Introduction to
Principles of Access Management

A Short Course Prepared for

The Alabama Department of Transportation

By

The Alabama Section of the
Institute of Transportation Engineers

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Preface

Service Project

This short course was prepared by the Alabama Section of the Institute of Transportation Engineers (ALSITE) as a public service for transportation agencies and metropolitan planning organizations in Alabama. It is being taught **FREE** to transportation agency planners, permit engineers, and others whose jobs involve access management.

The topic was selected after consultation with managers of the Alabama Department of Transportation and concerned city officials. ALSITE has found much interest in the topic, implying that the time has come for access management in Alabama. As shown by the data in Chapter 1, it is no longer possible to build enough highways to serve the mobility needs of Alabama. New road construction must be buttressed with other actions, like access management, to make our roads last longer and operate more efficiently.

The seven members of the task committee that prepared the short course were supplemented by other volunteers. Overall, more than 20 individuals participated in planning, writing, reviewing, and teaching this course. ALSITE now desires to train many of its members in access management techniques, so that they can teach this course across Alabama as many times as needed.

Goals of the Short Course

ALSITE's short-term goal is that participants enjoy the short course, that they learn facts and strategies that will help them with their jobs, and that they return home as advocates for access management.

ALSITE's long-term goal is to encourage all transportation agencies in Alabama to adopt some form of formal access management policy. This short course is the first step in educating stakeholders and building consensus on the need for such a policy.

Contents of the Short Course

Due to the limited amount of time available in a half-day short course, this participant workbook gives an overview of the topic, rather than a thorough treatment of individual access management processes. For a more detailed treatment, the reader may attend course 133078A, "Access Management, Location and Design," taught by the National Highway Institute (NHI). The NHI address may be found in Appendix B, along with a summary of course 133078A. ALSITE gratefully acknowledges the generosity of NHI, and recognizes that this participant workbook is patterned after and closely follows the workbook for the NHI course.

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CHAPTER 1
WHAT IS ACCESS MANAGEMENT?

1.1 Objectives of this Chapter

There are four objectives of this chapter:

1) Introduce access management concepts.
2) Explain why access management is used.
3) Document the results of good and poor access management policies.
4) Outline the remainder of the course.

1.2 Definition of Access Management

Access management involves balancing the two competing functions of roads – moving traffic and providing access to property. A street can be very good at either of these functions, but cannot be good at both at the same time. For example, a street 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 movement function of the roadway.

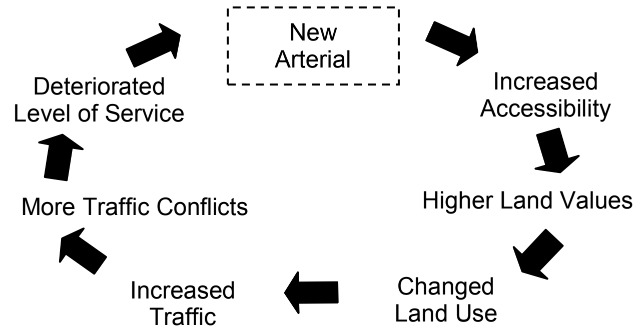
In simple terms, access management is a tool that preserves safe and efficient traffic movement while allowing reasonable access to adjacent property. The keys to good access management are applying good highway design principles, using good traffic engineering practices, and carefully planning and designing driveways and commercial entrances.

1.3 Life Cycle of a Typical Alabama Road

Every community in Alabama desires to provide new roads for its citizens. Once a politician cuts the ribbon to open a new road, drivers enjoy unrestricted mobility. The new road allows them to go where they want to, when they want to, because there are few other vehicles on the road. Adjacent property owners soon develop residential and commercial establishments, because customers can easily get to their businesses.

Over time, more property is developed and traffic volume grows. At the same time, congestion increases, sometimes to the point of gridlock. Drivers become frustrated and dread using the commercial establishments because of the difficulty of exiting and re-entering the highway. Businesses struggle to remain economically competitive, and usually deteriorate. What started as a vibrant, attractive street drifts into a blighted, strip mall with obsolete facilities. This is a typical life cycle for many highways, as illustrated in Figure 1-1. The key to preventing or delaying this condition is controlling access, as will be explained later in this short course.

Figure 1-1:
Highway Life Cycle (Stover and Koepke, 1988)



1.4 Preserving Traffic Flow

Preserving future road capacity involves two key concepts. First, large and constant increases in road use mean that new roads must be built with enough reserve capacity to meet future demand. Second, bottlenecks must be eliminated and roads must be operated so that drivers can find and use their exits comfortably and quickly, without disrupting traffic flow.

<u>Rapid Road Growth</u>

All measures of travel in Alabama are increasing rapidly. This is evident from the following 2000 statistics (ASCE, 2000).

Roads
- 94,311 miles of road (18th largest nationally)
- 3% increase in lane mileage during the last decade

Vehicles
- 3,960,149 registered vehicles (18th nationally)
- 24% increase in registered vehicles in last decade (national = 15%)
- 1.02 vehicles per licensed driver (national = 0.87)

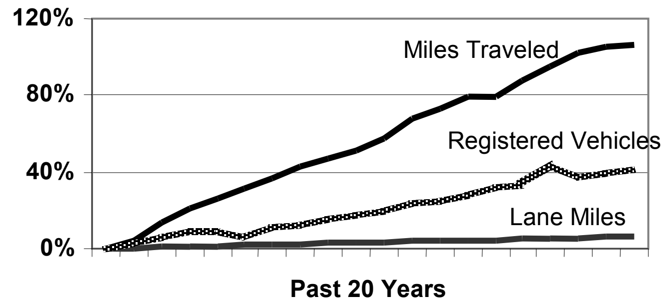
Drivers
- 3,521,444 licensed drivers
- 24% increase in licensed drivers in last decade (national = 14%)
- 79.2% of Alabamians possess drivers licenses (3rd nationally)

Travel
- 31.8% increase in miles traveled in last decade
- 12,716 miles traveled per capita (5th nationally)
- 0.53 miles driven per dollar of income (3rd nationally)
- Vehicle miles of travel doubled between 1981 and 2000
- Road use will increase at least 67% in next 20 years

Three measures of mobility growth are compared in Figure 1-2. Over 20 years, vehicles increased 42% and travel increased 100%, yet few lane miles of highway were built (6%).

Highways are too expensive and take too long to build to keep up with the explosive growth of travel in this state. Road use is far outstripping the supply of new highways. This means that Alabama drivers have only three choices: (1) accept increases in congestion, (2) provide additional revenue to build more roads, or (3) begin utilizing access management and similar procedures to make our highways last.

Figure 1-2: Alabama Growth Rates



Two conclusions jump out from the preceding statistics. The first and clearest point is that Alabamians are among the most mobile people in the nation, as indicated by factors like driver licenses per capita (3rd in U.S.), miles traveled per capita (5th in U.S.), and miles traveled per dollar of income (3rd in U.S.). The second conclusion is that travel is growing rapidly. Increases in vehicles, drivers' licenses, and miles traveled are all far above the national average.

Preserving Road Capacity

The second key concept involves designing roads and operating them to facilitate proper traffic movements. For example, drivers searching for the right store may hesitate, slow down, or make abrupt lane changes. Once the correct store and correct driveway are located, a small turn radius may cause uncertainty and excessively slow speeds. Poor lane markings may confuse drivers. Poor parking lot designs may require a car to wait for a preceding vehicle to park, creating a queue of vehicles that extends back into the main road. All of these are detrimental to traffic flow, and reduce a road's carrying capacity.

A driver should be able to see his or her destination early (i.e., the proper driveway), easily maneuver their vehicle to the exit, and quickly and safely leave the roadway. Where left turns are involved, this is more difficult because vehicles must wait for a gap in the opposing traffic flow. Once off the main road, 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 highway design, appropriate traffic control devices, and good access management practices.

1.5 Overview of Traffic Safety Situation

Most people are surprised to learn of the enormous number of traffic accidents in Alabama annually. Alabama traffic safety statistics for 2000 are shown in Table 1-1 (Alabama Traffic Crash Facts, 2000).

Table 1-1: 2000 Alabama traffic crash overview

- 968 fatalities
- 43,499 injuries
- 132,627 crashes
- 1.74 deaths per million vehicle miles, down 32.8% in decade
- $1.9 billion in economic loss
- 54% chance of being killed on injured in an Alabama traffic crash during your lifetime

Almost a thousand Alabama families experienced the grief of losing a loved one. These are tragic numbers that should make us all aware of the need to constantly improve traffic safety.

How Access Management Affects Safety

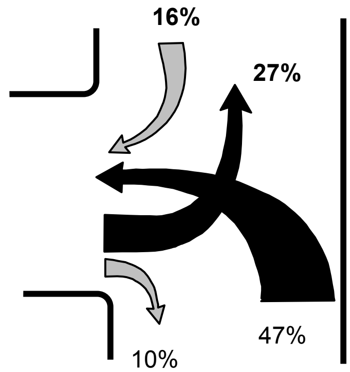
Access control can have a very positive effect on safety by reducing the number of locations where accidents can occur, and by choosing design features that minimize traffic crashes. For example, raised medians prevent left turns and eliminate many accidents. Table 1-2 shows crash rates from a study that compared raised medians with two-way left-turn lanes. Two-way left-turn lanes allow drivers to turn left at any point along a street, while raised median curbs prevent such turns. It is clear that raised curbs reduced accidents by 42% to 36% in this study, suggesting their use in access management as a safety tool.

Table 1-2: Average crash rates by median type
(Bowman and Vecellio, 1994)

Location	Raised Median	Two-Way Left-Turn Lane	Ratio Raised/TWLTL
Mid-block	180.23	311.37	0.58
Intersection	87.43	136.36	0.64

Because of the high degree of driver judgment in executing left turns through streams of moving traffic, they are over-represented in intersection and driveway crashes. This is especially true when traffic volumes are large. Figure 1-3 indicates that 74% of intersection/driveway crashes involve left turns. Right turns are three times less likely to be involved in crashes, and an access management policy that features right-turn-in, right-turn-out will yield high safety benefits.

Figure 1-3: Intersection/driveway traffic crashes by maneuver (NHI, 2003)



Researchers have identified accident relationships with many geometric features used in intersection and driveway design. Two examples are shown below as Figures 1-4 and 1-5. The first figure illustrates that extending intersection/driveway spacing from less than 300 feet to over 1000 feet eliminated 75% of the traffic accidents at the study site. The second figure illustrates that regardless of median type. Crash rates are lower where there are fewer access points per mile of roadway.

This brief review of accidents has shown that traffic safety is a serious challenge in Alabama. However, proper road design and good access management (selection of the number of access points, selection of median type, eliminating left turns, etc.) can significantly reduce the number of crashes).

Figure 1-4: Crashes/mile vs. access spacing
(Waushara County, 1986)

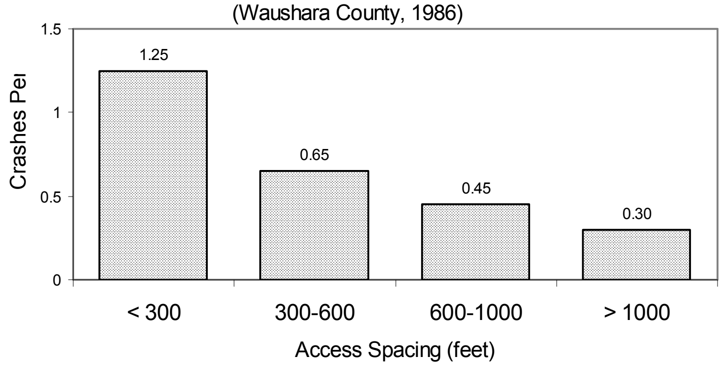
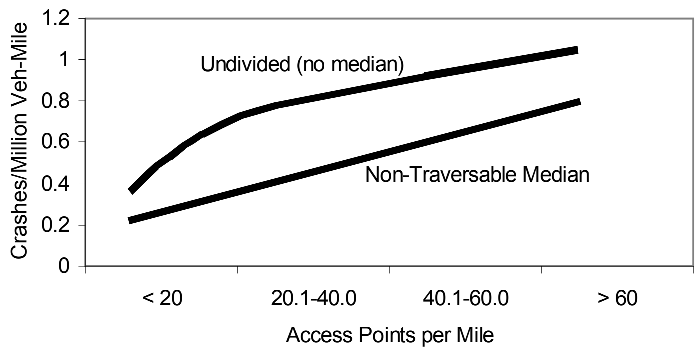


Figure 1-5: Crash rates by median type
(Suburban and Urban Roadways)



1.6 Symptoms of Poor Access Management

Where local jurisdictions and highway agencies have not devised and followed a sound access management policy, the following symptoms can often be found on urban and suburban streets:

- Congestion, possible gridlock
- Frustrated drivers
- Frequent traffic accidents
- Motorists attempting unusual maneuvers
- Continuous strip development
- Decreased property values
- Commercial establishments that are struggling to be competitive
- Residents who complain about noise, traffic, safety and related issues
- Growing pressure on the government to improve the street or to build a bypass

Once these symptoms become prevalent, it is difficult to restore street capacity without massive spending on road construction and improvement of traffic operations. Sadly, in most situations the use of access control principles could have prevented or delayed the adverse situations.

1.7 Benefits of Good Access Management

Putting a good access management policy into place is not easy, but the benefits far outweigh the difficulties. The traveling public, agencies owning and operating roadways, private investors and land developers, shoppers and residents share in the benefits noted in Table 1-3. Detailed explanations of these benefits will be given later in this course, but a few illustrations are offered here. For example, safety can be improved by increasing the spacing between driveways and median openings. This reduces the number of locations at which traffic conflicts (and traffic accidents) can occur. Likewise, traffic operations can be improved by making entrance and exit locations more visible to drivers, and by using design criteria that facilitates easy entrances and exits. This produces greater efficiency of traffic movement and preserves the street capacity over the long run.

Table 1-3: Benefits of an Effective Access Management Program

• Safety Fewer and less severe crashes Fewer auto-pedestrian conflicts
• Efficiency Less stop and go traffic Reduced delay Increased and preserved capacity Preservation of government investment in the roadway system
• Aesthetics More attractive corridors Improved community appearance
• Livable Communities Enhanced community character Preserve neighborhood integrity Preservation of private investment in abutting properties Lower vehicular emissions
• Administrative Functions Consistency in handling requests for driveways Reduced litigation State-local coordination

Patterned after NHI Course No. 13378

1.8 Have Others Recognized the Importance of Access Management?

The answer to this question is a resounding "YES," as illustrated by the following examples.

The Maine Department of Transportation recognized that one-sixth of its traffic crashes were occurring in driveways or at driveway entrances, and that the state highway system (12% of roads carrying 62% of state traffic) was becoming clogged. To counteract these trends, an access management program was developed to perform the following functions (Maine DOT, 2003):

- Increase safety by assuring predictable, well-designed and highly visible locations for vehicles entering and exiting highways.
- Support economic activity by planning and designing driveways to avoid user costs associated with increased traffic delays and conflicts.
- Control public costs by improving safety and preserving the highway system's ability to carry traffic.
- Promote community and environmental quality through strong local planning and access management.

The Colorado Department of Highways included the following statement in its access management code (Colorado, 1985). *The lack of adequate access management on the highway system and the proliferation of driveways and other access approaches is a major contributor to* *highway accidents and the greatest single factor behind the functional degeneration of highways in the state.*

The American Association of State Highway and Transportation Officials describes the role of access management in the life cycle of highways as follows (AASHTO, 2001):

The failure to manage access is the major cause of highway obsolescence.

From these few examples, it is clear that other states and local governments have found that there is much to gain from a good access management program and much to lose without it.

1.9 Steps in Implementing Access Management

Prior to applying access management to a specific road, a general access management policy and appropriate design criteria should be adopted. While these activities will be covered in some detail in Chapter 2, they are introduced here. There are four elements in determining the appropriate policies and design criteria (NHI, 2003):

1) Local roadways are classified according to their function and importance.
2) Allowable levels of access are defined for each functional class of road.
3) Appropriate geometric design criteria are developed and traffic engineering analysis procedures are identified for each level of access, and
4) Regulations and administrative procedures are adopted to conduct the program.

Once the process is functioning, there are two major determinations for each applicant– how often and where access is granted, and what particular geometric criteria govern the types and sizes of driveways that are allowed. The design criteria ensure smooth traffic flow, high capacity, and high levels of safety, and apply to the following types of elements:

- Minimum spacing between driveways,
- Driveway locations, dimensions, and design,
- Corner sight distance,
- Median opening locations, types and dimensions,
- Turn lanes, acceleration lanes and deceleration lanes,
- Spacing of traffic signals,
- Need for supplemental traffic control devices,
- Requiring that the development have good internal circulation,
- Requiring multiple parcels to use a single, joint access point, and
- Providing facilities for drainage of rainfall runoff.

Design to accommodate high volumes of future traffic is desirable. Motorists will benefit from good roads far into the future, and the investments of property owners and developers will be protected because their commercial establishments will remain attractive and convenient for users.

1.10 Can Access Management be Retrofit to Existing Streets?

Once a street is open and development has begun, congestion may increase more rapidly than anticipated. All parties may wish, in retrospect, that a strong access management policy had been adopted prior to the opening of the road. In these situations, is there an access management tool that can be applied retroactively? The answer is "yes," even though it would have been much better to adopt the access management policy before development began. Retrofit of access management is possible.

Usually this involves citizen-government-developer groups that work together to prepare access management plans for the most important corridors in a community. These plans typically call for additional care in future development, retrofitting access concepts such as directional median openings or left turn prohibition, and developing local ordinances or rules to carry out the plan. Usually, an expensive construction or rehabilitation project is required to halt the congestion and preserve land values. Much more about these concepts will be presented in Chapter 5 of this short course.

1.11 Proof That Access Management Actually Works

Many studies have demonstrated the effectiveness of access management. A National Highway Institute short course on (NHI, 2003) reviewed several studies of the effectiveness of access management applications, and compiled the following indicators of success (Table 1-4).

Table 1-4: Effectiveness of Access Management

- Reduces crashes by as much as 50%
- Increases capacity 23-45%
- Extends highway life
- Treats permit applicants consistently
- Protects abutting property value
- Reduces travel time and delay by 40-60%
- Decreases fuel consumption by 35%
- Reduces vehicular emissions
- Reduces transportation costs

The table shows that access management can be highly effective. Obviously, any method eliminates half of the traffic crashes is wonderful. Likewise, improving traffic capacity by 23% to 45 % is a substantial achievement.

1.12 Outline of the Short Course

The course is organized as six blocks of information, which correspond to the six chapters in this participant workbook:

Chapter 1: Introduction to Principles of Access Management
Chapter 2: Steps in Developing an Access Management Policy
Chapter 3: Access Management Principles
Chapter 4: Access Management Techniques
Chapter 5: Retrofit of Access Management to Existing Roads
Chapter 6: Example Applications of Access Management

1.13 References:

"Access Management Fact Sheet," New MDOT Driveway Access Permit Rules, Maine Department of Transportation, http://www.state.me.us/mdot/planning/bureauweb/accesslinks.htm, accessed March 27, 2003

"Access Management, Location and Design," Course No. 13378, National Highway Institute, U.S. Department of Transportation, 2003.

"Alabama Traffic Crash Facts 2000," Alabama Department of Transportation, 2001.

Bowman, B.L. and R.L. Vecellio, "Effect of Urban and Suburban Median Types on Both Vehicular and Pedestrian Safety", Transportation Research Record 1445, Transportation Research Board, Washington, D.C., 1994

Impacts of Access Management Techniques, NCHRP Report 420, Transportation Research Board, Washington, D.C., 1999

"Infrastructure Press Conference," Alabama Section of the American Society of Civil Engineers," Montgomery, Alabama, February 22, 2002.

Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, Washington, D.C. 2001

"State Highway Access Code," Department of Highways, State of Colorado, August 15, 1985.

Stover, V.G. and F.J. Koepke, "Transportation and Land Development," Institution of Transportation Engineers, Prentice-Hall, 1988.

CHAPTER 2:
STEPS IN ACCESS MANAGEMENT

2.1 Objectives of this Chapter

There are five objectives of this chapter:
1) Explain how to classify roadways according to their function and importance.
2) Define how to establish levels of access for each functional class of road.
3) Identify geometric design criteria and traffic engineering analysis for each access level.
4) Identify needed regulatory and administrative procedures.
5) Outline the steps to build consensus and establish an access management program.

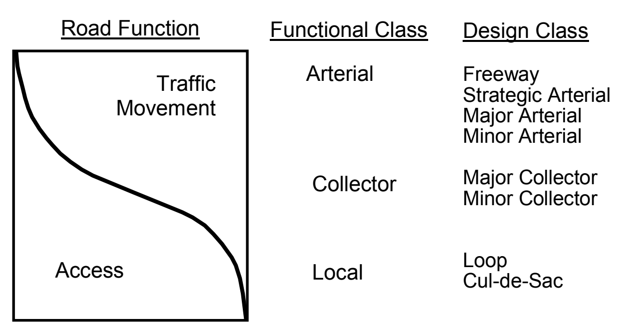
2.2 Roadway Classification Techniques

The following roadway classification method is defined in the Iowa Access Management Handbook (adapted from the access management procedures of College Station, Texas). Iowa stated “College Station’s ordinance was determined to be one of the most comprehensive ordinances developed by a city for access management.” Iowa indicated that the first step in access management is to understand that roadways fall into several functional categories:

1. **Local Streets** – streets that provide access to single family residential neighborhoods
2. **Collectors** – streets that link Local Streets with the arterial system and serve residential areas primarily internal to one neighborhood
3. **Minor Arterials** – streets that feed the major arterial system, support moderate length trips, and serve activity centers
4. **Major Arterials** – streets and highways that provide service to traffic entering and exiting the city between major activity centers within the city

Figure 2-1 is a graphical depiction of how the roadway functional classification relates to roadway accessibility.

Figure 2-1: Roadway functional relationships



The right columns of Figure 2-1 show the relationship between basic functional classification and design classification. The National Highway Institute short course on access management further defined this relationship (NHI, 2003):

> …each functional class can be divided into design classes. These design classes can be further divided into a number of typical designs of different levels of access and cross-section. For example, major arterials might include three different design types such as strategic arterial (long intersection spacing with few driveways) and other major arterials (long spacing between intersections, with both median and marginal access). Each of these may consist of two or more typical designs that have different median designs and number of lanes. Local roads consist of two general types – roadways that intersect other roads at both ends and cul-de-sacs.
>
> Individual roadways can be identified as serving access (i.e., cul-de-sac) or as a serving movement (i.e., a freeway with long interchange spacing). Most roadway segments lie between these two extremes. Many do not fit into a specific category (e.g., major collector or minor arterial). Additionally, many major roadways are not clearly identifiable as being a major arterial because of excessive access.

2.3 Allowable Levels of Access Based on Functional Classification

Once the functional class of a roadway has been selected, the appropriate level of access can be established. This is accomplished by designating criteria for factors like those shown below. These and other access management factors are discussed in detail in Chapter Four of this participant workbook.

1. Driveway spacing
2. Corner clearance
3. Median break spacing
4. Intersection spacing

2.4 Geometric Design Criteria and Traffic Engineering Analysis Procedures

Access design is influenced by operational controls, geometric design criteria, and physical site characteristics. Figure 2-2 shows that the relationship between the three factors is complex. For example, designation of a certain operational control factor might limit the allowable range of a particular design criteria like turning radii into a driveway.

Access design procedures work hand in hand with safety protocols. Safety, traffic efficiency, and driver expectation are all concerns in access management. The following brief checklist from NHI is a good starting point when considering an access management program.

- The design should fit the natural transitional paths and operating characteristics for drivers and vehicles. Smooth transitions should be provided for changes in direction.
- Grades at intersections should be as near level as possible.
- Sight distances must be sufficient to enable drivers to prepare for and avoid potential conflicts.
- On major roadways, intersections should be evenly spaced to the extent possible. This will enhance synchronization of signals, increase driver comfort, improve traffic operations, and reduce fuel consumption and vehicular emissions.

Figure 2-2: Relationship between operational controls, geometric design criteria, and site characteristics

Operational Controls

- Design vehicle dimensions
- Vehicle deceleration rate
- Vehicle acceleration rate
- Driver perception – reaction time
- Speed differential between vehicles
- Vehicle turning path and speed

⬇ LEADS TO ⬇

Geometric Design Criteria

- Lane widths
- Median dimensions
- Deceleration lane lengths
- Acceleration lane lengths
- Driveway spacing
- Driveway dimensions
- Channelizinig island dimensions

⬇ MAY BE CONSTRAINED BY ⬇

Site Characteristics

- Available right-of-way
- Median width
- Frontage width
- Setback to buildings and parking areas
- Signalized Iintersection spacing
- Spacing of other public streets
- Driveway spacing
- Corner clearance
- Spacing for median openings
- Etc.

2.5 Regulatory and Administrative Procedures

Below is a list of Access Management elements that must be considered before adopting and implementing a plan. Typically, both an oversight group and a stakeholders group consider these elements while making decisions and defining the plan.

- Purpose and intent
- Authority to develop an access management program and promulgate rules
- Classification systems and standards
- Definition of reasonable access
- Requirement for access permit
- Violations and enforcement
- Consistency requirements for local development decisions
- State review of subdivision and development requests on state highways
- Changes on access use
- Administrative due process
- Authority for local participation in access management on state highways
- Access management plans
- Access classification schedules
- Definitions

Many states and local agencies have developed successful access management programs. The literature indicates that the following strategies and considerations produce group support, leading to consensus and production of a balanced plan.

1. **Steering Committee** – The committee establishes a decision making process, determines how to proceed with the program, and assembles a work plan for program development.

2. **Public Involvement Plan** – This is needed to assure adequate involvement of stakeholders. Identify which groups need to be involved and what stage they should be involved.

3. **Advisory Committee** – The committee should be a diverse group and include key stakeholder groups with interest in access management issues. For example, at the state level this might include developers, consultants, business owners, pedestrian advocates, appointed and elected officials, etc.

4. **Building Support** – It is important to disseminate information on principles and benefits of access management. Develop partnerships with other agencies that would benefit from the program. Consult with affected parties and gain an understanding of their perspectives.

5. **Document Current Agency Practices** – Conduct a thorough assessment of current agency practices related to access management. This includes, for example, planning,

project development, permitting, traffic operations, design, right-of-way, safety, legal or any other activities that can affect access management efforts.

6. **Review Practices of Others** – Reviewing published literature, policies, and regulations of other agencies can provide an understanding of what access management can do for your agency. Identifying the pros and cons of other programs helps reduce costly mistakes and improves communications between the state and local levels.

7. **Evaluate the Legal Context** – A clear legal basis that is defensible in court is necessary to carry out an access management plan. Conduct a detailed analysis of existing statutory and case law to identify the legal context for controlling direct access to the state roadway network. Review all existing statutes addressing transportation planning, eminent domain, and administrative procedures to identify existing authority for access management at the state level, as well as restrictions on access control.

8. **Develop a Research Program** – Develop a current assessment of safety and operational problems associated with inadequate access management within the state. Address program development needs, as well as issues that appear to be of greatest concern to policy makers in the state.

9. **Administrative Considerations** – To maintain consistency throughout the state, access management regulations need to be general enough to cover a broad spectrum of development, but specific enough to guide access management decisions.

2.6 How to Develop an Access Management Policy in Alabama

This chapter has introduced the major components and overall decision processes involved in creating an access management program:

→ functional class → level of access
→ operational controls/ site characteristics → design criteria
→ administrative and regulatory considerations
→ build consensus, prepare a plan, and implement it

All of these can be employed in Alabama. All that is required is the emergence of leaders who realize that it is needed, and who determine to make it happen. This short course has been prepared as a service project by the Alabama Section ITE. It is intended to be the first step in the process, a catalyst to inform transportation professionals in Alabama of the need for improved access management.

2.7 References:

"Access Management, Location and Design," Course No. 13378, National Highway Institute, U.S. Department of Transportation, 2003.

"Access Management: Current Status of Policies in Iowa," Iowa Department of Transportation, April 1997, http://www.ctre.iastate.edu/research/access /amhandbook/index.htm.

Impacts of Access Management Techniques, NCHRP Report 420, Transportation Research Board, Washington, D.C., 1999

CHAPTER 3
ACCESS MANAGEMENT TECHNIQUES

3.1 Objectives of this Chapter

1. Outline how to determine whether access management is needed (now or in the future) for any particular roadway situation.
2. If access management is necessary, identify the type and extent of management to adequately handle the situation.
3. Review several prominent access management techniques that might be applicable in Alabama. In effect, this provides a "checklist" of actions that might be used.

This portion of the workbook was patterned after Chapter 4 of the National Highway Institute short course on access management (NHI, 2003), and much of the following information was taken from it. Readers should keep in mind that the ALDOT Maintenance Manual includes a section on permits. The ALDOT Standard Drawing Book and Guidelines for Operation contain applicable information as well. These sources should be consulted for permit applications dealing with state roadways in Alabama.

3.2 Introduction – The Key Role of the "Driveway Turnout" Permit

Agencies that own and operate arterial roadways control the access granted to roadside developers. Typically, the process is managed and documented through a "driveway turnout" permit process. In the simplest case, the developer executes a permit form, attaches site plans and other documents, and submits the package to the highway agency. The agency evaluates the application, determines the impact that the proposed development will have on the traffic and safety, and approves or disapproves it.

The permit evaluation and decision process is usually much more difficult for the agency than the brief discussion in the previous questions. This is especially true when the agency has no criteria for access management. If the permit evaluator is experienced, and has good methodology and good criteria, it is fairly easy to place the permit into one of four categories:

> **Acceptable** – For example, this might be a permit for a small development that is well designed. In some instances, it might be similar to a previous development that was approved because it met the criteria of the agency.
>
> **Acceptable with Changes** – In this situation, the evaluator is confident that a submitted permit plan will work satisfactorily if certain (minor) changes are incorporated. This might be because the evaluator is familiar with both the roadway and the type of development.
>
> **"May be" Acceptable** – This might be a new type of development, or a development in a busy traffic area, or a weak design, or have driveways in locations that might be susceptible to future congestion and accidents. Or, the

agency evaluator might be unsure due to lack of personal experience or technical tools to evaluate the permit.

Not Acceptable – This is usually a permit application that is obviously not appropriate for the site. It might grossly overload the roadway with new traffic, or the only possible driveway locations will cause complicated traffic patterns, delays, and collisions.

The decision is relatively easy for the first, second and last categories; however, the third category may be quite difficult. Often, a comprehensive traffic impact study is needed to provide estimates of future traffic and to quantify the level of congestion and safety. Sometimes the evaluator makes a study, but more typically, the developer is required to perform a study and provide the estimates as part of the permit application process.

Regardless of who performs the study, data must be provided to answer the following types of questions when evaluating a permit for a complex situation:

- How big is the development, and how many vehicles will it generate on a typical day? How many of the vehicles will use the roadway during the peak hour when traffic is at its worst?

- What is the level of service (LOS) of the existing roadway? Can the roadway handle the additional traffic now, without lowering the LOS to an unacceptable level?

- If the development grows, can it handle the additional traffic in the future?

- How many traffic accidents are occurring at this location now? Is the accident rate near or above the norm for other roads like it? How many additional accidents will be generated in the future?

- Does the development include roadway design features with "built in" problems that will only show up when future traffic volumes are large (lack of turn bays, poor corner sight distance, small turning radii, narrow lanes, etc.)?

- Can the driveway design be modified to improve future safety and traffic operations without increasing the cost? Or in difficult traffic operations or safety situations, can modifications be achieved without driving the cost to an unacceptable level for the developer?

- Does this type of development fail to qualify for direct access to the arterial? An example might be a subdivision where every lot has a driveway directly to the arterial.

If the analysis shows that some form of access management is needed, the evaluator must determine the appropriate type and the extent to which it will be employed. In general, it is much less expensive for the original construction to incorporate geometric design criteria that will accommodate future traffic, than to make modifications to the roadway later. In such instances, permit approval may be contingent upon such a design.

3.3 Access Management Techniques

A variety of access management, location and design policies can be used to improve roadway safety and operations, whether it is within a state, city or county jurisdiction. This chapter will review six of them, as listed in Table 3-1 and as explained in the paragraphs following the table.

Table 3-1:
Access management techniques to improve safety and traffic operations

1) Limit the Number of Conflict Points
2) Separate Conflict Areas
3) Remove Turning Vehicles from the Through Traffic Lanes
4) Reduce the Number of Turning Movements
5) Improve the Traffic Operations on the Access Drive or Intersecting Local Street
6) Improve Traffic Operations on the Roadway

- **Limit the Number of Conflict Points** This group of techniques recognizes that when drivers face complex situations, they make more mistakes and collisions will increase. Conversely, simplifying the driving task will improve traffic operations and reduce collisions. This is accomplished by limiting the number and type of conflicts in vehicle-vehicle, vehicle-pedestrian, and vehicle-bicycle situations.

- **Separate Conflict Areas** These access management techniques provide sufficient time for drivers to address one potential conflict problem before facing another. For a given driver perception-reaction time, as travel speed increases the necessary spacing increases. This also simplifies the driving task and contributes to improved operations and safety.

- **Remove Turning Vehicles from the Through Traffic Lanes** These techniques reduce the severity and duration of conflicts between turning vehicles and following through vehicles.

- **Reduce the Number of Turning Movements** The provision of cross-circulation between adjacent properties and the provision of service roads allows intersite movement without re-entry to the abutting major roadway. The elimination of short distance, slow movements reduces the number of vehicle-vehicle, vehicle-pedestrian and vehicle-bicycle conflicts along the major roadway.

- **Improve Traffic Operations on the Access Drive of Intersecting Local Street** These techniques allow drivers to maneuver from and to the major roadway more efficiently and safely. They also permit the accommodation of pedestrians and bicyclists more safely.

- **Improve Traffic Operations on the Roadway** This group of techniques is primarily of a policy nature, and is intended to preserve the functional integrity of the roadway. Thus, while a given technique may apply to a range of collector and major roadways, higher standards are commonly applied to the higher categories of roads.

Some techniques may fit into multiple categories. For example, right turn bays are used primarily to remove turning vehicles from the through traffic lanes (technique 3 in Table 3-1). However, they also contribute to improved traffic operations on the roadway (technique 6 in the table) because right-turning vehicles do not destroy traffic progression when a turn bay is present.

3.3.1 Limiting Conflict Locations

Conflicts occur where vehicle paths cross, merge, or weave. The 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.

The number of conflict points is a function of the number of legs in an intersection, or the number of allowed traffic movements. Three-way intersections have nine conflict points (Figure 3-1), while four-way intersections have 32 conflict points (Figure 3-2). Installing a non-traversable median reduces the number of conflicts to only four at a four-way intersection and to only two at a three-way intersection.

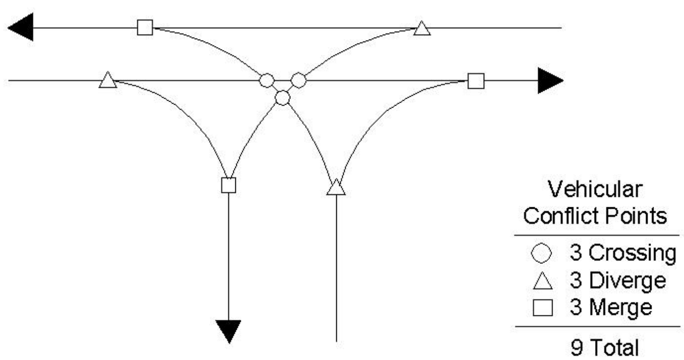


Figure 3-1: Vehicular conflicts at three-way intersection

Diverging, merging and weaving conflicts are called "minor" conflicts. Diverge maneuvers often require significant evasive action by drivers of "following" vehicles to avoid a collision. Diverge conflicts are especially serious on high-speed, high-volume roadways.

Merge conflicts place the burden for avoiding a collision on the driver making the turn maneuver. This driver must estimate the size of a gap in oncoming traffic and accelerate to fit into the gap. When a merging driver accepts a gap that is too small, the driver in the oncoming vehicle in the through traffic lane must take drastic action (accelerate or decelerate) to avoid a collision with merging vehicle.

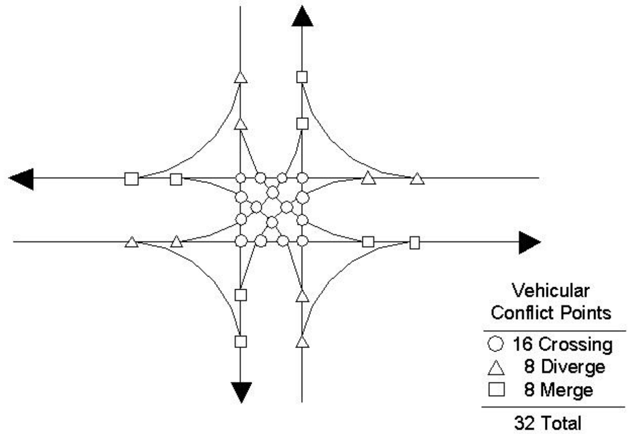


Figure 3-2: Vehicular conflicts at four-way intersection

Left-turn diverge maneuvers may cause the conflict point to migrate back upstream while the turning vehicle blocks the through lane while waiting for a gap in the opposing traffic.

The following are typical of the actions that can be taken to reduce the number of conflicts on arterial roadways:

- Purchase access rights.
- Install a non-traversable median.
- Close a median opening.
- Install a channelizing island to discourage left-turn maneuver (see Figure 3-3).
- Replace a continuous two-way left turn lane with a non-traversable median
- Install a divisional island to prevent entry into a left-turn bay.

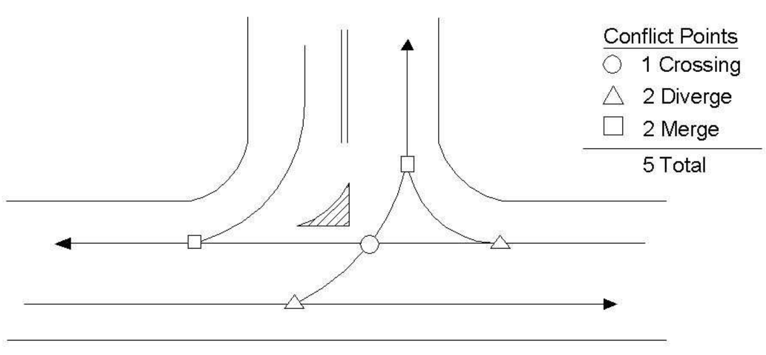


Figure 3-3: Driveway channelization island to discourage left-turns

3.3.2 Separating Conflict Areas

The separation of conflict points simplifies the driving task by giving drivers more time to respond to successive access-related events. The higher the speed, the further a vehicle travels during a given perception-reaction time. Also, drivers need more time to react to complex conflict areas.

In other words, minimum separation distances are a function of both the speed of traffic on a given section of roadway and the complexity of the decision presented to the driver. The complexity of the problem, in turn, increases with both the number and type of conflicts and the volume of traffic.

Among the methods that can be utilized to separate conflict areas are the following:

- Establish minimum access spacing.
- Establish minimum corner clearance.
- Establish minimum property line clearance.
- Limit the number of accesses per property.
- Designate the access for each property.
- Consolidate access drives.
- Optimize driveway spacing.

3.3.3 Removing Turning Vehicles from Through Lanes

Left turn vehicles are the primary cause of delays in intersections. If there is no left-turn bay, a vehicle waiting to turn left blocks through vehicles behind it. If there is a left-turn bay and a left turn signal phase, vehicles in all other lanes must wait during the left turn phase. Either way, delay increases for many vehicles. As discussed in chapter 1, left turning vehicles are involved in a high percentage of intersection and driveway crashes.

The large speed differential between turning vehicles and through vehicles results in a high potential for serious collisions. Even simple driveway and intersection geometrics require that turns be made at very slow speeds, and hence cause high differentials in speed. One good means of limiting the speed differential is to provide an auxiliary lane for turning maneuvers. This is especially important on high-volume and high-speed roadways.

How do we remove turning vehicles from through traffic lanes? There are several applicable methods, including the following:

- Install a left-turn deceleration bay at an existing median opening.
- Install a non-traversable median with left-turn bays.
- Increase the length of existing turn bay.
- Install an isolated left-turn bay.
- Install a shoulder by-pass lane.

- Install a right-turn deceleration bay.
- Install a continuous right-turn lane.
- Install a right-turn lane serving multiple access connections.
- Install a channelizing island for left turn ingress/offset opposing left turn bays.
- Install an alternating left-turn lane.
- Install a continuous two-way left-turn lane.

3.3.4 Reducing the Number of Turning Movements

The number of accidents for a given traffic movement is directly proportional to the number of vehicles making that maneuver. That being the case, reducing the volumes of turning movements with the highest accident rates will drastically reduce the number of accidents. The following techniques can be used to decrease the volume of turning movements to and from major roadways:

- Provide connection between adjacent parcels.
- Require adequate internal circulation.
- Provide alternative access.
- Provide a supporting circulation system (see Figure 3-4).
- Adopt vehicular use limitations.

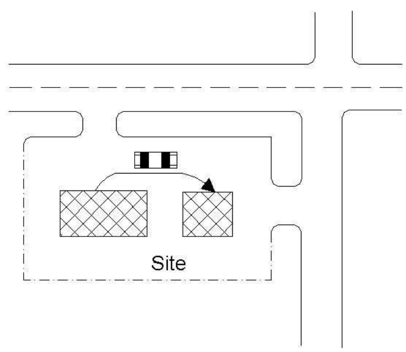


Figure 3-4: Internal traffic circulation system

3.3. 5 Improving Traffic Operations

In addition to access management techniques previously presented, the following methods can also improve traffic operations and safety.

- Long, uniform signal spacing
- Install access on the cross road
- Provide visual cues of upcoming access drives and public street intersections
- Provide off-street parking, or prohibit on-street parking
- Provide adequate sight distance
- Control the merge of left-turn egress vehicle
- Install channelizing island to control the right-turn merge
- Install right-turn acceleration lane

- Utilize shared access
- Install indirect u-turn
- Install Michigan u-turn
- Provide a frontage road
- Convert parallel streets to one-way pair
- Construct a bypass
- Use recess gates for large vehicles

3.3.6 Improving Driveway Traffic Operations

These techniques are primarily of a policy nature, and are intended to preserve the functional integrity of the roadway. Efficient and safe operations, access drives and minor public street intersections can be improved by the following:

- Use smooth vertical geometrics
- Provide adequate driveway throat width and curb return radii
- Provide adequate sight distance
- Install an additional egress lane
- Require driveway construction of high quality
- Define the ingress and egress sides of the access drive

3.4 Summary

This chapter has briefly introduced six techniques that can be used in access management. Obviously, many details have been omitted due to the brevity of the short course. Those individuals who are interested in acquiring a more in-depth knowledge might consult the National Highway Institute short course on this topic (NHI, 2003), or one of the many state highway agency websites that address access management (see Appendix B for a partial list).

Even better, those interested in access management might join the group of practicing transportation engineers who want to lead the process of developing an Alabama access management policy.

3.5 References

"Access Management, Location and Design," Course No. 13378, National Highway Institute, U.S. Department of Transportation, 2003.

Impacts of Access Management Techniques, NCHRP Report 420, Transportation Research Board, Washington, D.C., 1999

Intersection Channelization Design Guide, NCHRP Report 279, Transportation Research Board, Washington, D.C., 1985

Maintenance Manual, Alabama Department of Transportation, Montgomery, Alabama.

Guidelines for Operation, Alabama Department of Transportation, Montgomery, Alabama

CHAPTER 4
ACCESS MANAGEMENT GUIDELINES

4.1 Objectives of this Chapter

The two primary objectives of this chapter lie at the very heart of access management:

1) Provide guidelines that can be used to apply the access management techniques discussed in Chapter 3.
2) Since the limited time in this short course will not allow a detailed discussion of all available techniques, review a sample of techniques thought to be the most important for access management in Alabama:
    - intersection functional area and sight distance,
    - turn lanes,
    - median openings and spacing,
    - traffic signal spacing, and
    - driveway location and design.

4.2 Introduction

Access management is growing in importance, and in a sense, represents a new element of roadway design. It extends geometric design and traffic engineering principles to the location, design, and operation of access roads that serve activities along streets and highways. It also allows evaluation of the suitability of a site for different types of development from the standpoint of access.

Access management addresses the basic questions *of when, where, and how access should be provided or denied*, and what legal or institutional changes are needed to enforce these decisions. In a broad context, access management is resource management, since it provides a way to anticipate and prevent congestion and to improve traffic flow.

It is important to recognize that an agency's regulations may be applied to driveways and commercial entrances even without a formal access management program. Although each piece of abutting property is allowed access to the street or highway, the location, number and geometric design of the access points are governed by the agency's regulations.

The remainder of this chapter provides guidance for the design of five primary street elements involved in access management in Alabama. Due to time constraints of the short course, the material is not comprehensive. However, design rationale and criteria will be provided where appropriate.

4.3 Intersection Functional Area and Sight Distance

4.3.1 Functional Area

The functional area around an intersection or driveway is the area where drivers are taking actions related to the intersection. This includes making decisions (identifying the destination - street name or desired commercial establishment, judging gaps in traffic, looking for parking spaces, etc.) and maneuvering vehicles (changing lanes, decelerating, stopping, accelerating, merging, etc.) and other actions. There are speed differentials between vehicles and drivers are trying to make multiple decisions simultaneously. In other words, there is a lot going on, and such circumstances lead to increased congestion and traffic accidents.

It is important for the designer to understand the importance of good design of intersection and driveway elements in the functional area. Allowing drivers to see and identify destinations early, providing room for vehicles to maneuver into the proper lane, and building exits with appropriate dimensions minimize the complications an intersection functional areas.

4.3.2 Sight Distance

The safety and efficiency of traffic operations depend on the judgment, capabilities, and responses of individual drivers. The possibility of conflicts actually occurring can be greatly reduced through provision of adequate sight distances and appropriate traffic controls. Two types of sight distance are important in intersectional functional areas: stopping sight distance and intersection sight distance (corner distance).

Stopping sight distance (SSD) is provided continuously along each highway or street so that drivers have a view of the roadway ahead that is sufficient for them to stop to avoid a collision. Provision of stopping sight distance at all locations along each highway or street, including intersection approaches, is fundamental to intersection operation. There are two components of SSD. The first is perception-reaction, or the distance that the vehicle travels while the driver perceives the problem and moves his or her foot to the brake. The second component is the distance that the vehicle travels during braking.

There are two highway situations where SSD is especially important. These are when vehicles are going over the crest of a hill (vertical curve) or around a horizontal curve. In both situations, oncoming vehicles may be hidden by the curve. Fortunately, AASHTO has developed criteria for allowable sharpness of both vertical and horizontal curves to minimize the problem.

Intersection sight distance allows a driver of a stopped vehicle a sufficient view of the intersecting highway to decide when it is safe to enter or cross it. If the available sight distance for an entering or crossing vehicle is at least equal to the stopping sight distance for the major road, then drivers on both roads have sufficient sight distance to anticipate and avoid a collision. However, the situation quickly becomes complex. For example, an uncontrolled intersection is much different from a signal-controlled intersection. A heavy vehicle (tractor trailer or bus) takes longer to enter or cross, and thus needs a greater sight distance than an automobile. A vehicle crossing a six-lane facility needs more time than one crossing a two-lane road. A vehicle turning left is exposed to oncoming traffic longer than one turning right. In some cases, a major-road vehicle may stop or slow to accommodate the maneuver by a minor-road vehicle.

Table 4-1 lists acceptable stopping sight distance and intersection sight distances for a range of speeds and normal conditions. The AASHTO "Green Book" outlines the various intersection sight distance procedures for different circumstances, and should be consulted as needed during design (AASHTO, 2001). Regardless of the circumstances of specific vehicles at specific intersections, intersection sight distances that exceed stopping sight distances are desirable along the major road to enhance traffic operations.

Table 4-1: Stopping Sight Distance and Intersection Sight Distance (ASSHTO, 2001)

Design Speed (mph)	Stopping Sight Distance (ft)	Intersection Sight Distance*
15	80	170
20	115	225
25	155	280
30	200	335
35	250	390
40	305	445
45	360	500
50	425	555
55	495	610
60	570	665
65	645	720
70	730	775
75	820	830
80	910	885

*Intersection sight distance is for a stopped passenger car to turn left onto a two-lane highway with no median and grades of 3 percent or less. For other conditions, the time gap must be adjusted and the required sight distance recalculated.

4.3.3 Sight Triangles

Areas alongside intersection approaches and across their corners should be free of obstructions (i.e., landscaping or commercial signs) that might block a driver's view of potentially conflicting vehicles. These areas are known as "clear sight triangles." Two types of clear sight triangles are considered in intersection design, approach sight triangles and departure sight triangles. The dimensions of the sides of the sight triangles depend on the roadway design speeds and types of traffic control at the intersection. The design distances are based on observed driver behavior and speed choices of drivers on intersection approaches.

Each quadrant should be free of obstructions that might block an approaching driver's view of potentially conflicting vehicles. The length of the legs along both intersecting roadways should allow drivers to see potentially conflicting vehicles in time to slow or stop before colliding within the intersection. Figure 4-1 shows typical clear sight triangles for a vehicle approaching an uncontrolled or yield-controlled intersection.

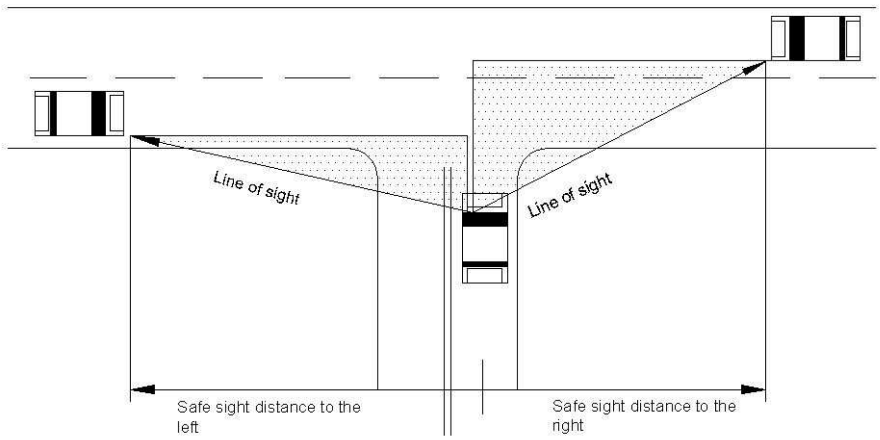


Figure 4-1: Intersection sight triangles

4.4 Turn Lanes

Turn lanes are used on arterial highways to perform several functions, including speed change (deceleration or acceleration) and storage for turning vehicles. When used appropriately, they allow turning vehicles to leave the through traffic lanes while minimizing interference with through traffic and they provide storage of vehicles waiting to complete the turn maneuver. The storage becomes a safe refuge for cautious drivers, allowing them the luxury of waiting for a safe gap in opposing traffic without feeling pressured because they are blocking through traffic.

AASHTO supports the use of turn lanes (AASHTO, 2003). “Deceleration lanes always are advantageous, particularly on high-speed roads, because the driver of a vehicle leaving the highway has no choice but to slow down on the through traffic lane if a deceleration lane is not provided. The failure to brake by the following drivers because of a lack of alertness causes many rear-end collisions.”

As outlined in the following paragraphs of this section, the incorporation of turn lanes into an arterial roadway involves two steps: (1) warrants – when to use turn lanes, and (2) design – length, width, taper, and other factors.

4.4.1 Warrants for Left-turn Bays

Each agency adopts its own warrants for left turn bays. The important considerations are usually the agency’s administrative philosophy (i.e., does the agency usually build with an eye towards he future, or does it use minimum acceptable criteria?), organization and staffing (agencies with small staffs and minimum budgets usually adopt only a few simple standard designs), and risk level and cost (this involves discretionary decisions about how to best use the public’s money to provide safety and efficiency of traffic movement). Even with these differences, most warrants are somewhat similar.

For divided roadways, left-turn bays are normally provided at all median openings on divided roadways (Florida and Oregon adopted such a warrant in their state codes).

For undivided roadways, isolated left-turn bays are provide on two-lane highways and undivided four-lane roads where through and turn volumes create an operational or a potential accident problem. Many different approaches have been used, including the examples shown below:

- Harmelink Method (Harmelink, 1967): This warrant is a family of curves based on left-turn volume and opposing volume, left turn volume and probability of a conflict between left-turning and advancing vehicles (Figure 4-2).

- AASHTO Method (AASHTO, 2001): AASHTO uses a simplified version of Harmelink's curves in tabular form.

- Institute of Transportation Engineers Method (ITE, 1991): This method uses a family of curves based on Harmelink's theoretical criteria and interpolations of Harmelink's curve using smaller speed intervals and smaller turn percentages.

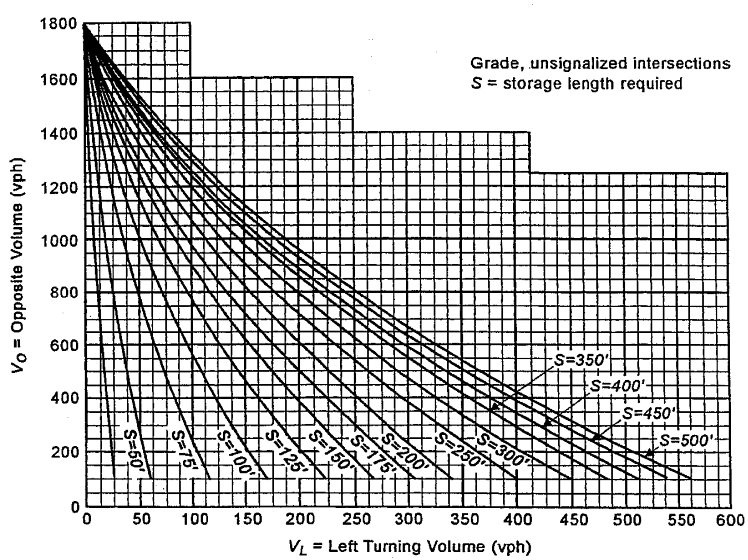


Figure 4-2 Harmelink's Warrants for left-Turn Bays on 4-Lane Roads

4.4.2 Left-Turn Bay Length

Once a left-turn bay is warranted, the next step is to determine its length.. The elements of a left-turn bay used in making this determination are shown in Figure 4-3. This involves vehicle speeds on the approach, number of vehicles stored in the bay while awaiting an opportunity to turn left, and sometimes the horizontal or vertical alignment.

ALDOT has defined the design length of speed change lanes. They are shown in drawing LTL-623 of the ALDOT Special & Standard Highway Drawings 2003.

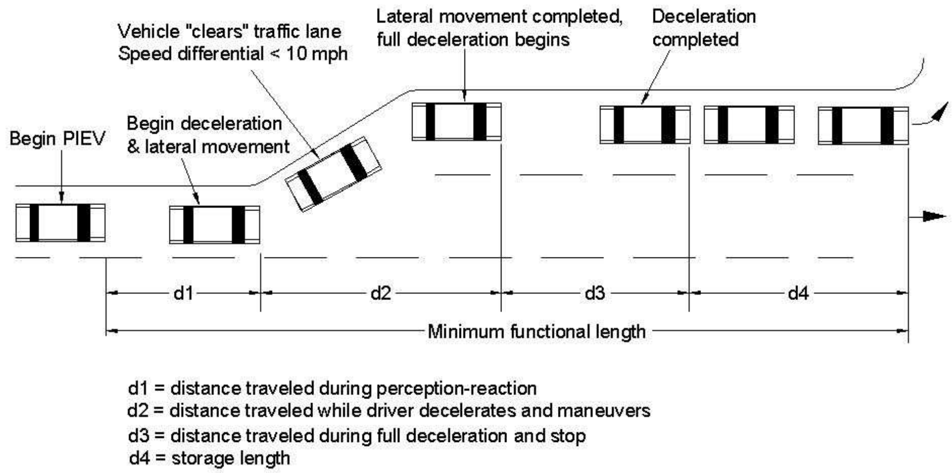


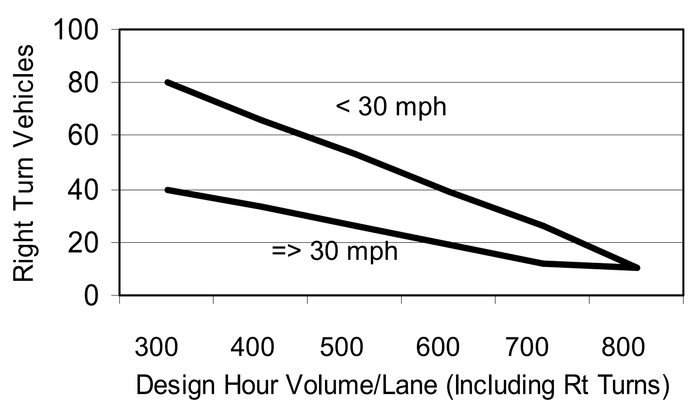
Figure 4-3: Elements of a left-turn bay

4.4.3 Warrants for Right-Turn Lanes

Because right turns do not affect traffic flow and safety as much as left turns, warrants for right-turn lanes are not as widely used as for left turn lanes. Where available, warrants are usually based upon right-turn volume and (same approach) through lane volume in the peak hour, speed, and crash experience.

Sometimes formal warrants are not used; when a right-turn lane appears to be needed, the right shoulder is simply paved and marked for turns. The Oregon DOT right-turn warrant is shown in Figure 4-4 as an example of a more formal warrant. In addition to the volume warrant in the figure, Oregon has a separate crash experience warrant.

Figure 4-4: Right Turn Lane Warrant
(Oregon DOT)



ALDOT generally requires right turn deceleration lanes for major development access points and public street intersections. ALDOT Standard Drawing LTL 623 is used as a design guideline. The chart is based on design speed, with adjustments for significant grades.

4.4.4 Acceleration Lanes

An acceleration lane allows an entering vehicle to accelerate and merge laterally into the through traffic lane. The acceleration lane must be long enough to allow the accelerating vehicle to reach the desirable merging speed, which equals or exceeds the average running speed of the through traffic.

Acceleration lanes are desirable where high speeds and lack of gaps in the traffic stream make it difficult for vehicles to enter the roadway. For example, left-turn acceleration lanes may be desirable at unsignalized median openings where high speeds and a lack of acceptable gaps prevail.

The substantial frontage required for an acceleration or deceleration lane limits the use of such lanes. In urban areas, a long signal spacing (half-mile or more) is needed to accommodate both acceleration and deceleration lanes, and still have a significant section of standard roadway. Where an acceleration lane is desired with short signalized intersection spacing (quarter-mile), a continuous auxiliary lane can be used effectively for acceleration and deceleration.

4.5 Median Openings and Spacing

A median is the part of the roadway that separates traffic traveling in opposite directions. It is significant to note that the median is a part of the "traveled way." So legally, the normal authority given to local governments can be applied more readily to median access control than to marginal access control.

For the general situation, there are four primary elements in the design of medians. They are the following:

- median type
- median width
- geometry of openings
    - end treatments
    - lengths of opening
- spacing of median openings

The discussion of medians and their characteristics in the remainder of this portion of the workbook is largely taken from the most recent National Highway Institute short course on access management (NHI, 2003).

4.5.1 Median Types

Median designs can be grouped into three categories. These are reviewed below, and their prominent qualities are listed.

- Non-traversable median: This is a raised or depressed median which cannot be crossed, or which actively discourages crossing.
    - It provides positive physical control of left turn and crossing maneuvers.
    - It should be incorporated into every major arterial roadway

- Traversable median: This is a flush or slightly raised median that a vehicle may easily cross.
    - It provides no positive physical control of left turn and crossing maneuvers.

- Continuous 2-way left-turn lane (TWLTL): This is a flush center lane, usually defined only by pavement markings, used to provide storage for vehicles making left-turns from the roadway.

    - It provides left turns from the roadway at any point.
    - It is applicable where there are frequent, low-volume driveways.
    - It is incompatible with the movement function of major arterials.

Knowledge of the three most common median types and their characteristics should guide the designer in selecting the median that is most applicable for any given situation encountered in an access management plan.

4.5.2 Median Widths

A median should be as wide as feasible to meet the design objectives, but the width should be in balance with other design components of the roadway cross section. The general range of median widths is from a minimum of 2 feet for the "narrow barrier" up to 80 feet or more. The wider medians permit each side of the roadway to be designed independently of the other.

4.5.3 Spacing of Median Openings

The minimum spacing of median openings is a function of permitted traffic movement patterns and the functional limit of the maneuver(s). The functional limit is comprised of the deceleration distance plus storage. Figure 4-5 illustrates the functional limit for three situations.

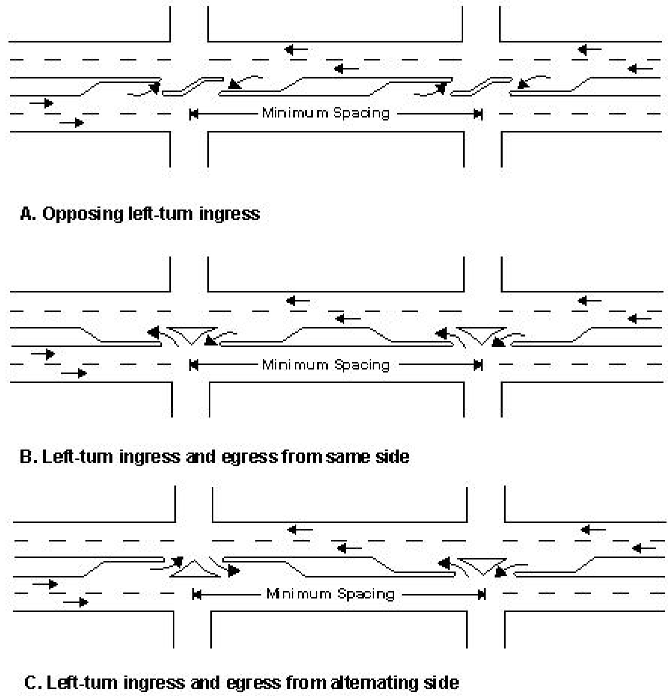


Figure 4-5: Minimum spacing of median openings

Figure 4-5a shows how to find the minimum spacing of median openings for ingress movements for opposite directions. The minimum spacing is equal to the sum of the functional length (deceleration plus storage) of the two left-turn bays plus a minimum length of full width median (at least 25 feet).

Figure 4-5b addresses spacing for ingress and egress from the same side of the roadway. Minimum spacing is the sum of the acceleration distance of the upstream egress opening, plus the deceleration, plus the storage in the downstream ingress opening, plus a minimum full width section at least 25 feet long. Figure 4-5c illustrates the spacing of median openings for ingress and egress alternating on opposite sides of the roadway. Minimum spacing is the sum of the two acceleration distances plus a minimum full width section.

4.5.4 Sample Median Criteria

The ALDOT Maintenance Manual includes guidance for median openings (called crossovers) on arterials. This information is displayed in Table 4-2 as an example of median criteria. The Manual provides instructions for submission of a permit application, and addresses issues like allowable locations for crossovers, minimum spacing between crossovers, construction criteria, turning lanes, median widths, tapers, need for signalization, etc. It also provides references to standard drawings, the ALDOT *Guidelines for Operation* book, and similar documents.

Table 4-2: Median crossover guidelines, ALDOT Maintenance Manual

AUTHORIZATION

Regulation of median crossovers on existing multi-lane divided highways with partial or no control of access is necessary to provide reasonably convenient access to adjacent roadside property in a uniform manner. Applications for median crossovers are to be submitted to the Maintenance Bureau through the Division Engineer. Each application shall contain the following:

1. Completed Form BM-166, Application for Right to Construct Median Crossover.
2. Drawing of proposed crossover showing location and distance (nearest tenth of a meter) to existing crossovers and intersections and points of access to roadside property. Measurement shall be center to center of existing and proposed crossovers.
3. A surety or performance bond.

Requests for median crossovers will be evaluated on an individual basis by the Department.

SELECTION CRITERIA

Median crossovers may be approved and construction authorized if one or more of the following criteria apply:

1. Intersections with public roads and streets
2. Access points for fire stations, hospitals and other emergency facilities.
3. Other crossover authorizations are to be based on the following:
    a. Distance to nearest crossover after considering following factors
    b. Estimated number of times used each day
    c. Stopping sight distance
    d. Traffic conflicts resolved by the installation of a crossover
    e. Traffic volumes
    f. Speed
    g. Median width
    h. Traffic conflicts created by the installation of a crossover
    i. Traffic movements created by the installation of a crossover

DISTANCE BETWEEN CROSSOVERS

Evaluation and authorization of crossovers based on the distance to the nearest crossover are regulated by the following criteria:

1. Rural or Low Traffic Density Area:
    a. 180 m minimum distance between center points of crossovers.
    b. 305 m minimum distance between center points of crossovers where service roads exist.
    c. 360 m minimum distance between center points of crossover

2. Urban or High Traffic Density Area:
    a. 90 m minimum distance between center points of crossovers
    b. 180 m minimum distance between center points of crossovers for residences

CONSTRUCTION CRITERIA

Construction of authorized median crossovers should be in accordance with Department policies and guidelines as follows:

1. Turn lanes shall be provided for crossovers at high traffic generators such as streets, roads, businesses, commercial facilities, public facilities, industrial facilities and complexes, shopping centers, housing complexes and trailer parks.

2. Crossovers should not be permitted in medians of insufficient width to protect the turning vehicles from traffic in the through lanes. Crossovers should not be permitted within the limits of turn lanes provided for driveways, street and road intersections.

3. Median crossovers and related left turn lanes and tapers should be designed and installed in accordance with criteria contained in Standard and Special Highway Drawings printed and published by the Department.

4. The need for signalization where median crossovers are constructed at entrances to high traffic generators, such as, but not limited to, city streets, roads, shopping centers and housing complexes, will be determined according to criteria in the Manual on Uniform Traffic Control Devices. Related cost of signalization shall be borne by the requesting agency or developer in accordance with the Department's Guidelines for Operation.

4.6 Traffic Signal Spacing

Experience has shown that once an area is fully developed, major arterials experience high traffic volumes and capacity problems. As the arterial approaches its maximum capacity (i.e., saturated flow), traffic signal operation and spacing become critical. An important part of signal operation is that conditions change all day long. A signal timing plan that works well in the peak hour will probably not work well in off-peak periods, because speeds and flow rates are different (see Table 4-3).

Table 4-3: Signal systems on urban/suburban streets must respond to two conditions

Peak Periods
- High volume
- Slower speeds, under 35 mph
- Longer cycles, 120 seconds are common

Off Peak Periods
- Lower volume
- Higher speeds 40-55 mph
- Shorter cycles, 60-70 seconds are common

Spacing of signalized intersections must provide efficient progression speeds (for a synchronized signal system) and maximum flow rates. Longer spacing between signals allows more flexibility, a wider range of allowable speeds, and a wider range of signal cycle lengths. More importantly, at higher congestion levels longer spacing between signals results in higher travel speeds. This is illustrated in Table 4-4.

Progression at reasonable speeds can be achieved at short signal spacing such as one-quarter mile, only when traffic volumes are very low. With a 90-second cycle and a quarter-mile spacing, the progression speed is only 20 mph. With a 120-second cycle it drops to less than 15 mph. A half-mile spacing allows timing plans that produce appropriate off-peak progression speeds at cycle lengths that are appropriate for off-peak traffic volumes. However, as arterial and cross-street traffic volumes increase, longer cycle lengths must be used to increase capacity by minimizing time lost during phase changes.

Table 4-4: Minimum signal spacing
For non-compact arterials

Applicable Speed (Mph)	Applicable Distance (feet)
20	1,300
25	1,600
30	1,800
35	2,200
40	2,600
45	3,000
50	3,600
55	4,200

Major urban arterials experience high traffic demand during peak periods. Research indicates that a uniform signal interval should be applied to every intersection to provide maximum capacity when the area is fully developed. This means selecting a signal spacing that will accommodate traffic speeds of at least 30 to 35 mph using the longest cycle length anticipated for peak period conditions.

As an aside, the primary guidance for signalized intersections (further apart is better than closer together) also applies to non-signalized intersections.

4.7 Driveway Location and Design

4.7.1 Example Policy

An excellent discussion of driveway location and design was prepared during an access management study for the City of Montgomery (Skipper Consulting, 2003). This information is repeated in the following paragraphs.

> Driveway spacing standards establish the minimum distance between access points along major thoroughfares. These standards help to reduce the potential for collisions, as travelers enter or exit the roadway. They also encourage the sharing of access for smaller parcels, and can improve community character by reducing the number of driveways and providing more area for pedestrians and landscaping. The location of driveways affects the ability of drivers to safely enter and exit a site. If driveways do not provide adequate sight distance, exiting vehicles may be unable to see oncoming traffic. In turn, motorists on the roadway may not have adequate time to avoid a crash. Driveway design standards assure driveways have an adequate design so vehicles can easily turn onto the site. Standards should also address the depth of the driveway area. Where driveways are too shallow, vehicles are sometimes obstructed from entering the site causing others behind them to wait in through lanes. This blocks traffic and increases the potential for rear-end collisions.
>
> Considerations in establishing separation standards include street function and classification, driving speeds, location of adjacent streets and driveways, the volume of trucks, driver expectancy, and the separation and reduction of motorist, bicyclist and pedestrian conflicts. Figure 4-6 illustrates techniques to access adjacent properties and reduce conflict points on an arterial roadway.
>
> Guidelines for a minimum turn radius, driveway width, and driveway slope are important because they help slower, turning traffic move off the arterial more quickly, and help the traffic leaving a driveway turn and enter the stream of traffic more efficiently. Requirements for turn radius, driveway width, and driveway slope are generally applied to non-residential developments and subdivisions. Each of these will be briefly discussed in the following paragraphs.

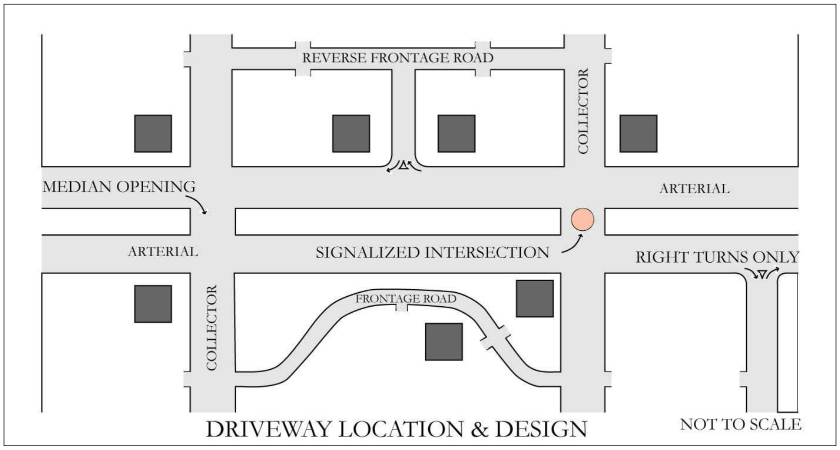


Figure 4-6: Reducing conflict points on an arterial

<u>Turn Radius</u>

The turn radius (or return radius) refers to the extent that the edge of the commercial driveway is "rounded" to permit easier entry and exit by turning vehicles. As shown in the diagram, a larger radius results in an "easier" entrance or exit movement for vehicles. The driveway movement can be performed at a greater speed and with less encroachment into oncoming through traffic (Figure 4-7). The preferred turn radii will depend on the type of vehicles to be accommodated, the number of pedestrians and cyclist crossing the driveway, and the operating speeds of the accessed roadway.

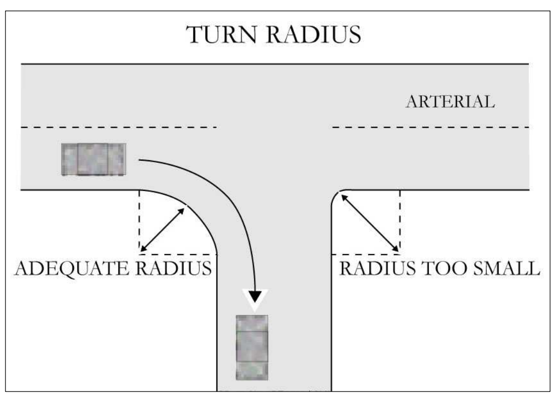


Figure 4-7: Effect of driveway radius

<u>Driveway Width</u>

It is important to regulate the maximum width of non-residential driveways. If the driveway is too wide, as is often the case, there is virtually unrestricted access. The result may be a wide driveway, which is unsafe to drivers, who may have a hard time deciding where to position themselves, and to pedestrians, who will have a greater distance of pavement to cross. In the worst case, uncontrolled access across the entire frontage leads to a severe deterioration in the level of service of the arterial and to costly road improvements. On the other hand, if the driveway is too narrow, the access speed to and from the driveway will be slow, impinging on through traffic.

General Driveway Design Standards:

- Construction of driveways along acceleration or deceleration lanes, left turn storage lanes and tapers should be avoided, unless no other reasonable access to the property is available.

- Driveways on undivided roadways shall be aligned directly opposite driveways on the opposite side of the road, or offset from each other in accordance with applicable City or State Standards, due to the potential for conflicting left turns or jog maneuvers and resulting safety or operational problems.

- Driveway width and return radius or flare should be adequate to serve the volume of traffic and provide for efficient movement of vehicles onto and off of the major thoroughfare. However, the width of driveways should not be so excessive as to pose safety hazards for pedestrians and bicycles.

- Driveways with more than two lanes should incorporate channelization features.

- Restrict the number of curb cuts to one entrance and exit drive. Where excessive access exists, install curbing to limit access to one location upon applications for expansions, redevelopments or change of use. Require shared driveways between two parcels at the property line, where practical.

Minimum Distance between Driveways

Maintaining a minimum distance between driveways along an arterial minimizes the number of access points that a driver must keep an eye on (see Figure 4-8). This simplifies driving and reduces the opportunities for conflicts and crashes.

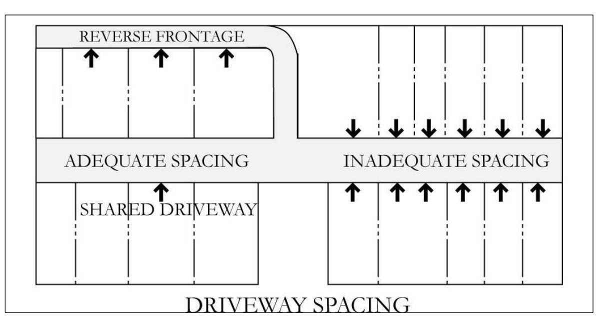


Figure 4-8: Driveway spacing example

Shorter access spacing can be permitted on lower classification roadways. Longer spacing is desirable on roadways in areas where speeds are higher. These guidelines can be used for both residential and non-residential development.

Driveway Spacing Standards:

- There should be at least 600 feet between each access point, either public or private, on an arterial roadway (see Figure 4-9).

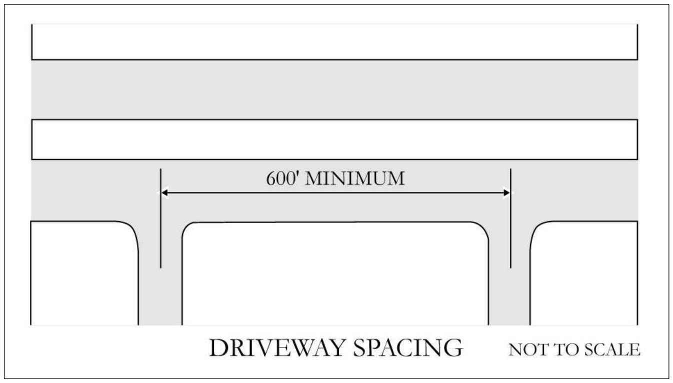


Figure 4-9: Driveway spacing illustration

There are mitigation measures that are applicable for developments that cannot meet the minimum driveway spacing criteria. The following are examples:

- Move the proposed driveway as far from the closest driveway or intersection, as possible. This is the minimum mitigation measure that will be accepted by the City, and in some instances is not an adequate mitigation by itself.

- Acquire a cross-easement for ingress and egress from an adjoining property, and use an existing driveway for the new development.

- Acquire a binding agreement from an adjoining property to remove an existing adjacent driveway in order to meet the minimum driveway-to-driveway separation criteria; and remove that extra driveway. Depending upon the trip generation characteristics of the subject development and the traffic volumes on the subject street, removal of an existing driveway may be considered adequate mitigation even when the full driveway-to-driveway separation distance does not fully meet the minimum driveway separation criteria.

4.7.2 Summary of Driveway Criteria

Many congestion and safety problems on arterials can be traced to the proliferation of driveways, which are often in poor locations and of substandard design. This portion of the workbook has used an example policy to illustrate how driveways can be regulated and designed under an access management program, so that their effect on safety and traffic operations is minimized.

4.8 References:

"Access Management Plan for Taylor Road and Chantilly Parkway," City of Montgomery, Skipper Consulting, Inc, Birmingham, Alabama, 2003.

Final Report: Guidelines for Left-Turn Lanes, ITE Committee 4A-22, Institute of Transportation Engineers, Washington, D.C., September, 1991.

Harmelink, M.D., "Aspects of Traffic Control Devices" Volume warrants for Left-Turn Storage Lanes at Unsignalized Grade Intersections," Highway Research Board Report No. 211, Highway Research Board, Washington, D.C., 1967.

Impacts of Access Management Techniques, NCHRP Report 420, Transportation Research Board, Washington, D.C., 1999.

Intersection Channelization Design Guide, NCHRP Report 279, Transportation Research Board, Washington, D.C., 1985

Maintenance Manual, Alabama Department of Transportation, Montgomery, Alabama.

Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, Washington, D.C. 2001

CHAPTER 5:
RETROFITTING ACCESS MANAGEMENT TO EXISTING ROADS

5.1 Objectives of This Chapter

The primary objectives of Chapter Five include the following:

1) Introduce the reader to the difficulty of retrofitting access management techniques (i.e., implementing it on a road where access was previously granted, based on needs of owners of individual property parcels, without consideration to impacts on operations of the roadway).
2) Outline some of the techniques used to retrofit access management to existing roads.
3) Review typical efficiencies of retrofit techniques.
4) Discuss the success of example previous projects.

The information presented and the reference materials provided in the chapter will (hopefully) allow readers to successfully implement access management techniques on roadways within their jurisdictions.

5.2 Constraints on Retrofit Projects

There are significant problems in applying access control to a developed arterial. Many studies have documented the damaging effects that frequent access points have on the quality of traffic flow provided by a roadway. The official who is responsible for safe, efficient movement of traffic is certainly aware of increasing crash rates and decreased levels of service that occur with an increase in traffic, an increase in access points, or both. In spite of these negative consequences, trying to remove access points that are already in place poses one of the greatest challenges to traffic managers today.

Implementation of access control techniques on existing roadways is very difficult. Right-of-way limitations and development in close proximity to the right-of-way are commonly encountered. Opposition by owners of the adjacent properties and affected businesses makes it difficult to obtain the necessary political acceptance. A summary of common constraints on retrofit projects includes the following:

Physical limitations

- Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, Washington, D.C. 2001
- Impacts on business
- Traffic flow effects
- Costs and benefits
- Legal issues
- Political considerations

In many instances, congestion (as evidenced by long queues at intersections), traffic crashes, and extensive travel delays will result in public demand for improvements to existing major streets.

Often it can be demonstrated that the benefits of fewer crashes, saved time and reduced fuel consumption exceed the cost associated with the implementation of access management improvements.

5.3 Techniques Applicable to Retrofit

The variety of access techniques which can be used in the retrofit of existing roadways can be grouped as to the length of roadway affected (point improvement or route segment) and by the physical elements involved, as identified in Table 5-1. General methods by which these physical improvements might be implemented are identified in Table 5-2.

Table 5-1: Classification of Physical Improvements

Physical Element	Point Improvement	Route Segment Improvement
Driveways	X	
Medians	X	X
Auxiliary Lanes	X	
Frontage Roads		X
Signal Removal	X	

Table 5-2
Techniques for Implementing point and route improvements

Physical Elements	Implementation Techniques
Driveways	• Relocate • Eliminate • Consolidate • Improve throat width/curb return radii and at vertical alignment • Increase corner clearance
Medians, Point	• Close • Redesign to permit specific movement only • Add turn bay/improve turn by geometrics
Medians, Route Segment	• Add non-traversable median • Close/redesign median openings • 2-way continuous left-turn lane
Auxiliary Lanes	• Right-turn deceleration lanes • Continuous right-turn lane • Right-turn acceleration lanes • Left-turn bays
Frontage Roads	• Reverse frontage • Increase separation from through roadway • One-way operation • Inter-parcel circulation

5.4 Driveway Improvements

It is important that driveways not be located close to major intersections. The following authoritative statement provides clear guidance on the issue (AASHTO, 2001):

> "Driveways should not be situated within the functional boundary of at-grade intersections. This boundary would include the longitudinal limits of auxiliary lanes."

A driveway located near an intersections is frequently blocked by a queue of stopped or slow moving vehicles; especially during peak periods. Accidents increase at such locations. It is good policy to relocate, consolidate, or eliminate driveways near intersections. Even though such actions are bound to improve operational conditions, they must be approached by the traffic manager through careful planning.

5.5 Safety Benefits of Adding Left-Turn Bays

The data presented in Table 5-3 indicates that retrofitting existing restrictive medians has a positive effect on safety, in both daytime and nighttime conditions. Interestingly, the reduction in the daytime rate was higher than the reduction in nighttime crashes. Left turn bays are certainly good access management applications, and traffic managers should consider including them at median openings on all roadways that intersect public streets and major private driveways.

Table 5-3: Left-turn crash rates before and after construction of left-turn bays

	Signalized			Un-signalized		
Light Conditions	Rate Before	Rate After	Percent Change	Rate Before	Rate After	Percent Change
DAY	0.94	0.73	-22	1.12	0.50	-55
NIGHT	1.12	1.00	-11	1.24	0.73	-41
TOTAL	1.00	.0.82	-18	1.16	0.58	-50

5.6 Raised Median Retrofit

The introduction of a raised median on an existing roadway in a developed area is often controversial. It is generally recognized that crashes and delays will be reduced if the median is installed. However, owners of adjacent businesses commonly believe that they will suffer a loss in business – especially if their access drives are not directly opposite a median opening. Unfortunately, very little research has been reported on the effect of medians and closure of median openings on business, in spite of the considerable interest in the topic. A major project being conducted in a related area will offer some insight, but the results will not be available until mid 1995. This is project 25-04, "Economic Effects on Adjacent Businesses Due to Restricting Left Turns," being conducted by the National Cooperative Highway Research Program.

Even though there is a dearth of formal research, case studies can be used to estimate the effect of medians and median openings. Case studies of selected roadways in Georgia, Florida, Maryland and Washington found significant improvements in the following areas:

- Decreased accident frequency and rates, and
- Improved travel speeds and delay reductions.

5.6.1 Change in Crash Experience

Studies conducted on Jimmy Carter Boulevard and Memorial Drive in Atlanta, Georgia indicated the following related to crash experiences:

- Total accidents at intersections were reduced between 11% and 35% when a ten inch raised median was introduced.
- Additionally, installation of a concrete safety shape barrier in the median reduced intersection accidents from 44% to 47%.

5.6.2 Operational Improvements

Analytical studies of the impacts of median closure on traffic operations are not scientifically conclusive, because median retrofit projects typically include other activities. It can become impossible to determine how much of the consequent benefit was due to the median change, and how much was due to some other change. For example, reducing the number of median openings also increases the signal spacing. This can have a significant impact on traffic signal timing and progression, therefore, the impacts of median installation alone are difficult to determine.

Table 5-4 presents a comparison of the operating characteristics for two roadways in Florida where medians were installed and median openings were reduced. As reflected in the table, significant improvements in increasing speeds and reducing delays can be expected with the implementation of these access management techniques.

Table 5-4: Comparison of average operational characteristics on two urban arterials

Travel Direction and Time of Day	Parameter	Sunrise Blvd	Oakland Park Blvd	Change
Eastbound, 7am - 8 am	Travel Speed Delay per Mile	21 52	24 32.4	+10% -38%
Eastbound, 4 pm - 6 pm	Travel Speed Delay per mile	19 65	21 50.1	+11% -23%
Westbound, 7am - 8 am	Travel Speed, Delay per Mile	22 45.1	23 41.6	+5% -12%
Westbound, 4 pm - 6 pm	Travel Speed, Delay per Mile	17 85	23 45.9	+35% -46%

5.6.3 Effects on Business

The potential impacts on businesses from installing a raised median on an arterial roadway is one of the primary roadblocks facing traffic engineers in implementing this access management technique. Most retailers oppose the installation of medians, especially if median openings that remain are not adjacent to their places of business.

The best opportunity for successful implementation of raised medians on area arterials occurs when the traffic engineer prepares thoroughly and develops a plan for educating local business owners and politicians. Educating them will be difficult under the best of circumstances. A positive step to offset negative bias is to obtain research results from retrofit projects in other jurisdictions, and to present it to business owners as well as politicians.

The Texas Transportation Institute conducted a project that provides useful information. The Institute evaluated a typical (successful) median installation retrofit project (Wooten, et al, 1964). Mail surveys were send to 316 businesses along six roadway segments in Houston and Port Arthur, Texas, where a raised median was installed to replace a continuous two-way left-turn lane. Personal interviews were conducted with 315 businesses along six highway segments in College Station, Houston, McKinney, Wichita Falls and Odessa, Texas, where a raised median was installed. The results of these surveys are summarized as follows:

- Most business owners indicated that customer counts increased or remained about the same after installation of the raised median opening.
- Businesses such as specialty retail, fast-food, and sit-down restaurants indicated increases in daily customer counts and gross sales following raised median construction.
- All business owners indicated customer volumes and gross sales decreased during construction.
- A majority of business owners indicated property access was better or about the same after installation of the raised medians.
- A majority of business owners indicated customer satisfaction and delivery convenience were better or about the same following installation of the raised medians.

5.7 Traffic Signal Removal

Benefits of removing unwarranted signals and those which interfere with efficient progression include smoother traffic flow, lower crash rates, reduced delay, reduced vehicular emissions, improved fuel economy and reduced congestion. It is generally recognized that removal of such unwarranted signals will improve safety and reduce maintenance costs. Although costs vary considerably, the one-time cost of removing an unwarranted signal and replacing it with stop signs has been estimated to be approximately equal to the annual costs of operation and maintenance. Where signals are closely spaced, removal of signals that interfere with efficient progression will improve traffic flow on major urban arterials.

Studies documented by a 1980 FHWA report (Kay, et al, 1980) entitled "Criteria for Removing Traffic Signals," demonstrated that removing unwarranted signals and converting the intersections to stop sign operation can have significant safety benefits. These benefits are reflected in Table 5-5.

Table 5-5: Signal Removal Case Studies

Case	Benefits Achieved
Case 1 26 urban signals converted to multi-way stop control	• Annual crash frequency reduced 68% • Injury crashes reduced 62% • Idling reduced 5 seconds per vehicle • 4800 gallons fuel saved per year for 10,000 ADT
Case 2 191 urban signals converted to two-way stop control	• Annual crash frequency reduced 3% • Injury crashes reduced 10% from 0.70 to 0.63 per MEV • Right angle crashes increased 51% rear-end crashes decreased 49% • Delay reduced by 10 seconds per vehicle • Number of stops reduced by over 50% • Fuel consumption reduced 0.002 gallons per vehicle

Public opposition and the resulting political presence is a common problem when attempting to remove unwarranted or marginally-needed signals. Studies conducted across the country indicate that removal of signals by traffic managers continues to be an extremely difficult task. Typically, opposition is expressed in the form of phone calls, letters and petitions to the traffic engineer and the city council, from residents and businesses in the immediate locale of the intersection.

Complaints usually concentrate on a perceived safety problem that would exist if the signal was removed. The safety problems most often mentioned include crashes, traffic fatalities, high speeds, and difficulty for pedestrians trying to cross the street. These concerns can usually be offset by the traffic engineer through a careful, factual presentation of the positive safety results of previous projects.

Many times, efforts to remove traffic signals fail due to these pressures. In order to afford the traffic engineer the best opportunity to succeed in removing unwanted traffic signals, the following must be accomplished:

- Appropriate technical studies must be conducted to demonstrate the positive impacts of signal removal;
- Public involvement must be sought and stakeholder “buy in” must be obtained; and
- Politicians must be educated and convinced of the positive benefits of proper traffic signal location.

5.8 References

Access Management, Location and Design – Participant Notebook, NHI Course No. 133078, National Highway Institute, October 2003.

Frawley, W.E. and W.L Eisele, "A Methodology for Determining Economic Impact of Raised Medians: Data Analysis on Additional Case Studies," TTI Research Report 3904-3,Texas Transportation Institute, October, 1999.

Hagenauer, G.F., J. Upchurch, D. Warren and M.J. Rosenbaum, "Intersections," Synthesis of Safety Research Related to Traffic Control and Roadway Elements, Vol. 1, Report FHWA-TS-82-232. Federal Highway Administration, December 1982.

Kay, J.L., L.G. Newdorff, and F.A. Wagner, "Criteria for Removing Traffic Signals, Technical Report," Federal Highway Administration Report No. FHWA/RD/80-104, Final Report, September, 1980.

Long, G.D., and J. Helms, "Median Design for Six-Lane Urban Roadways," Research Report, Transportation Research Center, University of Florida, October 1991.

Parsonson, P.S., M. Waters, and J.S. Fincher, Georgia Department of transportation, "Effect of Safety Replacing an Arterial Two-Way Left-Turn Lane with a Raised Median", Proceedings of the First National Access Management Conference, Vail, Colorado, 1993.

Policy on Geometric Design of Highways and Streets, American Association of State Highways and Transportation Officials, 2001.

Wootan, C.V., H.G. Meuth, N.J. Rowan, and T.G. Williams, A Median Study in San Antonio, Texas, Research Report 8-3, Texas Transportation Institute, Texas A&M University, College Station, Texas, August 1964.

CHAPTER 6:
CASE STUDIES

6.1 Objectives of This Chapter

The objective of this chapter is to briefly illustrate application of the principles outlined in the preceding chapters. This will impart a feeling for the ease or difficulty of applying access management guidelines to individual situations.

6.2 Case Study One

This example will involve an intersection that will be impacted by a proposed adjacent development. A right turn lane will be used to reduce the size of the queue waiting at the signal to generate benefits for this intersection plus downstream commercial developments.

6.3 Case Study Two

This example will be a continuation of Case Study One. Changes to the signal phasing and timing will be used to improve efficiency of operation, to decrease the queue length, and to benefit downstream commercial development.

6.4 Case Study Three

This example involves a complex situation involving a development on a major arterial street. A site impact study was performed through simulation modeling, verifying that the four-leg intersection would operate more efficiently if modified to become two three-leg intersections separated by 1200 feet. It illustrates that technical tools are available to simulate future traffic situations, and that they can be applied to access management situations.

List of Appendices

Appendix "A"
Access Management Definitions

Access -- A way or means of approach to provide vehicular or pedestrian entrance or exit to a property from an abutting property or a public roadway.

Access Connection -- Any driveway, street, road turnout or other means of providing for the movement of vehicles to or from the public road system or between abutting sites.

Access Management -- The process of providing and managing reasonable access to land development while preserving the flow of traffic in terms of safety, capacity, and speed on the abutting roadway system.

Access Management Plan -- A plan establishing the preferred location and design of access for properties along a roadway or the roadways in a community.

Access Point -- a) The connection of a driveway at the right-of-way line to a road. b) A new road, driveway, shared access or service drive.

ALDOT – Alabama Department of Transportation.

Alternative Means of Access -- A shared driveway, frontage road, rear service drive or connected parking lot.

Arterial – Arterial streets and roadways of regional importance intended to carry moderate to high traffic volumes over significant distances and are primarily to serve through traffic where a higher degree of access control is provided.

AASHTO -- Abbreviation of the American Association of State Highway and Transportation Officials, which conducts research and publishes many national road and non-motorized standards.

Channelized or Channelizing Island -- An area within the roadway or a driveway not for vehicular movement; designed to control and direct specific movements of traffic to definite channels. The island may be defined by paint, raised bars, curbs, or other devices.

City – *the name of the appropriate city goes here*.

Classification of Roads -- See Road Classification.

Collector – Collector streets are those which carry traffic from minor or neighborhood streets to the major system of arterial streets and highways, including the principal entrance streets of a residential development and streets for circulation within such a development.

Conflict -- A traffic event that causes evasive action by a driver to avoid collision with another vehicle, bicycle or pedestrian.

Conflict Point -- An area where intersecting traffic merges, diverges, or crosses.

Corner Clearance -- The distance from an intersection of a public or private road or street to the nearest access connection, measured from the closest edge of the driveway pavement to the closest edge of the road pavement.

Cross Access -- A service road or driveway providing vehicular access between two or more contiguous sites so the driver need not enter the public road system.

Cross Street -- The adjacent intersecting street or road.

Deceleration Lane -- A speed-change lane, including taper, for the purpose of enabling a vehicle to leave the through traffic lane at a speed equal to or slightly less than the speed of traffic in the through lane and to decelerate to a stop or to execute a slow speed turn.

Driveway -- Any entrance or exit used by vehicular traffic to or from land or buildings abutting a road.

Driveway Return Radius -- A circular pavement transition at the intersection of a driveway with a street or road that facilitates turning movements to and from the driveway.

Driveway, Shared -- A driveway connecting two or more contiguous properties to the public road system.

Driveway Spacing -- The distance between driveways as measured from the centerline of one driveway to the centerline of the second driveway along the same side of the street or road

Driveway Width -- Narrowest width of driveway measured perpendicular to the centerline of the driveway.

Egress -- The exit of vehicular traffic from abutting properties to a street or road.

Frontage Road or Front Service Drive -- A local street/road or private road typically located in front of principal buildings and parallel to an arterial for service to abutting properties for the purpose of controlling access to the arterial.

Ingress -- The entrance of vehicular traffic to abutting properties from a roadway.

Intersection -- The location where two or more roadways cross at grade.

Intersection Sight Distance -- The sight distance provided at intersections to allow the drivers of stopped vehicles a sufficient view of the intersecting roadways to decide when to enter the intersecting roadway or to cross it.

Lane -- The portion of a roadway for the movement of a single line of vehicles which does not include the gutter or shoulder of the roadway.

Local Road or Street – Local roads or streets are those used primarily for access to abutting properties.

Median -- The portion of a divided roadway or divided entrance separating the traveled ways from opposing traffic. Medians may be depressed, painted or raised with a physical barrier or may be landscaped.

Median Opening -- A gap in a median provided for crossing and turning traffic.

Nonconforming Access -- Features of the access system of a property that existed prior to the effective date of and do not conform to the requirements of these Guidelines.

Reasonable Access: The minimum number of access connections, direct or indirect, necessary to provide safe access to and from a public road consistent with the purpose and intent of these Guidelines. Reasonable access does not necessarily mean direct access.

Right-of-Way – A general term denoting land, property or interest therein, usually in a strip, acquired for or devoted to transportation purposes.

Road – See Street

Roadway -- That portion of a street, road or highway improved, designed or ordinarily used for vehicular travel exclusive of the berm or shoulder. In the event a highway includes two or more separate roadways, "roadway" refers to any such roadway separately, but not to all such roadways collectively.

Secondary Street or Side Street – See Local Road or Street.

Service Drive -- See Frontage Road or Rear Service Drive.

Shared Driveway -- See Driveway, Shared.

Sight Distance -- The distance of unobstructed view for the driver of a vehicle, as measured along the normal travel path of a roadway to a specified height above the roadway.

Standard – A definite rule or measure establishing a minimum level of quantity or quality that must be complied with or satisfied in order to obtain development approval, such as location or spacing requirement.

Street – A way for vehicular traffic, whether designated as a street, highway, thoroughfare, parkway, through-way, avenue, boulevard, land place, or however otherwise designated.

Taper -- A triangular pavement surface that transitions the roadway pavement to accommodate an auxiliary lane.

Thoroughfare -- A public roadway, the principal use or function of which is to provide an arterial route for through traffic, with its secondary function the provision of access to abutting property.

Throat Length -- The distance parallel to the centerline of a driveway to the first on-site location at which a driver can make a right-turn or a left-turn. On roadways with curb and gutter, the throat length shall be measured from the face of the curb. On roadways without a curb and gutter, the throat length shall be measured from the edge of the paved shoulder.

Trip Generation – The estimated total number of vehicle trip ends produced by a specific land use or activity. A trip end is the total number of trips entering or leaving a specific land use or site over a designated period of time. Trip generation is estimated through the use of trip rates that are based upon the type and intensity of development.

Undivided Roadway – A roadway having access on both sides of the direction of travel, including roadways having center two-way left-turn lanes.

Appendix “B
Sample Web Sites

Professional Organizations

Alabama Section of the Institute of Transportation Engineers
www.eng.auburn.edu/department/ce/alsite/

Institute of Transportation Engineers http://www.ite.or
ITE Bookstore http://www.ite.org/bookstore/index.asp

Transportation Research Board http://www.nas.edu/trb/
TRB Bookstore http://gulliver.trb.org/bookstore/
TRB Committee AD107-Access Management (national access management Web site)
http://www.accessmanagement.gov/

American Association of State Highway and Transportation Officials
http://www.aashto.org/aashto/home.nsf/FrontPage
AASHTO Bookstore www.transportation.org/publications/bookstore.nsf/Home?OpenForm

National Highway Institute http://nhi.fhwa.dot.gov/default.asp

Planning Commissioners Journal http://plannersweb.com/index.htm
Journal article, Access Management Overview http://plannersweb.com/access/accintro.html

State Departments of Transportation

Maine www.state.me.us/mdot/planning/bureauweb/accesslinks.htm

Florida http://wp.netscape.com/escapes/search/ntsrchdft-3.html?cp=ntserch&

Colorado www.dot.state.co.us/AccessPermits/index.htm

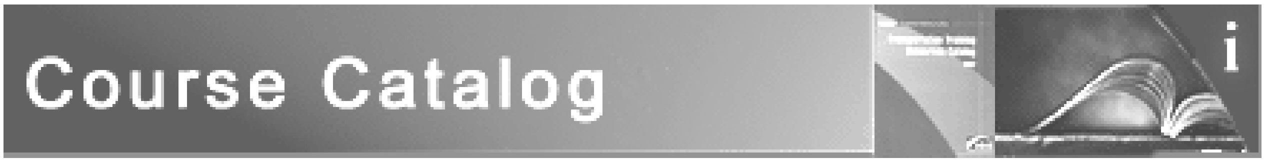
Iowa (through the Center for Transportation Research and Education at Iowa State University)
www.ctre.iastate.edu/research/access/Litrev.html

Other
Montgomery Area Metropolitan Organization website:
http://www.montgomerympo.org/mpo_documents.html
Go to the “MPO Documents” page, and click on the Taylor Road Corridor Study hot link

Several Example Web Sites Are Shown of the Remaining Pages of Appendix B

National Highway Institute

(Federal Highway Administration
http://nhi.fhwa.dot.gov/default.asp



Course Number: **133078A** Course Title: **Access Management, Location and Design**

Length (Days)	CEU	FEE
3 Days	1.8 Units	$ 400 Per Participant

Description: This course covers access management along streets and highways. General benefits, as well as the social, economic, political and legal implications of access control are examined. Existing access management practices and policies from States and jurisdictions are used as examples of what types of programs have been implemented and how effective they have been. Through in-depth discussion, access management techniques and the warrants for their use are reviewed. Guidelines for design and application of these access management techniques are described in detail. Strategies for developing and implementing retrofit programs to improve existing access control are presented. The course presents several "before" and "after" case studies, which show the impacts of retrofit programs on local businesses. Techniques and procedures for evaluating the impacts of access control on the safety and operations of the highway system are also covered.

Objective: Upon completion of the course, participants will be able to:

- Recognize the various elements involved in planning, developing, implementing, and administering an effective access management program.
- Assess the safety and operational impacts of alternative access management techniques.
- Demonstrate convincingly the merits of obtaining and maintaining good access management along streets and highways.

Target Audience: This course is designed for Federal, State, and local planners and engineers who are involved or expect to be involved in decisions on and/or design of access to existing or new sites.

Scheduled Sessions: Please contact the Local Coordinator listed below to register for a specific session. The Local Coordinator provides all logistical information (e.g. location, times, lodging, etc.). FHWA employees must register in LADS and contact the FHWA Coordinator to determine if an FHWA slot is available

Course Scheduling:
Danielle Mathis-Lee (703) 235-0528 Email:danielle.mathis-lee@fhwa.dot.gov

NHI Training Program Manager:
Bill Williams (703) 235-0539 Email:bill.williams@fhwa.dot.gov

Technical Information:
Vince Pearce (202) 366-1548 Email:vince.pearce@fhwa.dot.gov

Maine Department of Transportation
www.state.me.us/mdot/planning/bureauweb/accesslinks

Plan & Program Development Division	Systems Management Division	Transportation Research Division	General Information

Bureau of Planning

Access Management Program

- **Summary of the Access Management Program**
- **Planning a Driveway or Business Entrance? (Informational Brochure)**
- **Maps of Mobility Corridors**
- **Typical Trip Generation Rates and Driveway/Entrance Determination Criteria**
- **Access Management Rule Fact Sheet**
- **Driveways and Entrances Major Substantive Rule (Slide Show)**
- **Managing Access Makes Common Sense (Slide Show)**
- **Directions for Driveway/Entrance Applications**

Access Management Rules

- **Driveway Rules August, 2002**
- **Entrance Rules August, 2002**
- **Appendix A - Contact Information for Requesting an Application**
- **Appendix B - Citations and Associated Text**
- **Appendix C1 - Highways Regulated by Access RulesAdministered by MDOT**
- **Appendix C2 - Mobility and Retrograde Arterial Corridors**
- **Access Management Review Criteria for Subdivisions, 30-A MRSA §4404, sub-§5**
- **Appendix D - Urban Compact and Service Center Communities**
- **Appendix E - Reserved for future use**
- **Appendix F - Application for Permit by Rule for Forest Management and Farming Activities**
- **Appendix G - Application for Driveway/Entrance Permit**
- **Appendix H - MDOT Standard Design Details**
  [Drives on Non-Sidewalk Sections] [Residential Entrance onto Uncurbed Highway (Paved Shoulders)] [Commercial/Industrial Entrance onto Uncurbed Highway (Paved Shoulders)] [Shopping Center Entrance onto Highway(Paved Shoulders)] [Residential Entrance onto Curbed Highway (with/without sidewalks)] [Curbed Commercial/Industrial Entrance onto Curbed Highway (with/without sidewalks)] [Commercial/Industrial Double Entrances onto Curbed Highway (narrow right-of-way)] [Curb] [Terminal Curb Section] [Curb Transition]

Some documents require Adobe Acrobat Reader. If you have problems reading any document, please contact lori.brann@state.me.us

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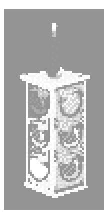
PLANNING COMMISSIONERS JOURNAL

Access Management
An Overview

by Elizabeth Humstone & Julie Campoli

[From Issue 29 of the PCJ, Winter 1998]



CONTENTS OF ARTICLE

The 1960s and 1970s were a major period of road building in the United States. Interstate highways were constructed, major arterial highways were improved, and new roads were developed to provide access to vast, undeveloped lands. With these improvements more commercial development appeared outside of urban and village centers, particularly along major highways and at interchanges.

With time, vacant lands between the commercial uses filled in. Individual curb cuts for each business lined the highway. Traffic increased. Congestion began to cause delays for drivers. People found it difficult to enter or leave businesses or homes along the road. The number of accidents grew. State and local officials widened roads to handle more cars. Before long there were traffic signals, left turn lanes, and four, six, and (continued)

About the Authors:

Elizabeth Humstone is Director of the Vermont Forum on Sprawl, and a long-time planner. She is also Chair of the State of Vermont's Housing & Conservation Trust Fund Board. You can contact her at: EHumstone@ compuserve.com

Julie Campoli is a landscape architect and principal of Urban Design & Landscape Architecture, based in Burlington, Vermont.

Appendix C

Maine DOT - Example Documents
from
Access Management Web Site

1) Summary of Access Management Program

2) Maine Dot - Access Management Fact Sheet

3) Typical Trip Generation Rates and Driveway Entrance Determination Criteria

Maine DOT
Summary Of Access Management Program

The 119th Maine Legislature approved LD 2550, An Act to Ensure Cost Effective and Safe Highways in Maine. The purpose of the act is to assure the safety of the traveling public and protect highways against negative impacts of unmanaged drainage. The law is intended to ensure safety, manage highway capacity, conserve state highway investment, enhance economic productivity related to transportation; and conserve air, water, and land resources. The Access Management Program for Maine includes Access Management Rules and Corridor Planning and Preservation Initiatives.

The Rules:
The Act specifically directs the MDOT and authorized municipalities to promulgate rules to assure safety and proper drainage on all state and state aid highways with a focus on maintaining posted speeds on arterial highways outside urban compact areas. The law also requires that the rules include standards for avoidance, minimization, and mitigation of safety hazards along the portions of rural arterials where the 1999 statewide average for driveway related crash rates is exceeded. Those rural arterials are referred to in the rules as "Retrograde Arterials".
The full set of rules became effective on May 25, 2002.

Corridor Planning and Preservation Initiatives:
Access management rules are viewed as only one part of the statewide access management program. The program envisions prioritized planning and preservation of Mobility Arterial corridors most at risk of losing capacity, safety, and of decreasing posted speeds, due to increasing development and commuter and visitor pressures. Mobility arterial corridors most at risk are those designated as NHS highways and highways where:

- Congestion is already being experienced,
- Driveway related crash rates exceed the 1999 statewide average,
- Municipalities have designated growth areas,
- Water and sewer infrastructure exists,
- Natural resources are threatened (e.g. water supply or salmon watersheds),
- MDOT highway reconstruction projects are planned, or
- Areas experiencing rapid uncontrolled growth.
-

The identification of these "most-at-risk" Mobility Arterial corridors is currently under way.
The Corridor Planning and Preservation Program includes corridors where MDOT, in partnership with adjoining municipalities, property owners, corridor committees, Scenic Byway corridor committees, and other stakeholders along a mobility arterial join forces to develop strategies that assures the stated purposes of the Access Management Law are met and maintained. Corridor Planning and Preservation Program partnerships would outline appropriate locations for access management techniques such as:

- Access rights acquisition,
- Development of frontage roads and shared driveways,
- Intersection improvements,

- Development of turn lanes,
- Installation of signals, and
- Development of appropriate local land use regulations that meet the intent of the law.
-

Plans will be required to outline corridor protection measures that assure maintenance of safety and speed, and management of drainage, as well as the development, protection, or enhancement of important natural and/or man-made environmental features along the highway corridor.

For more information contact Dale Doughty at dale.doughty@state.me.us

Maine Dot - Access Management Fact Sheet

Background

- In May 2000, the 119th Maine Legislature enacted P.L. 1999, ch. 676, An Act to Ensure Cost Effective and Safe Highways in the State, copy on back of this page.

- This legislation directed MaineDOT to draft rules and regulations for the design of driveways and entrances on state and state aid highways.

- This legislation required that the Legislature review and approve the portions of these rules applicable to arterial highways. These portions, known as major substantive rules, are shown in bold type in the draft rules.

What is access management?

- Access Management is the planned location and design of driveways and entrances to public roads.

What are the goals of access management?

- Increase Safety. Highway crashes related to cars entering and leaving the public way resulted in an estimated economic impact to the State of Maine of $1.2 billion over the past 10 years and of approximately $106 million in 1999 alone. In 1996, 1 in 6 crashes occurred at driveways or entrances; 1 in 5 people involved in crashes were involved in driveway or entrance related crashes. Access management will increase safety of highway and driveway users.

- Enhance Productivity. Arterial highways represent only 12% of the state-maintained highway system, but carry 62% of the state-wide traffic volume. Maintaining posted speeds on this system means Maine's people and its products move faster, thus enhancing productivity, reducing congestion-related delays and environmental degradation.

- Avoid Future Construction Costs. By preserving the capacity of the system we have now, we reduce the need to build costly new highway capacity such as new travel lanes and bypasses.

How do the proposed rules achieve these goals?

- The rules are organized in two parts: one set (green) applies to driveways (primarily residential) and the other set (blue) applies to entrances (primarily commercial).

- Rules are tailored to match the function of the road - less restrictive on minor collectors and more stringent on arterials.

- Rules provide permit-by-rule flexibility for farm and forest related uses.

What questions can I expect from my constituents?

- *Will these rules require me to give up my driveway(s)?* No. All existing driveways are grandfathered until there is a change in the use, location or grade.

- *Can I put my new driveway any place I want?* Not always. In cases where the sight distances are too short or its location otherwise creates a safety hazard, the location or design of the new access may have to be changed. On arterial highways, certain driveway spacing standards are necessary to preserve posted speed and safety.

- *Can commercial developments or public facilities be located anywhere?* No. In the past, unplanned siting of commercial and public facilities on arterial highways has seriously impaired the free flow of traffic in numerous locations, requiring taxpayers to fund expensive remedies. These rules promote location and access through existing access points, or in carefully planned locations to preserve the safety and posted speed of arterials and thus enhance productivity.

- *Do these rules stop growth and development?* Not at all! These rules *encourage* development where it is safest, and where it does not impede free-flowing traffic on major roadways.

If you have additional questions, please feel free to call Bruce Van Note (624-3010), Kathy Fuller, (624-3281) or Steve Landry, (624-3620) at the Maine Department of Transportation.

Maine Department of Transportation

Typical Trip Generation Rates and Driveway/Entrance Determination Criteria

For use in completing a permit application

Land Use	Estimated number of trips per day per unit*	Rate below which access is deemed a driveway
Single Family House	**10 trips/day/home**	**< 6 homes**
Apartment Building	**6.6 trips/day/dwelling unit**	**< 8 dwelling units**
Mobile Home Park	**4.8 trips/day/dwelling unit**	**< 11 dwelling units**
Single Tenant Office Building	**11.57 trips/day 1000 sq. ft.**	**< 5000 sq. ft.**
Day Care Center	**4.5 trips/day/student**	**< 12 students**
Home Beauty Salon	**42 trips/day/stylist**	**< 2 stylist**

* Estimated number of trips is based on the Institute of Traffic Engineers Trip Generation Manual, 1997. These represent estimates.

Appendix “D”
Example Alabama City Access Management Policy

This appendix contains an example city policy, in draft form. It was prepared for two “young” arterials in the City of Montgomery, Alabama, by Skipper Consulting, Inc. of Birmingham, Alabama.

Please keep in mind that this is a DRAFT document. It had not been adopted and placed into use at the time that this participant workbook was prepared.

For more information about the draft policy and to see a full copy of the background study that lead to preparation of the document, visit the Montgomery Area Metropolitan Organization website:

http://www.montgomerympo.org/mpo_documents.html

Go to the “MPO Documents” page, and click on the Taylor Road Corridor Study hot link.

SECTION 1

The City of Montgomery as well as communities throughout the country are increasingly concerned about the effects of development on service costs, community character and overall quality of life. Substantial resources have been and continue to be invested into the arterial roadways in and around the City of Montgomery. These arterial roadways serve as vital links between various parts of the City and serve as essential access for commerce, trade, tourism and recreational travel.

The City of Montgomery has identified two of its corridors that contain substantial undeveloped adjacent lands that are currently undergoing development pressures. The two corridors are identified as follows:

- Taylor Road (Alabama Highway 271) from Vaughn Road to U.S. Highway 231 and
- Chantilly Parkway (Alabama Highway 110) from East Chase Parkway to Vaughn Road.

By identifying these corridors, the City of Montgomery, in conjunction with the Alabama Department of Transportation, has established access guidelines for use by property owners in planning for development of their properties in such a manner the full capacities of these roadways can be realized and protected.

SECTION 2 - DEFINITIONS

A comprehensive list of definitions was included in this section of the draft policy (that list is shown as Appendix A of this report).

SECTION 3 - ACCESS MANAGEMENT GUIDELINES

Purpose, Intent and Application

A. The purpose of these *Guidelines* is to establish minimum regulations for access to property. Standards are established for new roads, driveways, shared access, parking lot cross access, and service roads. The standards of these *Guidelines* are intended to promote safe and efficient travel within the City of Montgomery along portions of Taylor Road and Chantilly Parkway; minimize disruptive and potentially hazardous traffic conflicts; ensure safe access by emergency vehicles; protect the substantial public investment in the street system by preserving capacity and avoiding the need for unnecessary and costly reconstruction which disrupts business and traffic flow; separate traffic conflict areas by reducing the number of driveways; provide safe spacing standards between driveways, and between driveways and intersections; provide for shared access between abutting properties; implement the recommendations of the *Access Management Plan, Taylor Road and Chantilly Parkway, January 2003*; ensure reasonable access to properties, though not always by the most direct access; and to coordinate access decisions with the Alabama Department of Transportation and/or the Montgomery County Commission, as applicable.

B. The standards in these *Guidelines* are based on extensive traffic analysis of Taylor Road between Vaughn Road and U.S. Highway 231 and Chantilly Parkway between East Chase Parkway and Vaughn Road by the City of Montgomery and the Alabama Department of Transportation (ALDOT) as applicable. This analysis demonstrates that the combination of roadway design, traffic speeds, traffic volumes, traffic crashes and other characteristics necessitate special access standards. The standards in these *Guidelines* apply to private and public land along road rights-of-way for the two roadways described which are under the jurisdiction of the City of Montgomery. The requirements and standards of these *Guidelines* shall be applied in addition to, the requirements of the City of Montgomery Zoning Ordinance and Subdivision Regulations.

C. The standards of these *Guidelines* shall be applied by the Zoning Administrator during plot plan review and by the Planning Commission during site plan review, as is appropriate to the application. The Planning Commission shall make written findings of nonconformance, conformance, or conformance if certain conditions are met with the standards of these *Guidelines* prior to disapproving or approving a site plan per the requirements of Montgomery Subdivision Regulations. The City of Montgomery shall coordinate its review of the access elements of a plot plan or site plan with the appropriate road authority prior to making a decision on an application. The approval of a plot plan or site plan does not negate the responsibility of an applicant to subsequently secure driveway permits from the Alabama Department of Transportation. Any driveway permit obtained by an applicant prior to review and approval of a plot plan or site plan that is required under these Guidelines will be ignored.

D. Neither the Zoning Administrator nor the Planning Commission shall take action on a request for a new road, driveway, shared access, or a service drive that connects to either of the public roads outlined in these *Guidelines* without first consulting the Alabama Department of Transportation. To ensure coordination, applicants are required to submit a plot plan, site plan or a tentative preliminary plat concurrently to both the City of Montgomery and the Alabama Department of Transportation as applicable. Complete applications shall be received in accord with the current Zoning and Subdivision Regulations of the City of Montgomery before the Planning Commission meeting at which action is to be taken. The submittal of a request for those roadways outlined in these *Guidelines* shall be accompanied by a traffic impact study conducted by a licensed professional engineer with known expertise in traffic engineering. As a minimum, the traffic impact study shall contain the following:

    1. Analysis of existing traffic conditions and/or site restrictions using current data.
    2. Projected trip generation at the subject site or along the subject service drive based on the most recent edition of the Institute of Transportation Engineers <u>Trip Generation</u> manual. The City of Montgomery may approve use of other trip generation data if based on recent studies of similar uses within similar locations in the Montgomery area.
    3. Illustrations of current and projected turning movements at access points. Include identification of the impact of the development and its proposed access on the operation of the abutting streets. Capacity analysis shall be completed based on the most recent

version of the Highway Capacity Manual published by the Transportation Research Board, and shall be provided in an appendix to the traffic impact study.

4. Description of the internal vehicular circulation and parking system for passenger vehicles and delivery trucks, as well as the circulation system for pedestrians, bicycles and transit users as applicable.
5. Justification of need, including statements describing how the additional access will meet the intent of these *Guidelines*, will be consistent with the *Access Management Plan, Taylor Road/Chantilly Parkway*, will not compromise public safety and will not reduce capacity or traffic operations along the roadway.

E. Failure by the applicant to begin construction of an approved road, driveway, shared access, service drive or other access arrangement within twelve (12) months from the date of approval, shall void the approval and a new application is required.

F. The Zoning Administrator or representative of the City of Montgomery shall inspect the driveway(s) as constructed for conformance with the standards of these *Guidelines* and any approval granted under it, prior to issuing an occupancy permit.

SECTION 4 - ROADWAYS SUBJECT TO ACCESS MANAGEMENT REGULATIONS

The access management regulations of these *Guideline*s apply to all property having fronting on or proposing to have access to the following roadways:

A. Taylor Road from Vaughn Road to U.S. Highway 231; and
B. Chantilly Parkway from East Chase Boulevard to Vaughn Road.

SECTION 5 - DRIVEWAY LOCATION AND DESIGN

All lots hereafter created and all structures hereafter created, altered or moved on property with frontage on or access to Taylor Road or Chantilly Parkway within the limits outlined in these Guidelines, shall conform to the following requirements:

General Driveway Design Standards:

- Construction of driveways along acceleration or deceleration lanes, left turn storage lanes and tapers should be avoided, unless no other reasonable access to the property is available.

- Driveways on undivided roadways shall be aligned directly opposite driveways on the opposite side of the road, or offset from each other in accordance with applicable City or State Standards, due to the potential for conflicting left turns or jog maneuvers and resulting safety or operational problems.

- Driveway width and return radius or flare shall be adequate to serve the volume of traffic and provide for efficient movement of vehicles onto and off of the major thoroughfare. However, the width of driveways shall not be so excessive as to pose safety hazards for pedestrians and bicycles.

- Driveways with more than two lanes should incorporate channelization features.

- Restrict the number of curb cuts or access points to one per property frontage or provide justification for additional access points as applicable.

- Shared driveways between two parcels at the property lines should be used where practical.

Access Location Standards

A. Access Point Approval - No access point shall connect to a public street or road, without first receiving approval of the location and cross-section specifications from the City of Montgomery, the Montgomery County Commission and the Alabama Department of Transportation, as applicable. No access point shall connect to a private road unless approved by the Planning Commission and by the parties with an ownership interest in the private road.

B. Factors on Location of Driveway Access -At a minimum, the following factors shall be considered prior to making a decision on the location of a driveway or other access point:

1. The characteristics of the proposed land use;
2. The existing traffic flow conditions and the future traffic demand anticipated by the proposed development on the adjacent street system;
3. The location of the property;
4. The size of the property;
5. The orientation of structures on the site;
6. The minimum number of driveways or other access points needed to accommodate anticipated traffic based on a traffic impact study, as provided by the applicant and verified by the City of Montgomery. Such traffic impact study shall demonstrate traffic operations and safety along the public street would be improved (or at least not negatively affected), and not merely that another access point is desired for convenience;
7. The number and location of driveways on existing adjacent and opposite properties;
8. The location of abutting streets or roads and the carrying capacity of nearby intersections;
9. The proper geometric design of driveways;
10. The spacing between opposite and adjacent driveways and from any nearby intersection;
11. The internal circulation between driveways and through parking areas;
12. The size, location and configuration of parking areas relative to the driveways; and
13. The speed of the adjacent roadway.

C. Access Point Location - Each access point location shall conform to requirements outlined in these *Guidelines* and current regulations of the City of Montgomery, the Montgomery County Commission, and/or the Alabama Department of Transportation.

D. Access Points within Right-of-Way - Driveways including the radii but not including right-turn lanes, passing lanes and tapers, shall be located entirely within the right-of-way frontage, unless otherwise approved by the road agency and upon written certification from the adjacent land owner agreeing to such encroachment.

E. Backing-up from Parking or Loading Area Onto a Public Street or Service Drive - Driveway access shall not be permitted for any parking or loading areas that require backing maneuvers in a public street or road right-of-way. Driveway access shall not be permitted for parking or loading areas that require backing maneuvers in a public street right-of-way or onto a public or private service drive.

F. Relationship to Lot Line - No part of a driveway shall be located closer than a distance equal to the flare radius of the driveway from a lot line unless it is a common or shared driveway. This separation is intended to help control storm water runoff and provide adequate area for any necessary on-site landscaping.

G. Existing Driveways – Except for shared driveways, existing driveways that do not comply with the requirements of these *Guidelines* shall be closed when an application for a change of use requiring a zoning permit or a site plan requiring approval is submitted and once approval of a new means of access under these *Guidelines* is granted. A closed driveway shall be graded and landscaped to conform to adjacent land and any curb cut shall be filled in with curb and gutter per the standards of the applicable road authority.

H. Intersection Sight Distance – Driveways shall be located so as not to interfere with safe intersection sight distance as determined by the appropriate road authority.

I. Traffic Signals – Access points on Taylor Road and Chantilly Parkway may require traffic signals to provide safe and efficient traffic flow. Any signals proposed for installation on Taylor Road and Chantilly Parkway shall meet the minimum criteria as outlined in the latest edition of the Manual on Uniform Traffic Control Devices as published by the Federal Highway Administration. Additionally, traffic signals proposed for installation on these roadways should be spaced at approximately 2000 feet intervals or as approved by the City of Montgomery and the Alabama Department of Transportation. A development may be responsible for all or part of any right-of-way, design, hardware, and construction costs of a traffic signal if it is determined that the signal is warranted by the traffic generated from the development. The procedures for traffic signal installation shall be in accordance with criteria established by the City of Montgomery and/or the Alabama Department of Transportation.

Number of Driveways Permitted

A. Access for an individual parcel, lot, or building site or for contiguous parcels, lots or building sites under the same ownership shall consist of either a single two-way driveway or a paired system wherein one driveway is designed, and appropriately marked, to accommodate ingress traffic and the other egress traffic.

B. Direct access for single family residential lots or parcels shall not be permitted from either roadway outlined in these *Guidelines.*

C. A temporary access permit may be issued for field entrances at the discretion of the City of Montgomery and/or the Alabama Department of Transportation. Field-entrance driveways will be reviewed on a case-by-case basis. The review shall take into account the proximity of the adjacent driveways and intersecting streets, as well as traffic volumes along the roadway.

D. For a parcel, lot, or building site with frontage exceeding 600 feet, or where a parcel, lot, or building site has frontage on at least two streets, an additional driveway may be allowed, provided that a traffic impact study is submitted by the applicant showing that conditions warrant an additional driveway and that all driveways meet the spacing requirements.

E. Certain developments generate enough traffic to warrant consideration of an additional driveway to reduce delays for exiting motorists. Where possible, these second access points should be located on a side street or service drive, or shared with adjacent uses, or designed for right-turn-in, right-turn-out only movements and shall meet the spacing requirements of these *Guidelines*. In order to be considered for additional access points, the applicant shall be required to submit a traffic impact study to the City which demonstrates the ability of the roadway system to accommodate the added access points and not degrade the level of services beyond acceptable standards.

Access Point Spacing Standards

A. Separation from Other Driveways

   1. The minimum spacing between unsignalized driveways and other access points should be 600 feet. The minimum spacing shall be measured from the centerline of one driveway to the centerline of another driveway. The City may grant temporary access approval for properties along the roadways covered in these *Guidelines* until such time minimum spacing requirements can be met, or alternative access meeting the requirements of this ordinance is approved
   2. In the case of expansion, alteration or redesign of an existing development where the applicant can demonstrate that pre-existing conditions prohibit adherence to the minimum driveway spacing standards, the City shall have the authority to modify the driveway spacing requirements or grant temporary access approval until such time that minimum spacing requirements can be met, or alternative access meeting the requirements of these *Guidelines are* approved. Such modifications shall be of the minimum amount necessary.

B. Access Point Separation from Intersections – Access points allowed along the applicable roadways covered by these *Guidelines* should be separated from the nearest right-of-way of an intersecting street by at least 600 feet. Access point spacing from intersections shall be measured from the centerline of the driveway to the nearest extended edge of the travel lane on the intersecting street.

C. Access Alignment

1. Access offsets should be in accordance with the minimum spacing standards as outlined in previous paragraphs.

2. Access points should be perpendicular to the existing public street or an approved private road and shall line up with existing or planned driveways on the opposite side of the road wherever facing lots are not separated by a median, unless doing so in a particular case is substantially demonstrated by a registered traffic engineer to be unsafe.

D. Throat Length or Vehicle Stacking/Storage Space- There should be two hundred fifty (250) feet (150 feet minimum) of throat length for entering and exiting vehicles at the intersection of a driveway and pavement of the public road or service drive as measured from the pavement edge. In areas where significant pedestrian/bicycle travel is expected, as determined by either the City or ALDOT, the ingress and egress lanes should be separated by a 4-10 feet wide median with pedestrian refuge area.

E. Construction Standards

1. Curb radii – curb radii standards for the roadways covered in these *Guidelines* shall meet the current requirements of the City as outlined in their Subdivision Regulations and the ALDOT.
2. Deceleration lanes and tapers:
   a. Deceleration lanes should be required at all permitted access points along both roadways covered in these *Guidelines*.
   b. Deceleration lane and taper lengths should be constructed as outlined in the ALDOT Special and Standard Highway Drawings, most recent edition.
   c. Where the amount of frontage precludes the construction of a deceleration lane and taper combination entirely within the property lines of a parcel, the property owner will work with adjoining property owners to coordinate access to both parcels of property.
   d. A continuous right-turn lane may be required where driveway spacing requirements restrict the use of consecutive turn bays and tapers, and is determined by the City and/or ALDOT the lane would not be used as a through lane.
3. Left Turn Lanes – The construction of median openings at private access points and public streets will require the construction of left turn lanes in accordance with the current standards of the City and ALDOT. Left turn lanes, if not present at current median openings, will be constructed by entities requesting permits for private driveways and/or public streets that align with such access.
4. Directional Signs and Pavement Markings - In order to ensure smooth traffic circulation on the site, direction signs and pavement markings shall be installed as outlined in the Uniform Manual on Traffic Control Devices or as directed by the City and/or ALDOT.

5. Shared Access - Shared access is strongly encouraged and in some cases may be required.

F. Shared Driveways: Sharing or joint use of a driveway by two or more property owners shall be encouraged. In cases where access is restricted by the spacing requirements outlined in these Guidelines, a shared driveway may be the only access design allowed. The shared driveway shall be constructed along the midpoint between the two properties unless a written easement is provided which allows traffic to travel across one parcel to access another, and/or access the public street.

G. Frontage Roads: In cases where a frontage road exists, property access should be provided via such frontage road, rather than by direct connection to the abutting arterial street.

H. Rear Service Drives: Rear service drives shall be encouraged, especially for locations where connection to a side street is available. In addition to access along the rear service drive, direct connection(s) to the arterial street may be allowed, provided that the driveways meet the requirements of these *Guidelines*.

I. Parking Lot Connections - Where a proposed parking lot is adjacent to an existing parking lot of a similar use, there shall be a vehicular connection between the two parking lots where physically feasible, as determined by the City and/or ALDOT. For developments adjacent to vacant properties, the site shall be designed to provide for a future connection. A written access easement signed by both landowners shall be presented as evidence of the parking lot connection prior to the issuance of any final zoning approval.

J. Access Easements - Shared driveways, cross access driveways, connected parking lots, and service drives shall be recorded as an access easement and shall constitute a covenant running with the land. Operating and maintenance agreements for these facilities should be recorded with the deed

K. Medians and Median Openings

1. The type, location and length of medians on public roads shall be determined by the entity having jurisdiction over such roads. This determination will be made in consultation with the City and ALDOT and will be based on existing and projected traffic conditions; the type, size, and extent of existing and projected development and traffic generated by development; traffic control needs; and other factors.
2. The minimum spacing between median openings should be 2,000 – 2,500 feet.
3. Median openings intended to serve development must meet or exceed the minimum median opening spacing standards and must also be justified by a traffic impact analysis approved by the City and/or ALDOT. The cost for preparation of the traffic impact analysis and construction of the median opening or openings, including installation and operation of signals and other improvements where warranted, shall be borne by the applicant.

Service Drives and Other Shared Access Standards

A. The use of shared access, parking lot connections and service drives, in conjunction with driveway spacing, is intended to preserve traffic flow along major thoroughfares and minimize traffic conflicts, while retaining reasonable access to the property. Where noted above, or where the City and/or ALDOT determines that restricting new access points or reducing the number of existing access points may have a beneficial impact on traffic operations and safety while preserving the property owner's right to reasonable access, then access from a side street, a shared driveway, a parking lot connection, or service drive connecting two or more properties or uses may be required instead of more direct connection to the arterial or collector street. However, where traffic safety would be improved, and the driveway spacing requirements of this *Guidelines* can be met, then direct connection to the roadways covered by these *Guidelines* may be allowed in addition to a required service drive.

1. In particular, shared access, service drives or at least a connection between abutting land uses may be required in the following cases:

    a. Where the driveway spacing standards of this section can not be met.
    b. When the driveway could potentially interfere with traffic operations at an existing or planned traffic signal location.
    d. The site is along a collector or arterial with high traffic volumes, or along segments experiencing congestion or a relatively high number of crashes.
    e. The property frontage has limited sight distance.
    f. The fire (or emergency services) department recommends a second means of emergency access.

2. In areas where frontage roads or rear service drives are recommended, but adjacent properties have not yet developed, the site shall be designed to accommodate a future road/facility designed according to the standards of the City and/or ALDOT. The City and/or ALDOT may approve temporary access points where a continuous service drive is not yet available and a performance bond or escrow is accepted to assure elimination of temporary access when the service road is constructed.

B. The standards for service drives shall be as follows:

    1. Site Plan Review - The City and/or ALDOT shall review and approve all service drives to ensure safe and adequate continuity of the service drive between contiguous parcels as part of the current site plan review process.
    2. Front and Rear Service Drives - A front or rear service drive may be established on property which abuts only one public road. The design of a service road shall conform to current design guidelines of the City and/or ALDOT.
    3. Location - Service roads shall generally be parallel to the front property line and may be located either in front of, or behind, principal buildings and may be placed in required yards. In considering the most appropriate alignment for a service road, the City and/or ALDOT shall consider the setbacks of existing and/or proposed buildings and anticipated traffic flow for the site.

4. Distance from Intersection on Service Drives - Frontage road and service drive intersections at the collector or arterial streets shall be designed according to the same minimum standards as described for driveways in these *Guidelines*.
5. Driveway Entrance - The City and/or ALDOT shall approve the location of all accesses to the service drive, based on current City and/or ALDOT driveway standards. Access to the service drive should be located so that there is no undue interference with the free movement of service drive and emergency vehicle traffic, where there is safe sight distance, and where there is a safe driveway grade as established by the City and/or ALDOT.
6. Parking - The service road is intended to be used exclusively for circulation, not as a parking, loading or unloading aisle. Parking shall be prohibited along two-way frontage roads and service drives. One-way roads or two-way roads designed with additional width for parallel parking may be allowed if it can be demonstrated through traffic studies that on-street parking will not significantly affect the capacity, safety or operation of the frontage
7. Road or service drive. Perpendicular or angle parking along either side of a designated frontage road or service drive is prohibited.
8. Directional Signs and Pavement Markings - Pavement markings may be required to help promote safety and efficient circulation. All directional signs and pavement markings along the service drive shall conform to the current Manual of Uniform Traffic Control Devices.
9. In the case of expansion, alteration or redesign of existing development where it can be demonstrated that pre-existing conditions prohibit installation of a frontage road or service drive in accordance with the aforementioned standards, the City and/or ALDOT shall have the authority to allow and/or require alternative cross access between adjacent parking areas through the interconnection of main circulation aisles. Under these conditions, the aisles serving the parking stalls shall be aligned perpendicularly to the access aisle with islands, curbing and/or signage to further delineate the edges of the route to be used by through traffic.

Nonconforming Driveways

A. Driveways that do not conform to these Guidelines, and were constructed before the effective date of these *Guidelines,* would be considered legal nonconforming driveways. Existing driveways granted a temporary access permit are legal nonconforming driveways until such time as the temporary access permit expires.

B. Loss of legal nonconforming status results when a nonconforming driveway ceases to be used for its intended purpose. Any reuse of the driveway may only take place after the driveway conforms to all aspects of these *Guidelines*.

C. When the owner of a property with an existing, nonconforming driveway or driveways, applies for a permit to upgrade or change the use of the property, the City and/or ALDOT will determine whether it is necessary and appropriate to retrofit the existing driveway or driveways.

1. The property owner may be required to establish a retrofit plan. The objectives of the retrofit plan will be to minimize the traffic and safety impacts of development by bringing the number, spacing, location, and design of driveways into conformance with the standards and requirements of these *Guidelines,* to the extent possible without imposing unnecessary hardship on the property owner. The retrofit plan may include:
   a. elimination of driveways,
   b. realignment or relocation of driveways,
   c. provision of shared driveways and/or cross parking lot connection,
   d. access by means of a service drive
   e. restriction of vehicle movements (e.g. elimination of left-turns in and out),
   f. relocation of parking,
   g. such other changes as may enhance traffic safety as determined by the City and/or ALDOT.
2. The requirements of the retrofit plan shall be incorporated as conditions to the permit for the change or upgrade of use and the property owner shall be responsible for the retrofit.

D. Driveways that do not conform to the regulations in these *Guidelines* and have been constructed after adoption of these *Guidelines*, shall be considered illegal nonconforming driveways.

E. Illegal nonconforming driveways are a violation of these *Guidelines*. Driveways constructed in illegal locations shall be immediately closed upon detection and all evidence of the driveway removed from the right-of-way and site on which it is located. The costs of such removal shall be borne by the property owner.

Appendix “E”

Alabama Department of Transportation
Permit Information

The following information was reprinted with permission of the
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