ACCESS MANAGEMENT

BOWLING GREEN, KENTUCKY

Prepared For:

The City of Bowling Green
Public Works Department

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Section 1.1 – What is Access Management?

Access Management is controlling the access and roadway geometrics for connections to the City of Bowling Green's transportation network. Various techniques are used including restrictive driveways, medians, deceleration and acceleration lanes and connectivity. The use of these features has proven to increase safety and efficiency on the roadways and extend the functionality of the transportation network.

Section 1.2 – The City's Goals

The primary goals of Access Management within the City of Bowling Green are to improve roadway safety, improve traffic operations, protect taxpayer's investments in roads and create better conditions for pedestrians. Some secondary goals include opportunities to beautify areas and to reduce cut through traffic on residential roads.

Section 1.3 - Benefits of Access Management

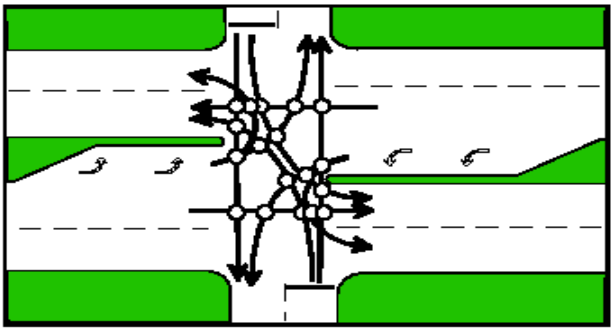
Access Management has been shown to increase safety and efficiency on roads. The following information is geared toward the higher volume roadways; however, the same principals should be considered for local roads.

One of the most noticeable improvements associated with controlled access is the reduction in conflict points, which increase safety and efficiency. Figure 1.1 shows the conflict points associated with each type of median opening.

The more controlled the median opening is, the lesser probability there is for severe crashes. For example, with a full median opening, there are 18 major crashes that could occur because drivers are allowed to maneuver their cars freely. With a closed median, conflict points are reduced to 2 per driveway and these crashes would generally be minor rear end or sideswipe. Access management allows drivers sufficient sight distance and reaction time to recognize and react to potential hazards. This helps create a safer environment for pedestrians and drivers.

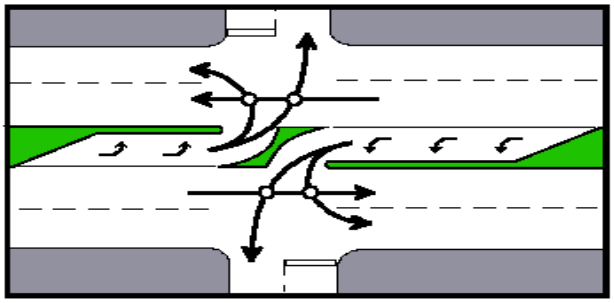
Figure 1.1 - Conflict Points

Full Median



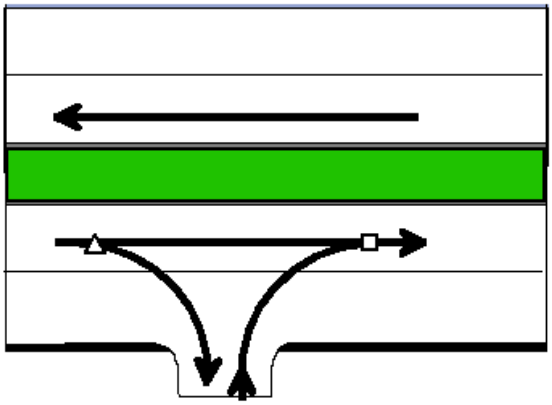
18
MAJOR
Conflicts

Directional Median Opening



4
MAJOR
Conflicts

3 Way Intersection/Closed Median



0
MAJOR
Conflicts

2
MINOR
Conflicts

Efficiency of through traffic is greatly increased when access is controlled. There are less conflict points and therefore less stop-and-go traffic. Because vehicles at some drives do not have sufficient gaps to cross high volume roads, channelizing traffic to signals reduces the delay at the side streets and driveways. The greater efficiency creates increased and preserved capacity of the road. This in turn preserves the investment of the roadway system by delaying the need to add more lanes.

Raised medians and better-spaced driveways can improve the aesthetics of a community. Landscaping can be included in raised medians and buffer areas. However, if it is improperly designed or maintained, the vegetation may become a safety hazard as sight distance is diminished. The regulated spacing of driveways also reduces the visual clutter of a road, i.e., consolidation of commercial signs and driveways.

All of these factors, plus the comfort level felt by the drivers and pedestrian increase the appeal of the community. Everyone benefits by cooperative effort to provide good access design. The public safety and investment in the roadways is protected by the application of access management techniques. Property values remain stable or may increase along roadways, which carry significant traffic volumes so long as the traffic can flow smoothly with a minimum of congestion and conflicting movement. Each driver is rewarded with lower vehicle operating costs due to the smoother operations and less delay and with greater safety and comfort due to fewer conflicting traffic movements.

Often access management is thought of as just median openings, however, access management extends much further to include driveways, land planning and transportation facility planning.

Section 1.4 - The City's Role

The City of Bowling Green uses the concept of access management to help alleviate traffic concerns and ensure a viable future roadway network within their jurisdiction.

Section 1.5 - City's Authority

In order to promote safe and reasonable access between public roadways and adjacent land; improve the convenience and ease of movement of travelers on public roads; and permit reasonable speeds and economy of travel while maintaining the capacity of the roadway, the location and design of access points shall be in accordance with the access management regulations within this document. These regulations shall apply to all existing, planned, or proposed

roadways within the jurisdiction of the City of Bowling Green. New or proposed roadways within the City not identified on the adopted Street Classification Map shall interconnect with the existing roadway network in a uniform and efficient manner.

The following indemnifies the City and gives them the authority to enforce these access management regulations and guidelines.

- The applicant shall hold harmless the City of Bowling Green, its officials, appointed agents and employees against any action for personal injury or property damage sustained by reason of the exercise of a permit issued hereunder.
- The City may install barriers across or cause the removal of any driveway providing direct access to a City street, which is constructed without a driveway permit after the effective date of this article. The property owner listed on the City's most recent tax rolls shall be sent written notice of the City's action within ten (10) days thereafter. When practical, the City will notify the property owner and/or illegal access user of pending action.
- It shall be unlawful for any person to drive a vehicle onto or from any City street at a point other than a permitted driveway.
- When a permitted driveway is constructed or used in violation of this article, permit terms and conditions, the City may obtain a court order enjoining the continued violation of this article, permit terms and /or conditions. The City may revoke driveway permits if at any time the permitted driveway and its use fail to meet the requirements of this article or the terms and conditions of the permit.

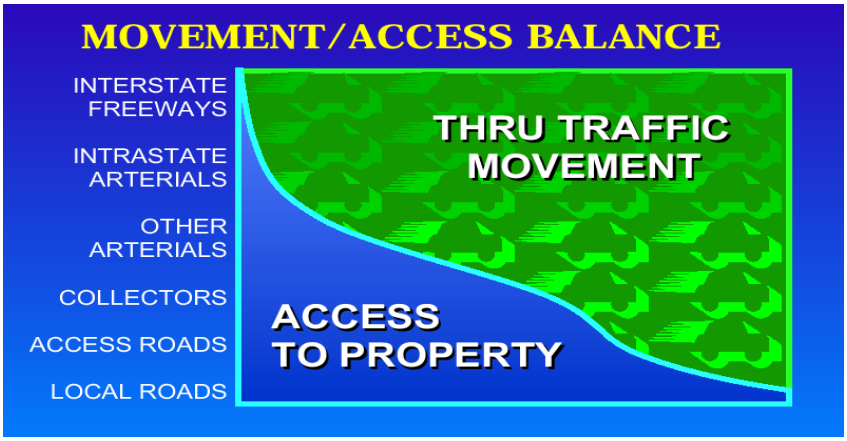
Any access points along routes maintained or controlled by the Kentucky Transportation Cabinet should follow the following procedure. A copy of the plans for all access points to be constructed along a state maintained or controlled route shall also be submitted to the State for review and approval during the same time as plans are submitted to the City of Bowling Green. Permission for the construction of access points along state maintained roadways is subject to the approval of plans by both the local and state agencies.

The City Engineer or his/her designee may, at its discretion, reasonably waive or modify the requirements of this document if it is determined that such action is warranted given the nature of the individual project.

Section 1.6 - Roadway Classification

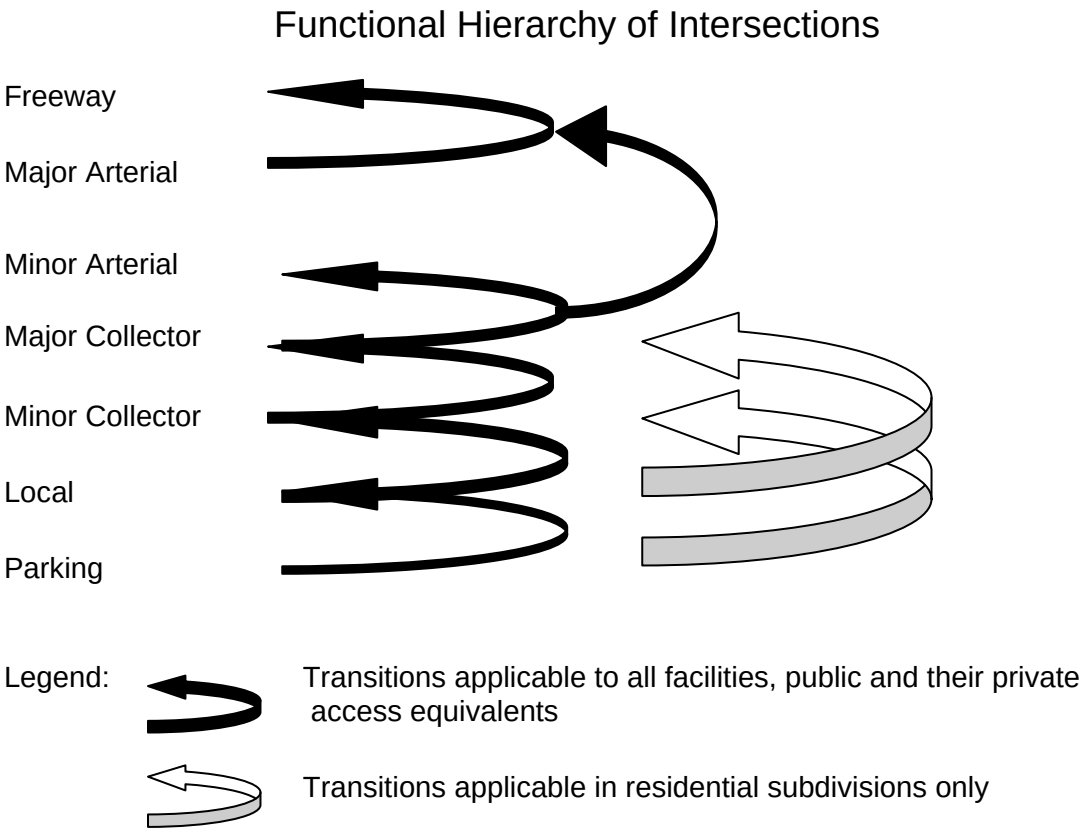
It is important to classify the roadways within the City to effectively manage the traffic on those roads. Within any community there are different types of streets, which are planned and constructed to serve different purposes. On one end of the scale, the multi-lane freeway is designed to carry high volumes of traffic at high speeds over relatively long distances. Virtually no direct access between these freeways and the land, which abuts them, is allowed. On the other end of the scale is the local residential cul-de-sac, whose function is to provide access to and from the property abutting it and to provide the first link between that property and the entire roadway network. The bulk of the streets in a community, however, do no fit neatly into either of these two categories. Most streets provide, in varying degrees, for both the through movement of traffic and access to the property abutting those streets but, unfortunately, these two functions often conflict with one another. New developments need adequate access to the property in order to be viable but each additional access point lessens the capacity of the roadway to carry traffic volumes. This compromise can be accomplished through the application of a comprehensive policy based on the principles of access management. Figure 1.2 shows the correlation between access and functional class.

Figure 1.2 – Functional Hierarchy



As shown, local/residential roads can function with the highest number of access connections. However, a freeway should have the greatest control of access, limiting the connections to major crossroads. The actual roadway structure is also important in the success of a roadway network. Local roads should feed to collectors, which should feed into arterials, etc. This is shown in Figure 1.3 below. This street hierarchy is important for various reasons. One is to keep high volume through traffic from cutting through local roads.

Figure 1.3 – Functional Hierarchy of Intersections



Reference: V.G. Stover, Medians Short Course, Center for Urban Transportation, University of South Florida for the Florida Department of Transportation, October 1995.

Section 1.7 - Roadway Classification Regulations

Table 1.1 includes the Classification Guidelines incorporated by the City of Bowling Green.

Table 1.1 – Street Design Standards

(Inserted from the Warren County Subdivision Regulations)

EXHIBIT 5-1 STREET DESIGN STANDARDS

		COLLECTORS		LOCAL							
	ARTERIAL	MAJOR	MINOR	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		FRONTAGE	ALLEY
				THROUGH	CUL-DE-SAC	THROUGH	CUL-DE-SAC	THROUGH	CUL-DE-SAC		
Volume Range (Vehicle Trips/Day)	>10,000	4,500 TO 10,000	1,000 TO 4,500	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	N/A	N/A
Right-Of-Way Width (Min. Feet)	100 [NOTE 1]	80 [NOTE 1]	60	50	50	60	60	60	60	40	16 [NOTE 1]
Number of Lanes (Minimum)	5 [NOTE 2]	3 [NOTE 2]	2	2	2	2	2	2	2	2	1
Lane Width (Min. Feet)	12	12	12	12	RS1A, 1B, RS1C=12 RS1D, RM2, RM3, 4=15	15	15	15	15	12	12
Superelevation (Max. Percent)	8	6	6	NORMAL CROWN	NORMAL CROWN	NORMAL CROWN	NORMAL CROWN	NORMAL CROWN	NORMAL CROWN	NORMAL CROWN	NORMAL CROWN
Grade (Max. Percent)	5	8	8	10	10	8	8	8	8	8	6
Grade [NOTE 3] (Min. Percent)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4
Stopping Sight Distance (Min. Feet)	400	300	300	250	250	250	250	250	250	200	N/A
Radius of Horizontal Curves (Min. Feet)	770	530	300	280	280	300	300	300	300	200	200
Length of Vertical Curves (Min. Feet) [NOTE 4]	160 K=160	130 K=60	100 K=40	100 K=30	100 K=30	100 K=40	100 K=40	100 K=40	100 K=40	100 K=30	100 K=30
Shoudler Width (Min. Feet)	N/A	N/A	N/A	2 [NOTE 5]	2 [NOTE 5]	N/A	N/A	N/A	N/A	2 [NOTE 5]	2
Sidewalks [NOTE 6]	4 feet wide BOTH sides	4 feet wide BOTH sides	4 feet wide BOTH sides	RS1A, 1B, RS1C, 1D, RM2, 3, 4 4 feet wide on ONE side	RS1A, 1B, RS1C, 1D, RM2, 3, 4 4 feet wide on ONE side	4 feet wide on BOTH sides within Bowling Green. As necessary to provide connectivity in Warren County	4 feet wide on ONE side within Bowling Green. As necessary to provide connectivity in Warren County	4 feet wide on BOTH sides within Bowling Green. As necessary to provide connectivity in Warren County	4 feet wide on ONE side within Bowling Green. As necessary to provide connectivity in Warren County	Not Required	Not Required
Curb/Gutter Required? [NOTE 6]	Required	Required	Required	RS and RM districts only	RS and RM districts only	Required	Required	Required	Required	Not Required	Not Required
Interior (Corner) Radius of Pavement (Min. Feet)	50	50	50	25	25	50	50	50	50	25	25
Design Speed (mph)	50	40	30	30	30	30	30	30	30	N/A	N/A
Intersection Spacing (Min. Feet)	660	500	500	150	150	150	150	150	150	200	100
Intersection Spacing (Max. Feet)	N/A	N/A	N/A	1400	1300	N/A	600	N/A	600	N/A	N/A
Intersection Approach Tangent (Min. Feet)	300	200	200	100	100	100	100	100	100	---	---
Length of Tangent between Reverse Curves (Min. Feet)	240	175	150	130	130	150	150	150	150	100	100

Note 1 Medians and/or Shoudlers and Ditches may increase needed Right-Of-Way width.
Note 2 Two Way Left Turn Lanes may be replaced with Medians and Dedicated Turn Lanes.
Note 3 Min. grades for Roadways with Curb & Gutter. If Roadways with Shoulders and Ditches are permitted, the min. grade may be 0.0% provided that min. required ditch Slopes are maintained.
Note 4 Not less than K for each algebraic difference in Grade.
Note 5 Six (6) foot shoulders required without sidewalks.
Note 6 See Zoning Ordinance for definition of zoning districts.

The City of Bowling Green shall assign to each roadway, or portion thereof, within their jurisdiction of the City a functional classification based on a consideration of existing and projected traffic volumes, adopted local transportation plans and needs, the existing and/or projected character of lands adjoining the roadway, adopted local land use plans and zoning, and the availability of reasonable access to those lands. These functional classifications are defined as follows:

1. Arterial: These roadways are capable of providing medium to high speeds and traffic volumes over medium to long distances. Direct access to abutting land is subordinate to providing service to through traffic.
    a. Private direct access to an arterial roadway shall be permitted only when the property in question has no other reasonable access to the public roadway network.
    b. The design and location of allowable private access points must comply with all applicable sections of this regulation.
    c. All private direct access points to Arterial roadways shall be designated as “Temporary” and all requirements of Section J, “Temporary Access Points” of this regulation shall apply.
    d. See the attached map, Figure 1.4 for roads designated as Arterial roadways.
2. Collector: These roads are capable of providing moderate travel speeds and traffic volumes and generally provide the linkage between Arterial and Local roadways. There is a reasonable balance between access and mobility needs within this classification.
    a. Generally, only one private access point shall be provided to an individual parcel from a Collector roadway unless it can be shown that additional access points would not be detrimental to the safety and operation of the roadway and are necessary for the approved use of the property.
    b. The design and location of allowable access points must comply with all applicable sections of this regulation.
    c. See the attached map, Figure 1.4 for roads designated as Collector roadways.
3. Local: These streets allow for low to medium travel speeds and traffic volumes and are linked to the roadway network through intersections with Arterial or Collector roadways and other Local roadways. Access needs take priority over through traffic movement without compromising the public health, welfare, and safety.

a. The number of access points to a parcel is limited only to the requirements of Minimum Corner Clearance, Minimum Sight Distance and the Minimum Spacing Standards included in the Driveway Design Standards located in Appendix A.
b. All roadways or portions thereof as shown on the Street Classification Map not previously designated as Arterial or Collector roadways are hereby designated as Local Roadways. Frontage Roads are considered access drives and should be considered Local.

4. Alleys: Alleys are any rear access road that is not classified above which allow access to residences and businesses. These accesses are less restrictive than local roads.

Any change to an Access Classification should include public involvement with an opportunity for public comment.

Section 1.8 – Access Management Components

The primary components of Access Management include: driveways, medians, auxiliary lanes and connectivity. (See Figure 1.5).

Figure 1.4 – Roadway Classification Map

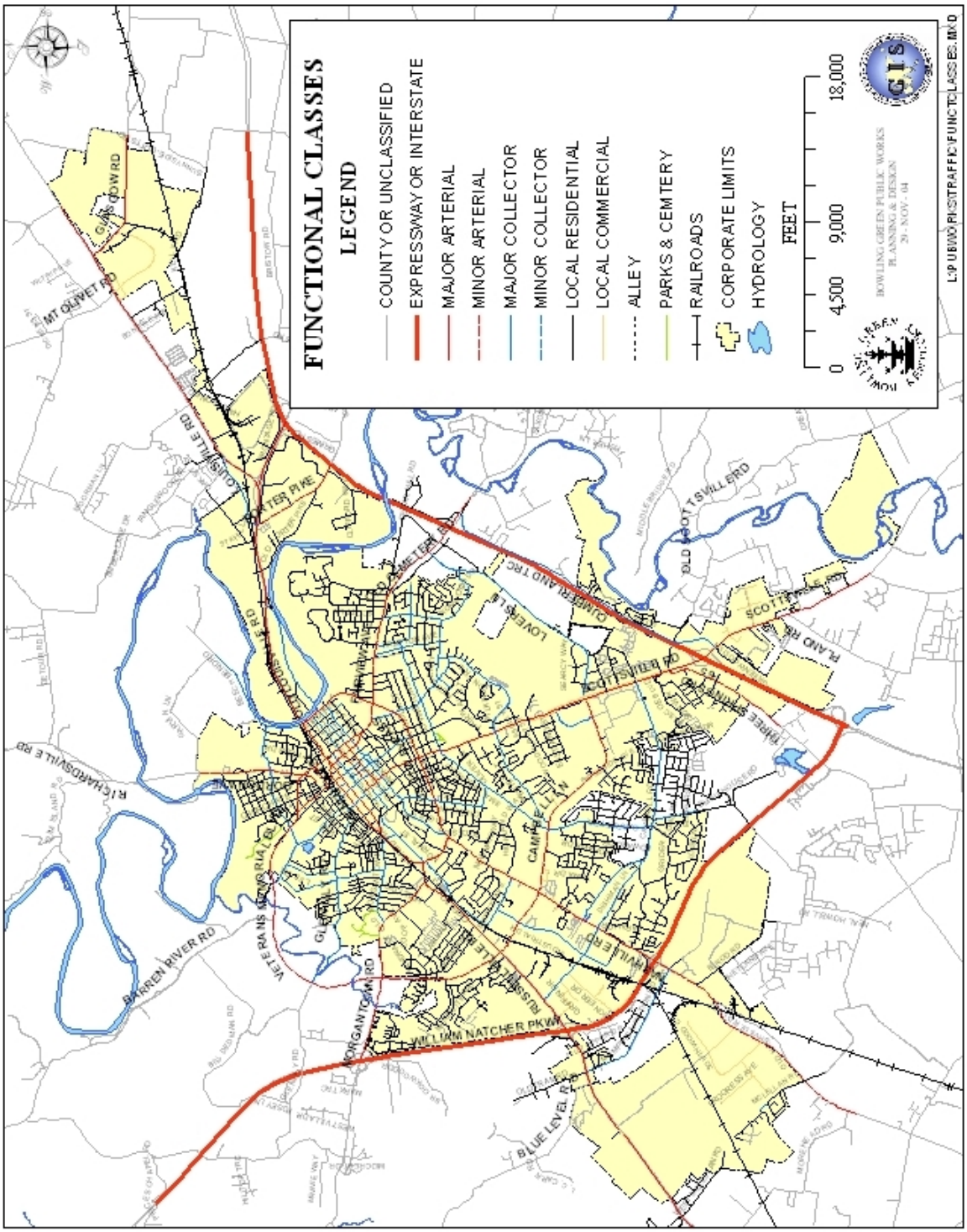
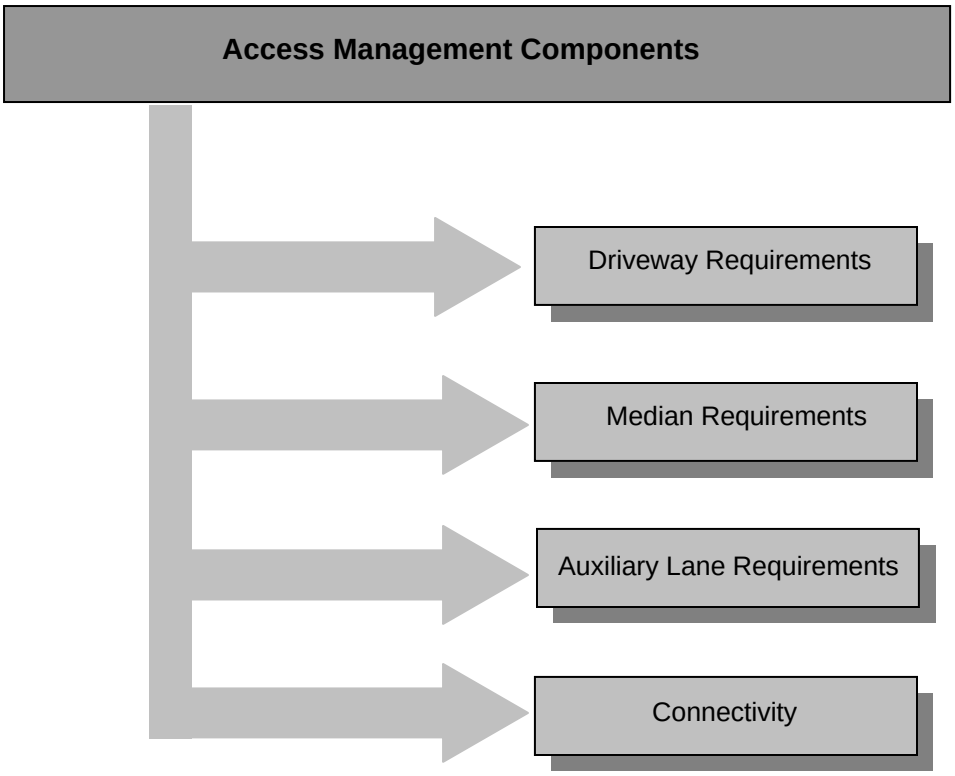


Figure 1.5 – Access Management Components



Driveways allow for ingress and egress from a roadway to abutting properties. The control of the spacing and design of driveways help to create a smooth flow of traffic and have been proven to reduce crash rates.

Medians physically separate different directions of traffic flow. The proper design of medians controls the movements to and from the through road to a side street or driveway. The management of median openings facilitates a smoother flow of traffic, a separation of opposing traffic and channelizes traffic to traffic signals. Properly designed and spaced medians have also been proven to reduce crash rates, especially the more serious head on and angle crashes.

Auxiliary lanes are incorporated into access management designs to facilitate the flow of traffic near and at driveways and median openings. Auxiliary lanes, including left and right deceleration lanes, allow traffic exiting the through lanes

an area to decelerate and be safely stored with minimal effects to the through traffic. Acceleration lanes allow traffic entering the through traffic to merge with minimal disruption to the through traffic.

Connectivity allows traffic to progress from local roads up the functional class hierarchy, to arterials and freeway roads. This progression reduces the "cut through" traffic on local roads and provides the proper balance of access. Connectivity between abutting properties reduces the trips on the through road thus eliminating additional conflict points and congestion.

Section 1.9 - Helpful Access Management Websites

For more information on Access Management, the following websites provide guidance:

- www.dot.state.fl.us/planning/systems/sm/accman/pdfs/ampromo3.pdf
- www.odot.state.or.us/tdb/planning/access_mgt/

Section 1.10 - FAQ's

Some frequently asked questions regarding Access Management include questions about emergency vehicle access, the safety of u-turns, and economic impacts.

Q1. *Will emergency vehicles be able to access a site once raised median and other control devices are in place*?

A1. Yes, these medians and other controlling features should be designed with mountable curbs for emergency vehicles. Also, representatives for all affected public services should be contacted during the design of the projects.

Q2. *Are U-Turns safe and do they add extra driving time*?

A2. If properly designed, yes U-Turns are a safe maneuver. They divide the maneuvers, i.e., a right turn, merge into median, u-turn, so drivers concentrate on less conflict points at one time. Also, the left turn lane provides safe storage until the driver can see the traffic ahead of them is clear. In most instances, u-turns do not add a significant time increase to a trip. This is because there is less delay at the side street/driveway to turn right than to wait for all of the lanes of traffic to clear to turn left. Usually the increased safety of U-Turns outweighs the few extra seconds of driving time.

Q3. *Does Access Management keep customers away?*

A3. Studies have found that "destination" businesses (doctors, specialty retail stores, service oriented businesses) are not affected by access management modifications. Interviews with both customers and business owners have shown that most people have no problem making a slightly longer trip, including U-turns to access destination businesses. Although pass-by businesses (convenience stores, gas stations, fast food restaurants) may be impacted more by access management modifications, studies show that even pass by businesses are not negatively impacted as long as reasonable access is provided. As traffic flow is made more efficient, the roadway can handle more traffic and congestion levels decrease. This results in more motorists being exposed to your business. Attached is one of several reports on the economic impacts of Access Management in the appendix of this document. (Florida Department of Transportation, Office of the State Transportation Planner, Systems Planning Office

In order to make the best access management decisions possible, the City relies upon business and property owners, as well as others in the community, to provide input to the process. Information such as the specific access requirements of each business, internal traffic circulation and parking, truck requirements, plans for expansion, and any unusual circumstances are all very valuable to the engineers and planners who develop access management plans.

SECTION 2 - PERMITTING

Section 2.1 - Permitting Guidelines

There are four avenues of obtaining a permit. They each have their own set of requirements, considerations and reviewing entities. However, with each permit approval some considerations for access management should be:

- How many connections will be allowed?
- Where will they be located?
- What is the throat length?
- Other design concerns?
- How will this traffic affect the adjacent road(s)?
- How will this traffic circulate on the site?
- Are there any impacts to third parties? Adjacent properties? Deliveries?
- Is a Traffic Impact Study Required?

With any type of review, a field investigation of the site should be conducted. This ensures there are no additional concerns with the site and that all of the considerations listed above have been reviewed.

Section 2.2 - Contact and Permitting Information

The flow charts depicted in Figures 2.1, 2.2, and 2.3 show the information needed and the process for a permit review. Figures 2.2 and 2.3 include the Kentucky Department of Highways as part of the review process should the road involved be state maintained.

Figure 2.1

Access Permitting

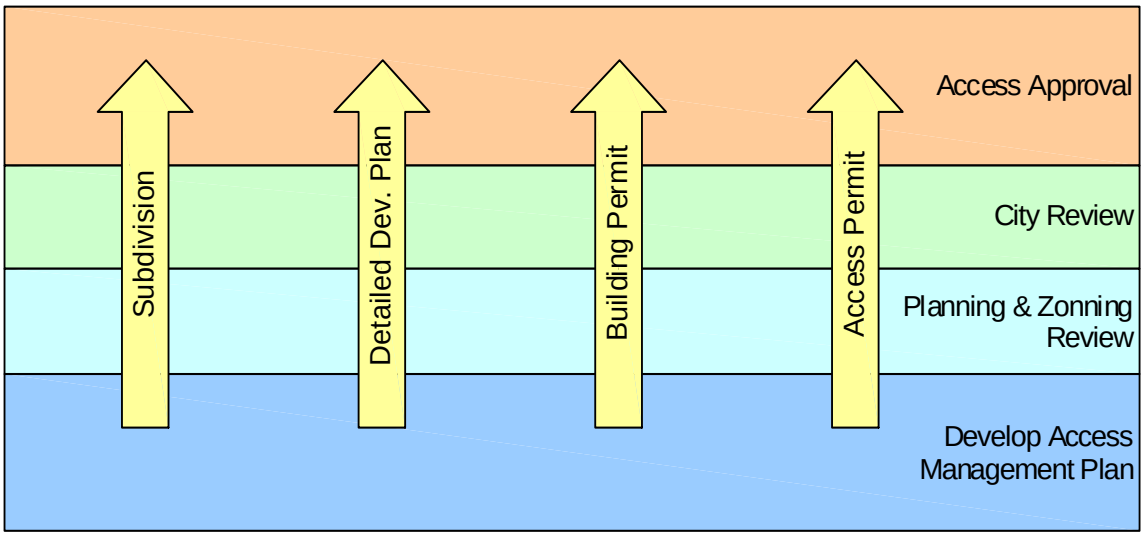


Figure 2.2

Access Permitting

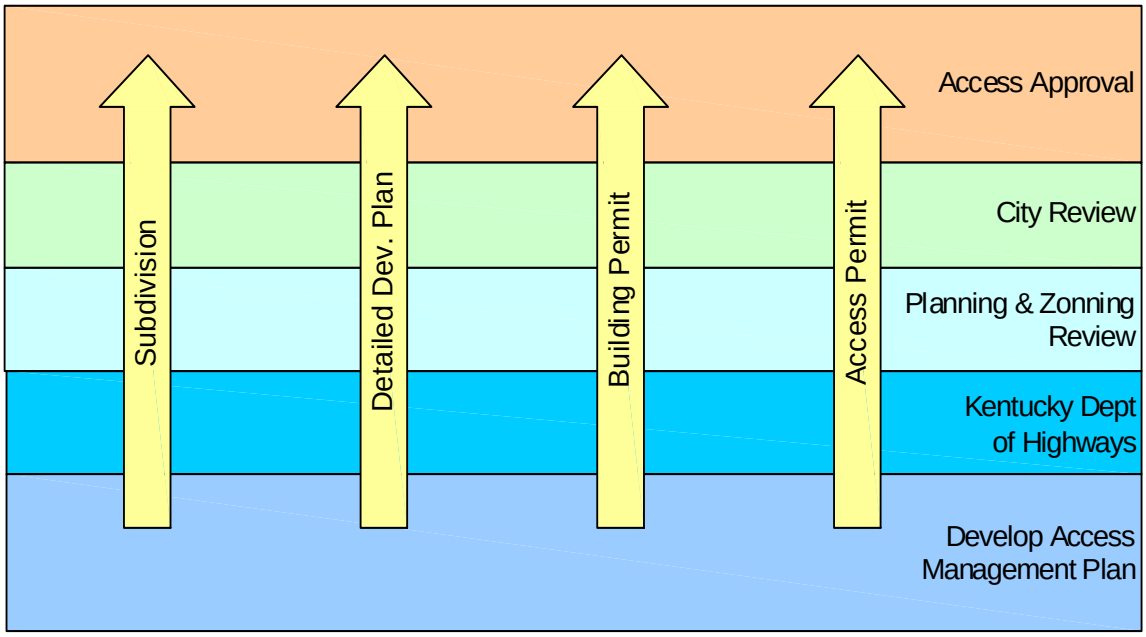
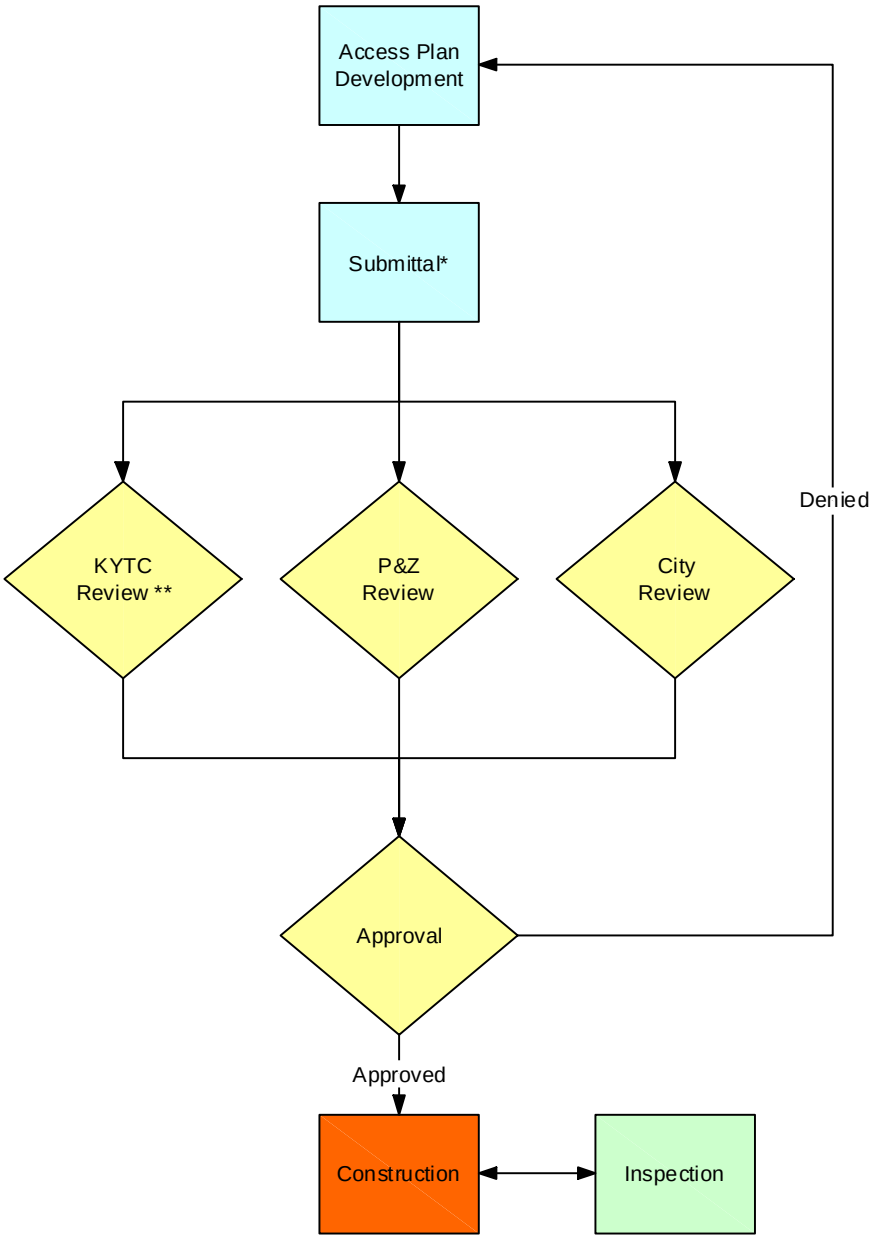


Figure 2.3

Access Plan Review Process



Notes
* Subdivisions and Detailed Development Plans are to be submitted to Bowling Green Warren County Planning Commission. Building Permits are to be submitted to Housing and Community Development. Access Plans are to be submitted to Public Works, Planning and Design Division.
** Access to state maintained roadways require review by the Kentucky Department of Highways.

Section 2.3 - Permitting Regulations

a. **Increased trip generation.** If the development includes a change in the property use that will increase the trip generation by 20% the developer will need to get the site plan approved through the City's permit process. If the trip generation is less than 20% of the original use and the Developer is not proposing changes within the right of way then the developer should submit the plans for development to the City for their information. The latest edition of the ITE Trip Generation Handbook should be used to calculate the future number of trips.

b. **New development on a vacant lot.** When a vacant parcel is to be developed the developers will need to go through the permit approval process as outlined in the previous flowcharts. The size and type of development will determine the depth of the City's review.

c. **Parcel vacated longer than one year.** If a parcel has been improved, but these improvements have been vacated for over a year, the parcel should go through the permit approval process again. However, if the property is in an area targeted for revitalization the City may decide to reduce some of the their standards.

d. **Ingress/egress improvements.** A safety upgrade is defined as no change to the existing property use but the private/public entity wants to improve conditions for ingress/egress to the development. Current standards can be modified as long as the applicant can show a marked improvement to current conditions

e. **Multiple jurisdiction approval.** The developer should be aware some properties are under multiple jurisdictions. All affected agencies should be contacted for approval before any construction begins. If any jurisdiction recommendations contradict another's, the stricter of the two should be adhered to or a meeting should be scheduled to resolve the differences. Some other agencies that may be involved in the review procedure may be Warren County, the State of Kentucky and Railroad agencies.

f. **New driveway construction and/or modification to existing driveway.** No person shall construct, reconstruct, relocate or in any way alter the design or operation of any driveway providing direct vehicular movement to or from any public street from or to property adjoining a public street without an access. A building permit will serve as a default access permit

as issued by the city building inspector when the access addition or modification is part of a larger project involving building construction. Modifications to existing driveways as well as the addition of new driveways not included in a building permit shall be reviewed by the City Engineer or his/her designee and given written approval. A right-of-way work permit, obtained from the Public Works Department, shall also be required at this time. The written approval of the City Engineer or his/her designee shall be required for all apartment, commercial and industrial property driveways or internal driveways. No work shall be undertaken on a driveway until the applicant has received the executed permit.

g. **Traffic Impact Study**. If the proposed development requires a Traffic Impact Study, final approval of the access to the property is pending final approval of the TIS. Traffic studies shall be submitted in accordance with the City's Traffic Impact Study Procedures. This requirement may be waived if the City Engineer determines that the driveway has been adequately analyzed in a previous traffic study.

h. **Joint private access easement.** A joint private access easement may be required between adjacent lots fronting on arterial and major collector streets in order to minimize the total number of access points along those streets and to facilitate traffic flow between lots. Lots with sufficient frontage to safely meet the design requirements of driveway spacing shall be permitted their own driveways. The owner or developer of property required to use shared driveways shall be responsible for obtaining easements on adjacent property as necessary.

i. **Variances.** The City of Bowling Green has the right to grant variances from these regulations based on safety issues, availability of ROW, or other existing conditions. The City is under no obligation to grant a variance based on past allowances.

Access permits shall be issued only in compliance with this article and may include terms and conditions authorized by the article. In no event shall a driveway be allowed or permitted if it is determined by the City Engineer or his/her designee to be detrimental to the public health, welfare and safety.

SECTION 3 - DRIVEWAYS

Section 3.1 - Driveway Guidelines

a. **Driveway design, location and spacing are fundamental to the success of access management.** While regulating driveway spacing and design may restrict direct access to certain businesses, the benefits allow for safer and more efficient use of the roadways and access to private developments. By placing the driveways in specific areas it is easier to control and design for the conflict points associated with these connections. In addition, driveways and turning lanes must be designed so that they are capable of handling the amount of traffic expected to use them. The number of points where the movement of through traffic can come into conflict with traffic moving into or out of adjacent properties should be kept to a minimum and turning movements should be physically separated from through movements wherever necessary and practicable. The proper design of driveways encourages a smooth flow of traffic to and from connecting properties. If a driveway is not designed properly, traffic on the through road may have to slow considerably, stop, or swerve into another lane to avoid a car turning. This greatly reduces capacity and causes safety concerns.

b. **The primary information needed to begin review of a new driveway connection is the development type, the type of road the driveway is connecting to, the trip generation, the type of vehicles entering and the adjacent property use.** It is also essential that the reviewer have information regarding the existing conditions of the roadway such as the presence of curb, gutter, sidewalk, etc. For single-family residential access onto a residential street, a typical 12-foot drop curb driveway is a sufficient design. If sidewalk is present, a concrete drive entrance that meets the City's standards shall be used. An industrial warehouse generating 1,000 trips a day with 20% heavy truck traffic on an arterial road will need review of acceleration/deceleration lanes, a wider driveway for the truck turning radius with a radius return among other safety and efficiency considerations. As this shows, each driveway needs careful consideration to ensure the roadways and drivers are not adversely affected.

c. **There are two major types of driveways, residential and commercial.** Residential driveways serve low volume single family, duplex and small apartment complex properties, less than 8 units. Large multifamily housing driveways should be reviewed as Minor/Major Commercial Driveways depending on the size of the development. Commercial driveways can be

subdivided into three categories, major commercial, minor commercial and industrial. A major commercial driveway is any commercial driveway in which the actual or anticipated traffic volume is 500 or more vehicles entering and leaving during a 24-hour period. Typical major commercial drives serve large shopping malls, big box stores, strip shopping centers, restaurants, etc. Minor commercial driveways involve actual or anticipated traffic volumes that are less than those for a major commercial driveway. These driveways typically serve real estate offices, small medical offices, hair salons, "mom and pop" type operations and smaller apartment buildings. Industrial driveways should be reviewed as a commercial drive with emphasis on the heavy truck traffic associated with the site. Larger radii, lane width, throat length and storage queues may be necessary.

d. **Joint Use/Cross Access Driveways should be encouraged where feasible.** If cross access is not feasible under existing conditions, a stub out should be included in permits for possible future cross access agreements. Cross access should only be considered for like land uses. If adjacent land uses promote the success of a joint use driveway they should be incorporated. Success of joint use/cross access driveways partially depends upon sufficient throat depth for drivers to access their choice of destination after entering the drive and site plans should be laid out to encourage these drives. Such elements of site design can be determined through a thorough traffic impact study. Sometimes grade differences and site characteristics, i.e., creek, wetlands or historical significant areas prohibit the use of joint/cross access.

e. **Divided drives for the inclusion of signs and/or landscaping to beautify their property are often desired in many developments.** These features should be designed with care not to promote wrong way movements, hinder sight distance or divert attention away from driving. Raised medians shall be located a sufficient distance from the main roadway as to allow for all turning movements anticipated in and out of the site. In addition, lane widths should also be of sufficient width to prevent damage to curbs and shoulders at these access points.

f. **Safety upgrades of existing driveways may include relocating, eliminating, consolidating, and/or redesigning driveways.** Owners may realize after a project is built that the driveway may not operate as safely and efficiently as anticipated. If this occurs, the City will work with the owners to improve the condition of their site and bring conditions as near current standards as possible. A joint field meeting should be scheduled to review the conditions and the causes as to why the site is not functioning as planned. The improvements can then be planned and

implemented. If the trip generation has exceeded the 20% increase, the Developer may be required to go through the site plan approval process again.

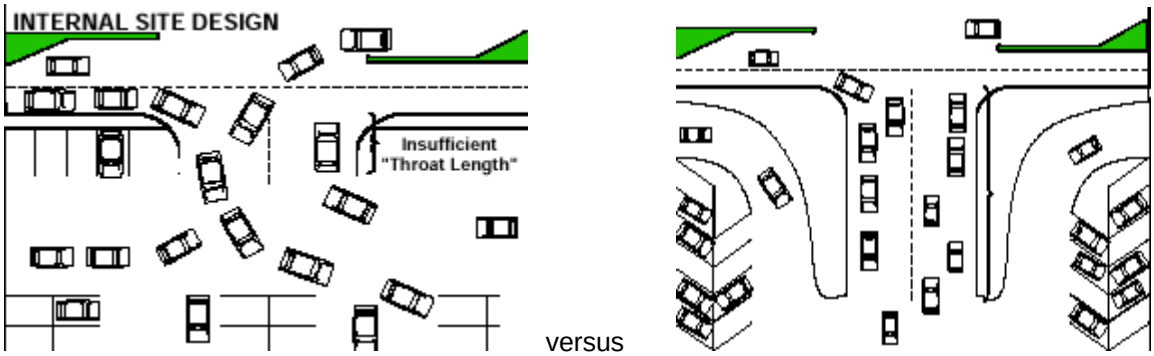
Section 3.2 - Driveway Design Elements

a. The angle of a driveway is measured between the highway centerline and the driveway centerline measured in a clockwise direction.

b. Driveway grade is another important driveway design element. The driveway grade is the slope of the driveway (positive or negative). Along with the slope of the driveway, the differential between the grade of the roadway shoulder or sidewalk portion of the roadway corridor and the grade of the driveway should be reviewed. This differential should be minimized to help traffic ingress and egress from the site.

c. Throat lengths play an important role in the ingress and egress to a development. As shown in the figure, insufficient throat length can create confusion and cause vehicles to become "stuck" in unsafe areas. Adequate throat lengths help to facilitate a smooth flow of traffic giving drivers the opportunity to enter the site before their first decision point. This is shown in Figure 3.1.

Figure 3.1 – Throat Length



d. Gated entrances should have sufficient throat depth that during the peak hour traffic will not back out into the road while they wait for the gate to open.

e. One of the fundamental design elements of a driveway is to include a radius return or a drop curb/flare. A radius return describes a situation in which the curb and gutter or shoulder follows a radius to ingress and egress the site. A drop curb/flare is defined as a typical urban driveway where the sidewalk, if present, and curb and gutter are dropped to meet the roadway and then transitioned back to the normal height. A radius return requires more right of way but it guides the driver and also provides a smoother transition. A drop curb requires little right of way and is easier to construct however since drivers must reduce their speed to turn, through traffic is slowed down.

f. The City of Bowling Green has standard driveway widths to help create a safe, smooth transition between roadways and private property. Developers often believe wider drives are better. However, this is not always the case. If the driveway is extremely wide without pavement markings to guide the drivers, they tend to chart their own course within the drive, which may introduce conflicting movements an/or hinder sight distance. In addition, the wider the drive the greater the distance a pedestrian has to travel to cross the entrance thus creating a riskier crossing situation. Also, if the wide drive has a very wide landscaped median, drivers may think the each drive is a two-way access point, which introduces the potential for head on collisions.

g. In order to minimize the potential for accidents and delay to through vehicles driveway spacing is critical. All adjacent driveways must be separated by the minimum driveway spacing measured from near edge to near edge of adjacent driveways.

h. The location of driveways adjacent to intersecting streets shall conform to the minimum corner clearances. Corner clearance is the distance from an intersection to the first intersection or driveway, measured from near edge to near edge. This helps to ensure the major intersections' functional areas are not degraded by the introduction of additional conflict points. Corner clearance values are dependent upon the roadway classification. Should two streets with differing classifications intersect, the minimum corner clearance for the higher classified street will apply along each leg of the intersection.

i. All driveways and intersecting roadways shall be designed and located so that the minimum sight distances are met. Driveways may be prohibited where adequate sight distance is not available for the established speed limit or the design speed of a future street improvement, if higher. If an inspection by the City Engineer or his/her designee indicates that driveway sight distance may be insufficient, the applicant will be required to submit vertical and horizontal information to the City that verifies adequate sight distance is available for the proposed driveway location. The City Engineer or his/her designee may deny access or a specific driveway location to any abutting public street if said access cannot be provided in a reasonable and safe manner.

j. The width, angle, grade, curb, radii, and other design elements of access points shall be in accordance with the Design Standard Tables, Appendix A. All driveway elements should meet City specifications found in the Standard Drawing section of this manual.

Section 3.3 - Driveway Regulations

a. **Each existing tract of land is entitled to one direct or indirect access point to the public roadway network provided that its location and design fulfill, as a minimum, the requirements of minimum corner clearance, minimum sight distance, and alternative cross access agreements could not be coordinated.** Vehicular access to or from property adjoining a public street shall be provided to the general street system, unless a public authority has acquired such access. The provisions of this document shall not be deemed to deny reasonable access to the general street system.

b. **A site plan/plot plan showing all existing right of way, easements, curbs, storms drain inlets, flumes, underground and overhead utilities, median cuts, adjacent driveways, sidewalks, or other potential obstructions shall be required for each non-residential driveway permit applications.** If the subject property is along a road with a raised median and there is no median opening servicing the property, i.e., within 150 feet of the property lines, the driveways and roadway characteristics on the opposite side of the median shall not be required to be shown on the permit request.

c. **A right-of-way work permit will be required for any driveway work done on public right-of-way.** This permit will not be required for driveways being constructed as part of a current project that has been approved through a building permit or detailed development plan.

d. **Sidewalks shall slope down at a (running) grade not more than 12:1 to meet the elevation of the driveway unless the City Engineer or his/her designee approves a method that will provide acceptable use by the handicapped.** In addition, the cross slope of the sidewalk shall not exceed 2% (1/4" per foot) through the entire width of the drive entrance.

e. **Any driveway approach shall have an initial positive grade when curb, gutter, and sidewalk are present.** The initial approach shall extend onto private property if necessary, but driveways shall not be constructed at locations or in such manner that water is diverted from the street onto private property.

f. **In order to ensure vehicles ease of access to and from roadways, maximum grades for drive entrances are necessary.** Average drive slope shall not exceed a twelve percent (12%) up slope or five percent (5%) down slope within 10 feet of back of sidewalk when present. The average drive slope shall not exceed a ten percent (10%) up slope or twelve percent (12%) down slope within 15 feet of back of curb or edge of pavement when no sidewalk is present or required. Any sidewalk affected by driveway approach construction shall be modified to adequately address handicap (ADA) issues and transition at no greater than 12:1 down to the driveway. Driveway grades and other design standards are shown in the drive entrance detail in the Standard Drawing Section.

g. **No back in or back out vehicle maneuvering from a driveway shall be allowed to occur on any public street or right of way with the exception of residential drives on local and minor collector streets.** All vehicle maneuvering on large apartment complexes, commercial and industrial properties into a parking space or up to a loading dock or into any other area shall be accomplished by off street maneuvering areas and internal driveways.

h. **For any driveway, the point of radius return tangency with the street curb shall not extend beyond the property line (projected perpendicular to the street centerline), except as provided in shared driveway agreements and as approved by the City of Bowling Green.**

i. **No portion of any driveway shall be located within four feet (4') of any fire hydrant, electrical pole or any other surface public utility.** At the applicant's expense, applicant may have the surface utility moved if the public utility agency involved determines that the move will not detrimentally affect the service.

j. **Driveways should be located 5 to 10 feet away from any inlet.** The driveway curb return shall be designed so as to not interfere with or affect the nearby drainage inlets.

k. **Major access points on opposite sides of arterial and collector roadways shall be located opposite each other.** If not so located, turning movement or driveway location restrictions may be imposed as determined necessary by the City Engineer or his/her designee.

l. **Ingress/egress easements may be required in order to maximize the efficient utilization of access points.** Access drives shall be designed, located, and constructed in a manner to provide and make possible the coordination of access with and between adjacent properties developed (present or future) for similar or compatible uses.

m. **Any access point that does not comply with one or more sections of this regulation may be designated as "Temporary" upon approval by the City of Bowling Green.** In all cases where said access points are classified as "temporary", such designation shall be duly noted on the plot plan or site plan submitted for approval. When a property served by a temporary access point is provided an alternative means of access, such as a connection to a frontage road, on an intersecting street, or a shared driveway, the City Engineer or his/her designee may require that the temporary access be eliminated, altered, or limited to certain turning movements. Temporary driveways shall only be permitted with the understanding that they will be modified to meet current standards when construction is complete or at a time designated by the City Engineer or his/her designee.

n. **When an application for building permit or change in property use results in changes in the type of driveway operation, and the driveway is not in conformance with this article, the reconstruction, relocation or conformance of the access to the article may be required.** The City Engineer or his/her designee may not require driveway revisions unless one or both of the following access change conditions has occurred:

- The existing use of the driveway is projected to increase in actual or proposed daily vehicular volume on the driveway by twenty percent (20%) or more. This determination shall be made by the City Engineer or his/her designee using generally accepted transportation engineering standards.

- The change in the use of the property or modifications to the property restricts the flow of vehicles entering the property in a manner, which is anticipated to disrupt normal traffic flow on the public street, thereby creating a hazard. “Change in property use” may include but is not necessarily limited to: change in type of business; expansion in existing business; change in zoning; combination of parcels of land; and the subdividing of land, which creates new parcels. It does not include modifications in advertising, landscaping, remodeling, general maintenance or aesthetics that do not affect internal or external traffic flow or safety.

o. **If it is found during review of proposed land development plans that the new traffic accessing public streets will adversely affect the capacity of the roadway, the City of Bowling Green shall require the developer to provide a Traffic Impact Study.** This study may provide such provisions as the present or future construction of a frontage road, restriction or channelization of turning movements, or other improvements related to access in order to maintain the capacity of the adjacent roadway. Traffic Impact Studies are discussed in detail as a separate section in the Traffic Management Manual.

p. **Proposed driveways within queuing lanes on adjacent roadways will be prohibited.**

SECTION 4 – MEDIAN TREATMENTS

Section 4.1 - Median Treatment Guidelines

a. Medians should be included or planned to be included on all arterial roads, where there is enough right of way to be obtained. On major collector roads, medians should be seriously considered for inclusion for future projects. For minor collector and local roads, medians should be included where their benefits are greater than their costs or for aesthetic purposes.

b. Multiple median openings very closely spaced do not meet current recommended practices. These medians can often reduce the safety and efficiency of a road. Some past typical design flaws of medians include narrow medians where cars cannot be safely stored within them; no left turn lanes; median openings that are too wide; etc. Some of these flaws can be corrected through median retrofit projects funded by either the City or private developers. If developers will be adding additional traffic thus affecting the median opening, they may be required to bring it up to standards, or as close to standards as feasible.

c. Some ways in which to improve medians and conditions near medians may include median closure, redesign to permit only specific movements, adding a left turn lane, including a median retrofit project, reviewing the operation of a Two Way Left Turn Lane or adding auxiliary lanes. If a median opening is closed or directionalized check to see if the driveway it serviced had a left turn out and either re-stripe or remove existing striping to discourage wrong way movements. Left turn lanes will greatly increase the safety associated with any median retrofit project. By adding a safe area for cars to decelerate, stop and safely be stored before making a left turn, the probability of rear end accidents is greatly reduced. These lanes also help the through traffic to maintain their free flow speed.

Section 4.2 - Median Treatment Design Elements

a. The proper design of medians and median openings is necessary to ensure the safety and efficiency benefits. If possible and warranted, all median openings should be designed with left turn deceleration lanes. These lanes should be long enough for cars to exit the through lane of traffic, without considerably slowing, decelerate and stop to wait for a gap in traffic. If an adequate deceleration lane cannot be included, these openings may be signed with a “No Left Turn” or a “No U-Turn” sign. Additional information regarding turn lanes can be found in Section 5.

b. Raised medians incorporate an actual barrier between the two opposing flows of traffic on a roadway. Raised medians are generally designed with mountable curb and at least 14 – 40 feet wide (median width). The median openings act as traffic control devices. Many times these medians restrict direct access to properties from the other side of the road; however, access is maintained by allowing vehicles to make u-turns or through connectivity between sites.

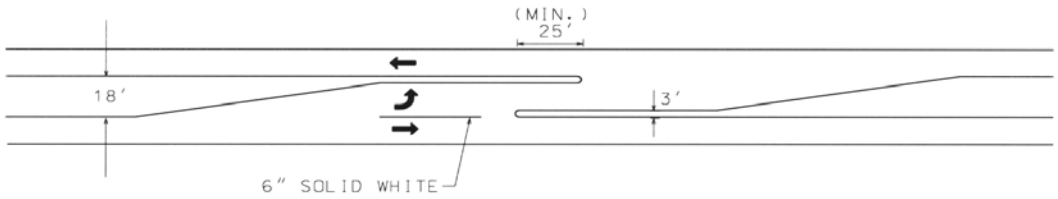
c. Painted medians incorporate pavement markings on the road, which provide guidance to motorists. Many times these medians are disregarded since physical obstacles are not present to prevent them from making the movement they desire. In addition, markings get worn and it becomes difficult for motorists to see these markings.

Raised or painted median openings may be designed at a signalized intersection, a full, unsignalized opening or a directional median opening. At a signalized intersection, a traffic signal permits movements and most movements are controlled by the signal indicators. Unsignalized full median openings permit left turns to and from the main road and the intersecting road or driveway. Generally, the traffic on the main road has the right of way while traffic on the secondary road or driveway connection is regulated by stop or yield signs.

d. Directional median openings allow for left turns from the major road but preclude left turns from the intersecting road or driveway. Other directional median openings allow for left turns into an intersecting road or driveway and/or out of the driveway.

Overlapping noses on directional median openings can help discourage wrong way movements. Other design elements to be considered with medians are proper sign placement and sight distance. Figure 4.1 depicts an example of a properly designed directional median opening.

Figure 4.1 – Design of Directional Median Opening



e. A Two Way Left Turn Lane (TWLTL) is defined as a center lane of a road which is striped to allow left turns from any place along the road. This effectively creates a situation with a high number of conflict points, since every driveway functions as a full median opening. See Figure 1.1 for conflict points at full median openings. The design of Two Way Left Turn Lanes are encouraged on low volume roads with a high proportion of left turning vehicles (>20%) and a low density of driveways (<12 driveways per traffic direction per mile) in commercial areas. The traffic volumes should be below 28,000 ADT; if the traffic volumes are below 17,500 ADT a three lane typical section should be reviewed. Two Way Left Turn Lanes should not be incorporated into 6 lane roadways. Where there are high pedestrian volumes, pedestrian refuge islands should be considered. These create a visual and concrete area for a pedestrian to wait if they cannot cross the entire street at one time. However, care should be taken if these islands are landscaped that the landscaping does not hide the pedestrians.

f. Median spacing helps preserve the efficiency of the traffic and the future capacity of the road. The location of full median openings should be at existing or future signal locations. Generally, full median opening spacing should not be less than ¼ mile (1320 feet). This ensures optimal efficiency for signals should these openings become signalized. Corridors should be reviewed for the inclusion of other full or directional median openings. Generally, municipalities grant full median openings at public streets or the highest trip generator. Some exceptions include locations with high volumes of heavy truck traffic and potentially at high schools. Reasons for this include the need for truck turning radius and accommodating inexperienced drivers during peak times near schools. The median opening locations should also be reviewed to ensure that an

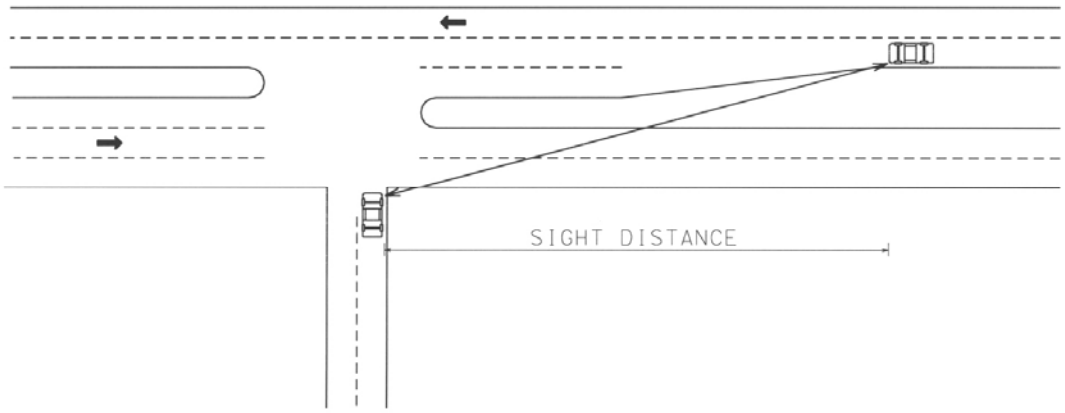
adequate left turn deceleration lane is incorporated with the median opening. If there is nothing to generate left turns from one side of a median opening, it may be omitted. Some factors to consider would be the number of u-turns utilizing the opening and the proper signing necessary to prohibit left turns. Due to safety considerations, full median openings with little opportunity to become signalized should not be included on six lane roadways. Vehicles tend to become trapped in the median opening with difficulty seeing the three approaching lanes.

g. Wide median opening widths should be avoided to help control traffic within median openings. The median width is measured from the opposing median noses. This width should vary between 65 feet and 100 feet with an average of 75 feet. The wider the side road or driveway, the wider the median opening width will need to be. If side roads or driveways are offset, they should be reviewed for median opening widths and conflicting turning movements.

h. Access management corridor plans are beneficial by planning development along a corridor with future access point locations identified. Signal spacing can also be planned considering future build out of adjacent land. By proper planning and use of impact studies, the development community may cost share or be solely responsible for signals along a corridor.

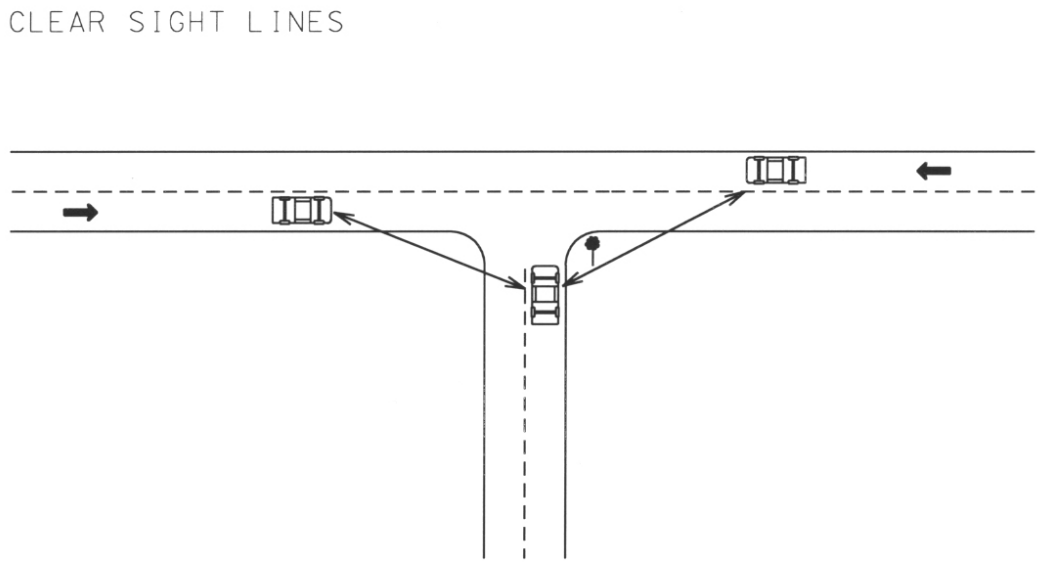
i. Sight Distance should be reviewed at each median opening. Some of the different types of sight distance associated with median openings are intersection sight distance, U-turn sight distance and sight distances for left and right turns. These are graphically represented in Figures 4.2, 4.3 and 4.4 and their values are found in the Design Standards Tables.

Figure 4.2 – Stopping Sight Distance



Stopping sight distance shows the distance needed for the through vehicle to see the car at the driveway and stop if the car at the driveway enters the road.

Figure 4.3 - Right and Left Turn Sight Distance



This diagram shows the distance of clear sight for the driver exiting the driveway to see the approaching vehicles to determine if it safe to enter the road. Care should be taken not to obstruct these sight lines with landscaping, bus shelters or other visual obstructions as shown below.

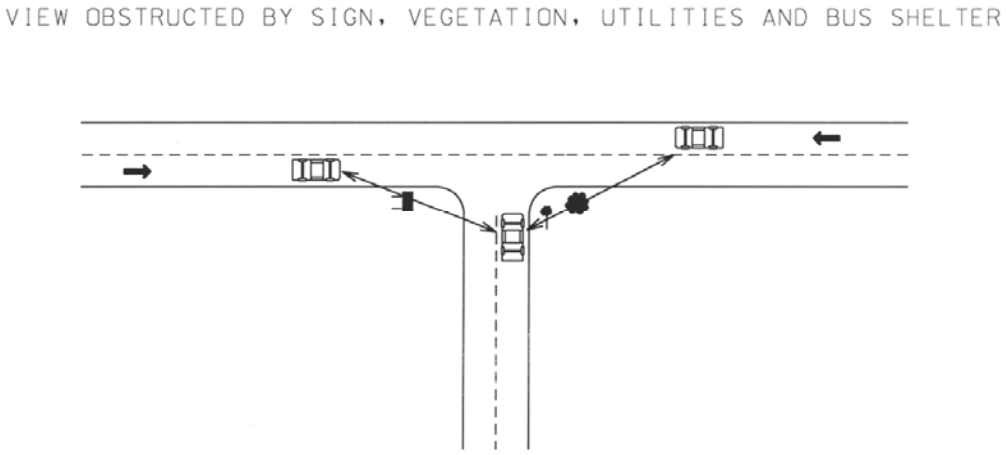
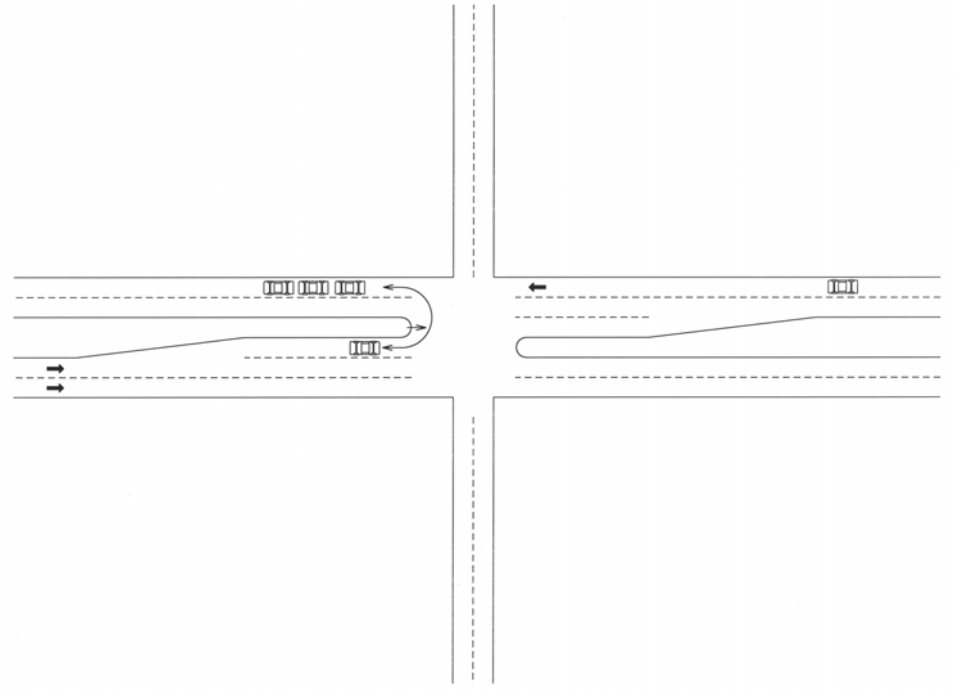


Figure 4.4 – U-Turn Sight Distance



Section 4.3 - Median Treatment Regulations

Access points shall be designed such that those which will warrant signalization shall be spaced a minimum distance of one quarter mile apart and one quarter mile from the nearest signalized intersection. The location and design of the signalized access points shall be determined by a traffic engineering study prepared by a qualified traffic engineer at the developer's expense. This study shall be subject to the approval of the City Engineer and shall account for at least the following variables:

a. Traffic signal phasing as determined by analysis of projected turning movements;

b. Traffic signal cycle length as determined by analysis of projected traffic volumes;

c. Type of signal to be installed (actuated or pretimed);

d. Relationship to adjacent signals (existing or proposed) for purposed of signal interconnection and coordination;

e. Roadway geometrics and sight distance considerations; and

f. Accident experience.

If the installation or modification of a traffic signal is approved, the developer may be required to participate in the cost of design, purchase, installation, and operation of the signal equipment.

SECTION 5 – AUXILIARY LANES

Section 5.1 – Auxiliary Lane Guidelines

Auxiliary lanes are any separate lanes used for left and right turning vehicles decelerating or accelerating. Left turn deceleration and storage lanes should be provided at all median openings that allow left and/or u-turns. Right turn deceleration lanes should be included when a right turning vehicle will cause the through traffic to slow or create congestion in the outside lane.

Acceleration lanes allow drivers entering the roadway to accelerate and then merge laterally into the through traffic lane. Acceleration lanes are desirable where high speeds and a lack of gaps in traffic make it difficult for vehicles to enter the roadway.

At those access points where vehicles turning to and from the roadway will affect the capacity of the roadway or create an unacceptable accident risk, the developer shall dedicate sufficient right of way and construct deceleration/acceleration lanes as necessary to maintain the capacity of the roadway and minimize the potential accident risk.

A. Left Turn Deceleration Lane Regulations

Left turn deceleration lanes allow drivers to exit the through lane before beginning to slow. This allows for minimal disruption to the through movement and provides a safe area to wait to turn. The City of Bowling Green has standards for left turn lane warrants for roads, these Standards are found in Appendix A.

The left turn lanes should be long enough to include a taper, a safe deceleration area, and queuing of cars. Some typical left turn deceleration lane lengths are shown in Appendix A.

B. Left Turn Acceleration Lane Regulations

The minimum warrants for acceleration lanes are shown in Appendix A. Acceleration lanes must be long enough to allow the accelerating vehicle to reach the desirable merging speed. The desirable merging speed should be the average running speed of the through traffic (NHI). Left turn acceleration lane lengths are shown in Appendix A.

Section 5.2 – Right Turn Deceleration Lane Regulations

a. In general, right turn deceleration lanes shall be provided when:

- The posted speed of the through route is 35 mph or more, AND
- The traffic volume on the mainline route is at least 10,000 vehicles per day, AND
- The number of right turning vehicles at peak hour into the driveway or minor street is:

  - Over 30 on 2 lane routes with posted speeds over 45 mph.
  - Over 40 on 4 lane routes with posted speeds over 45 mph.
  - Over 80 on 2 lane routes with posted speeds under 45 mph.
  - Over 110 on 4 lane routes with posted speeds under 45 mph.

Right turn deceleration lanes should also be considered where:

- Poor internal site design and circulation leads to backups on the mainline.
- The peak hour turning traffic activity is unusually high (eg. >10%).
- Operating speeds on the mainline route are >55 mph and right turns are not expected.
- The driveway or minor public road intersection is difficult to see.
- The driveway entrance is gated.
- Right turning traffic consists of a large number of trailers or other large vehicles.
- Rear end collision experience is unusually high at a location.

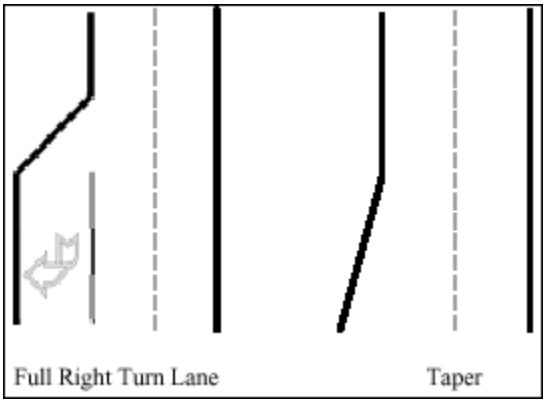
The use of right turn lanes should be guided by a traffic study.

b. When designing right turns lanes it can be assumed a vehicle making a right turn can slow to 15 mph and safely negotiate the turn. This is based on the assumption of an adequate turning radii, throat volume and other driveway features. A queue length is generally not needed since right-turning vehicles should not be stopping on the main road. When a driveway is approved within the separate right turn lane of a public street intersection, the lane shall be extended a minimum of 50’ in advance of the driveway. No driveway shall be permitted within the taper area of any separate right turn or deceleration lane. A continuous deceleration lane may be required as a condition of a driveway permit when two or more

deceleration lanes are planned, and their proximity necessitates that they be combined for proper traffic flow and safety. The transition taper for a continuous deceleration lane shall not extend into or beyond a public street intersection. If the applicant is allowed to locate a driveway with a deceleration lane within 100' of an arterial intersection, he may be required to extend the deceleration lane to such intersection. The 100' shall be measured from the center of the driveway to the intersection of the extended right of way lines of the arterial intersection. The applicant shall be responsible for the design, right of way adjustment of utilities and construction costs of any auxiliary lane and street widening required as a condition of the driveway permit in accordance with the City's guidelines.

c. Some multi-lane highways with adequate capacity may not need right turn lanes if the outside lane can function as a continuous right turn lane and vehicles can safely maneuver around the turning vehicle without slowing considerably. Some alternatives to a full right turn lane are a right turn taper or use of a larger ingress radius. These offer the motorists a small area to begin exiting the through lane prior to the ingress lanes of the driveway. A right turn taper is usually no longer than 100 feet long.

Figure 5.1 – Right Turn Lane vs. Taper



Recommended lengths for right turn deceleration lanes are found in Appendix A.

Section 5.3 – Right Turn Acceleration Lane Regulations

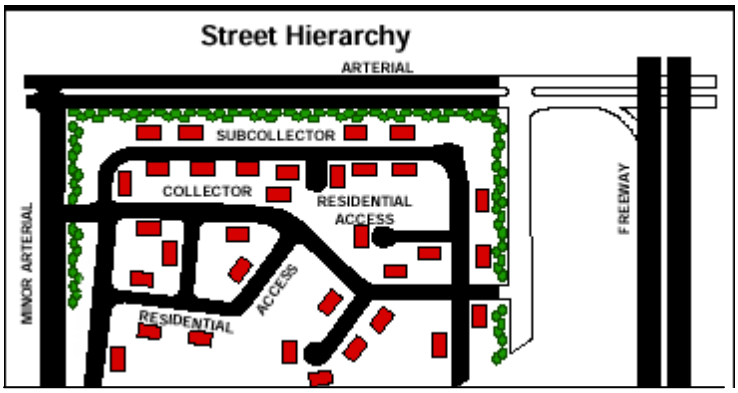
The minimum warrants for acceleration lanes are shown in Appendix A. Acceleration lanes must be long enough to allow the accelerating vehicle to reach the desirable merging speed. The desirable merging speed should be the average running speed of the through traffic (NHI). Right turn acceleration lane lengths are shown in Appendix A.

SECTION 6 – CONNECTIVITY

Section 6.1 – Functional Class

Connectivity is an integral component of access management, which the City has incorporated into their planning efforts. Connectivity can be achieved by having the correct progression from a local feeder road to a collector road and then from there to an arterial road. Functional class connectivity is shown in Figure 6.1.

Figure 6.1 – Street Hierarchy



Section 6.2 – Parcel Level

Connectivity can also be thought of as having more than one access to a side road for a large development, having cross access, i.e., connecting more than one driveway by a frontage road or connecting more than one development to one driveway. Connectivity allows trips to be distributed between the internal systems and the hierarchy of the roadway structure. A variety of street types should be included in development plans to help interconnectivity and reduce volumes on major roadways. A common access management tool used to promote connectivity within developments is the use of frontage roads. These roads allow the traffic that would utilize the main road to access business to use an alternate parallel road, the frontage road, to make their turns. Connectivity also allows for pedestrian routes, which encourage walking between destinations, and removes internal trips from the adjacent road network.

The City Engineer or his/her designee may require the use of frontage roads to provide access to property adjacent to Arterial roadways or as shown on the Transportation Map. The landowner/developer may be required to construct the

frontage road to the side and/or rear property lines or reserve sufficient right of way to allow future construction. As adjacent property develops landowner/developers shall be required to interconnect the individual portions of frontage roads as appropriate. Access to the roadway via an intersecting street or a shared driveway may be required if the use of a frontage road is not feasible. The Subdivision Regulations has the standards for frontage roads.

SECTION 7 – Definitions (National Highway Institute Document)

1. **Acceleration Lane –** An auxiliary lane, including taper, for the purpose of enabling a vehicle entering a roadway to increase its speed to a rate at which it can safely merge with through traffic.
2. **Access –** The ability to enter or leave a public street or highway from an abutting private property or another public street.
3. **Access – Control of –** The condition where the right of vehicular traffic movement to abutting property to the highway is fully or partially controlled by public authority.
4. **Access – Right of –** The right of an abutting property owner to vehicular movement to and from the highway and the owner's property.
5. **Access Control Plan –** A roadway design plan which designates access locations and their designs for the purpose of bringing those portions of roadway included in the access control plan into conformance with their access category to the extent feasible.
6. **Access Point –** The connection of a driveway at the right-of–way line to the highway.
7. **ADT –** The annual average two-way daily traffic volume. It represents the total annual traffic for the year, divided by 365.
8. **Arterial Highway –** A highway primarily for through traffic, usually on a continuous route.
9. **Auxiliary Lane –** A separate lane for the purpose of enabling a vehicle entering or leaving a roadway to increase or decrease its speed to a rate at which it can more safely merge or diverge with through traffic.
10. **Buffer Area –** The area between the outside edge of shoulder or curb and the right-of-way line.
11. **Conflict –** A traffic even that causes evasive action by a driver to avoid collision with another vehicle, usually designated by a light application or evasive lane change.
12. **Conflict Point –** An area where intersecting traffic either merges, diverges or crosses.
13. **Corner Clearance –** The minimum dimension parallel to a highway between the curb, pavement, or shoulder lines of an intersecting highway and the nearest edge of a driveway.
14. **Deceleration Lane –** An auxiliary 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.

15. **Directional Island –** An area within the roadway not for vehicular movement; designed to control and direct specific movements of traffic to definite channels. The island may be defined by paint, raised concrete, or other devices.

16. **Divided Highway -** A two-way road on which traffic traveling in opposite directions is physically separated by a median.

17. **Downstream –** The direction along the roadway toward which the vehicle flow under consideration is moving.

18. **Driveway –** The physical connection between a public street or highway and an abutting private tract of land.

19. **Egress –** The exit of vehicular traffic from abutting properties to a highway.

20. **Frontage Road –** A local street or road located parallel to an arterial highway for service to abutting properties for the purpose of controlling access to the arterial highway.

21. **Grade –** The rate or percent of change in slope, either ascending or descending, form or along the highway. It is to measure along the centerline of the roadway or access.

22. **Guideline –** A recommended value, which reflects good engineering practice and which should be followed in most situations.

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

24. **Ingress –** The entrance of vehicular traffic to abutting properties from a highway.

25. **Interchange –** A facility that grade separates intersecting roadways and provides directional ramps for access movements between the roadways. The structure and the ramps are considered part of the interchange.

26. **Lane –** The portion of a roadway for the movement of a single line of vehicles and does not include the gutter or shoulder of the roadway.

27. **Level-of-Service –** A qualitative measure of the effect of a number of factors including speed and travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience, and operating costs.

28. **Local Road –** A county road or city street for which the primary function is to provide access to adjacent properties.

29. **Median –** The physical portion of a highway separating the traveled ways for opposing traffic flows.

30. **Median Opening –** A gap in a median provided for crossing and turning traffic.

31. **Merging –** The process by which two separate traffic streams moving in the same general direction combine or unite to form a single stream.

32. **MUTCD –** The Manual of Uniform Traffic Control Devices

33. **Right-of-Way –** The land within legally-defined property boundaries vested in the governing body and designated for highway purposes.

34. **Roadway –** That portion of a highway improved, designed or ordinarily used for vehicular travel exclusive of the berm or shoulder. In the even a highway includes two or more separate roadways, “roadway” refers to any such roadway separately but not to all such roadways collectively.

35. **Rural –** Any area not included in a business, industrial, or residential zone of moderate or high density, whether or not it is within the boundaries of a municipality.

36. **Sight Distance –** The distance visible to the driver of a passenger vehicle measured along the normal travel path of a roadway to a specified height above the roadway when the view is unobstructed to traffic.

37. **Stopping Sight Distance –** The distance required by a driver of a vehicle, traveling at a given speed, to bring the vehicle to a stop after an object on the roadway becomes visible. It includes the distance traveled during driver perception and reaction times and the vehicle braking distance.

38. **Storage Length –** Additional lane footage added to a deceleration lane to store the maximum number of vehicles likely to accumulate during a peak period so as not to interfere with the through travel lanes.

39. **Traffic Control Device –** Any sign, signal, marking or device placed or erected for the purpose of regulating, warning, or guiding vehicular traffic and/or pedestrians.

40. **Traffic Gap –** The clearance interval in time or distance between individual vehicles.

41. **Turning Radius –** The radius of an arc which approximates the turning path of a vehicle.

42. **Undivided Highway –** A road that has no directional separator, wither natural or structural, separating traffic moving in opposite directions.

43. **Urban –** Any territory within an incorporated area or with frontage on a highway which is at least 50% built up with structures devoted to business, industry, or dwelling houses for a distance of a quarter of a mile or more.

44. **Warrant –** A requirement based on a legal precedent, or officially adopted policy-mandated for use within the jurisdiction of the adopting governmental unit.

45. **Weaving Maneuvers –** The crossing of traffic streams moving in the same general direction accomplished by merging and diverging.

APPENDIX A
TO
ACCESS MANAGEMENT:

DRIVEWAY/MEDIAN DESIGN STANDARD TABLES

AND

AUXILIARY LANE TABLES

Table A1 - Design Standards for Local Roads

Design Feature	Speed Limit	Max	Min	Comments
Driveway Profile				See standard drawing for drive entrances included in this appendix.
Condition A				With sidewalk, curb & gutter
Grade G1	All	+12% / -5%		Within 10' of back of sidewalk
Grade G2	All	+15% / -15%		Recommended beyond first 10'
Condition B & C				B – curb & gutter only; C – shoulder only
Grade G1	All	+10% / -12%		Within 15' of back of curb or edge of shldr.
Grade G2	All	+15% / -15%		Recommended beyond first 15'
Driveway Angle	All	90°	80°	
Throat Length	All	N/A	N/A	
Driveway Width	All			
Residential		24'	12'	24' should be for multifamily res. only
Minor Comm'l		30'	24'	Width should be based on typical use and reviewed on a case by case basis.
Major Comm'l		40'	24'	
Industrial		50'	30'	
Number of Driveways: < 125' of frontage	All	1	1	Two one-way DWs may be reviewed. Low volume roads (<400 ADT) may have a maximum of two driveways if ALL other requirements can be met.
Number of Driveways: 125'-199' of frontage	All	2	1	
Number of Driveways: > 200' frontage	All	1/add'l 200' of frontage	1	
Radius Return	All	10'	5'	May be larger based upon land use.
Drop Curb	All			OK to use
Driveway Spacing [1,2]	All		45'	[1] Measured from edge of driveway [2] Permitted driveways shall be no closer to a property line than 5' and not within the required sight triangle.
Sight Distance for Side Road Looking Right (Passenger Car)	20 25		170' 255'	
Sight Distance for Side Road Looking Left (Passenger Car)	20 25		210' 265'	
Sight Distance for Side Road Looking Right (Trucks)	20 25		230' 340'	
Sight Distance for Side Road Looking Left (Trucks)	20 25		360' 440'	

Table A1 - Design Standards for Local Roads
(concluded)

Design Feature	Speed Limit	Max	Min	Comments
Stopping Sight Distance (Wet Pavements)	20 25		100' 100'	
Sight Distance for U Turn at Unsignalized Openings	20 25		N/A N/A	Most local roads will not have medians
Corner Clearance	All			See Figures A1 and A2
Full Median Spacing	All	N/A	250'	If medians are included, as fits

Table A2 - Design Standards for Collector Roads

Design Feature	Speed Limit	Max	Min	Comments
Driveway Profile				See standard drawing for drive entrances included in this appendix.
Condition A				With sidewalk, curb & gutter
Grade G1	All	+12% / -5%		Within 10' of back of sidewalk
Grade G2	All	+8% / -8%		Recommended beyond first 10'
Condition B & C				B – curb & gutter only; C – shoulder only
Grade G1	All	+10% / -12%		Within 15' of back of curb or edge of shldr.
Grade G2	All	+8% / -8%		Recommended beyond first 15'
Driveway Angle	All	90°	80°	
Throat Length	All	N/A	50'	
Driveway Width	All			
Residential		24'	12'	24' should be for multifamily res. only
Minor Comm'l		30'	24'	Width should be based on typical use and reviewed on a case by case basis.
Major Comm'l		40'	24'	
Industrial		50'	30'	
Number of Driveways: < 250' of frontage	All	1	1	Two one-way DWs may be reviewed
Number of Driveways: 250'-399' of frontage	All	2	1	
Number of Driveways: > 400' frontage	All	1/add'l 300' of frontage	1	
Radius Return	All	35'	10'	May be larger based upon land use
Drop Curb	All			OK to use
Driveway Spacing [1,2]	25 30 35		105' 125' 150'	[1] Measured from edge of driveway [2] Permitted driveways shall be no closer to a single family residential lot property line than 5' and not within the required sight triangle.
Sight Distance for Side Road Looking Right (Passenger Car)	25 30 35		255' 360' 375'	

Table A2 - Design Standards for Collector Roads (concluded)

Design Feature	Speed Limit	Max	Min	Comments
Sight Distance for Side Road Looking Left (Passenger Car)	25		265'	
	30		320'	
	35		330'	
Sight Distance for Side Road Looking Right (Trucks)	25		340'	
	30		450'	
	35		685'	
Sight Distance for Side Road Looking Left (Trucks)	25		440'	
	30		520'	
	35		720'	
Stopping Sight Distance (Wet Pavements)	25		100'	
	30		175'	
	35		250'	
Sight Distance for U-Turns at Unsignalized Openings	25		N/A	Most minor collector roads will not have medians
	30		N/A	
	35		520'	
Corner Clearance	All			See Figures A1 and A2
Full Median Spacing	All	N/A	660'	
Directional Median Spacing	All	N/A	as fits	

Table A3 - Design Standards for Arterial Roads

Design Feature	Speed Limit	Max	Min	Comments
Driveway Angle	All	90	80	
Driveway Grade	All	5%		
Differential in Grade	All	+/-3%		
Throat Length	All	N/A	100'	
Driveway Width	All			
Residential		24'	12'	24' should be for multifamily res. only
Minor Comm'l		30'	24'	Width should be based on typical use and reviewed on a case by case basis.
Major Comm'l		40'	24'	
Industrial		50'	30'	
Number of Driveways: < 350' of frontage	All	1	1	Two one-way DWs may be reviewed
Number of Driveways: 350'-559' of frontage	All	2	1	
Number of Driveways: > 560' frontage	All	1/add'l 300' of frontage	1	
Radius Return	All	75'	35'	May be larger based upon land use
Drop Curb	All			Should not be used
Driveway Spacing [1,2]	30		125'	[1] Measured from edge of driveway
	35		150'	
	40		185'	[2] Permitted driveways shall be no closer to a single family residential lot property line than 5' and not within the required sight triangle.
	45		230'	
	50		275'	
	55		330'	
Sight Dist for Side Road Looking Right (Passenger Car)	30		360'	
	35		375'	
	40		590'	
	45		780'	
	50		970'	
	55		1135'	

Table A3 - Design Standards for Arterial Roads
(concluded)

Design Feature	Speed Limit	Max	Min	Comments
Sight Distance for Side Road Looking Left (Passenger Car)	30		320'	
	35		330'	
	40		540'	
	45		720'	
	50		900'	
	55		1110'	
Sight Distance for Side Road Looking Right (Trucks)	30		450'	
	35		685'	
	40		920'	
	45		1225'	
	50		1530'	
	55		2320'	
Sight Distance for Side Road Looking Left (Trucks)	30		520'	
	35		720'	
	40		920'	
	45		1215'	
	50		1510'	
	55		2295'	
Stopping Sight Distance (Wet Pavements)	30		175'	
	35		250'	
	40		325'	
	45		400'	
	50		475'	
	55		550'	
Sight Distance for U-Turns at Unsignalized Openings	30		N/A	
	35		520'	
	40		640'	
	45		830'	
	50		1040'	
	55		1250'	
Corner Clearance	All			See Figures A1 and A2
Full Median Spacing	All	N/A	1320'	
Directional Median Spacing	All	N/A	660'	

Table A4 - Minimum Warrants for Left Turn Deceleration Lane

35 mph		45 mph		55 mph		65 mph	
Lt Turn Vol/Hour	Directional Vol (Veh/ Hr/Lane)	Lt Turn Vol/Hour	Directional Vol (Veh/ Hr/Lane)	Lt Turn Vol/Hour	Directional Vol (Veh/ Hr/Lane)	Lt Turn Vol/Hour	Directional Vol (Veh/ Hr/Lane)
10	400	10	350	10	375	10	300
20	300	20	225	20	175	20	150
30	225	30	150	30	100	30	100
40	175	40	100	40	100	40	100
50	150	50	100	50	100	50	100
60	100	60	100	60	100	60	100

Table A5 - Deceleration Turn Lane Lengths

Design Speed (mph)	Entry Speed (mph)	Urban Decel Distance	Rural Decel Distance
35	25	145’	N/A
40	30	155’	N/A
45	35	185’	N/A
50	40/44	240’	320’
55	48	N/A	385’
60	52	N/A	455’
65	55	N/A	520’

Note: The urban conditions refer to curb and gutter typical sections while the rural refer to shoulder typical sections.

Table A6 - Right Turn Deceleration Lane Lengths

Design Speed (mph)	Decel Distance (ft)	Minimum Taper Ratio (ft/ft)
25	150	7.5:1
30	185	8:1
35	235	10:1
40	295	11.5:1
45	350	13:1
50	405	15:1
55	450	18.5:1

Table A7 - Minimum Warrants for Acceleration Lanes

40 mph		45 - 55 mph	
Turn Volume/ Hour	Directional Volume (Vehicles per Hour per Lane)	Turn Volume/ Hour	Directional Volume (Vehicles per Hour per Lane)
15	N/A	15	250
20	N/A	20	180
25	N/A	25	140
30	310	30	120
35	250	35	N/A
40	180	40	N/A
45	150	45	N/A

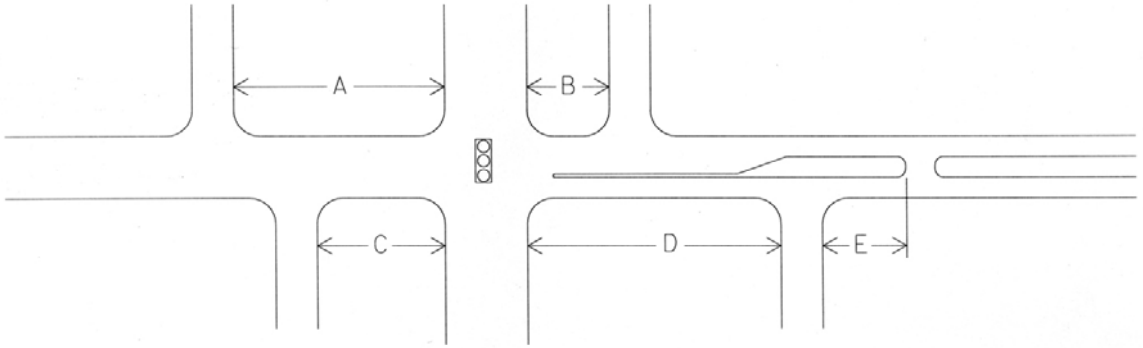
Table A8 - Left Turn Acceleration Lane Lengths

Design Speed (mph)	Accel Distance (ft)	Minimum Taper Ratio (ft/ft)
25	100	7.5:1
30	190	10:1
35	270	12.5:1
40	380	15:1
45	550	15:1
50	760	20:1
55	960	22.5:1

Table A9 - Right Turn Acceleration Lane Lengths

Design Speed (mph)	Accel Distance (ft)	Minimum Taper Ratio (ft/ft)
25	90	7.5:1
30	190	10:1
35	240	12.5:1
40	320	15:1
45	480	15:1
50	700	20:1
55	910	22.5:1

Figure A.1 – Minimum Corner Clearances of Driveways From Intersecting Streets



Signalized Intersection Control

Signalized Intersection	Description of Items
A	The minimum distance from an intersection to a driveway on the departure lanes where no barrier median is present
B	The minimum distance from an intersection to a driveway on the approach lanes where a barrier median is present
C	The minimum distance from an intersection to a driveway on the approach lanes where no barrier median is present
D	The minimum distance from an intersection to a driveway on the departure lanes where a barrier median is present
E	The minimum lateral distance between a driveway and a median opening

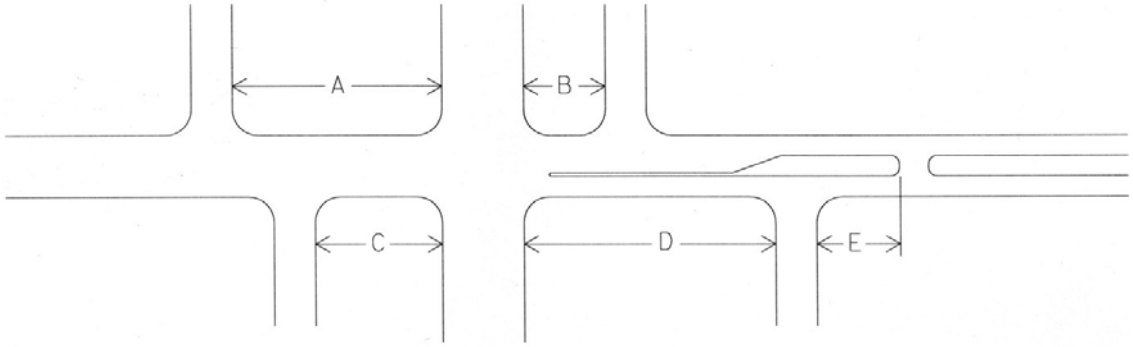
Minimum Corner Clearances for Signalized Intersections*

	Access Classification		
Item	Arterial	Collector	Local
A	230’	175’	50’
B	115’	85’	50’
C	230’	175’	50’
D	230’	175’	50’

Note: Distances measured from edge of pavement.

* Should a street of lesser classification intersect one of higher classification and access is desired on the lesser of the two, the greater of the two clearance distances will be required or as great as the lot frontage width permits.

Figure A.2 – Minimum Corner Clearances of Driveways From Intersecting Streets



Unsignalized Intersection Control

Signalized Intersection	Description of Items
A	The minimum distance from an intersection to a driveway on the departure lanes where no barrier median is present
B	The minimum distance from an intersection to a driveway on the approach lanes where a barrier median is present
C	The minimum distance from an intersection to a driveway on the approach lanes where no barrier median is present
D	The minimum distance from an intersection to a driveway on the departure lanes where a barrier median is present
E	The minimum lateral distance between a driveway and a median opening

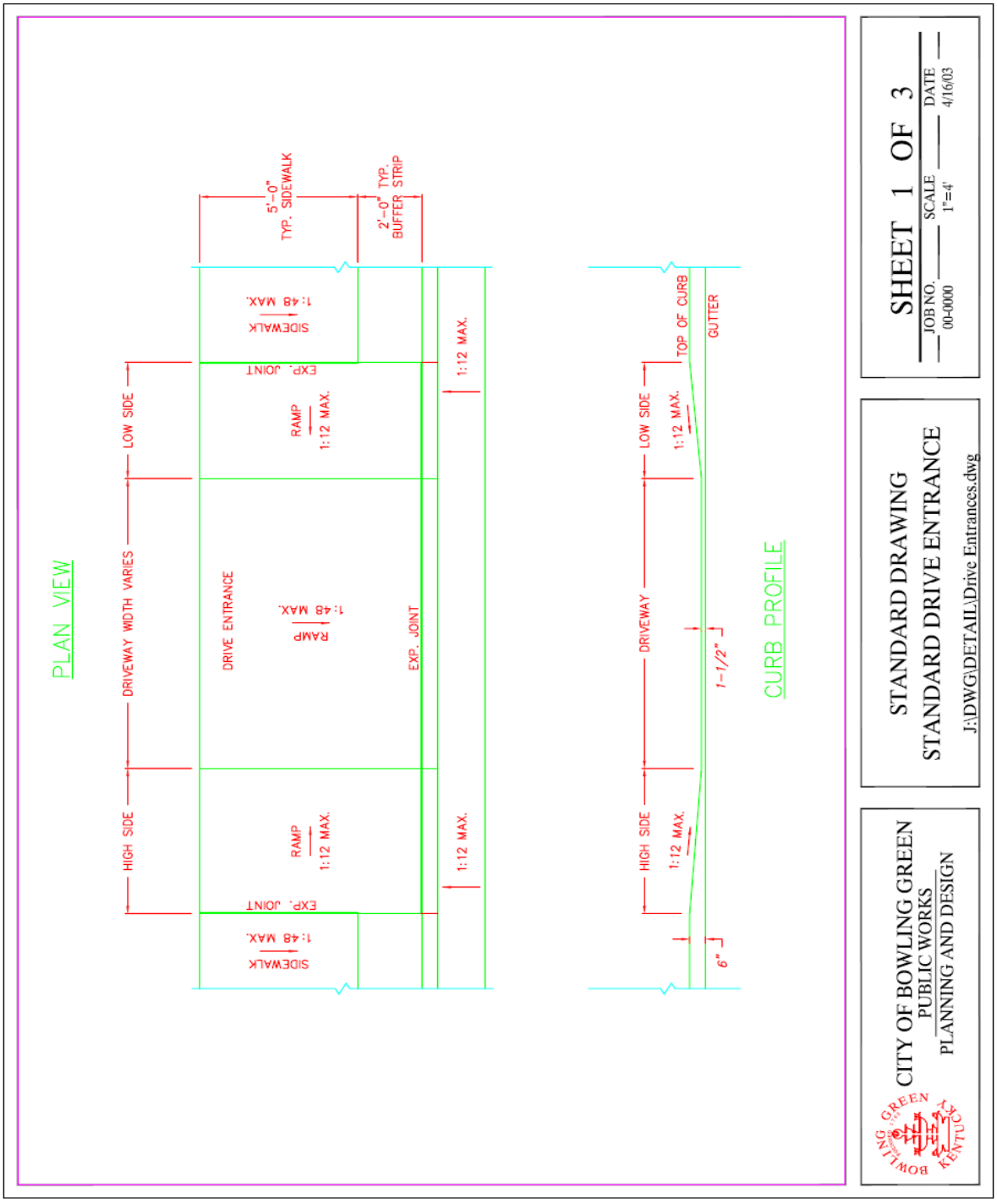
Minimum Corner Clearances for Unsignalized Intersections*

	Access Classification		
Item	Arterial	Collector	Local
A	115’	85’	50’
B	115’	85’	50’
C	115’	85’	50’
D	115’	75’	50’

Note: Distances measured from edge of pavement.

* Should a street of lesser classification intersect one of higher classification and access is desired on the lesser of the two, the greater of the two clearance distances will be required or as great as the lot frontage width permits.

Figure A.3 –Standard Drawing: Standard Drive Entrance



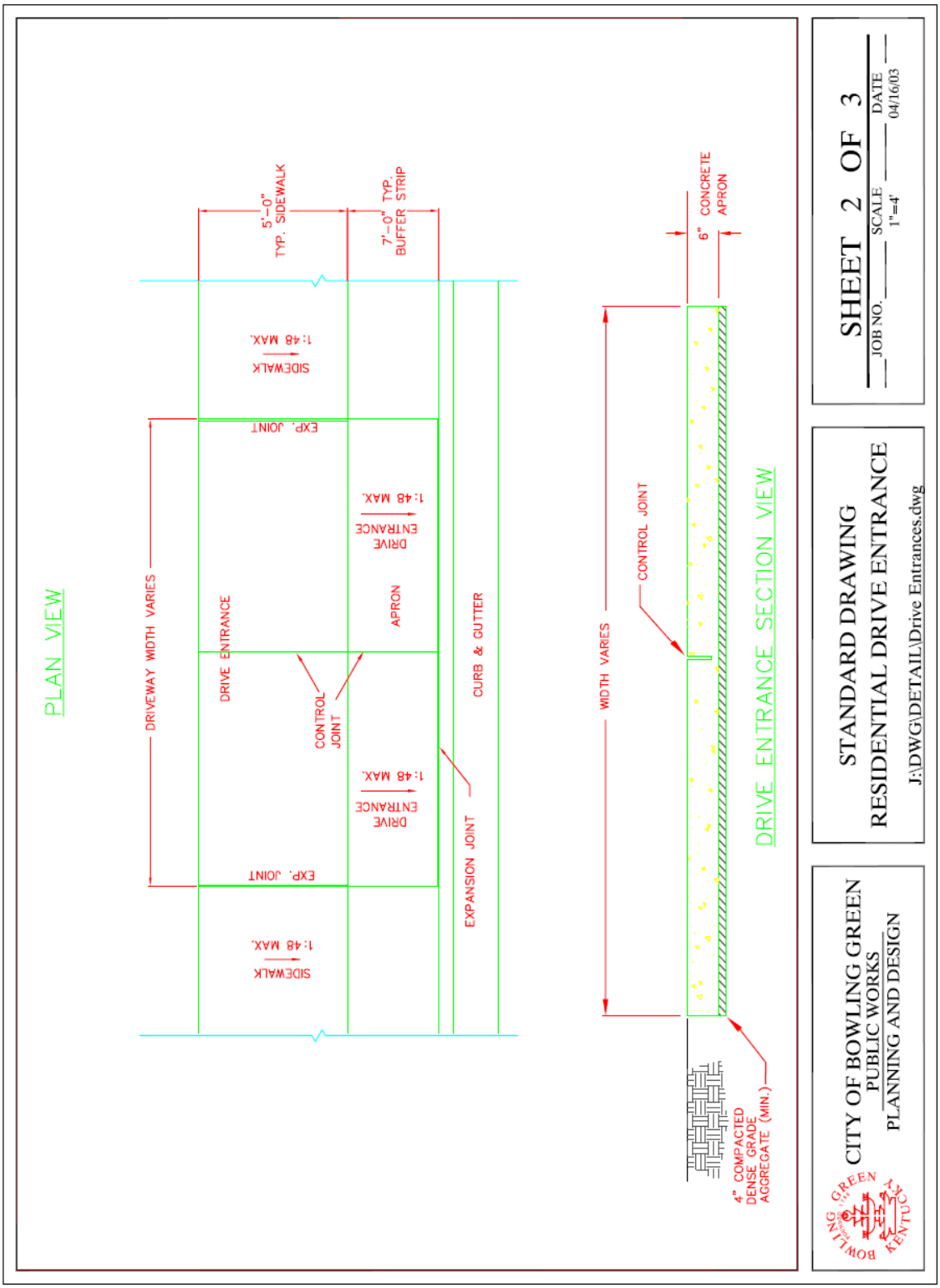
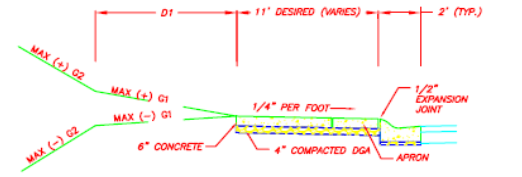
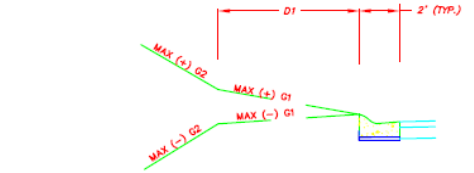


Figure A.4 –Standard Drawing: Residential Drive Entrance

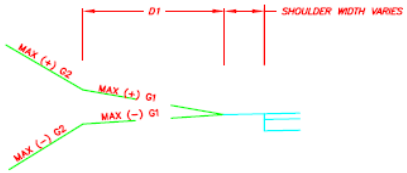
Figure A.5 –Standard Drawing: Drive Entrance Profiles



DRIVE ENTRANCE PROFILE (SIDEWALK, CURB & GUTTER)
CONDITION A



DRIVE ENTRANCE PROFILE (CURB & GUTTER ONLY)
CONDITION B



DRIVE ENTRANCE PROFILE (SHOULDER ONLY)
CONDITION C

DRIVE ENTRANCE MAXIMUM GRADES*					
CONDITION	G1		G2**		D1
	+	–	+	–	
A	12%	5%	15%	15%	10'
B	10%	12%	15%	15%	15'
C	10%	12%	15%	15%	15'

*MAXIMUM GRADES ARE CONSIDERED TO BE THE AVERAGE GRADE WITHIN THE SPECIFIED DISTANCE. GRADES APPLY ONLY TO ENTRANCES ADJACENT TO ROADWAYS CLASSIFED AS LOCALS OR COLLECTORS.

**FOR DRVEWAYS ADJACENT TO ROADWAYS CLASSIFIED AS LOCAL ONLY, USE 8% FOR COLLECTOR. G2 IS ONLY A RECOMMENDED MAXIMUM, NOT A REQUIREMENT AS IS G1.

DRIVE ENTRANCE STANDARDS TABLE		
	MAXIMUM WIDTH	MINIMUM WIDTH
RESIDENTIAL	24'	12'
MINOR COMM.	30'	24'
MAJOR COMM.	40'	24'
INDUSTRIAL	50'	30'

LOCATION, SPACING, AND NUMBER OF DRIVE ENTRANCES SHALL COMPLY WITH BOWLING GREEN ACCESS MANAGEMENT GUIDELINES.

SPECIAL RESTRICTIONS APPLY TO DRIVE ENTRANCES LOCATED ON CORNER LOTS (SEE ACCESS MANAGEMENT GUIDELINES).

EDGE OF PAVEMENT SHALL BE 5' FROM PROPERTY LINE.

NOTES

ALL CONCRETE SHALL BE K.D.O.T. "A" 3,500 PSI

D.G.A. (DENSE GRADED AGGREGATE) BASE SHALL BE COMPACTED PRIOR TO PLACEMENT OF CONCRETE

DRIVEWAY WIDTH REQUIREMENTS WILL DEPEND ON DRIVEWAY TYPE (SEE TABLE ABOVE).

A 1/2" EXPANSION JOINT IS REQUIRED IF DRIVEWAY MATERIAL IS CONCRETE.

ALL CONSTRUCTION SHALL BE COMPLETED IN FULL COMPLIANCE WTIH THE AMERICANS WITH DISABILITIES ACT ("ADA") AND ARCHITECTURAL AND TRANSPORTATION BARRIERS COMPLIANCE BOARD, FEDERAL REGISTER 36CFR PARTS 1190 AND 1191, ACCESSIBILITY GUIDELINES FOR BUILDINGS AND FACILITIES.

CITY OF BOWLING GREEN
PUBLIC WORKS
PLANNING AND DESIGN

STANDARD DRAWING
DRIVE ENTRANCE PROFILES
J:\DWG\DETAIL\Drive Entrances.dwg

SHEET 3 OF 3
JOB NO. ____ SCALE N.T.S. ____ DATE 1/31/05

APPENDIX B
TO
ACCESS MANAGEMENT:

REPORT ON ECONOMIC IMPACTS OF ACCESS MANAGEMENT

ECONOMIC IMPACTS OF ACCESS MANAGEMENT

A growing number of state and local transportation agencies are adopting regulations aimed at managing driveway access and incorporating raised medians into roadway projects in urban areas. The purpose of these actions is to reduce traffic conflicts, protect driver safety, and improve traffic flow on major roadways. Yet introducing a median or regulating driveway access on an existing roadway is often controversial. In particular, owners of abutting businesses often feel that their business will be adversely affected. Below is a synthesis of recent research on the economic impacts of access management to assist transportation agencies in responding to public questions and concerns.

Effects on Business Activity

Several studies were conducted in the 1990s to help fill the need for more information on the potential economic effects of access management. These studies have focused largely on the potential impacts of left-turn restrictions (median projects) on business activity, although some have also addressed changes to driveway access. Due to the proprietary nature of sales information and the variety of factors that affect business activity, analysis of this issue has been difficult. Most studies have focused on business owner perceptions of impacts, before and after case examples, or generalized comparisons of business activity across corridors. Below is a summary of available studies and findings, beginning with the most recent.

Kansas

In 1999, the Kansas Department of Transportation studied 15 businesses that had filed inverse condemnation lawsuits against the Department in the past on access related issues.[1] In nearly every case, the landowner had claimed that the applicable regulation, ranging from driveway consolidation to mainline relocation, would have devastating effects on their business and the highest and best use of their property. Some had been compensated for potential impacts. Each property was studied to determine if the economic impacts had in fact been realized. The study examined specific economic impact claims of the landowners, as well as "before" and "after" aerial photography of the involved parcels and roadways, and historical land uses for each parcel.

■ In all but one of the cases either the claimant was still in possession of the property and operating the business, the property was being used for the same use by a different operator, or the use of the property had been upgraded. The only exception was where a mainline was relocated with two gas stations remaining on the old mainline, which was converted to a frontage road. In this case, drivers had to go about 2 miles out of their way to reach the frontage road and the gas stations went out of business.

[1] Michael Rees, Tim Orrick, and Robert Marx, "Police Power Regulation of Highway Access and Traffic Flow in the State of Kansas," presentation, *79 th Annual Meeting of the Transportation Research Boar*d, Washington D.C., January 10, 2000.

- The results provide strong anecdotal evidence that except in extreme factual situations, changes in access or traffic patterns did not cause a change in the highest and best use of abutting properties.

Texas

A study of the economic impacts of left-turn restrictions was conducted for the Texas Department of Transportation in the mid-1990s. The study was intended both to identify potential impacts and to establish an assessment methodology. Researchers found that prearranged on-site interviews worked far better than telephone or mail surveys, which had very low response rates. Another suggested method was to obtain the endorsement of area Chambers of Commerce prior to approaching business owners for information. A letter of endorsement, signed by the appropriate Chamber of Commerce representative was sent to each of the business owners asking for their cooperation in the study.

Due to the sensitivity of information on business activity, researchers did not ask for sales details, but for general perceptions as to whether business activity had changed over time using ranges (e.g. better/worse/same). Information on historical property values was obtained through the use of appraisal district computers or by purchasing CDs from private companies with this information. Key findings included the following:[2]

- Perceptions of business owners before a median was installed were more pessimistic than what usually happened.
- Business owners reported no change in pass-by traffic after median installations.
- Most business types (including specialty retail, fast-food restaurants and sit-down restaurants) reported increases in numbers of customers per day and gross sales, except for gasoline stations and automotive repair shops, which reported decreases in the numbers of customers per day and gross sales.
- Most adverse economic impacts were realized during the construction phase of the median installations.
- Employment within the corridors experienced upward trends overall, with some exceptions during construction phases.
- When asked what factors were important to attracting customers, business owners generally ranked “accessibility to store” lower than customer service, product quality and product price, and ahead of store hours and distance to travel.
- About 94% of business owners reported that their regular customers were at least as likely or more likely to continue patronizing their business after the median installation.
- Along corridors where property values were studied, the vast majority of land values tayed the same or increased, with very few exceptions.

[2] Eisele, W.L., W.F. Frawley, “A Methodology for Determining Economic Impacts of Raised Medians: Data Analysis on Additional Case Studies.” *Research Report 3904*-3, Texas Transportation Institute, College Station, Texas. October 1999.

*Prepared by Kristine M. Williams, AICP, Center for Urban Transportation Research, University of South Florida, Tampa, January 28, 200*0.

Iowa

A statewide study of the effects of access management on business vitality was conducted in Iowa in 1996. [3] Before and after data were collected on a series of corridor case studies. Data were collected from a variety of secondary sources, as well as opinion surveys and field investigations. Seven projects were selected for more in-depth research, to illustrate the variety of project types, access management issues, and geographic situations across the state. Results indicated that:

- Corridors with completed access management projects performed better in terms of retail sales than the surrounding communities. Business failure rates along access managed corridors were at or below the statewide average for Iowa. Although this suggests that access management projects generally did not have an adverse effect on the majority of businesses, some businesses may have been negatively impacted.
- Eighty percent of businesses surveyed in Iowa along access managed corridors reported sales at least as high after the project was in place. Relatively few businesses reported sales declines associated with the access management project, although these business owners clearly felt that they were hurt by the project. The firms perceiving negative impacts were a mixture of business types.
- Similarly, about 80 percent of businesses reported no customer complaints about access to their businesses after project completion. Those businesses that tended to report most complaints were highly oriented toward automobile traffic.
- In all cases, 90-100 percent of motorists surveyed had a favorable opinion of improvements made to roadways that involve access management. The vast majority of motorists thought that the improved roadways were safer and that traffic flow had improved.

Florida

Two studies for the Florida Department of Transportation have addressed economic effects of median reconstruction projects. Both studies used a combination of before and after data and opinion surveys to gauge effects of the median reconstruction. The results were as follows:

- A survey of merchants on Oakland Park Boulevard in Ft. Lauderdale, Florida, was conducted after closure of several median openings and reconstruction of the raised median (Figure 1). Seventy-percent of the merchants indicated that the median changes had no adverse effect on truck deliveries, and over 60% perceived no change in business activity following the project. More than half of the merchants (57%) reported that they favored the median changes, and 80% of those traveling on the corridor favored the project.

[3] Iowa State University, Iowa Access Management Research and Awareness Project: Executive Summary, 1997.

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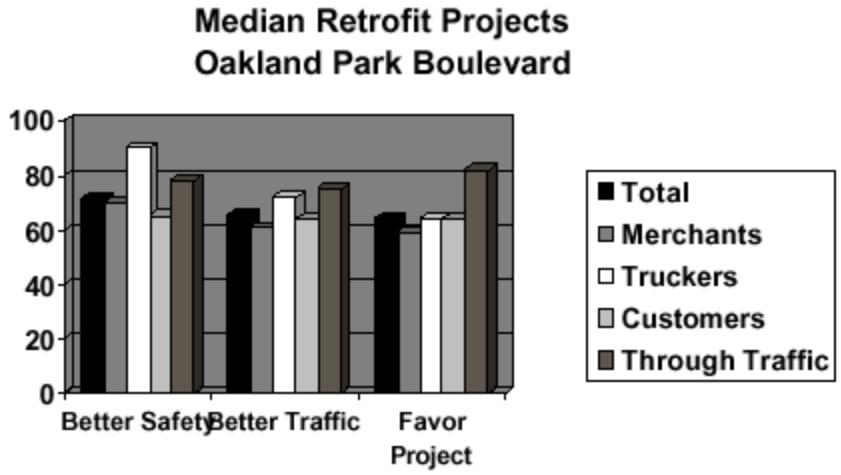

Figure 1: Opinion survey following Oakland Park Boulevard median reconstruction. Source: Florida Department of Transportation, District 4, Traffic Operations.

- Another study was conducted in the Orlando metropolitan area of drivers and business owners affected by median changes in 5 corridors.[4] The projects resulted in closure of some median openings and redesign of others to directional movements with deceleration lanes. The study involved personal surveys and relied upon attitudes toward the changes. In general, the business community had less favorable attitudes toward the project than the drivers that were surveyed. A sizeable minority of business owners surveyed (about 43%) reported that their volume of business had decreased, while the majority of business owners indicated that the value of their business was unaffected or increased (57%) and that the changes were not inconvenient to delivery trucks.

Conclusions

These results generally indicate that median projects have little overall adverse impact on business activity. Although some business report increases in sales and some report decreases, the majority of businesses report no change in business activity following a median project. Destination type businesses, such as certain restaurants and specialty stores, appear less sensitive to access changes than businesses that rely primarily on pass-by traffic, such as gas stations or convenience stores. In addition, because the likelihood of left-turns into a business declines as opposing traffic volumes increase, medians or other access changes will have less effect on the frequency of left turns into businesses on high volume roadways or during peak travel periods.

[4] Ivey, Harris and Walls, "Districtwide Median Evaluation Technical Memorandum: Corridor Land Use, Development & Driver/Business Survey Analysis," prepared for FDOT District 5, 1995.

Although medians do not appear to have a significant adverse economic impact on corridor businesses, such projects do tend to invoke anxiety among affected business owners. One solution is *direct and meaningful involvement of affected businesses in median issues.* A Florida study of public involvement in median projects found that Florida Department of Transportation District offices with a public involvement process for median projects had fewer administrative hearings and reported greater success in achieving their access management objectives than other Districts.[5] Such success was attributed to a fair and open process for responding to public concerns, including early public involvement in design decisions, as well as an open house meeting format, to provide a more personal atmosphere.
Although several studies have attempted to assess the potential economic effects of left turn restrictions, none have systematically examined the potential long-term economic benefits of access improvements. Poorly designed vehicular access not only adversely impacts the character and efficiency of a corridor, but also its economic vitality over time. Property values that have increased rapidly during commercial development tend to decline after the area is built out, if the character and efficiency of the corridor has been damaged in the process. The end result is a pattern of disinvestment as successful businesses choose other, higher quality locations. This is exemplified by the growing number of older commercial strips across the country that are now experiencing economic decline. Further research is needed to document these trends in property values over time.

[5] K. Williams, "Public Involvement in Median Projects," *Proceedings of the Urban Street Symposiu*m, Transportation Research Board, Dallas, TX, 1999. See also: *Public Involvement Handbook for Median*

Projects, Center for Urban Transportation Research, University of South Florida, Tampa, 1994 (available at www.cutr.eng.usf.edu.)

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APPENDIX C
TO
ACCESS MANAGEMENT:

LIST OF REVISIONS TO ACCESS MANAGEMENT

REVISIONS

- 2/01/03
- 11/16/04
- 05/01/05
- 06/05/06