after the access is constructed.

Table 4-2: Minimum Spacing Criteria – Directional Access

Access Category	Posted Speed (MPH)	Minimum Spacing (ft)*			
		Right-in Only (Upstream)	Right-out Only (Downstream)	Right-in/ Right-out	Other Directional Accesses
Commercial/Industrial Driveway	<45	250	250	275	450
	45 - 50	440	440	660	660
	≥55	500	500	660	660

*These spacing requirements may not be feasible for some locations. If this spacing cannot be provided, then further analysis may be needed to demonstrate that there will still be acceptable traffic operations after the access is constructed.

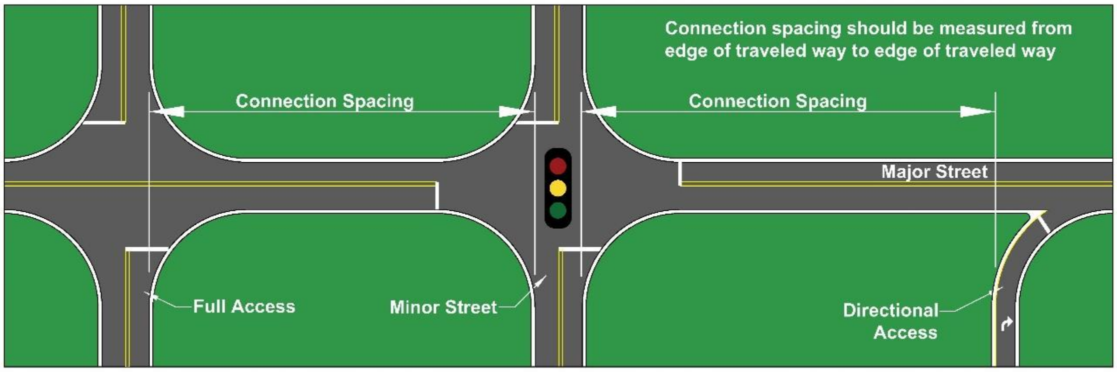
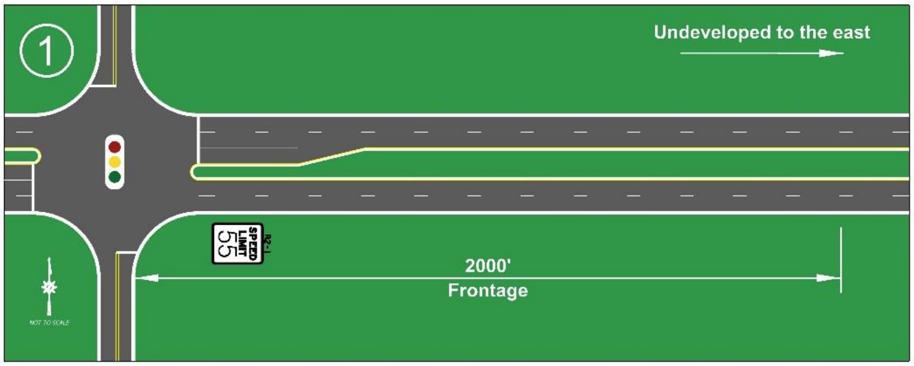
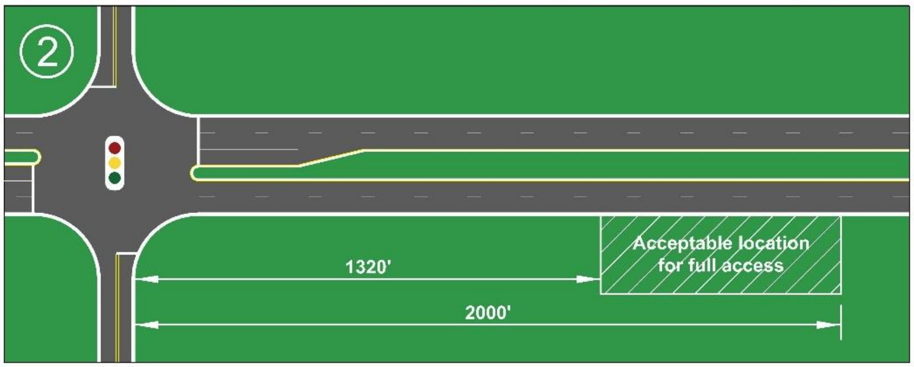


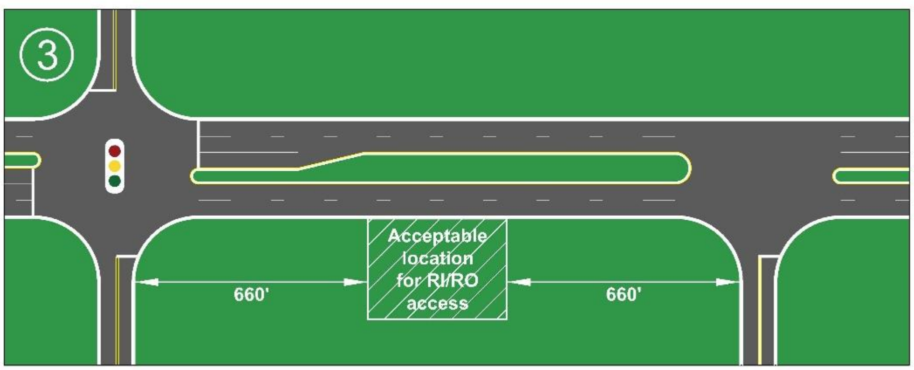
Figure 4-4: Measuring Connection Spacing



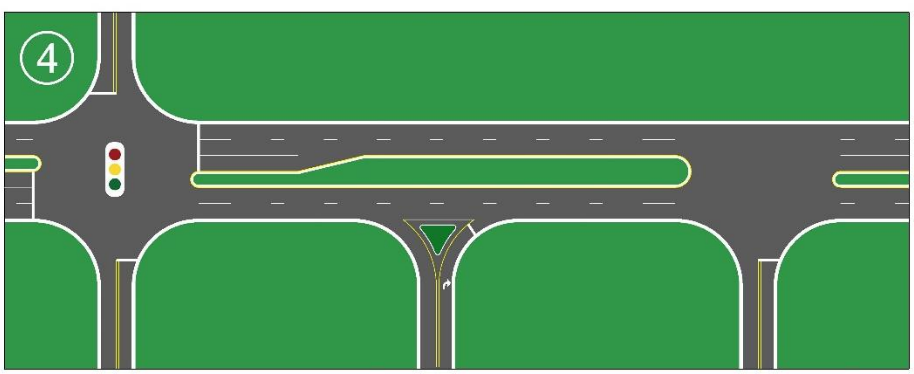
1. Establish existing conditions – This is a divided highway with a 55 MPH posted speed limit. There is an existing full access signalized intersection west of the study property. The developer is requesting a full access and a right-in/right-out access within their 2,000 frontage.



2. Locate full access – Refer to Table 4-1. An unsignalized full access is allowed a minimum of 1,320' from the existing signal. Verify sight distances are adequate and select optimal location.



3. Locate directional accesses – After full access location is set, determine optimal location for the RI/RO access. Refer to Table 4-2. The RI/RO must be spaced a minimum of 660' away from both of the full accesses. Verify sight distance is adequate.



4. Finalize access plan

**Figure not to scale*

Figure 4-5: Connection Spacing Example

4.3.2 Corner Clearance

In many cases, parcel boundaries may require driveways near intersection corners. The required driveway corner clearance refers to the distance between an intersection and the nearest access connection. It is desirable to maximize this distance to preserve traffic flow in the vicinity of intersections. Corner clearances should meet the minimum criteria shown in Tables 4-1 and 4-2. Like the minimum connection spacing requirements, there will be cases where the minimum corner clearances are not feasible. Those cases should be discussed with ALDOT staff.

4.3.3 Accesses Near Interchanges

One of the most important access management challenges occurs in the immediate vicinity of interchanges. The appropriate level of access near an interchange is a function of the posted speed limit and the connection type. The spacing should be measured just as the connection spacing is measured – from edge of traveled way to edge of traveled way (as previously shown in Figure 4-4). Table 4-3 shows the minimum required spacing for the first access crossroad from the ramp. This spacing criterion does not supersede the denied access area around interchanges.

Table 4-3: Access Spacing Near Interchanges

Posted Speed (MPH)	Spacing Dimension (ft)			
	First RI/RO Access	First Directional Median Opening	First Full Access	First Signalized Access
≤ 45	750	990	990	1,320
>45	990	1,320	1,320	2,640

4.3.4 Residential Driveway Spacing Requirements

ALDOT recognizes that different land uses have specific needs, generate varying levels of traffic volumes, and have differing impacts on adjacent roadways. With that in mind, ALDOT treats residential and commercial/industrial connections differently. ALDOT will allow a maximum of one access point or one connection per existing parcel for single-family residential homes. If multiple single-family homes are getting built as part of a subdivision plan, then efforts should be made to minimize the number of accesses on the state route. Alternative access configurations may need to be considered.

4.3.5 Limitations and Alternative Access Configurations

There will be situations where it is not feasible or safe to provide separate driveways to each commercial business or to each house within a subdivision. In an effort to reduce the number of accesses on their roadways, ALDOT may require alternative access configurations (e.g. shared-use accesses, service roads, and back frontage roads). An illustration of these alternative access configurations is provided in Figure 4-6.

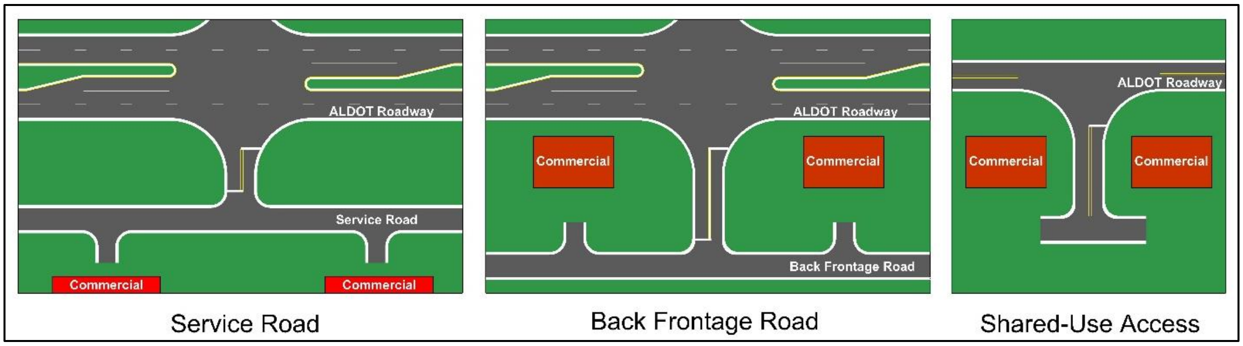


Figure 4-6: Alternative Access Configurations

4.3.6 Traffic Signal Spacing Requirements

Appropriate traffic signal spacing is a key element in promoting efficient traffic signal operations. Signal spacing that is too close can hinder traffic progression and cause excessive queues at intersections. Traffic signals spaced as evenly as possible help to improve vehicle fuel efficiency, reduce vehicle emissions, and lower crash rates by reducing unnecessary stop-and-go traffic. Also, traffic signals should only be considered when warranted based on federal guidelines as outlined in the ALDOT *Traffic Signal Timing and Design Manual*[8]. Properly spaced traffic signals allow access to and from the roadway while preserving safe and efficient traffic operations. Proposed traffic signals should meet the minimum requirements of Table 4-1 and require approval by ALDOT.

4.3.7 Roundabout Spacing

Accesses near roundabouts should meet the minimum connection spacing and corner clearance spacing required in Tables 4-1 and 4-2. No accesses should be allowed within the splitter island of the roundabout. More details on roundabout design are provided in ALDOT's *Roundabout Planning, Design, and Operations Manual*[9].

4.4 DRIVEWAY GEOMETRIC DESIGN

Driveway design is a critical component of the transportation system and essential to achieve efficient operations. Entry width, radius, offset, and throat length are the key components of driveway design. These driveway features are illustrated in Figure 4-7. The following sections outline general required driveway design characteristics. For detailed driveway design characteristics see the ALDOT *Permit Manual*[10] and ALDOT Standard & Special Drawings[11].

[8] https://www.dot.state.al.us/publications/Design/pdf/TrafficDesign/TrafficSignalManual.pdf
[9] https://www.dot.state.al.us/publications/Design/pdf/TrafficSafetyOp/RoundaboutPlanningDesignOpManual.pdf
[10] https://www.dot.state.al.us/publications/Maintenance/pdf/Permits/PermitManual.pdf
[11] https://alletting.dot.state.al.us/Docs/Standard_Drawings/StdDrawingSelect.htm

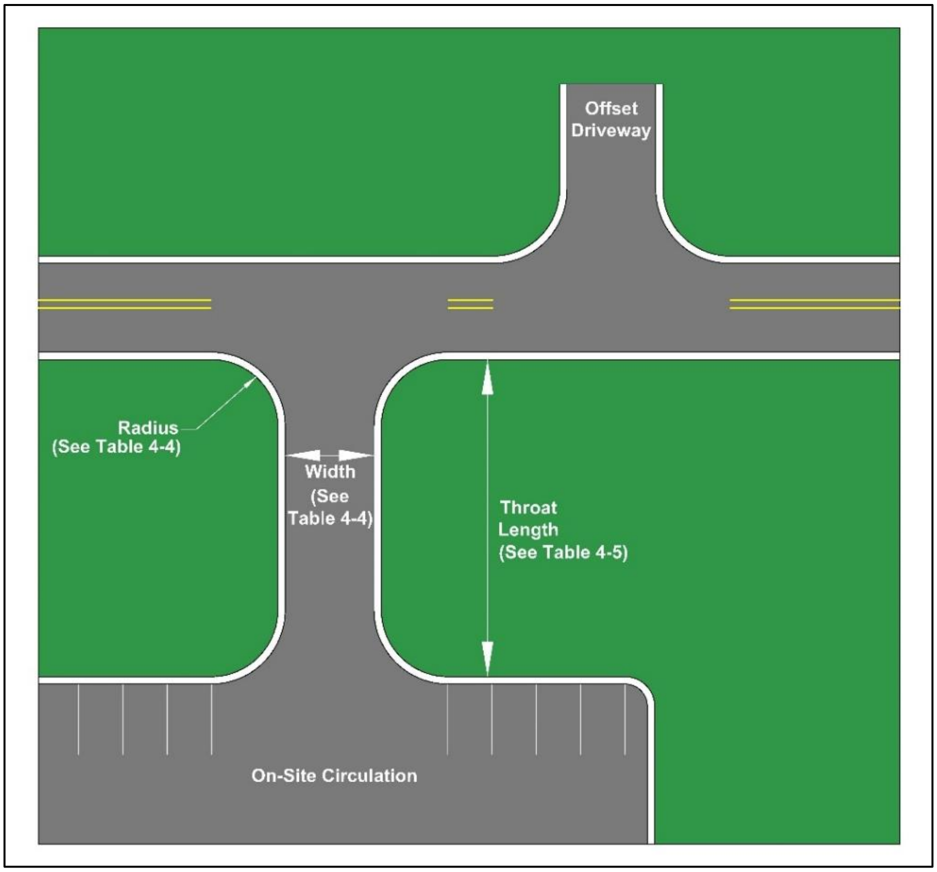


Figure 4-7: Driveway Features

4.4.1 Driveway Width & Radii

Inadequate driveway design creates conflicts that can be detrimental to safety and operations on the mainline. The driveway entry width is the most critical component of driveway design because it has to serve both right-turning and left-turning vehicles. For non-residential driveways, the width should be sufficient to allow a vehicle to enter without having to slow down excessively, and it should allow vehicles to enter and exit simultaneously.

Driveways serving large traffic generators or industrial facilities should be individually designed to handle the typical large truck that uses the access. AASHTO vehicle turning paths should be evaluated to determine the required width beyond ALDOT minimums. In the case of median-divided driveways, care should be taken to limit the width of the median to a minimum along ALDOT right-of-way to limit the overall width of the intersection. The minimum driveway widths for different land use types are provided in Table 4-4.

Driveway radii should be designed to provide safe and easy vehicle movement for the largest vehicle that will regularly use the driveway. As described previously, AASHTO vehicle turning paths should be examined for land uses that generate a high volume of trucks. ALDOT may require that turning path analysis be submitted with the permit application for these types of accesses. The selected design vehicle should maintain a 2’ clearance from the traveled way, curb line, or median during a right turn maneuver. Additionally, where pedestrian and bicycle facilities are present, driveways should be designed so that they can accommodate those facilities and so that those facilities are usable by individuals with disabilities. The *Alabama Statewide Bicycle and Pedestrian Plan*[12] provides further details on bicycle and pedestrian facilities.

Table 4-4 summarizes the minimum radii for various types of driveways based on the land use served. ALDOT reserves the right to require specific driveway dimensions outside of these minimum values.

Table 4-4: Minimum Driveway Design Guidelines

Driveway Type	Min. Driveway Radius (ft) ‡	Min. Driveway Width (ft) ‡
Single-Family Residential Lot	25	12
Non-Commercial Agriculture	25	16
Commercial/Office/Retail/Subdivisions	50*	24*†
Industrial-Type Facilities	75*	26*

*Should be individually designed to handle the typical large truck that uses the access connection
† One-way driveways can be less than 24 feet but must be at least 12 feet.
‡ Designs below these minimums only allowed with ALDOT approval

4.4.2 Driveway Offsets

Access connections on opposite sides of the roadway, if not lined up directly across from each other, can cause traffic operation issues due to overlapping left turn movements (at locations with two-way left turn lanes or divided highways with short turn lane lengths) or jog maneuvers (on undivided roadways). A jog maneuver occurs when a vehicle makes one continuous movement between two driveways instead of two distinct turning movements. Accesses on opposite sides of the road should either be lined up directly across from each other or meet the spacing requirements laid out in Table 4-1. If those criteria cannot be met, then the minimum spacing between two offset intersections should be 400', as shown in Figure 4-8.

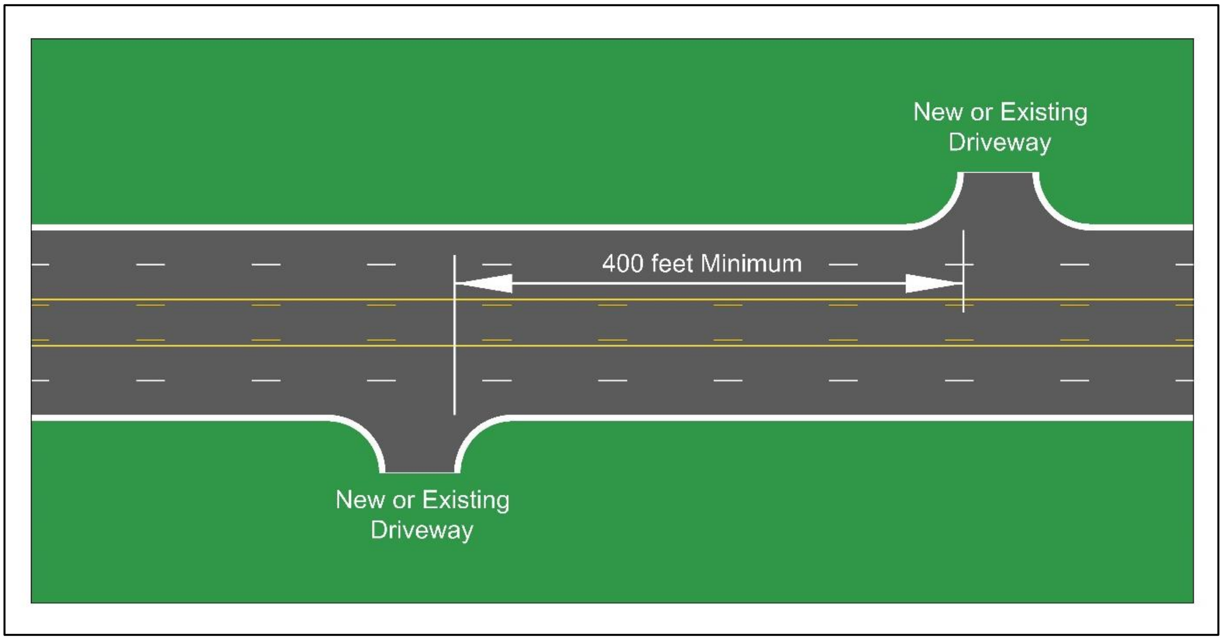


Figure 4-8: Driveway Offsets

[12] https://www.dot.state.al.us/programs/BicyclePlan.html

4.4.3 Throat Length

Throat length can be defined as the distance from the edge of the traveled way along the main roadway to the first point at which there are conflicting movements on a service road or parking area. The throat length distance is a key component for safe and efficient traffic operations along the main roadway. The throat length should be designed to facilitate the movement of vehicles off the roadway to prevent the queuing of vehicles onto the traveled way. ALDOT may require a queue analysis of the applicable location of internal circulation to demonstrate that the throat length is adequate for accommodating the projected queue. Throat lengths should be discussed with ALDOT whenever considering frontage roadways. Table 4-5 summarizes the required minimum driveway throat lengths, depending on the number of exit lanes at the full buildout of a development. When there is a higher number of exit lanes present, there is generally a higher volume of exiting traffic, thus a longer throat length is required. This section is not meant to supersede minimum connection spacing criteria provided in Section 4.3.

Table 4-5: Minimum Driveway Throat Length

Driveway Throat Length* (ft)		
1 Exit Lane	2 Exit Lanes	3+ Exit Lanes
100	150	200

*Capacity analysis should be conducted to verify that the expected queues for exiting traffic do not impede the on-site circulation

4.5 Turn Lanes

Left turns at intersections with permissive left turn movements require turning vehicles to yield to oncoming traffic and wait for an acceptable gap to make the left turn maneuver. In cases where there is no exclusive left turn lane, these vehicles must slow down or stop in a through lane while awaiting an acceptable gap. These conditions increase the risk of a rear-end crash and may result in left-turning vehicles taking risks and accepting gaps in oncoming traffic that are too small, thus increasing the chance of a right-angle crash. For these reasons, an exclusive left turn lane may need to be provided.

Likewise, when a right-turning vehicle is approaching an intersection, they must decelerate to safely make their maneuver. If there is no exclusive right turn lane, then the slower-moving turning traffic will be mixed with and adversely impact the faster-moving through traffic.

Although there are clear safety and operational benefits of exclusive turn lanes, they may not be required or even feasible for all locations. For this reason, an analysis must be performed to determine whether an exclusive turn lane is warranted. The following sections provide procedures for performing turn lane warrant analyses and describe the ALDOT geometric requirements for turn lanes.

4.5.1 Turn Lane Warrants

Turn lane warrant procedures for two-lane and multi-lane roadways are discussed in the following sections. These procedures apply to turn lanes at unsignalized connections (e.g., intersections, driveways, and median crossovers) and also to signalized connections where left turns operate as "permissive," requiring left-turning vehicles to yield to oncoming traffic and wait for an acceptable gap to make their maneuver.

For initial screening, refer to ALDOT's quick reference sheet for turn lanes in Appendix D. This quick guide should not function as a substitute for the warranting process described in this section.

A turn lane is considered "warranted" when any of the following conditions are met:

- An engineering evaluation indicates insufficient stopping sight distance for traffic movements impacted by the turn.
- An evaluation of crash experience indicates that there have been five or more crashes within a 12-month period that could have been mitigated by the installation of a turn lane.
- An engineering evaluation of the impacts of heavy vehicles (percent trucks, grades, etc.) on turn operations and safety.
- An evaluation of applicable traffic volumes shows a turn lane to be warranted. A Turn Lane Quick Guide is available in Appendix D of this Manual. It can be used as a screening tool to determine whether a turn lane is warranted. If the Turn Lane Quick Guide indicates a turn lane is warranted, then Section 4.5.2 of this Manual should be consulted to determine dimensional requirements for the turn lanes. If the applicant does not concur with the results of the Left/Right Turn Lane Quick Guide or it does not apply to a particular situation, a full left turn lane warrant analysis based on the procedures documented in NCHRP Report 457 [13] should be conducted and the results submitted to ALDOT with the permit application.
- A left turn lane should be required at all connections on median divided roadways. This applies not only to new median openings and connections but also to existing connections and median openings when there is a change of use resulting from a proposed development.
- A right turn lane should also be considered at major intersections based on engineering judgment in conjunction with the following:
  - corridor-specific access management plans
  - roadway widening plans
  - roadway resurfacing projects

Even if none of the above conditions are met, ALDOT may still require a turn lane based on their engineering judgment.

4.5.2 Turn Lane Geometric Design

Once the need for an exclusive left or right turn lane has been established, the design of the new lane must conform to all applicable ALDOT guidelines. The following sections describe the ALDOT geometric requirements (storage length, taper dimensions, and width) for exclusive left turn lanes.

4.5.2.1 Turn Lane Lengths

Single turn lanes along ALDOT routes should provide space for turning vehicles to decelerate as well as storage for turning vehicles to queue. As stated in AASHTO's *A Policy on Geometric Design of Highways and Streets*: "The length of the auxiliary lanes for turning vehicles consists of three components: (1) entering taper, (2) deceleration length, and (3) storage length. Desirably the total length of the auxiliary lane should be the sum of the length for these three components. Common practice, however, is to accept a moderate amount of deceleration within the through lanes and to consider taper length as a part of the deceleration within the through lanes."

The various geometric design elements of a turn lane are illustrated in Figure 4-9. The minimum turn lane length requirements are provided in Table 4-6. These values were derived from AASHTO's *A Policy on Geometric Design of Highways and Streets* and include a 10 MPH speed reduction in the through lane before entering the turn lane. Appendix E provides additional guidance on minimum left turn lane storage lengths.

[13] https://onlinepubs.trb.org/onlinepubs/nchrp/esg/esg.pdf

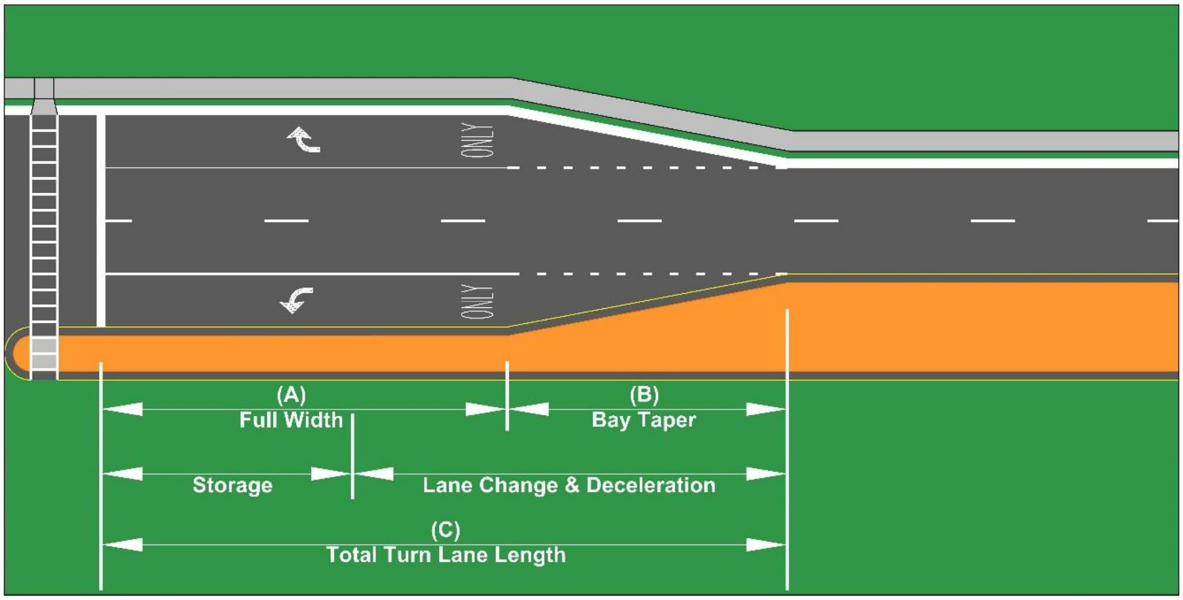


Figure 4-9: Turn Lane Length Components

Table 4-6: Turn Lane Length Minimums

Posted Speed (MPH)	Full Width Length* (ft) (A)	Bay Taper Length (ft) (B)	Total Length* (ft) (C)
35	115	160	275
40	165	160	325
45	215	160	375
50	245	180	425
55	295	180	475
60	320	180	500
65	370	180	550

*Does not include storage requirements. Lengths are based on allowed 10 MPH deceleration in the through lane.

4.5.2.2 Turn Lane Tapers

Taper lengths are provided to approximate the path drivers follow when entering a turn lane. ALDOT requires a straight-line taper for turn lanes. The taper length requirements are based on the posted speed limit and range from 160’ to 180’.

4.5.2.3 Turn Lane Storage

Turn lanes should provide sufficient storage length to accommodate the number of vehicles likely to accumulate during specific intervals within periods of peak traffic. The minimum turn lane lengths provided in Table 4-6 do not include storage length. Those minimum lengths would need to be increased depending on the percentage of trucks, intersection control type, and/or traffic volumes.

For left turn lanes at signalized intersections, the storage length depends upon signal cycle length, signal phasing, and the arrival/departure rate of turning vehicles. The required storage length should be based upon queueing analysis performed with traffic analysis software. Storage length that accommodates the 95th percentile queue length should be provided.

For all turn lane storage lengths, special care should be given to accommodate the truck storage requirements of the turn lane (where applicable).

4.5.2.4 Dual Left Turn Lanes

Certain situations may warrant dual left turn lanes. ALDOT requires a capacity analysis for situations where the left-turning volume exceeds 250 VPH to determine whether a dual left turn lane is warranted. In some cases, lower volumes may warrant dual left turn lanes to maintain or improve capacity and/or operational efficiency. For example, the addition of dual left turn lanes typically results in a higher percentage of green time in a signal cycle being available to through traffic for the major street. Such special cases also require capacity analysis to be performed.

Minimum deceleration and taper lengths shown in Table 4-7 apply to dual left turn lanes. Storage requirements for dual left turns require a detailed capacity analysis using an ALDOT-approved traffic model. Where dual left turns are provided, a minimum median width of 30’ is recommended (two 12’ lanes, 2’ offset, and a 4’ divider).

4.5.2.5 Shifting Taper Lengths

When a left turn lane is constructed on an undivided roadway, an adequate transition length must be provided for the through lanes to allow for a safe shift for the through vehicles. The shifting taper length is based on the posted speed limit and width of offset, as shown in Table 4-7. The typical widening width is 12’ if widening to one side or 6’ if widening symmetrically. Figures 4-10 and 4-11 illustrate the shifting taper lengths with widening on just one side and widening symmetrically, respectively.

Table 4-7: Shifting Taper Length

Posted Speed (MPH)	Shifting Taper Length (ft)
≤ 40	$STL = WS^2 / 60$
≥ 45	$STL = WS$

Where:
STL = Shifting taper length (ft)
W = Width of offset (ft)
S = Posted speed limit

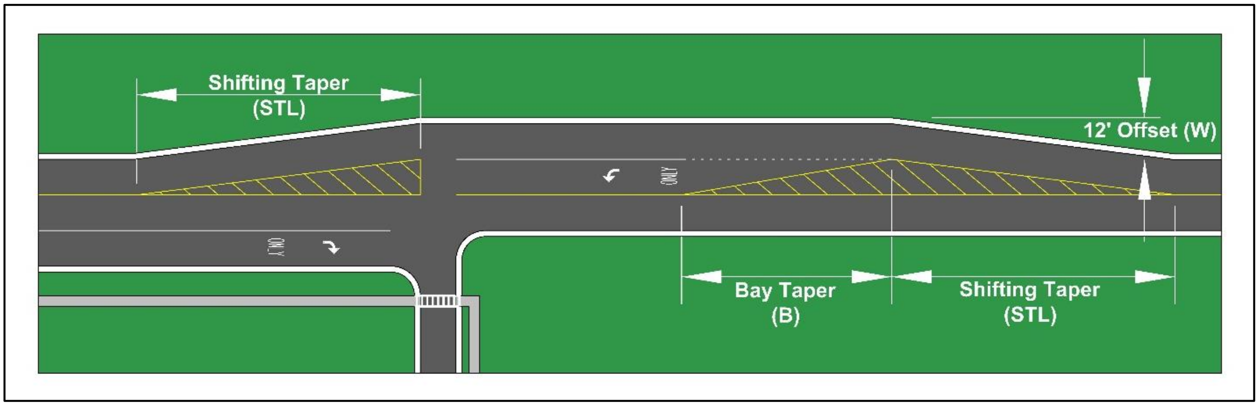


Figure 4-10: Shifting Taper Length – Widening on One Side

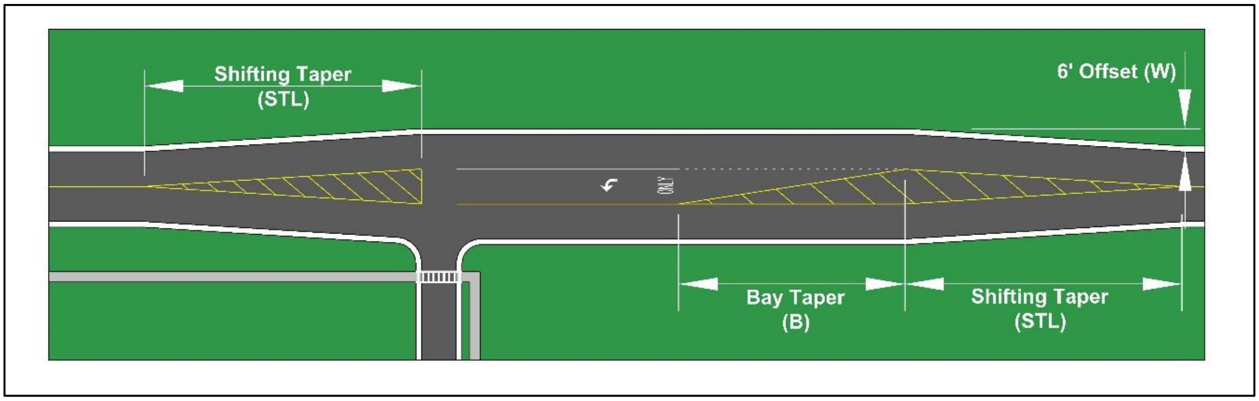


Figure 4-11: Shifting Taper Length – Symmetrical Widening

4.5.2.6 Left Turn Bypass Lanes

Left turn bypass lanes provide another option for separating turning vehicles from through vehicles. Because left-turning vehicles need to decelerate or stop in the through lane, bypass lanes are not as safe as exclusive left turn lanes; however, bypass lanes are preferable to no left turn treatment at all. Figure 4-12 shows a conceptual bypass lane. A detailed drawing is provided on ALDOT's safety office website here[14].

Bypass lanes should only be considered at three-legged intersections on two-lane roads when cost or right-of-way constraints limit the ability to construct turn lanes. Bypass lanes should not be used at four-legged intersections.

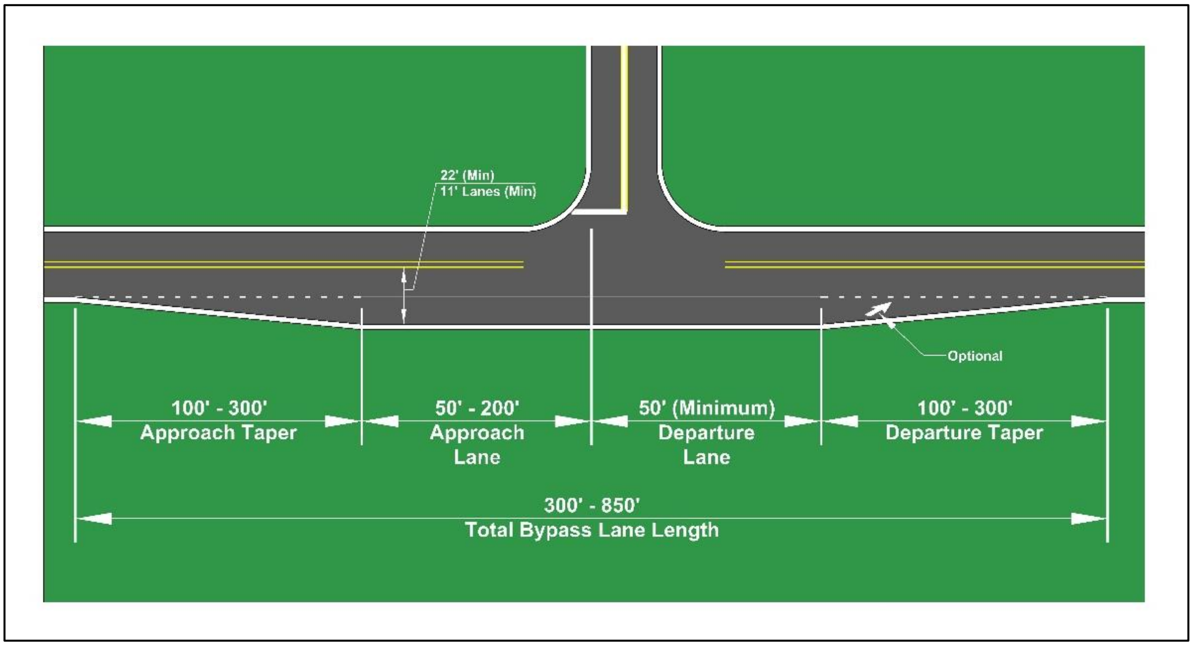


Figure 4-12: Left Turn Bypass Lane

4.5.2.7 Channelization Design

When a channelized island is provided at the terminus of a right turn lane, consideration should be given to the angle at which the right turn lane joins the intersecting road. Channelized right turns are often

[14] https://www.dot.state.al.us/publications/Design/pdf/TrafficSafetyOp/LeftTurnBypassLane.pdf

constructed with a wide radius that can require the driver to either look over their left shoulder or use their mirrors to merge into the through lanes. This can result in high rates of rear-end crashes (when looking over the shoulder instead of looking forward) or side-swipe crashes (when a vehicle in the through lane is in a blind spot).

"Smart channel" designs at the termini of right turn lanes help to widen drivers' cones of vision towards both pedestrians and vehicular traffic on the intersecting road, which improves the safety for both.

Critical components of a "smart channel" design are illustrated in Figure 4-13. More detailed drawings of the design are provided on ALDOT's website[15]. The angle at which the turn lane intersects the cross street should be approximately 70°.

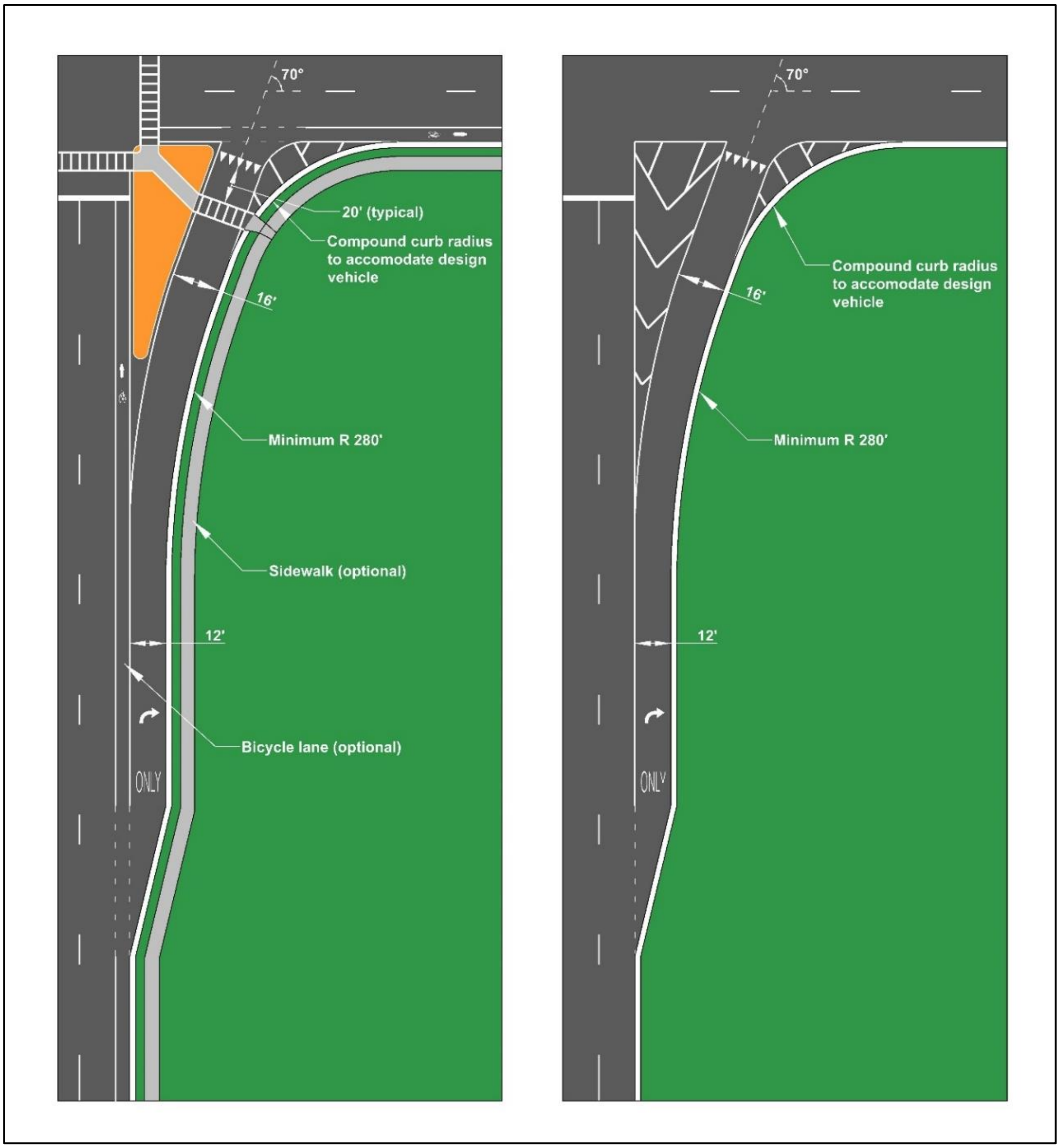


Figure 4-13: Smart Channel Design

[15] https://www.dot.state.al.us/publications/Design/pdf/TrafficSafetyOp/SmartChannel.pdf

4.6 ACCELERATION LANES

Acceleration lanes provide drivers turning onto a roadway with sufficient length for drivers to accelerate until the desired roadway speed is reached. Additionally, the acceleration lane must be long enough to allow drivers to position their vehicle adjacent to a gap in the through traffic and maneuver into that gap before the lane ends. While acceleration lanes are typically constructed for interstate/freeway entrance ramps, they can also be beneficial on major streets with high speeds and high turning volumes.

The acceleration lane length should be based on the design speed of the roadway. Figure 4-14 shows an acceleration lane and Table 4-8 provides the minimum required acceleration lengths based on a 15 MPH initial speed. The bay taper lengths previously provided in Table 4-6 can also be used for acceleration lanes. These values should be adjusted if vehicles are accelerating from a stopped position or if they are beginning at a speed higher than 15 MPH, per the guidelines provided in *A Policy on Geometric Design of Highways and Streets*.

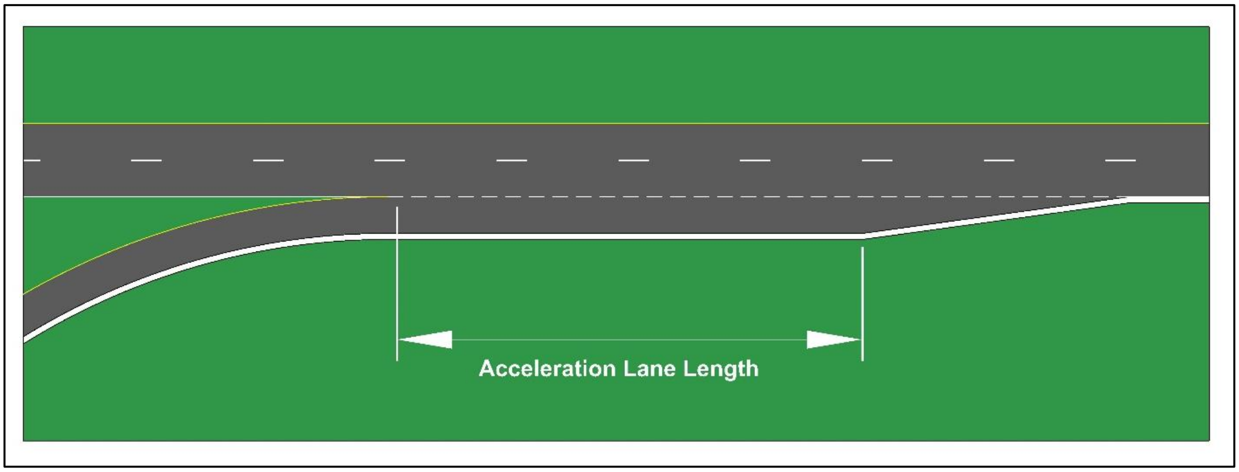


Figure 4-14: Acceleration Lane Length

Table 4-8: Minimum Acceleration Lane Length

Design Speed (MPH)	Acceleration Lane Length (ft)
30	140
35	220
40	300
45	490
50	660
55	900
60	1140
65	1350
70	1560

4.7 Retrofit Techniques

Access management techniques can be applied to existing/developed roadways as part of a process commonly referred to as "retrofit" by application of the guidelines set forth in this Manual. Introduction of access management techniques on roadways that are currently developed will often be difficult and controversial. Innovative solutions will be needed to achieve the desired goals of improved safety and traffic operations along state roadways.

These techniques should be considered whenever property access is considered along a state roadway. Each permit/construction project is an opportunity to provide an access management solution that will make roadways safer and improve traffic operations. Wherever possible, the guidelines in this Manual should be followed when developing retrofit solutions to current roadways. A list of appropriate retrofit techniques is provided in Appendix F.

4.8 Local Access Management Strategies

Although ALDOT only has jurisdiction over the state's highways, the guidelines in this Manual can also be adopted and applied at local levels to manage access to local roads. Developments that only access local roads can affect operations on adjacent state highways, and developments that only access state highways can affect operations on adjacent local roads.

ALDOT can require that traffic impact studies be conducted for developments that do not directly access the state highway system but will impact the traffic conditions on the existing highway system.

It is through a cooperative relationship between ALDOT and local governments that the safety and operational benefits of access management can be fully realized on all roads in Alabama.

Access management case studies are provided in Appendix G.

Appendix A

References

ALABAMA DEPARTMENT OF TRANSPORTATION

Reference	Where to Find It
AASHTO *Highway Capacity Manual* (HCM 2010)	American Association of State Highway and Transportation Officials website: www.transportation.org
AASHTO *A Policy on Geometric Design of Highways and Streets*	American Association of State Highway and Transportation Officials website: www.transportation.org
Alabama Traffic Data	Alabama Traffic Data website: https://aldotgis.dot.state.al.us/TDMPublic/
ALDOT Highway Functional Classification (HFC) Maps	1. Go to the ALDOT home page at www.dot.state.al.us 2. In the top banner, click on **Maps** 3. Click on the button labeled **HFC** **4.** Click on the button labeled **See all HFC Counties/Regions** 5. Select the appropriate map from the drop-down menu for the applicable Region
ALDOT *Maintenance Manual*	1. Go to the ALDOT home page at www.dot.state.al.us 2. Click on **Publications** 3. Type "Maintenance Manual" in the search bar, then select it from the list of results
ALDOT *Miscellaneous Guide Sign Manual*	1. Go to the ALDOT home page at www.dot.state.al.us 2. Click on **Publications** 3. Type "Miscellaneous Guide Sign Manual" in the search bar, then select it from the list of results
ALDOT *Permit Manual*	1. Go to the ALDOT home page at www.dot.state.al.us 2. Click on **Publications** 3. Type "Permit Manual" in the search bar, then select it from the list of results
ALDOT Standard and Special Drawings	1. Go to the ALDOT home page at www.dot.state.al.us 2. Click on **Business** 3. Under the **Project Planning** section, click on **Construction Information** 4. Expand the **Resources** drop-down menu, then select **Standard and Special Drawings**
ALDOT Standard Specifications for Highway Construction	1. Go to the ALDOT home page at www.dot.state.al.us 2. Click on **Business** 3. Under the **Project Planning** section, click on **Construction Information** 4. Expand the **Resources** drop-down menu, then select **Specifications**

Reference	Where to Find It
ALDOT *Traffic Signal Timing & Design Manual*	1. Go to the ALDOT home page at www.dot.state.al.us 2. Click on **Publications** 3. Type "Traffic Signal Design Guide & Timing Manual" in the search bar, then select it from the list of results
ALDOT *Utilities Manual*	1. Go to the ALDOT home page at www.dot.state.al.us 2. Click on **Publications** 3. Type "Utilities Manual" in the search bar, then select it from the list of results
ALDOT Warrant Analysis Worksheet	1. Go to the ALDOT home page at www.dot.state.al.us 2. Click on **Publications** 3. Type "Warrant Analysis Worksheet" in the search bar, then select it from the list of results
ITE *Trip Generation Manual*	Institute of Transportation Engineers website: www.ite.org
***Manual on Uniform Traffic Control Devices* (MUTCD)**	Federal Highway Administration website: http://mutcd.fhwa.dot.gov/pdfs/2009/pdf_index.htm
NCHRP Report 457	Transportation Research Board website: www.trb.org/publications/**nchrp**/esg/esg.pdf

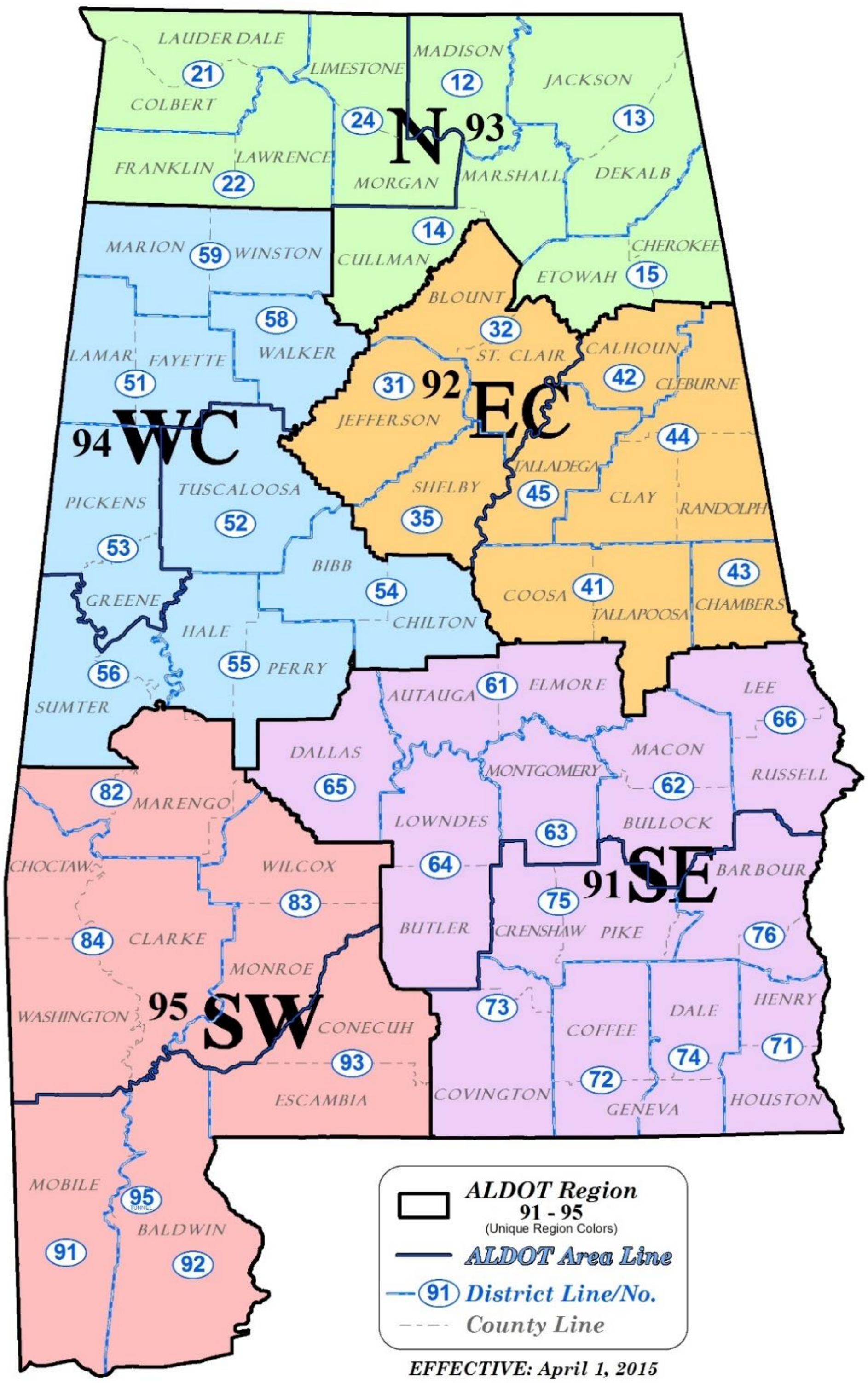
Appendix B

ALDOT Region and Area Contacts

Appendix B – ALDOT Region and Area Contacts

Office	Address	Phone Number
North Region	**1525 Perimeter Parkway, Suite 400** **Huntsville, AL 35806**	**256-505-4955**
Guntersville Area	23445 U.S. Highway 431 / P.O. Box 550 Guntersville, AL 35976-0550	256-837-0111
District 12	4711 Governor's House Drive, Huntsville, AL 35805	256-837-0111
District 13	3417 AL Highway 71, Dutton, AL 35744	256-228-6028
District 14	15797 Highway 69 North, Joppa, AL 35087	256-586-4178
District 15	4509 Airport Road, Gadsden, AL 35904	256-442-4436
Tuscumbia Area	295 Highway 20 East / P.O. Box 495 Tuscumbia, AL 35674-0495	256-389-1400
District 21	295 Highway 20 East, Tuscumbia, AL 35674	256-389-1441
District 22	850 AL Highway 101, Town Creek, AL 35672	256-974-0648
District 24	21113 Highway 20 West, Tanner, AL 35671	256-353-8862
East Central Region	**100 Corporate Parkway, Suite 450** **Hoover, AL 35242**	**205-327-4962**
Birmingham Area	1020 Bankhead Highway West, 35204 / P.O. Box 2745 Birmingham, AL 35202-2745	205-328-5820/ 800-342-3815
District 31	1020 Bankhead Highway West, Birmingham, AL 35204	205-581-5702
District 32	6480 2nd Ave W, Oneonta, AL 35121	205-274-2112
District 35	3805 Highway 31, Calera, AL 35040	205-668-0173
Alex City Area	240 Highway 280, 35010 / P.O. Box 1179 Alexander City, AL 35011-1179	256-234-4265/ 800-952-5631
District 41	240 Highway 280, Alexander City, AL 35010	256-234-8480
District 42	1545 U.S. Highway 431 North, Anniston, AL 36204	256-820-3131
District 43	9100 U.S. Highway 280 West, Auburn, AL 36830	334-887-3341
District 44	10214 Highway 9, Delta, AL 36258	256-253-2158
District 45	30265 AL Highway 21, Talladega, AL 35160	256-362-1240
West Central Region	**204 Marina Drive, Suite 100** **Tuscaloosa, AL 35406**	**205-562-3099**
Tuscaloosa Area	2715 East Skyland Boulevard Tuscaloosa, AL 35405	205-553-7030
District 52	2715 East Skyland Boulevard, Tuscaloosa, AL 35407	205-554-3288
District 54	8586 AL Highway 22 West, Maplesville, AL 36750	334-366-2954
District 55	9371 Highway 14, Greensboro, AL 36744	334-624-8851
District 56	129 Smith Avenue, Livingston, AL 35470	205-652-7964
Fayette Area	399 25th Street NE Fayette, AL 35555	205-932-7560
District 51	432 12th Street NW, Fayette, AL 35555	205-932-8930
District 53	20233 Highway 17 South, Carrollton, AL 35447	205-367-8746
District 58	542 Cordova Cut Off Rd, Jasper, AL 35501	205-221-9128
District 59	372 Industrial Drive, Hamilton, AL 35570	205-921-2117

Office	Address	Phone Number
Southeast Region	**Capitol Commerce Center, Building B** **100 Capitol Commerce Boulevard, Suite 210** **Montgomery, AL 36117**	**334-353-6850**
Montgomery Area	1525 Coliseum Boulevard / P.O. Box 8008 Montgomery, AL 36110	334-269-2311/ 800-505-1158
District 61	3298 AL Highway 143, Elmore, AL 36025	334-567-4379
District 62	21205 Highway 82 East, Union Springs, AL 36089	334-738-2150
District 63	608 Chisholm Street, Montgomery, AL 36110	334-242-6572
District 64	2618 Fort Dale Road, Greenville, AL 36037	334-382-6614
District 65	7489 US Highway 80 W, Marion Junction, AL 36759	334-875-4455
District 66	11717 U.S. Highway 280 East, Salem, AL 36874	334-480-8943
Troy Area	299 Elba Highway Troy, AL 36079	334-566-4830
District 71	171 Sam Houston Boulevard, Dothan, AL 36303	334-794-4958
District 72	3710 Plaza Drive, Enterprise, AL 36330	334-347-8166
District 73	11975 Lavon Shaddix Lane, Andalusia, AL 36420	334-222-5555
District 74	461 Black Forest Drive, Ozark, AL 36360	334-774-4542
District 75	299 Elba Highway, Troy, AL 36079	334-670-2475
District 76	760 Highway 30, Eufaula, AL 36027	334-687-3161
Southwest Region	**1701 I-65 West Service Road North** **Mobile, AL 36618-1109**	**251-470-8200**
Mobile Area	1701 I-65 West Service Road North Mobile, AL 36618-1109	251-470-8200
District 91	1701 I-65 West Service Road North, Mobile, AL 36618	251-470-8209
District 92	47450 Rabun Road, Bay Minette, AL 36507	251-937-2086
District 93	10610 Highway 31, Evergreen, AL 36401	251-578-7546
Grove Hill Area	129 Grove Hill Avenue East Grove Hill, AL 36451	251-275-4103
District 82	20541 Range St., Thomaston, AL 36783	334-627-3458
District 83	3360 Camden Bypass, Camden, AL 36726	334-682-4718
District 84	600 Max Gillis Road, Grove Hill, AL 36451	251-275-3675


LAUDERDALE
21
COLBERT
LIMESTONE
MADISON
12
JACKSON
13
24
N
93
FRANKLIN
22
LAWRENCE
MORGAN
MARSHALL
DEKALB
14
CULLMAN
CHEROKEE
ETOWAH
15
MARION
59
WINSTON
58
WALKER
BLOUNT
32
ST. CLAIR
CALHOUN
42
CLEBURNE
LAMAR
FAYETTE
51
31
92
EC
JEFFERSON
94
WC
44
TALLADEGA
PICKENS
TUSCALOOSA
52
SHELBY
45
35
CLAY
RANDOLPH
53
BIBB
54
GREENE
COOSA
41
TALLAPOOSA
43
CHAMBERS
HALE
CHILTON
55
PERRY
56
SUMTER
AUTAUGA
61
ELMORE
LEE
66
DALLAS
65
MACON
MONTGOMERY
62
RUSSELL
82
MARENGO
LOWNDES
63
BULLOCK
CHOCTAW
WILCOX
64
91
SE
BARBOUR
83
75
84
CLARKE
BUTLER
CRENSHAW
PIKE
76
MONROE
HENRY
WASHINGTON
95
SW
CONECUH
73
DALE
COFFEE
93
74
71
ESCAMBIA
COVINGTON
72
GENEVA
HOUSTON
MOBILE
95
BALDWIN
91
92
ALDOT Region
91 - 95
(Unique Region Colors)
ALDOT Area Line
91 District Line/No.
County Line
EFFECTIVE: April 1, 2015

Appendix C

Traffic Impact Study Checklist and Report Outline

Traffic Impact Study Checklist and Report Outline

If it is determined that a traffic impact study is required, the following tasks should be completed:

☐Conduct a scoping meeting or conference call with ALDOT
- ☐Define the study area
- ☐Determine traffic data needed (hours and locations)
- ☐Determine critical analysis requirements
- ☐Determine the horizon year and development phasing
- ☐Discuss crash history within study area
- ☐Discuss trip generation source
- ☐Determine if there are any existing access management plans in place or any upcoming developments within the study area

☐Collect traffic data
☐Determine peak hours
☐Analyze existing conditions for each peak hour
☐Grow traffic and analyze background conditions for each peak hour, if necessary
☐Estimate trip generation (including pass-by and new trip splits)
☐Distribute and assign traffic within the study area
☐Analyze future conditions for each peak hour (during each phase of development, if necessary)
☐Perform traffic signal warrant evaluation if necessary
☐Determine improvements needed to mitigate the development impact
☐Compile analysis and findings into a report (see outline below)

REPORT OUTLINE

1. Preface
2. Introduction & Overview
   - Overview of Development
   - Analysis Scenarios
3. Existing Traffic Conditions
   - Project Study Area
   - Existing Geometric Data
   - Existing Traffic Data
   - Existing Traffic Conditions Analysis
4. Future “No Build” Traffic Conditions (as applicable)
   - Future Roadway Improvements
   - Background Traffic Growth
   - Future “No Build” Traffic Volumes
   - Future “No Build” Traffic Conditions Analysis
5. Future “Build” Traffic Conditions
   - Description of Proposed Development
   - Trip Generation Estimates
   - Site-Generated Traffic Distribution
   - Future “Build” Traffic Volumes
   - Traffic Signal Warrant Analysis (as applicable)
   - Future “Build” Traffic Conditions Analysis
6. Conclusions/Recommendations
7. Appendices
   - Proposed Site Layout
   - Signal Timing Sheets (as applicable)
   - Traffic Count Data
   - Existing Capacity Analysis
   - Signal Warrant Analysis (as applicable)
   - Future “No Build” Capacity Analysis (as applicable)
   - Future “Build” Capacity Analysis

Appendix D

Left/Right Turn Lane Quick Guide

ALABAMA DEPARTMENT OF TRANSPORTATION

Appendix D – Left/Right Turn Lane Quick Guide

Directions: The Information contained in this worksheet could be used as a turn lane guide along ALDOT roadways. Follow steps 1-3 to determine estimated peak hour traffic conditions for the proposed development, and then compare with turn lane traffic volume guides at the bottom of the sheet to determine if a turn lane requirement should be considered. Note the following:

- This sheet does not replace a traffic study (when required) nor does it replace actual development specific turn lane warrant procedures as described in Chapter 4 of the ALDOT *Access Management Manual*.
- For more information regarding traffic impact studies see Chapter 3 of the ALDOT *Access Management Manual*.
- For more information regarding turn lane requirements see Chapter 4 of the ALDOT *Access Management Manual*.
- Contact your local ALDOT District staff (refer to Appendix B) with any questions regarding information on this sheet.

Step #1: Trip Generation Estimates – Peak Hour Inbound Only

Residential Land Uses:

- Single-Family Detached Housing:________units * (0.60)
- Single-Family Attached Housing:________units * (0.33)
- Multifamily Housing (Low-Rise):__________units * (0.33)

Lodging Land Uses:

- Hotel: ______units * (0.30)
- Motel:______units * (0.20)

Office Land Uses:

- General Office Building: (__________ft^2 floor area/1000) * (1.34)
- Medical/Dental Office: (__________ft^2 floor area/1000) * (2.45)

Retail/Service:

- Shopping Center (>150k sf): (________________ft^2 floor area/1000) * (1.64)
- Shopping Plaza (40k-150k sf): (_______________ft^2 floor area/1000) * (4.34)
- Strip Retail Plaza (<40k sf):(_________________ft^2 floor area/1000) * (3.30)
- Supermarket:(___________________________ft^2 floor area/1000) * (4.48)
- Fast Casual Restaurant:(___________________ft^2 floor area/1000) * (6.91)
- Fast Food Restaurant w/ Drive Thru: (_________ft^2 floor area/1000) *(17.18)
- Convenience Store(2-4k sf)/Gas Station: _______fueling positions * (9.21)

Institutional Land Uses:

- Day Care Center: ___________students * (0.42)
- Elementary School:__________students * (0.40)
- Middle/Jr. High School:______students * (0.37)
- High School:________________students * (0.35)

Industrial Land Uses:

- Manufacturing: (____________ft^2 floor area/1000) * (0.52)
- Warehousing: (______________ft^2 floor area/1000) * (0.14)
- Industrial Park: (____________ft^2 floor area/1000) * (0.28)

Step #2: Determine Direction of Approach

Evaluate the existing field conditions and determine the following directions of approach for peak hour inbound site traffic:

______% Traffic approaching driveway as right turns

______% Traffic approaching driveway as left turns

The need for a turn lane is not totally absolved when the estimated number of peak hour turns falls below the values shown above. A turn lane or turn lane warrant analysis may still be required at ALDOT's discretion.

Step #3: Peak Hour Driveway Traffic Volumes Calculation

______% Rights (from Step #2) *_______Trips (from Step #1) =________Peak Hour Right Turns

______% Lefts (from Step #2) *_______Trips (from Step #1) =_______Peak Hour Left Turns

Left Turn Lane Guidelines:

Roadway Under 6,000 veh/day AADT
If the peak hour left turns are greater than **40** then a left turn lane is **required**.

Roadway Over 6,000 veh/day AADT
If the peak hour left turns are greater than **30** then a left turn lane is **required**.

Right Turn Lane Guidelines:

Roadway Under 6,000 veh/day AADT
If the peak hour right turns are greater than **30** then a right turn lane is **required**.

Roadway Over 6,000 veh/day AADT
If the peak hour right turns are greater than **20** then a right turn lane is **required**.

Appendix E

Left Turn Lane Storage Length Calculations

ALABAMA DEPARTMENT OF TRANSPORTATION

Directions: The following equation may be used to estimate the required left turn storage length:

L = (V/N)(2)(S)

where:

L = storage length (ft)
V = peak hour left-turn volume (vph)
N = number of cycles per hour for signalized intersections (use 30 for un-signalized intersections)
2 = a factor that provides for storage of all left-turning vehicles on most cycles
S = queue storage length (typically assumed as 25 ft/vehicle)

Based on the information illustrated above, Table A.1 illustrates approximate left turn storage requirements for a range of hourly left turn volumes at unsignalized intersections and signalized intersections with various cycle lengths.

If an unsignalized intersection has 45 left turns per hour, Table A.1 indicates that a minimum storage length of 100 ft is required. Therefore, the minimum turn lane length for the design speed would be sufficient. If there are more than 70 left turns per hour then the minimum storage length is 120 ft. Therefore, the total turn lane length must be lengthened by 20 ft.

TABLE A.1 Minimum Left Turn Storage Lengths

Approximate Vehicle Storage Requirements						
Un-signalized Intersections	Peak Hour Left Turn Volume (VPH)					
	<30	**30**	**40**	**50**	**60**	**70**
	100 ft *	100 ft *	100 ft *	100 ft *	100 ft	120 ft
Signalized Intersections	Peak Hour Left Turn Volume (VPH)					
	<50	**50**	**60**	**70**	**80**	**90**
90 sec. Traffic Signal Cycle	100 ft *	100 ft *	100 ft *	100 ft *	100 ft	115 ft
100 sec. Traffic Signal Cycle	100 ft *	100 ft *	100 ft *	100 ft	115 ft	125 ft
110 sec. Traffic Signal Cycle	100 ft *	100 ft *	100 ft *	110 ft	125 ft	140 ft

* 100 ft minimum storage length is required.

The values presented in Table A.1 should be used as a guide of when to consider detailed queue calculations. They are not intended to replace actual queue calculations.

Appendix F

Retrofit Techniques

Limit the Number of Conflict Points

The following improvements should be considered when it is desired to reduce the number of conflict points:

1. Install median barrier with no direct left turn access
2. Install raised median divider with left turn deceleration lanes
3. Install one-way operations on the highway
4. Install traffic signal at high-volume driveways that meet spacing criteria and applicable traffic signal warrants
5. Channelize median openings to prevent left turn ingress and/or egress maneuvers
6. Widen right through lane to limit right turn encroachment onto the adjacent lane to the left
7. Install channelizing islands to prevent left turn deceleration lane vehicles from returning to the through lanes
8. Install physical barrier to prevent uncontrolled access along property frontages
9. Locate driveway opposite a three-legged intersection or driveway and install traffic signals where warranted
10. Install driveway channelizing island to prevent left turn maneuvers
11. Install driveway channelizing island to prevent driveway encroachment conflicts
12. Install channelizing island to control the merge area of right turn egress vehicles

Separate Conflict Areas

The following improvements should be considered when conflict areas need to be separated:

1. Regulate minimum spacing of driveways
2. Regulate minimum corner clearance
3. Optimize driveway spacing
4. Regulate maximum number of driveways per property frontage
5. Consolidate access for adjacent properties
6. Consolidate existing access whenever separate parcels are assembled under one purpose, plan, entity, or usage
7. Designate the number of driveways regardless of future subdivision of that property
8. Require access on lower classified roadways in lieu of arterial access

Mitigate Speed Limit Issues

The following improvements should be considered when speed limit issues need to be mitigated:

1. Improve driveway sight distance
2. Restrict parking on the roadway next to driveways to increase driveway turning speeds
3. Regulate minimum sight distance
4. Increase the effective approach width of the driveway
5. Improve the driveway profile
6. Regulate driveway construction and maintenance (require performance bonds)
7. Install channelizing islands to prevent driveway vehicles from backing onto a state roadway
8. Install channelizing islands to move ingress merge point laterally away from the roadway
9. Move sidewalk-driveway crossing laterally away from the roadway

Remove Turning Vehicles from Through Lanes

The following improvements should be considered when turning vehicles need to be removed from the through lanes:

1. Install left turn or right turn lanes
2. Install sufficient deceleration distance for the turn lane
3. Install sufficient storage capacity for the turn lane
4. Construct a service/frontage roadway
5. Install supplementary access on lower classified roadways
6. Install additional driveway when total driveway demand exceeds capacity
7. Encourage connections between adjacent properties
8. Require adequate internal design and circulation plans for adjacent properties

Appendix G

Case Studies

ALABAMA DEPARTMENT OF
TRANSPORTATION

CASE STUDY 1: GAS STATION REDEVELOPMENT

BACKGROUND

A gas station has been vacant for over 5 years, and a new owner has purchased the property. See Figure E-1. It is on a corner lot at the intersection of a state highway (4-lane divided, 55 MPH) and a local route (2-lane, 35 MPH). There are currently two accesses to the state highway (1 full and 1 right-in/right-out) and one very wide (>100') full access to the local route. The fueling truck route is also shown on Figure E-1. The developer intends to rebuild the gas station pumps and convenience store, open it back up, and keep the same driveway locations.

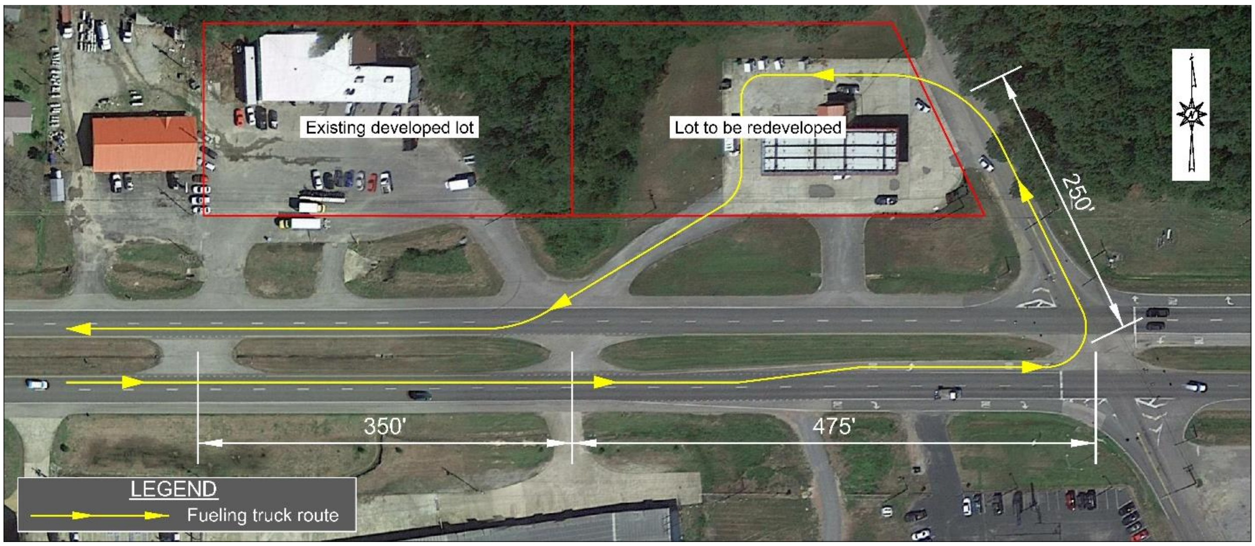


Figure E-15: Lot to Be Redeveloped

- Is the developer allowed to keep all of the driveway locations?
- Where would you recommend their access(es) be located?
- Are there any other opportunities for access management in the study area?

EVALUATION

Even though the land use is not changing, permitting is still required and the accesses should be retrofitted to maximize the spacing between those accesses and the signalized intersection. Refer to Table 4-1 and Table 4-2. On the east side of the property, the access width should be significantly reduced. This will increase the spacing and reduce the number of conflict points. Even though this would be short of the minimum criteria, it is needed to allow for the fueling truck route. The existing "shared" access on the west side of the property is also too wide and should be narrowed. The existing right-in/right-out driveway in the middle of the property should be eliminated.

Table 4-1: Minimum Spacing Criteria – Full Access

Access Category	Posted Speed (MPH)	Minimum Spacing (ft)*		
		Signalized	Unsignalized	
			Divided	Undivided
Commercial/Industrial Driveway	<45	1,000	660	450
	45 - 50	1,320	1,320	660
	≥55	2,640	1,320	1,320

Table 4-2: Minimum Spacing Criteria – Directional Access

Access Category	Posted Speed (MPH)	Minimum Spacing (ft)*			
		Right-in Only (Upstream)	Right-out Only (Downstream)	Right-in/ Right-out	Other Directional Accesses
Commercial/Industrial Driveway	<45	250	250	275	450
	45 - 50	440	440	660	660
	≥55	500	500	660	660

Figure E-16: Proposed Access Modifications

CASE STUDY 2: CORRIDOR ACCESS MANAGEMENT

BACKGROUND

A corridor access management plan is under development for a state highway. There are three closely spaced intersections. The southern intersection provides access for a boat ramp and must remain at its current location with full turning movements. The middle intersection has three legs and is signalized. It serves an industrial area and experiences a high percentage of truck traffic. The northern intersection has three legs and is unsignalized. Trucks making the southbound left turn movement at the middle intersection routinely queue into the northern intersection. The two-way left-turn lane north of the signalized intersection is 18 feet wide. There are several full access driveways north of the signal. See Figure E-3 below.

Figure E-17: Existing

- How would you consolidate conflict points between the two northern intersections?
- What median modifications would you make?

EVALUATION

Since the middle intersection is already signalized and serves an industrial park, it would be most logical to realign the northern intersection to form a fourth leg at the existing signal. This would require ROW acquisition, and the feasibility of that should be explored before proceeding with the project.

On the northern side of the intersection, a six-foot raised concrete median could be constructed after the realignment, leaving enough width for a twelve-foot-wide southbound left turn lane. North of the turn lane taper, a full-width raised median could be constructed. This would effectively turn the existing full access driveways into right-in/right-out driveways (see Figure E-4).

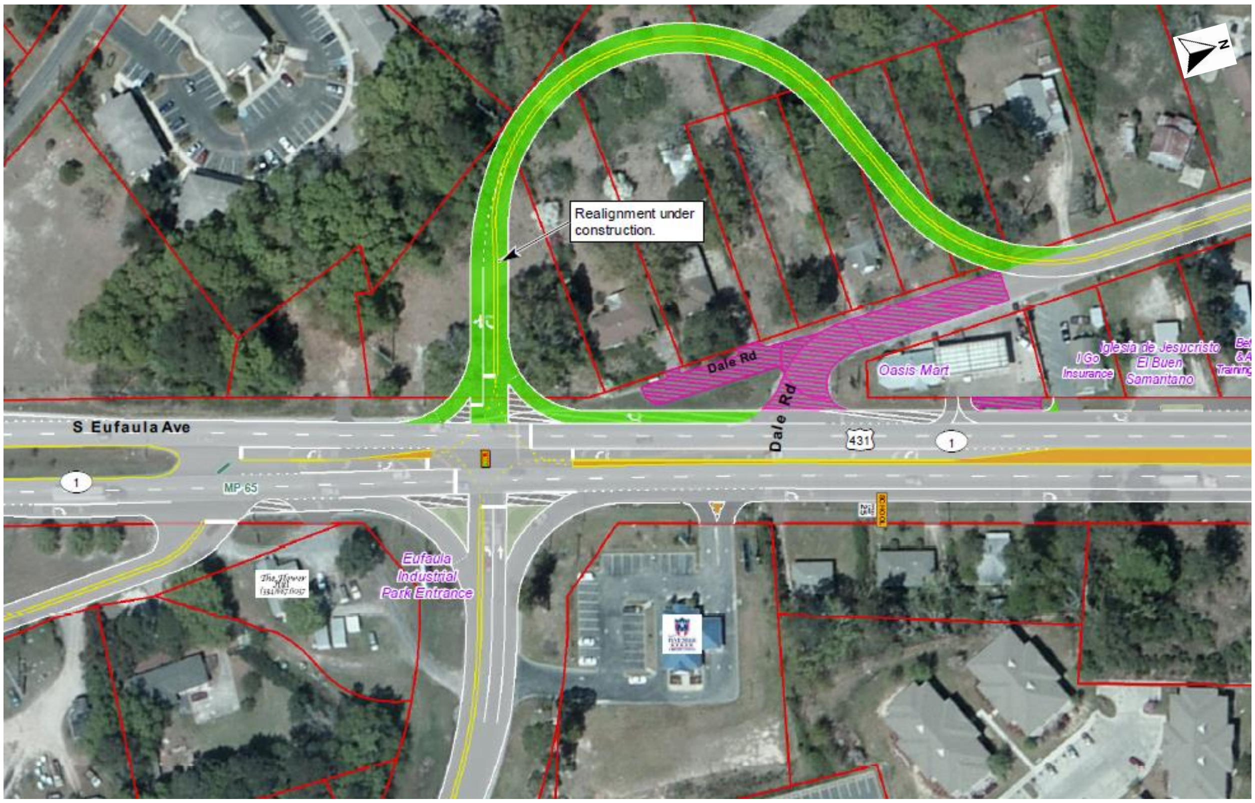


Figure E-18: Proposed Access Management Plan

Case Study 3: Improvements to Mitigate Crashes

Background

On their daily commute, the District Administrator has noticed a large amount of crashes and near misses around an unsignalized intersection of a state highway (4-lane divided, 55 MPH) and a county road (see Figure E-5). After obtaining and analyzing crash records for the area, the District office noticed several crash trends (see Figure E-6). There are two channelized right turns with wide radii that show high rates of rear-end and sideswipe crashes. At the main intersection, there were high rates of angle and left turn crashes that resulted in incapacitating injuries. Additionally, the acceleration lane on the southern side of the main intersection experienced a high number of sideswipe crashes.

Figure E-19: Existing Median Spacing

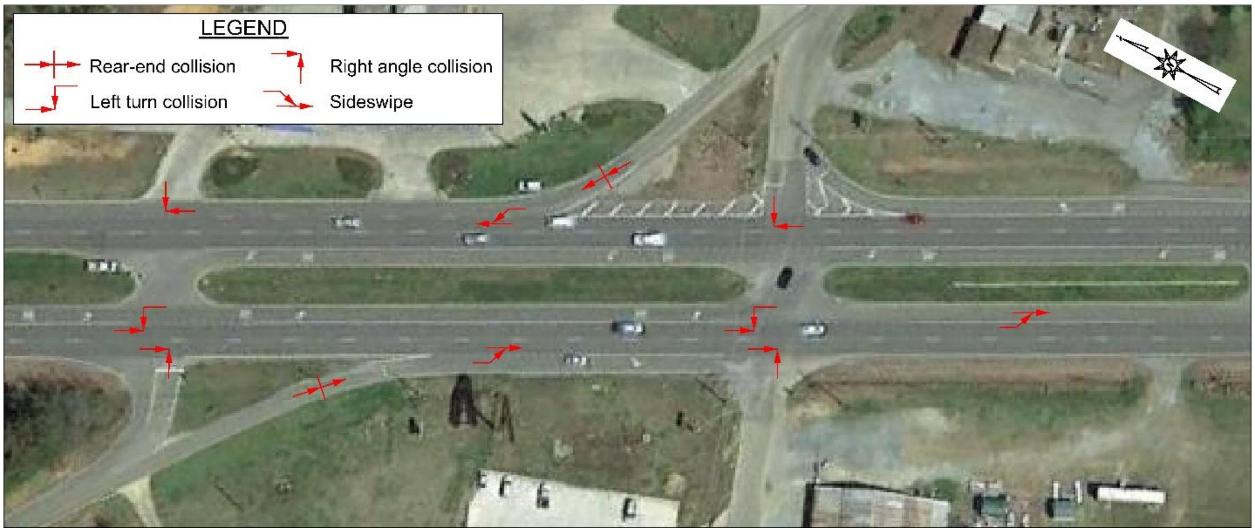


Figure E-20: Crash Trends

- How could those crash trends be addressed?

- Is there a way to reduce the number of accesses to the existing gas station?

- A signal warrant analysis was conducted and did not come close to meeting any of the volume warrants. Are there any alternative intersection designs that could potentially work?

EVALUATION

There are several different crash trends that need to be addressed:

- Rear-end and sideswipe crashes on the channelized right turn lanes – See Section 4.5.2.7 regarding design of "smart channels." This design helps to widen drivers' cones of vision and reduce these types of crashes.
- When designing the smart channel on the northern side, the gas station access on the side road could be eliminated to help improve corner clearance (see Section 4.3.2). When modifying/eliminating accesses to gas stations, consider the path that fuel trucks must take to enter and exit the property.
- Since a signal is not warranted at the main intersection, other options should be considered to mitigate the number of angle and left turn crashes. See Section 2.8.3 for alternative intersection designs. Due to the roadway geometry, a restricted crossing U-turn (RCUT) intersection could be considered. Traffic volume data should be collected at the main intersection and adjacent median openings and analysis should be performed to determine if the RCUT will operate efficiently.
- If left turn and through movements at the main intersection are going to be prohibited as part of an RCUT design, then U-turn locations should be provided near the main intersection. The U-turn locations should be designed based on heavy vehicle turning paths, which will often require that bulb-outs be constructed.

Figure E-21: Proposed Improvements at Main Intersection

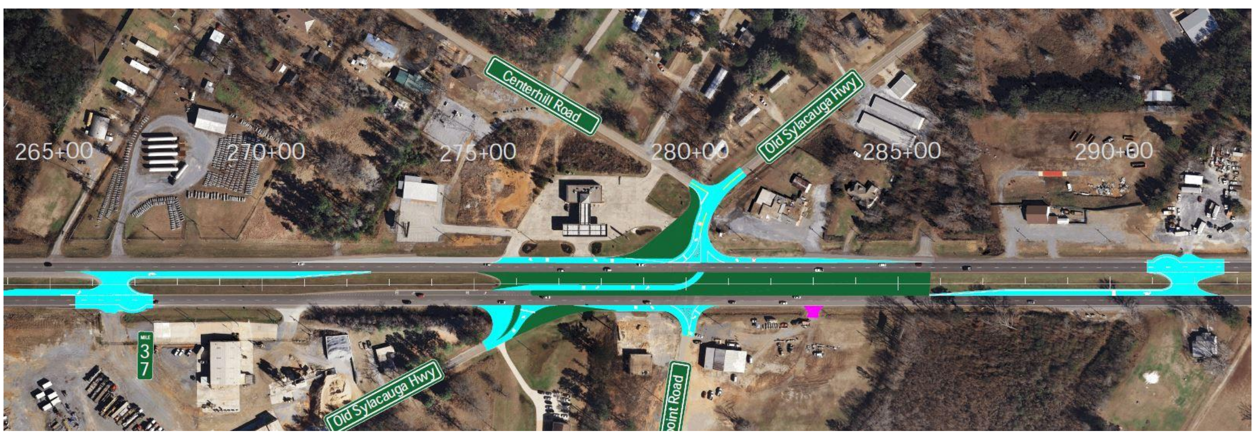


Figure E-22: Overall RCUT Design

Figure E-23: Before Access Management

Figure E-24: After Access Management – Intersection View

Figure E-25: After Access Management – Overall View

CASE STUDY 4: LARGE GENERATOR NEAR MAJOR INTERCHANGE

BACKGROUND

A large gas station is proposed to be constructed near an interchange. The gas station is proposed to include 120 fueling positions and a large convenience store. The state route is a divided, 4-lane principal arterial with no posted speed limit in the vicinity.

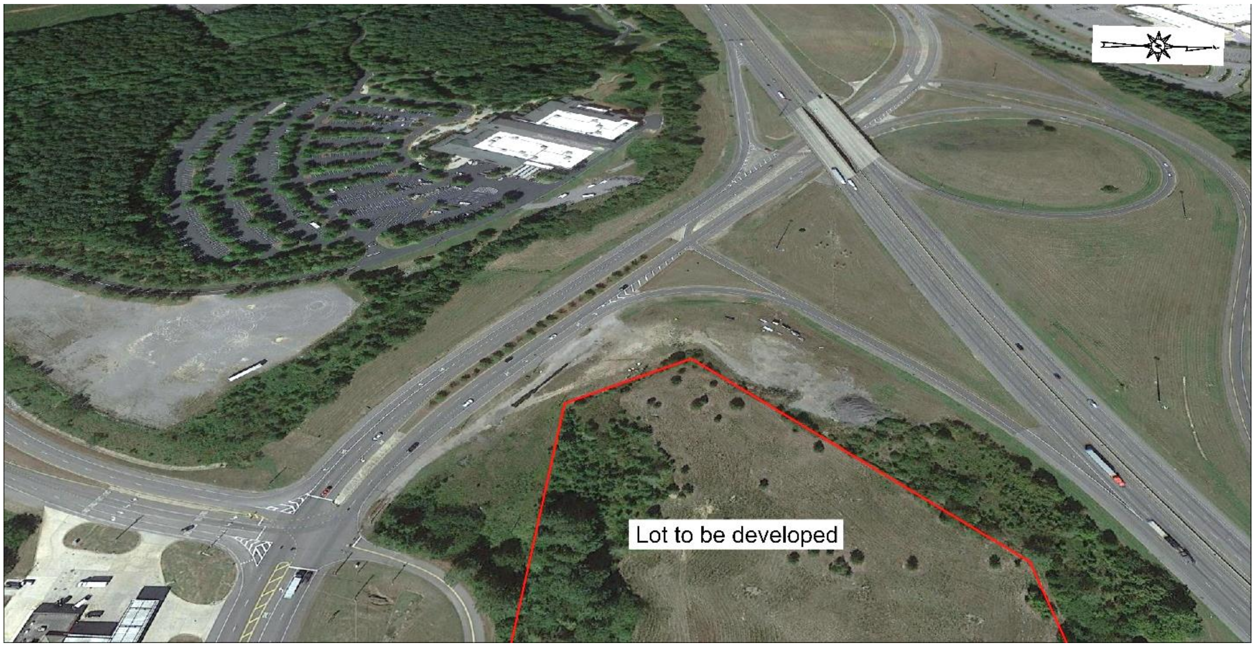


Figure E-26: Lot to Be Developed

- What steps need to be taken to evaluate this development?
- Is a traffic impact study required?
- If a traffic impact study is required, which intersections should be included in the study area?
- What improvements could be expected?

EVALUATION

Referring to Table 3-1, a gas station with 6 or more fueling positions will generate more than 100 trips in the peak hour. So, this development with 120 fueling positions should definitely be evaluated in a traffic impact study. The developer should contact local ALDOT staff (District Administrator) and have a scoping meeting or conference call to discuss the TIS requirements.

After consulting ITE's *Trip Generation* for Land Use 945 (Gasoline/Service Station with Convenience Market), it is found that this development will generate more than 1,600 PM peak hour trips (51% entering, 49% exiting). However, the data set for this land use only includes data from sites with 10 - 25 fueling positions. Since the number of fueling positions is well outside of the data set, ALDOT should consider requiring the developer to collect traffic data from an existing gas station of similar size for the purpose of developing more accurate trip generation rates.

Per Table 3-2, this is considered a large development and the study area should include all signalized and unsignalized intersections within ½ mile of the site property boundaries. In this case, that would include the one access to the site and the two sides of the interchange.

Traffic data should be collected per Section 3.3.4 and capacity analysis should be performed per Section 3.3.8. Knowing that approximately 800 vehicles will be entering the site during the PM peak hour and that most of those trips will be coming from the interstate, improvements could be expected for the interstate exit ramps and for the left turn entering the site. Per Section 4.5.2.4, when the left-turning volume exceed 250 vehicles per hour, then dual left turn lanes are warranted. This will most likely be the case after the generated trips are distributed through the study area. Additionally, the exit ramps might need additional lanes to move traffic more efficiently towards the site. Special consideration should be given to the exit ramp queueing to ensure that it won't extend into the interstate through lanes.

The analysis should be documented per Section 3.4 (Traffic Impact Study Report Formatting) and this should be submitted to ALDOT for review and approval.

Figure E-27: After Interchange Improvements

Figure E-28: After Interchange Improvements

Figure E-29: After Interchange Improvements

CASE STUDY 5: RESIDENTIAL TO COMMERCIAL

BACKGROUND

A developer has purchased a residential lot near an intersection of two state routes (both are 2 lane, 55MPH), and the property has been rezoned for commercial use. There is an existing access just east of the intersection that the developer proposes to use for their commercial development, as shown in Figure E-16.

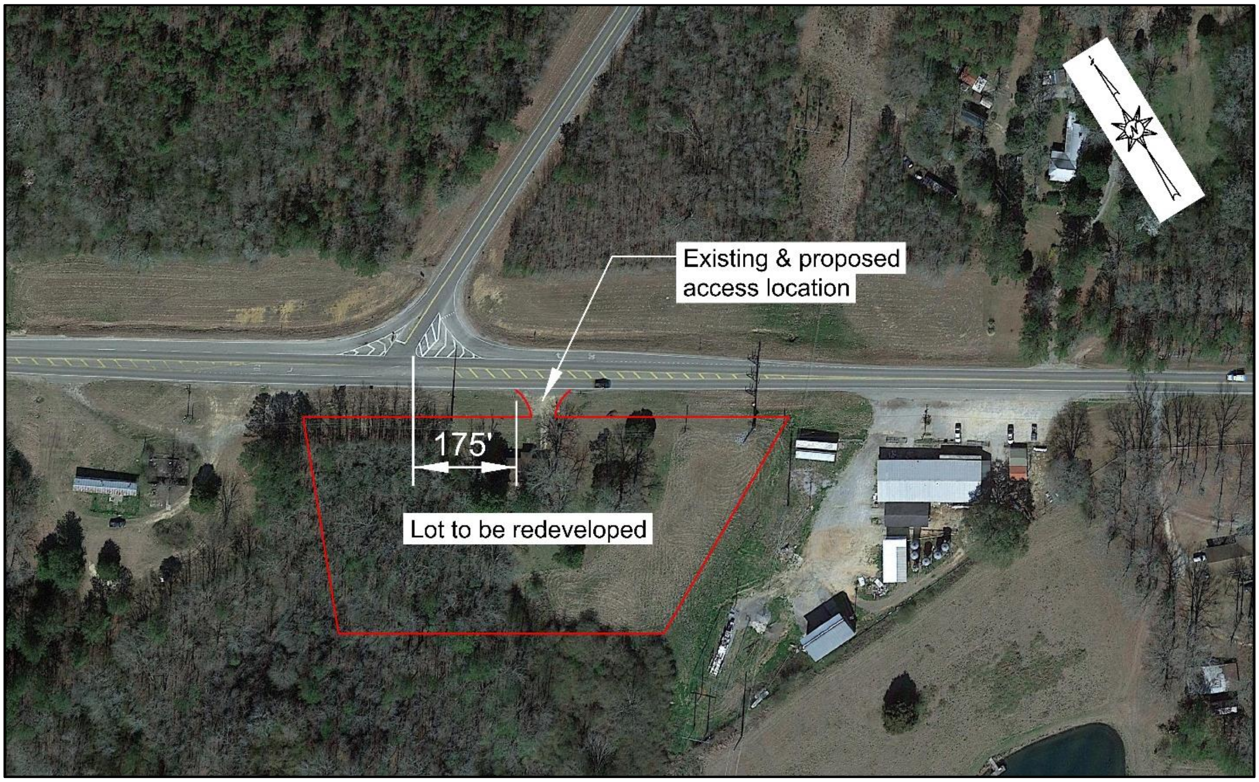


Figure E-30: Lot to Be Redeveloped

- Is the developer allowed to keep the existing access location?

- If not, what alternatives would you suggest?

Evaluation

Even without referring to the spacing tables, it is clear that this would not be an ideal location for a commercial access due to its proximity to the intersection. The developer should be required to eliminate the existing access and construct a new one as a fourth leg to the intersection, as shown in Figure E-17.

Depending on the size and type of commercial development, a traffic impact study may be required. The traffic impact study would include a turn lane warrant analysis for the new access. Even if a left turn lane is not warranted, it would be beneficial to construct the left turn lane due to the existing roadway geometry.

Figure E-31: Proposed Access Modification