# Access Management Guidebook for Major Arterial Intersections

Iowa Department of Transportation

IOWA ACCESS MANAGEMENT

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# ACCESS MANAGEMENT GUIDEBOOK FOR MAJOR ARTERIAL INTERSECTIONS

This guidebook is designed to help staff from the Iowa Department of Transportation (Iowa DOT), metropolitan and regional planning agencies, and other organizations both plan and design projects using effective access management techniques. This material will also assist those educating local commercial and governmental stakeholders about the importance of effective access management.

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# Overview

## Background

Iowa's roadways play a dual role in serving through vehicle traffic while also providing direct access to adjacent land and development. When access to major arterial and collector roadways—by way of driveways and minor public roads—is not effectively managed, the result is often an increase in crash rates, congestion, and delay for motorists. Access management is defined as the control of driveways and intersections to maintain safety at a roadway's full traffic carrying capacity. Research has shown access management techniques to be highly effective in improving both safety and traffic operations. In fact, research on case study routes in Iowa shows that access management projects lead to an average 40 to 50 percent reduction in crash rates. These figures are also consistent with research results in other locations across the United States. In addition, access management approaches are substantially less costly than building new facilities and can even provide considerable increases in traffic capacity and travel speed. Furthermore, the businesses and land development impacts of access management projects have been shown to be either minor or positive. Drivers and business customers prefer to drive on well-managed roadways.

## Previous Iowa Access Management Research and Outreach Projects

Research in Iowa and elsewhere has shown access management to be highly effective in increasing highway safety and improving traffic operations. This guidebook supplements several previous documents produced as a result of research conducted in Iowa since the late 1990s. Iowa's access management documents and products include

- Access Management: A Review of Recent Literature
- Access Management: Current Policies and Practices in Iowa
- Access Management Awareness Program Phase II Report
- Access Management Awareness Program Phase III Training Materials
- Access Management Awareness Program Phase IV Report
- Access Management Handbook
- Access Management Toolkit: Answers to Frequently Asked Questions
- Access Management and Corridor Management One-Day Workshop

Many of these materials are readily available online at www.intrans.iastate.edu. In addition, much more information on access management, including the Transportation Research Board *Access Management Manual*, can be found at www.accessmanagement.info. Although the previously produced Iowa-based materials have been well-received and used extensively throughout the state, the need for additional materials focused on specific access-related issues at major arterial intersections was identified by the Iowa Department of Transportation (Iowa DOT). As a result, this guidebook was developed with assistance from an advisory committee as a resource for the planning and design of access at and around major intersections.

# Overview

## Purpose of This Document

While access management is an important issue for many roadways across the state, a particularly important situation occurs where two major arterial roadways meet. This, for example, would occur when a primary expressway meets with a state highway or with a higher-volume farm to market road. These "crossroads" locations are often important in terms of local and regional traffic and are also attractive locations for commercial activities that depend on market accessibility, highway traffic, and high visibility. These intersections are also where traffic crashes are more likely to happen, simply due to higher overall traffic volumes. Commercial businesses such as fueling stations, convenience stores, retail "strip" developments, big box retailers, and motels find such locations especially attractive and generally want access to be as direct as possible for their customers. Nonetheless, if access is not carefully managed at these locations, the resulting situations can compromise both safety and traffic operations.

Ultimately, this guidebook will assist staff at the Iowa DOT, metropolitan and regional planning organizations, and other agencies with both project planning and design. It will also assist in working with stakeholders who often need to be educated about why access management is important.

This guidebook addresses the importance of managing access at the intersections of major arterial roadways—roadways that carry higher volumes of traffic and are of a greater regional or local significance—through:

- illustrating both good and poor practices through case studies, using situations documented at major roadway intersections across the state of Iowa;
- documenting and defining the lessons learned from the case studies;
- discussing potential access management treatments such as frontage and backage roads, driveway access and median break spacing, new raised or flush medians, directional access, and alternative access from minor roadways; and
- explaining how to address potential land use, political, legal, and other issues in order to implement a chosen access management strategy.

# Case Studies

## Selection and Distribution

This guidebook explains the importance of managing access near major roadway intersections by detailing actual examples from across the state. The case studies were chosen from a list of potential locations suggested by the Iowa Department of Transportation project advisory committee and input from the research staff at the Institute for Transportation (InTrans) at Iowa State University. The selected case studies represent both good and poor examples of access management in practice. They cover a wide variety of land use situations and community sizes and characteristics from locations across Iowa.

## Format

In all, eleven case studies are detailed in this guidebook. In addition to a detailed inventory of the physical characteristics of each location, such as roadway/driveway configurations and area land use, investigation of these case studies included analysis of traffic operations and crash data. Each case study includes

- a description of the broader community characteristics;
- a description of the specific case study "intersection" area, including roadway types and traffic volumes;
- a description of basic roadway geometrics and the location of access points in the area;
- a description of local land uses and business types;
- a description of any unique characteristics of the case study;
- a summary of positive and negative aspects of the access treatments, or lack thereof, at the case study location, including analysis of crashes indicative of access-related safety concerns; and
- a diagram of the case study location overlaid on aerial photography, which includes details of local roadway and land use characteristics.

The locations of case studies are not specifically identified. This has been done purposefully. Invariably, all cases contain examples of both good and poor access management practices. The case studies are provided to help identify typical state of the practice in Iowa in terms of access management. Photos of locations may be several years old, as they were chosen to provide examples of good and poor practice. This, in turn, helps develop more formal approaches for access management.

# Case 1

## Background

The first case study is located at the at-grade intersection of a state highway and a local major arterial roadway in a rapidly growing suburb of one of Iowa's largest metropolitan areas. This location is also within one of the community's largest commercial shopping areas. In addition, this study intersection is less than ¼ mile west of a grade-separated freeway interchange with the aforementioned state highway, as shown in Figure 1.

## Roadway and Land Use Characteristics

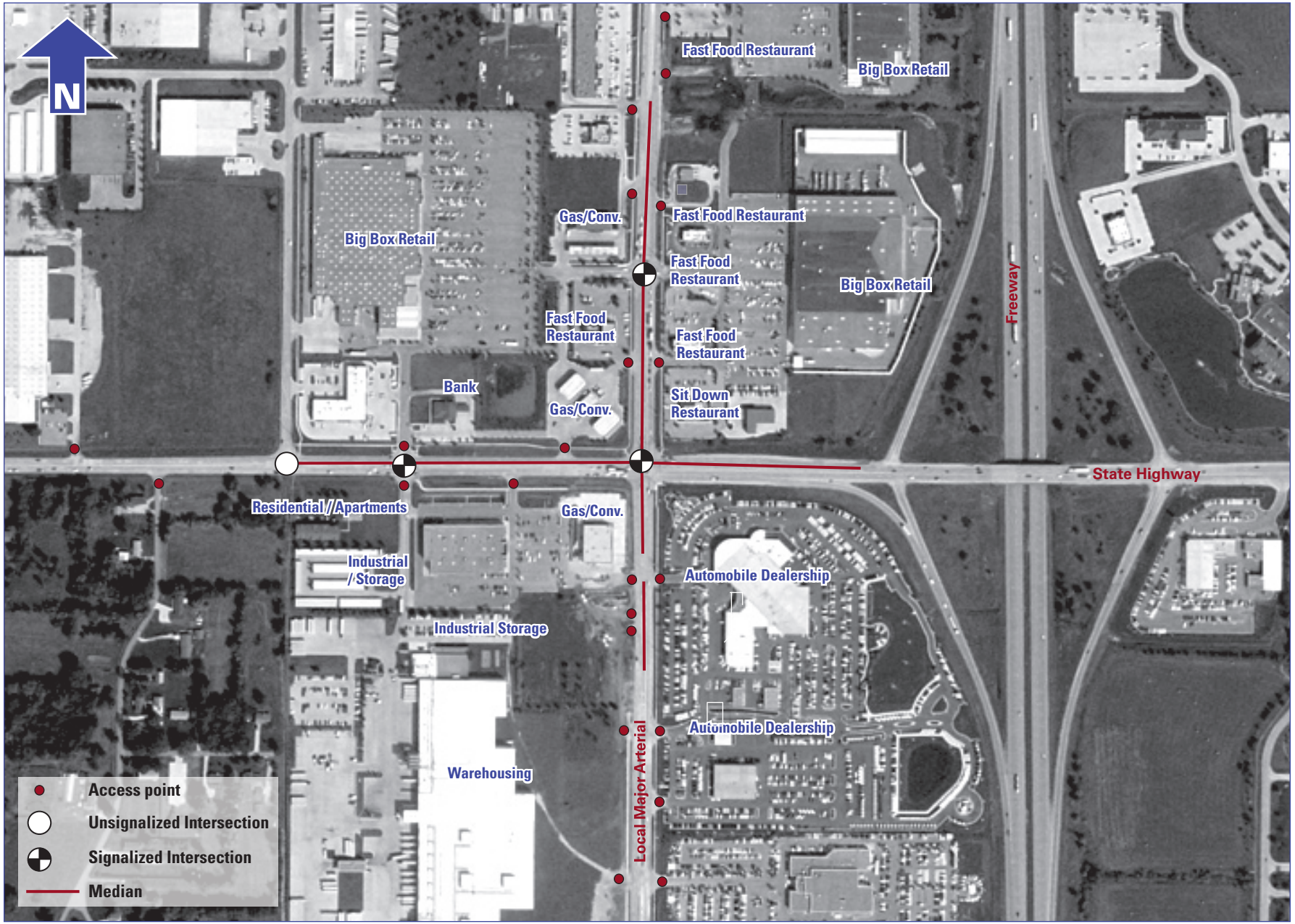
The crossroads intersection at the center of this case study is signalized. Traffic volumes on the east-west state highway vary between approximately 20,600 vehicles per day (VPD) west of the intersection to nearly 28,000 VPD to the east near the freeway. Volumes on the north-south local arterial vary from approximately 8,400 VPD south of the intersection to nearly double this to the north. Both roadways are four-lane divided facilities, with median breaks at several access points. The east, west, and north legs have a posted speed limit of 35 mph. The speed limit changes to 45 mph along the west leg about ¼ mile from the study intersection. The south leg speed limit is posted at 45 mph. As shown in Figure 1, there are a variety of land uses within the study area. The uses include big box retailers, auto dealerships, a few gas station/convenience stores, and a number of both sit-down and fast-food restaurants. Besides commercial uses, the southwest quadrant of the intersection is largely made up of warehousing and light industrial uses.

## Access Characteristics

For the most part, access is well-managed at this study location. The high-volume east leg of the intersection is completely access-controlled as it provides access to and from the southbound lanes of the nearby freeway. South of the intersection, where traffic volumes are relatively low, there are two access points into an auto dealership approximately 400 and 800 feet from the intersection. Four accesses—one located across from the northernmost driveway to the auto dealership, two right-in, right-out accesses located very close together about 600 feet from the intersection, and another located across from the southern driveway to the auto dealership—serve development on the west side of this south leg. To the west, right-in, right-out only access is provided on both the north and south sides of the state highway at approximately 300 and 500 feet from the intersection, with a full unsignalized intersection about 900 feet west of the signalized intersection. The north leg of the case study is the most densely developed, with several businesses in close proximity to the case study intersection. Right-in, right-out only accesses serve both sides of the roadway approximately 400 feet north of the intersection. A full signalized access just 300 feet farther north serves a large portion of the development on both sides of the corridor.

Furthermore, this development utilizes backage roads and cross access between several businesses, as can be seen in Figure 1. Additional right-in, right-out access points are found on the east side of the north leg approximately 950 feet north of the intersection and on the west side just 50 feet farther north.

*Figure 1. Case Study 1*



## Observations

As previously noted, access is generally well-managed at the first case study location, but both positive and negative observations can be made. Positive applications of access management here include the following:

+ Use of raised medians throughout the study area to delineate travel lanes and remove most left turns from the through traffic stream;
+ Restriction of all direct driveway accesses along the very high-volume east leg;
+ Use of left-turn bays at signalized intersections on the high-volume north and west legs;
+ Alignment of driveways across from each other at full-access (median break) locations;
+ Consolidation of access for several businesses into relatively few access points; and
+ Use of backage roads and cross access between land uses to improve on-site traffic circulation off the main roadways.

Although this case study site is generally well-managed, there are a few possible areas of improvement at this location. Negatives for this case study, as well as possible remedies, include the following:

– Relatively high driveway density on the south leg—driveways on the west side of the road could be eliminated or consolidated and the two auto dealership accesses could be consolidated farther from the intersection;
– Relatively short distance from the study intersection to the first driveways on the west leg—the easternmost driveway on the south side could be relocated farther west or consolidated to provide for better operations of the nearby left-turn bay; and
– Lack of connectivity between development on the northeast quadrant and development directly to the north—cross access (providing direct internal roadway/driveway connections between adjacent parcels) could be provided, eliminating need for traffic using the arterial to access between adjacent, similar developments.

In fact, the city where this case study is located has recently been addressing access issues as this area continues to develop by moving the first driveway on the south side of the west leg farther west and providing new cross access between development in the northeast quadrant and the development directly to the north.

In summary, this case study demonstrates generally good access management practice. In fact, the access management techniques utilized at this location appear to have had a positive effect on safety. When analyzing crash data, it was found that, traditionally, access-related crashes are relatively rare in this area. Nonetheless, as with many locations, access management improvements could still be made, especially as traffic volumes increase with further development.

# Case 2

## Background

The second case study is centered on the intersection of two U.S. highways at the edge of one of Iowa's smaller metropolitan areas. The location is also within one of the community's major commercial areas. The two highways at the center of this case study meet at a partial cloverleaf interchange with major intersections approximately ¼ mile to both the north and south, as shown in Figure 2.

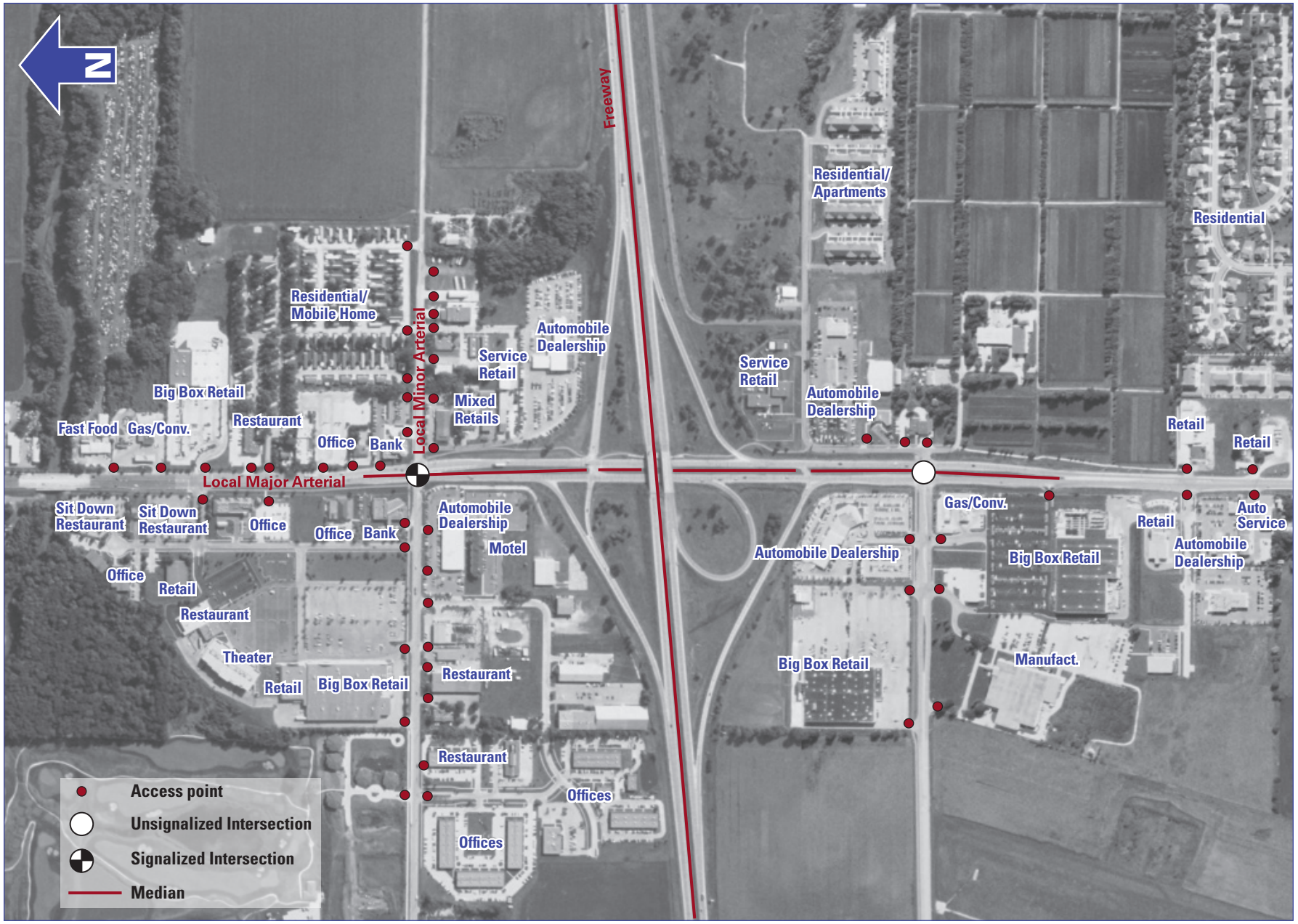
## Roadway and Land Use Characteristics

At this interchange, the north ramp terminal is signalized, as are the intersections just to the north and to the south. Traffic volumes on the east-west U.S. highway range from approximately 20,700 vehicles per day (VPD) west of the interchange to nearly 26,000 VPD to the east. Volumes on the north-south U.S. highway vary from approximately 20,600 VPD south of the interchange to approximately 25,600 VPD between the interchange and the next intersection, which is with a local minor arterial, to the north. Volumes on this highway north of the east-west minor arterial are approximately 23,000 VPD. Volumes on the local minor arterial vary from approximately 7,800 VPD west of the intersection to less than 1,000 VPD to the east. The east-west highway is a grade-separated freeway design throughout the study area. The north-south highway is an at-grade four-lane divided facility in the vicinity of the interchange, but changes to a two-lane facility approximately ½ mile to the south and to a five-lane (four-lane plus a center two-way left-turn lane) facility about ¼ mile north of the interchange. The east-west highway has a posted speed limit of 65 mph. The north-south highway is posted at 40 mph around the interchange but changes to 35 mph about ½ mile north of the interchange. As shown in Figure 2, a variety of land uses has developed and continue to develop around this interchange. These uses include several auto dealerships, a hotel, several sit-down and fast-food restaurants, big box retailers, gas station/convenience stores, a movie theater, various strip-development retailers, banks, and office space.

## Access Characteristics

Access is well-managed throughout much of this area. The east-west highway is a freeway design and, by definition, is completely access-controlled. The four-lane divided southern leg is well-managed, with access limited to intersections and a few right-in, right-out only accesses more than ¼ mile from the interchange. The southern leg does taper to a two-lane roadway as it transitions to primarily residential development and has more access points over ½ mile from the interchange. The northern leg of this case study intersection is an example of both good and poor access management. The west side of the high-volume north leg is well-managed. All development north of the interchange and south of the minor arterial accesses onto the east-west minor arterial, which is a good practice.

*Figure 2. Case Study 2*



Access to development in the northwest quadrant of the study area north of the minor arterial—which includes several restaurants, small offices, big box retail, and a movie theater—is very well-managed. Access to this development is provided onto the minor arterial approximately 400 feet west of the intersection with the north-south major arterial and at a signalized access more than 1,100 feet north of this same intersection and nearly 2,400 feet north of the interchange. Backage roads and cross access between parcels provides internal circulation for the variety of land uses in this area. In contrast, access along the east side of this portion of the major arterial is poorly managed, with a total of nine accesses along the same traveled way served by the single access on the west side. These access points are located at distances approximately 200, 350, 500, 675, 800, 900, 1,100 (the signalized access/intersection), 1,400, and 1,600 feet north of the intersection with the east-west minor arterial. In addition, very little internal circulation or cross access is provided for development on this east side.

## Observations

Access is relatively well-managed throughout most of the second case study location, with the east side of the north leg as a notable exception. This area continues to grow as a local and regional commercial activity center. As a result, traffic volumes on the roadways discussed in this case study will most likely continue to rise significantly in coming years. Other planned development and transportation improvements in the adjacent areas also indicate that this trend will continue. Therefore, as the character of the local area changes, additional management of access may likely be necessary, especially along the north leg where the access density is high. Based on development trends and traffic-volume growth, a raised median may be necessary along this leg in the near future. Future development in this and adjacent areas may also increase traffic on the east-west minor arterial, calling for additional applications of access management along this roadway.

In summary, positive applications of access management in and around this case study location include the following:

+ Use of grade separation at the intersection of two major highways;
+ Use of raised medians near the interchange and to the south to delineate lanes and eliminate left turns;
+ Use of two-way left-turn lanes to remove left turns from the traffic stream on the north leg, although this stretch may be reaching its functional limits;
+ Restriction of all driveway accesses along the west side of the high-volume north leg;
+ Use of protected left turns and turn lanes at signalized intersections on the high-volume north and south legs;
+ Elimination of direct access from the majority of the south leg;
+ Consolidation of access for land uses on the west side of the north leg into a minimal number of access points; and

+ Use of backage roads and cross access between land uses to improve internal traffic circulation for the development in the northwest portion of the study area and ultimately remove traffic from the high-volume north leg.

Although well-managed in some areas, there are needed areas of improvement at this site. Negatives for this case study, as well as possible remedies, include the following:

– Very high driveway density on the east side of the north leg, north of the east-west minor arterial—driveways on the east side of the road could be consolidated and/or cross access used to connect properties and businesses in this area;

– The first access drive/frontage east of the intersection of the minor arterial and major arterial is very close to the intersection—alternative access could be provided farther east or left turns could be restricted at this point;

– Access density along the minor arterial is relatively high and could become problematic if traffic increases—driveways could be consolidated and/or cross access used to connect properties and businesses in this area; and

– The north leg is nearing its capacity and its traffic volumes are increasing. Although two-way left-turn lanes are an effective access management technique, they become less safe as volumes increase to around 20,000 VPD.

In summary, this case study demonstrates both good and poor access management practice. An analysis of crash data shows few access-related crashes throughout most of the study area, but the north leg does show significantly more access-related crashes. This problem on the north leg further indicates a problem with a combination of high access density and a treatment reaching its functional limits. Therefore, improvements can and will likely need to be made as traffic volumes increase with any future development.

# Case 3

## Background

The third case study is centered on the at-grade intersection of a U.S. highway and a local major arterial near the heart of another small metropolitan area. This location is also at the intersection of two of the area's densest commercial corridors. Furthermore, these two roadways intersect very close to a high-volume at-grade railroad crossing, as shown in Figure 3.

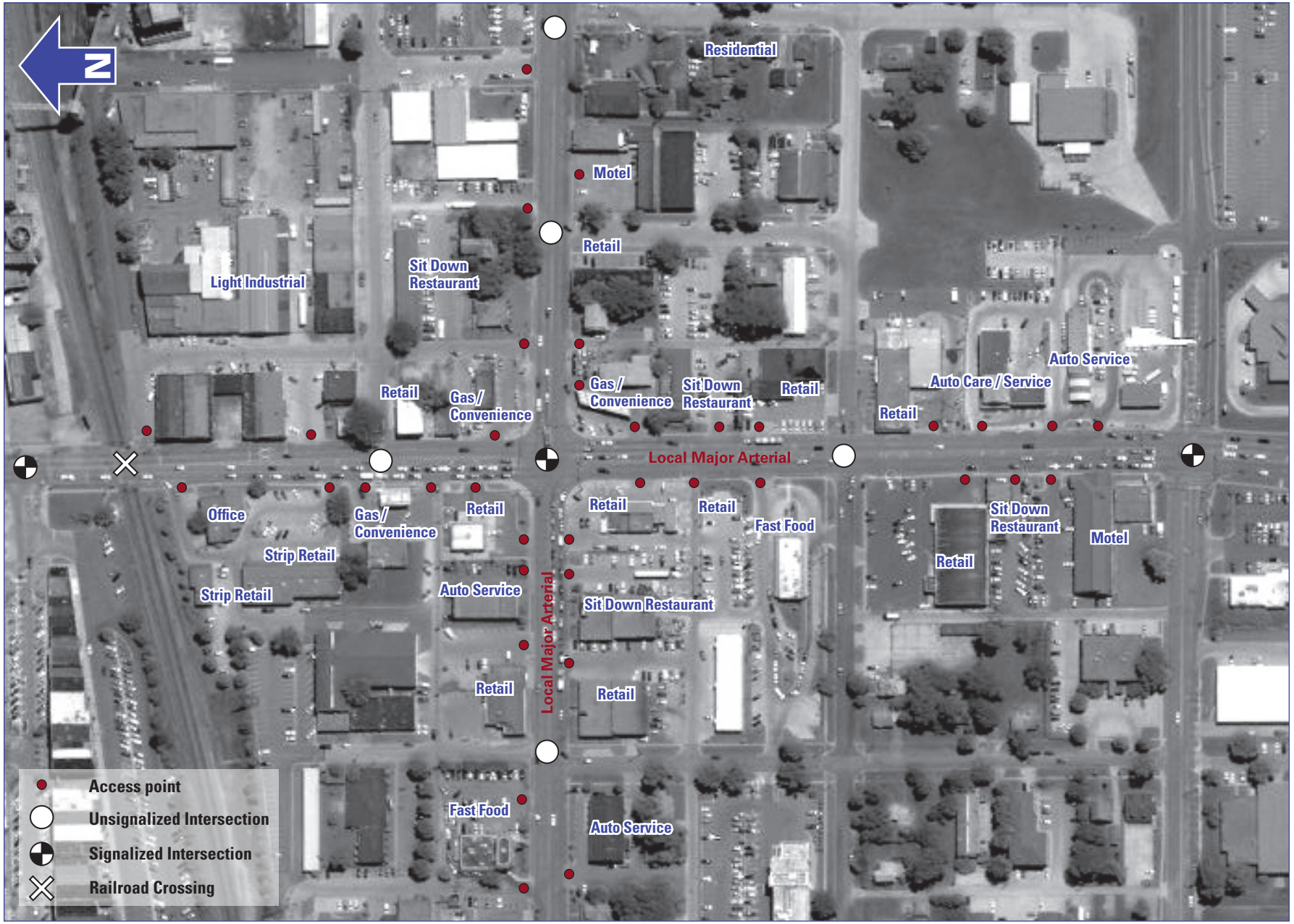
## Roadway and Land Use Characteristics

The intersection at the center of this case study is signalized. Traffic volumes on the east-west arterial vary between approximately 14,000 vehicles per day (VPD) west of the intersection to nearly 13,000 VPD to the east. Volumes on the north-south leg vary from approximately 21,000 VPD south of the intersection to 16,000 VPD to the north. Both roadways are four-lane facilities. The north-south highway has a center two-way left-turn lane, while the east-west roadway does not have any dedicated turn lanes. The speed limit on the west and south legs of the intersection are posted at 30 mph, while the east leg is posted at 35 mph. The speed limit on the north leg transitions from 30 mph around the intersection to 25 mph about 400 feet north of the intersection. As shown in Figure 3, there are several different land uses within the study area. Businesses include several gas station/convenience stores, various commercial/retail stores, car care/service-oriented businesses, motels, and a number of both sit-down and fast-food restaurants. In addition to these land uses, the northeast and northwest quadrants of the intersection also contain some light industrial uses.

## Access Characteristics

Overall, access is very poorly managed throughout this case study location. Specifically, the high-volume western leg of this study intersection lacks any significant access control, with nearly a dozen access points located within 750 feet of the intersection. On the higher-volume south leg, even though there is a center left-turn lane provided, there are numerous access points along each side, starting less than 150 feet from the intersection. To the east, several more accesses can be found on both sides of the roadway, beginning at 175 feet from the intersection and again every 100 to 150 feet thereafter. The northern leg of the case study is bisected by a high-volume railroad line approximately 650 feet north of the intersection. In addition, there are several access points between the intersection and the railroad crossing. Most of the development north of the study intersection also accesses onto alleys and minor local roads, but many of the connections between parcels are somewhat circuitous and these connections are underutilized, as shown in Figure 3.

*Figure 3. Case Study 3*



## Observations

Overall, access is very poorly managed at the third case study location. However, a couple positive applications of access management can be seen at this location:

+ Use of left-turn lanes on the north and south legs, and
+ The existence of alleys and minor local roads in portions of the study area that could potentially improve internal traffic circulation for area development.

There are many potential areas of improvement at this location. Negatives for this case study, as well as possible remedies, include the following:

– Relatively short distance from the intersection to the first driveways on all legs and, overall, too many driveway accesses—consolidation of access points could reduce turning traffic delays and conflicts;
– Poor internal circulation—introduction of better cross access could redirect traffic to signalized intersections;
– Lack of left-turn lanes along east-west arterial—better utilization of alleys and minor supporting roadways and/or addition of left-turn lanes or a raised median could reduce turning traffic delays and conflicts; and
– Lack of raised medians to reduce left turns throughout the study area—addition of a median would delineate travel lanes and eliminate most left turns from the traffic stream.

An analysis of crashes at this location clearly indicates access-related safety issues. In summary, this case study demonstrates overall poor access management practice. Access management could greatly improve traffic operations and safety at this location.

# Case 4

## Background

The fourth case study is located around the at-grade intersection of a U.S. highway and a local major arterial in another rapidly growing suburb of a large metropolitan area. This location is also adjacent to a regional amusement park that sees high seasonal traffic volumes, plus the study intersection is less than ¼ mile south of a freeway interchange with the aforementioned U.S. highway, as shown in Figure 4.

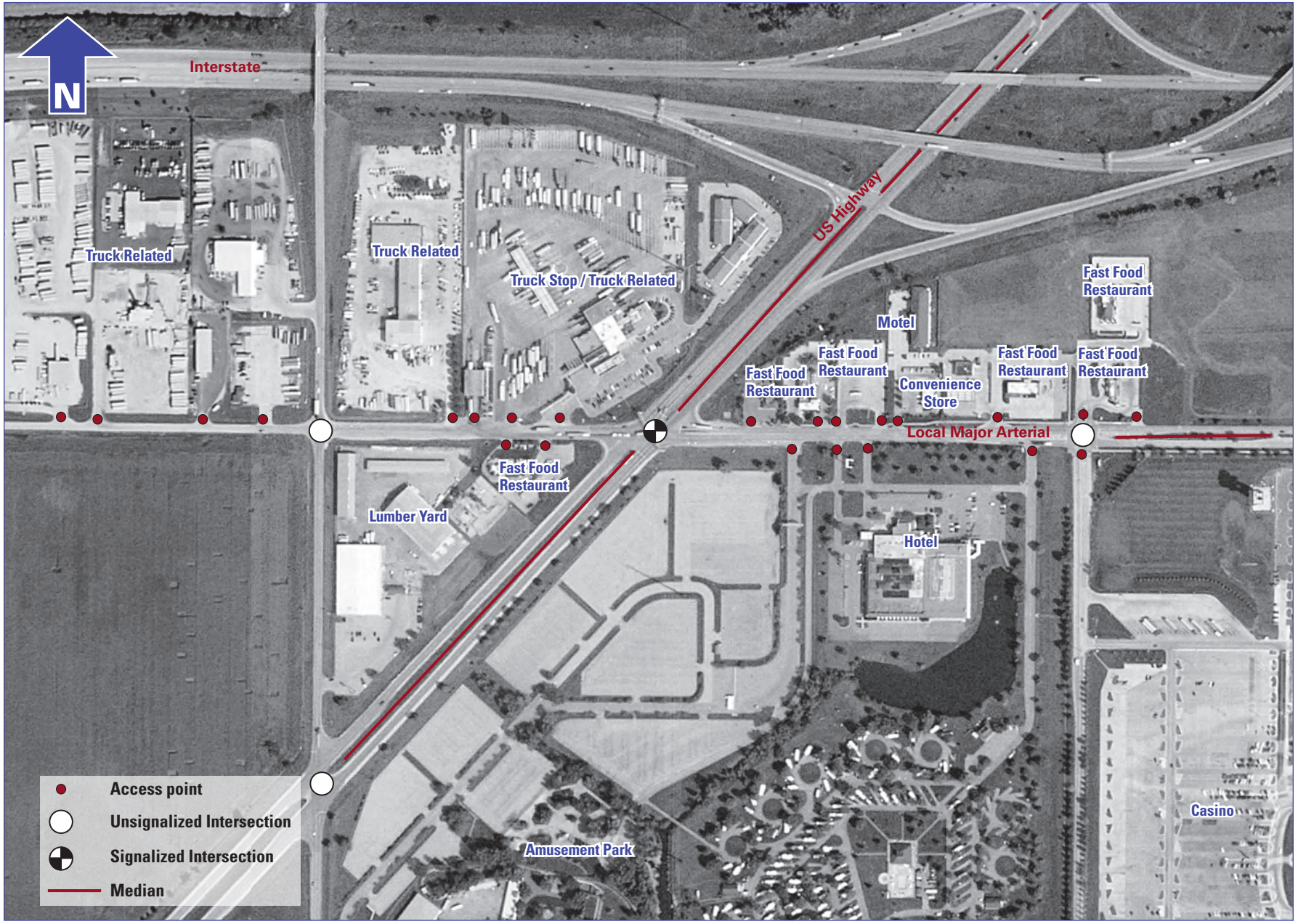
## Roadway and Land Use Characteristics

The intersection at the center of this case study is signalized. The interchange ramp terminals north of this intersection are also signalized. Both the north-south highway and east-west arterial are four-lane facilities, with the highway divided by a depressed median. The east-west arterial is a simple four-lane cross-section without turn lanes at and near the study intersection, but approximately ¼ mile east of the study intersection, the arterial is divided by a raised median with left-turn bays. Traffic volumes on the north-south highway vary from approximately 15,100 vehicles per day (VPD) north of the intersection to just under 9,000 VPD to the south. Volumes on the local minor arterial vary from approximately 6,000 VPD on the west leg to nearly 13,000 VPD to the east. Traffic volumes on the freeway range from approximately 50,000 VPD west of the interchange to nearly 36,800 VPD to the east. The east-west arterial has a posted speed limit of 35 mph throughout the study area. The highway is posted at 50 mph south of the signalized intersection, but the speed limit changes to 45 mph to the north as it approaches the freeway interchange. As shown in Figure 4, varieties of land uses have developed and continue to develop around this interchange. These uses include several sit-down and fast-food restaurants, a lumber yard, gas station/convenience stores, a large truck stop, several trucking-related service businesses, and the previously mentioned regional amusement park.

## Access Characteristics

Access is well-managed along the northern and southern legs of this study location, with this U.S. highway completely access-controlled through the use of medians and restriction of driveways. All access to adjacent land uses is provided from the local major arterial and the supporting roadway network. A total of six accesses are located along the west leg of the arterial within 700 feet of the study intersection. These busy accesses serve the large truck stop, several trucking-related businesses, and a fast-food restaurant. The east leg of the minor arterial also contains numerous access points beginning only about 300 feet from the intersection. There are eleven accesses within the first ¼ mile east of the study intersection, all of which see significant activity during the summer months. As shown in Figure 4, most of these accesses are located along the north side of the roadway and serve several fast-food restaurants, a convenience store, and a motel. In all, four separate drives serve the amusement park along the south side of the roadway.

*Figure 4. Case Study 4*



## Observations

This case study demonstrates both good and poor management of access; therefore, both positive and negative observations can be made. Positive applications of access management here include

+ Use of raised medians on the north and south legs to delineate travel lanes and eliminate left turns;
+ Restriction of all driveway accesses along the north-south highway; and
+ Use of protected left turns and turn lanes at signalized intersections.

As noted above, there are areas of possible improvement at this location. Negatives for this case study, as well as possible remedies, include

– Relatively high driveway density on the west leg of the local major arterial—driveway accesses to the truck stop and trucking-related businesses could be consolidated. Internal circulation or cross access could be improved to reduce conflicts;
– Relatively short distance from the study intersection to the first driveways on the east leg—the western-most driveways on this leg could be consolidated and aligned to provide for better operations of the nearby intersection;
– High driveway density on the east leg of the minor arterial—the driveways to the businesses on the north side of the road could be consolidated, as could drives to the amusement park along the south side;
– Lack of internal circulation and connectivity between businesses on the north side of the east leg—alternative access ways and cross access could be provided, eliminating the need for traffic using the arterial to access between adjacent developments;
– Lack of left-turn lanes along the east-west arterial—better utilization of minor supporting roadways and/or addition of left-turn lanes or a raised median could reduce conflicts, especially during peak season for the amusement park; and
– Discontinuous access treatments along the east leg—addition of turn lanes or a raised median could provide a more uniform roadway and ultimately reduce conflicts.

An analysis of crashes at this case study location shows a clear difference between the U.S. highway and the local major arterial. While the highway traditionally shows few access-related crashes, analysis of the major arterial clearly indicates access-related safety issues, especially along the east leg. In summary, this case study demonstrates both good and poor access management practice. In general, removal of all access from the north-south highway is a positive measure. Unfortunately, as development has increased in the area, access along the east-west arterial has not been well-managed, especially considering the high volume of left turns in this area. Improvements can and will likely need to be made to improve operations and safety in the future.

# Case 5

## Background

The fifth case study is located at the intersection of a U.S. highway and a local major arterial roadway in a suburb of a large metropolitan area. These two roadways meet at a split diamond interchange. In addition, the U.S. highway intersects a state highway at the other end of this interchange just ¼ mile farther north, as shown in Figure 5. Together, these three roadways are situated at what is one of the community's newest and fastest growing commercial and retail shopping areas.

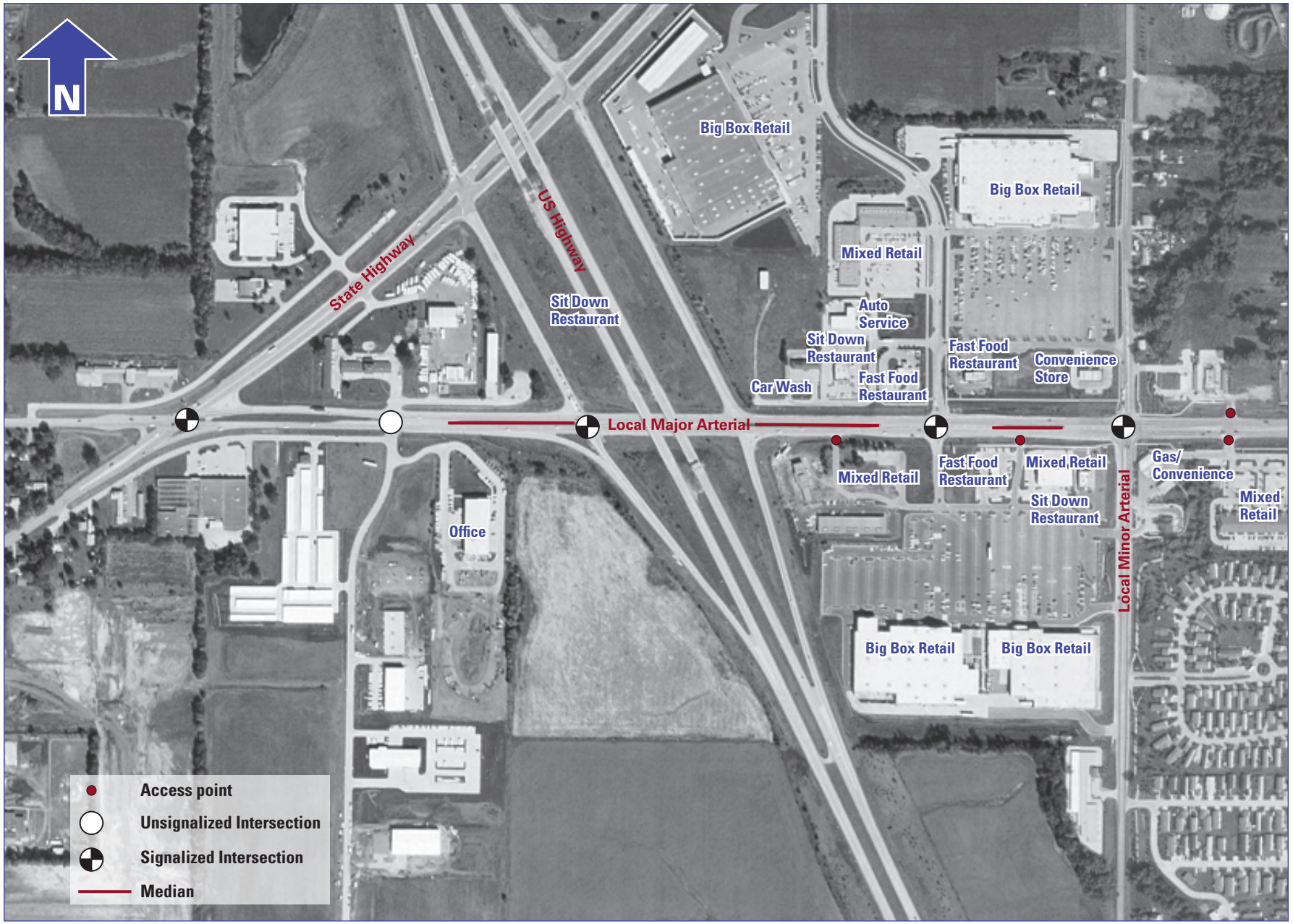
## Roadway and Land Use Characteristics

The four ramp terminals along the interchange are all signalized, as are the two intersections directly to the east along the local arterial and the intersection of the arterial and the state highway west of the study interchange. The east-west arterial is an at-grade four-lane divided facility, while the U.S. highway is a grade-separated freeway design. The state highway is a four-lane facility divided by a depressed median. Traffic volumes on the north-south U.S. highway are approximately 24,300 vehicles per day (VPD) around the study intersection, while volumes on the east-west arterial range from about 13,400 VPD west of the interchange to approximately 19,000 VPD between the interchange and an intersection with a local minor arterial about ¼ mile farther east. Volumes east of this point increase to about 22,000 VPD. Volumes on this minor arterial are approximately 5,000 VPD to the north of the major arterial and 7,900 VPD to the south. Traffic volumes on the state highway are approximately 8,100 VPD. The U.S. highway has a posted speed limit of 65 mph in this area. The east-west arterial is posted at 45 mph, while the state highway is posted at 50 mph throughout the study area. The local minor arterial and local collector that serve development in this area and intersect the major arterial are both posted at 35 mph. As shown in Figure 5, there are a variety of land uses located within the study area. The uses include several big box retailers, a few gas station/convenience stores, mixed retail, and a number of both sit-down and fast-food restaurants. Besides these commercial uses, the eastern leg of this study areas leads to a large residential area.

## Access Characteristics

Overall, access is well-managed at this study location. The north-south freeway is completely access-controlled, while the state highway is well-managed through the use of medians and minimal access points. The east-west arterial has also been well-managed. To the west of the study intersection, access has been controlled with the use of medians and dedicated left-turn lanes at the ramp terminal, the signalized intersection with the state highway, and an unsignalized minor street access that serves both sides of the roadway approximately 1,000 feet west of the interchange. To the east, access is restricted to signalized intersections and two right-in, right-out only accesses located on the south side of the road approximately 400 and 1,200 feet east of the interchange ramp terminus.

*Figure 5. Case Study 5*



This eastern leg provides access to a significant amount of development both north and south of the roadway. The local minor arterial and collector roadways that intersect this major arterial provide the direct access to the individual businesses and other developments in the area.

## Observations

As noted, access is well-managed at this case study location. Positive applications of access management here include

+ Use of grade separation at the intersection of two major roadways;
+ Use of raised and depressed medians throughout the study area to delineate travel lanes and remove most left turns from the through traffic stream;
+ Restriction of all driveway accesses along the U.S. highway and much of the state highway;
+ Limitation of direct driveway accesses along the major arterial and state highway;
+ Use of dedicated left-turn bays at signalized intersections, as well as some minor street accesses, throughout the study area;
+ Alignment of driveways across from each other at full-access (median break) locations;
+ Use of minor supporting roadways and cross access between land uses to provide direct access and to improve internal traffic circulation;
+ Consolidation of access for several businesses into relatively few access points; and
+ Use of continuous two-way left-turn lanes along the minor arterial and collector roadways providing direct access to development.

Although this example is well-managed, there are possible areas of improvement at this location. A negative for this case study, as well as its possible remedy, includes

– Relatively short distance from the interchange to the first signalized intersection on the east leg—relocating the signalized intersection farther east could reduce backup along the major arterial.

Analysis of crashes at this location indicates that the access management techniques utilized appear to have had a positive effect on safety. Traditionally, access-related crashes are rare here. In summary, this case study demonstrates good access management practice. Nonetheless, as with many locations, access management improvements could still be made, especially as traffic volumes increase as development grows.

# Case 6

## Background

This case study is located at the intersection of an Interstate highway and a U.S. highway in a suburb of a large metropolitan area. The two roadways meet at a diamond interchange with intersections located approximately ¼ mile to both the east and west, as shown in Figure 6. This location is also part of the metropolitan area with significant residential growth. As a result, the east-west U.S. highway has become a major commuting route in recent years.

## Roadway and Land Use Characteristics

At this interchange, both the east and west ramp terminals are signalized, as are the intersections to the east and to the west. Traffic on the north-south Interstate averages nearly 97,000 vehicles per day (VPD). Volumes on the east-west highway vary between approximately 39,200 VPD west of the interchange and more than 30,000 VPD to the east. While the Interstate is a grade-separated freeway design, the U.S. highway is a four-lane divided facility with median breaks at signalized intersections throughout the study area. The freeway has a posted speed limit of 65 mph, and the east-west highway is posted at 50 mph. As shown in Figure 6, land uses in this area include a truck stop, hotels, auto dealerships, big box retail, office space, restaurants, a regional tourist attraction, and a mix of other retail and warehousing uses.

## Access Characteristics

Overall, access is well-managed at this case study location. The Interstate is completely access-controlled, while the U.S. highway is well-managed through the use of medians, turning lanes, and minimal access points. To the west of the interchange, a continuous raised median is found along the arterial throughout the study area, with median breaks at the west interchange ramp terminal and at an intersection approximately 1,000 feet farther west. Both of these access points are signalized, as noted before. The westernmost intersection provides access for all land development in the southwest quadrant of the study area, which includes a large truck stop and a big box retail store. Other supporting roadways/drives connect to the single access and serve these businesses. No other access is provided within 2,000 feet west of the interchange. Similar access treatments are found to the east of the interchange. A median is used along the arterial, with median breaks at the signalized east interchange ramp terminal, at a signalized intersection approximately 1,200 feet farther east, and at an unsignalized intersection another 1,700 feet farther east. In addition, the median transitions from a raised median to a wider depressed median between the latter two intersections. Development north of this leg is served by a frontage road that connects the hotels, restaurant, and tourist attraction to both access points mentioned above. South of the east leg, development is served by a similar frontage road and supporting road system connecting the two accesses to development in the study area and farther south.

*Figure 6. Case Study 6*

## Observations

As noted, access is largely well-managed at this case study location. Positive applications of access management here include

+ Use of grade separation at the intersection of two major highways;
+ Use of raised or depressed medians throughout the study area to delineate travel lanes and remove most left turns from the through traffic stream;
+ Consolidation of access into relatively few access points;
+ Use of protected left turns and turn lanes at signalized intersections on the east and west legs; and
+ Use of supporting roadways, frontage roads, and cross access between land uses to improve on-site traffic circulation off the main roadways.

A few possible areas of improvement at this location do exist. Negatives for this case study, as well as possible remedies, include

– Lack of connectivity between development on the northeast quadrant and development directly to the east—cross access could be provided, eliminating the need for traffic using the arterial to access between adjacent, similar developments;
– Lack of connectivity between development on the southeast quadrant and development directly to the east—cross access could be provided, eliminating the need for traffic using the arterial to access between adjacent, similar developments; and
– Close proximity of the south frontage road along the east leg to the U.S. highway could cause backups at the signal both along the arterial as well as the frontage road—a backage road could eliminate traffic backups.

In summary, this case study demonstrates good access management practice. Nonetheless, as with many locations, access management improvements could still be made, especially as traffic volumes increase as development grows.

# Case 7

## Background

The seventh case study is located around the intersection of an Interstate and a state highway at the edge of a large metropolitan area. The two roadways meet at a grade-separated partial cloverleaf interchange, as shown in Figure 7. This location is also in an area of significant new development. As a result, in recent years, the state highway has become a major commuting route to and from area suburbs.

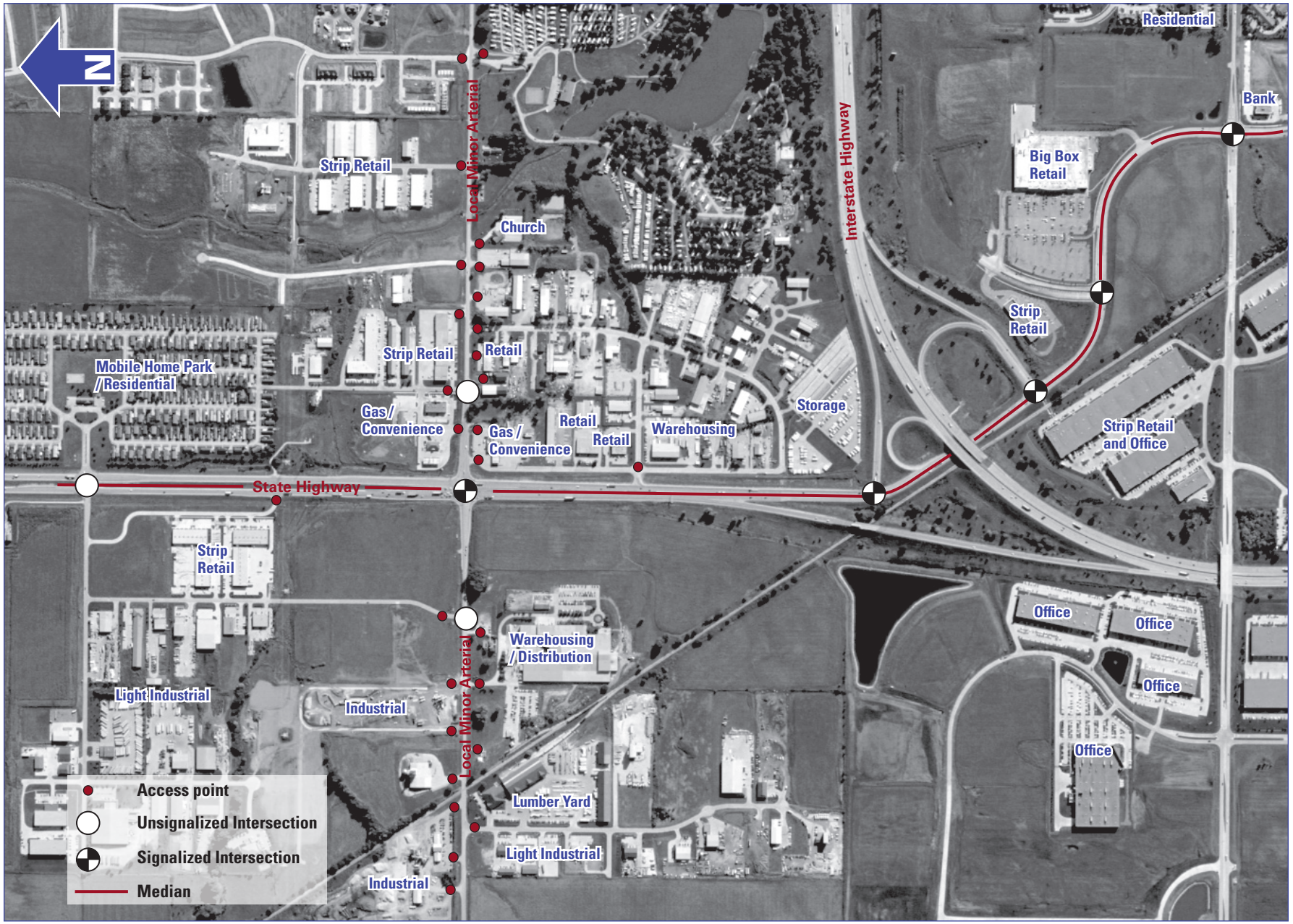
## Roadway and Land Use Characteristics

At this interchange, both ramp terminals that handle traffic exiting the Interstate are signalized. Other intersections along the state highway are signalized as well. South of the interchange, traffic signals can be found approximately 850 feet to the south at the entrance to a retail development and another 1,700 feet farther south at an intersection with a local major arterial. To the north, in addition to the ramp terminal, there is another signalized intersection with a local minor arterial approximately ½ mile north of the interchange. Traffic volumes on the Interstate are around 85,800 vehicles per day (VPD) in the study area, while volumes on the state highway vary between nearly 27,000 VPD on the north end of the study area to more than 31,000 VPD just north of the interchange. Traffic volumes on the east-west local minor arterial north of the interchange are approximately 5,000 VPD. While the Interstate is a grade-separated freeway design, the state highway is a four-lane divided facility with median breaks at major intersections. The minor arterial is a two-lane cross-section. The freeway has a posted speed limit of 65 mph, while the speed limit on the state highway is 50 mph near the interchange and 55 mph near the northern edge of the study area. The aforementioned minor arterial is posted at 35 mph through and around the intersection with the state highway. As shown in Figure 7, local land use includes warehousing, big box and strip retail, gas station/convenience stores, office space, banking, and several industrial and light industrial uses.

## Access Characteristics

While access is well-managed in parts of this study area, it has not been well-managed in others. South of the interchange, access along the state highway is limited to primarily signalized intersections, with two other limited accesses present. Further access to the nearby development is provided off of an east-west local major arterial. North of the interchange, access is provided at one right-in, right-out intersection approximately ¼ mile north of the interchange at the signalized intersection with the local minor arterial 1,200 feet farther north, at access points on both sides of the highway another 1,300 feet north, and at an unsignalized intersection 1,300 feet beyond this to the north. As shown in Figure 7, most of the development along the state highway also accesses onto the local minor arterial. Access along the local minor arterial west of the state highway is relatively well-managed, with the first driveway access set back about 850 feet from the intersection with the state highway.

*Figure 7. Case Study 7*



East of the highway, several access points are found within 1,000 feet of the intersection, including a frontage road along the state highway that meets the minor arterial very near the state highway. In addition, very little internal circulation or cross access is provided for development on the south side of the minor arterial.

## Observations

This case study demonstrates both good and poor management of access; therefore, both positive and negative observations can be made. Positive applications of access management here include

+ Use of raised and depressed medians along the state highway to delineate travel lanes and separate most left turns from the through traffic stream;
+ Use of protected left turns at signalized intersections;
+ Use of frontage roads and cross access between some land uses to improve on-site traffic circulation off the main roadways;
+ Use of grade separation at the intersection of two major highways; and
+ Consolidation of access for some businesses.

Negatives for this case study, as well as possible remedies, include

– Relatively high driveway density along the east leg of the local minor arterial—driveway accesses could be consolidated, plus internal circulation or cross access could be improved to reduce conflicts;
– Lack of connectivity between development on the east side of the state highway—cross access could be provided;
– Relatively short distance from the intersection to the frontage road on the east leg of the minor arterial—alternative access could be provided; and
– Lack of continuous frontage or backage roads along the state highway.

In summary, this case study demonstrates both good and poor access management practice. As with many locations, access management improvements could be made, especially as traffic volumes increase as development grows. This state highway meets the Interstate highway at the boundary between two local municipalities, providing an example of where better coordination with local agencies can improve the management.

# Case 8

## Background

The next case study is located at the intersection of a U.S. highway and a local major arterial roadway in a large metropolitan area. This location is also within one of the community's larger commercial shopping areas, which includes a regional mall, as shown in Figure 8.

## Roadway and Land Use Characteristics

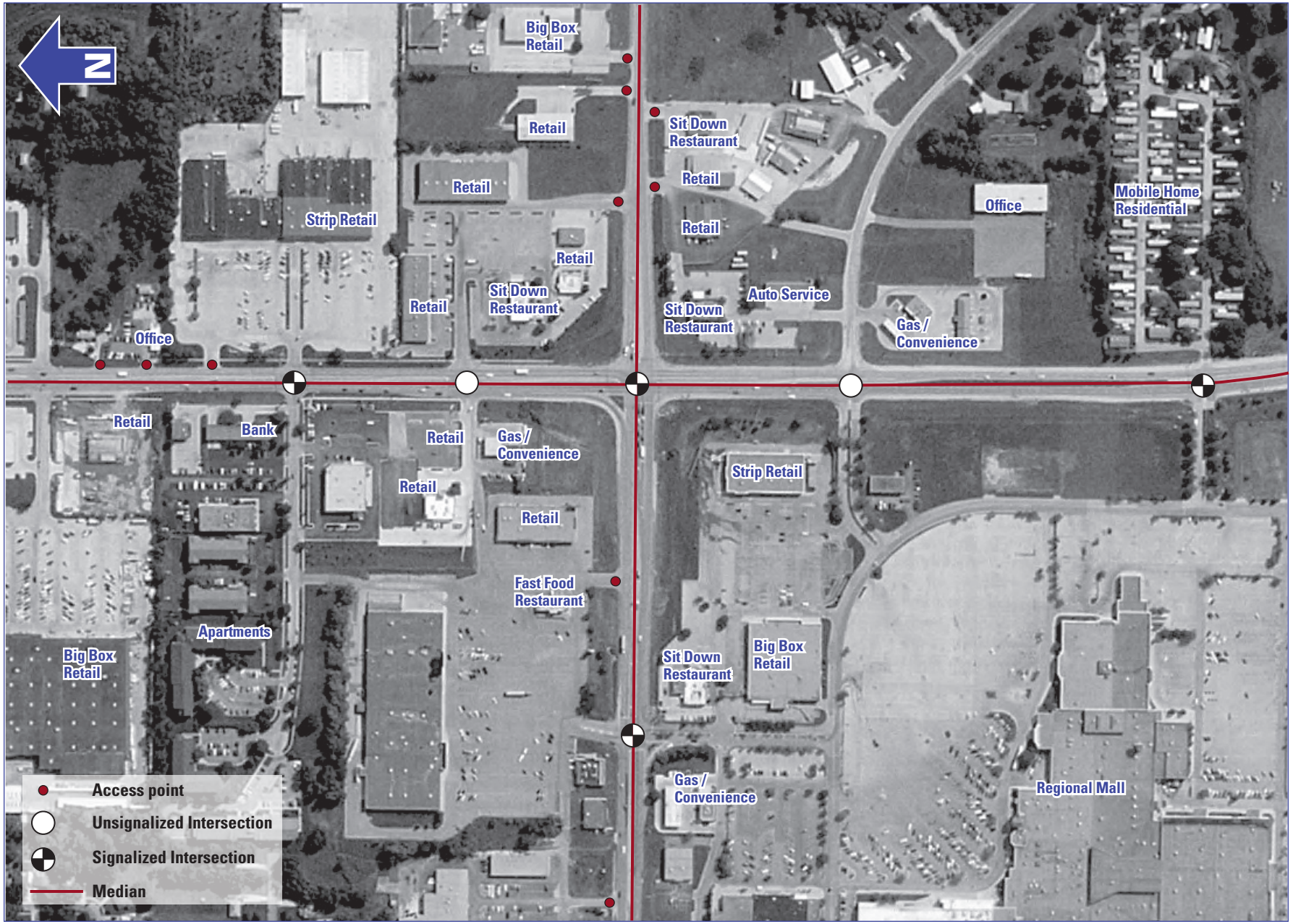
The intersection at the center of this case study is signalized. In addition, another signalized intersection is located approximately 950 feet to the north, and two signalized intersections that serve as accesses to a regional mall can be found 1,000 feet to the west and 1,600 feet to the south of the case study intersection. Traffic volumes on the east-west arterial vary between more than 18,000 vehicles per day (VPD) west of the intersection to approximately 8,200 VPD to the east. Volumes on the north-south U.S. highway vary from approximately 17,300 VPD south of the intersection to more than 26,000 VPD to the north. Both roadways are largely four-lane divided facilities with occasional median breaks, although the east leg tapers to a two-lane undivided road approximately 450 feet from the intersection at the center of this case study. The U.S. highway speed is posted at 45 mph throughout most of the study area but changes to 55 mph near the southern limits of the study area. The major arterial is posted at 40 mph. As shown in Figure 8, there are a variety of land uses located around this intersection. The commercial uses include several big box retailers, a few gas station/convenience stores, both sit-down and fast-food restaurants, banking, office, other general and strip retail businesses, and the large regional mall in the southwest quadrant of the study area. Besides these commercial uses, there are apartment buildings and mobile homes located nearby but farther out from the case study intersection.

## Access Characteristics

Access is largely well-managed at this case study location. The south leg of the study intersection is highly access-controlled, with continuous raised medians and access points limited to an unsignalized intersection approximately 600 feet south of the case study intersection and a signalized intersection another 1,000 feet farther south. Both of these intersections provide access to the regional mall and development in the southeast quadrant of the study area. Along the west leg, a right-in, right-out only access is provided on the north side of the arterial at approximately 550 feet west of the case study intersection, with a full signalized intersection about 450 feet farther west. A second right-in, right-out only access is located on the north side of the roadway another 250 feet west. On the north leg, a full unsignalized access approximately 450 feet north of the case study intersection serves a considerable number of businesses in the northwest and northeast quadrants of the study area. As shown in Figure 8, developments in these two quadrants also utilize backage roads and cross access between several businesses.

A full signalized intersection is located another 500 feet north, providing additional access to these areas. Along the east leg where traffic volumes are relatively low, a

*Figure 8. Case Study 8*



raised median extends approximately 450 feet east from the intersection. Six access points can be found beyond this point, with four along the north side and two along the south side of the roadway.

## Observations

As noted before, access is largely well-managed at this case study location. Positive applications of access management here include

+ Consolidation of access for several businesses into relatively few access points;
+ Use of raised medians throughout the study area to delineate travel lanes and remove most left turns from the through traffic stream;
+ Restriction of all direct driveway accesses along the high-volume, high-speed south leg;
+ Use of protected left turns and dedicated left-turn bays at signalized intersections;
+ Alignment of driveways across from each other at full-access (median break) locations; and
+ Use of minor supporting roadways and cross access between land uses to improve internal traffic circulation off the main roadways.

There are a few possible areas of improvement at this location. Negatives for this case study, as well as possible remedies, include

– Relatively high driveway density on the east leg—driveways could be consolidated and/or cross access used to connect properties and businesses in this area;
– Relatively short distance from the study intersection to the first driveways on the east leg—the westernmost driveways on both sides could be relocated farther east or consolidated, and
– Lack of connectivity between some development in the northeast quadrant and development directly to the east and to the north—internal connections/access could be provided.

In summary, this case study demonstrates good access management practice. The access management techniques utilized at this location appear to have had a positive effect on safety. When analyzing crash data, it was found that, traditionally, access-related crashes are rare in this area. Nonetheless, as with many locations, access management improvements could still be made, especially as traffic volumes increase as development expands.

# Case 9

## Background

The next case study is located at the intersection of a U.S. highway and a local major arterial roadway in one of the state's smaller metropolitan areas. The two roadways meet at an at-grade signalized intersection, although the southern leg of the intersection is an access into development along the south side of the highway. In recent years, since the local major arterial was first built, this location has attracted significant new commercial development.

## Roadway and Land Use Characteristics

The intersection at the center of this case study is signalized. Traffic volumes on the U.S. highway vary between nearly 13,000 vehicles per day (VPD) west of the intersection to about 13,700 VPD to the east. Volumes on the local arterial are approximately 12,700 VPD. Both roadways are four-lane divided facilities. The speed limit along the U.S. highway is 50 mph through the study area, while the major arterial speed limit is posted at 45 mph. As shown in Figure 9, there are a variety of land uses located within the study area. These uses are primarily commercial and include big box retail, auto dealerships and service businesses, hotels, and several other retail businesses.

## Access Characteristics

Both good and poor access management practice can be noted at this location. The north leg of this case study, the local arterial, is completely access-controlled throughout the study area. The east leg is also completely access-controlled through the next signalized intersection approximately 1,900 feet farther east. To the west, access is not as highly managed. Along the north side of the west leg, accesses can be found at distances of approximately 300, 550, 1,000, and 1,500 feet from the intersection. Along the south side of this leg, there are access points approximately 1,000 and 1,500 feet from the intersection. As shown in Figure 9, median breaks are found along this leg at all but the first access point on the north side, allowing left turns into and out of development to the north and south.

## Observations

This case study demonstrates both good and poor management of access. Positive applications of access management here include

+ Use of medians to delineate travel lanes and remove most left turns from the through traffic stream;
+ Restriction of all direct driveway accesses along the north and east legs;
+ Use of protected left turns and turn lanes at signalized intersections; and

*Figure 9. Case Study 9*

+ Alignment of some driveways across from each other at full-access (median break) locations.

There are also potential areas of improvement at this location. Negatives for this case study, as well as possible remedies, include

– Relatively high driveway density on the west leg—driveways on the north side of the road could be eliminated or consolidated farther from the intersection;

– Short distance from the intersection to the first driveways on the west leg—the easternmost driveway on the north side could be relocated farther west or consolidated to provide for better operations of the left turn bay;

– Lack of internal circulation and connectivity between developments in the northwest quadrant—cross access could be provided, eliminating the need for traffic using the U.S. highway to access between adjacent, similar developments;

– Close proximity of the frontage road along the south side of the U.S. highway could cause backups at the signal and along the frontage road—an improved supporting roadway system could help this problem; and

– Overall, the unplanned strip-type development could have been developed as a planned node development.

An analysis of crashes at this case study location shows a clear difference between safety along the U.S. highway and the local major arterial. While the local arterial traditionally shows few access-related crashes, analysis of the highway indicates access-related safety issues, especially along the west leg. In summary, this case study demonstrates both good and poor access management practice. Access management improvements could still be made, especially as traffic volumes increase as development grows.

# Case 10

## Background

The next case study is located at the intersection of two U.S. highways in one of the state's smaller metropolitan areas. This location is also at the center of one of the community's major commercial areas. These two highways meet at a partial cloverleaf interchange, as shown in Figure 10.

## Roadway and Land Use Characteristics

At this interchange, neither ramp terminal is signalized, but both of the intersections just to the north and to the south are signalized. Traffic volumes on the east-west U.S. highway vary between approximately 13,200 vehicles per day (VPD) west of the interchange to 17,100 VPD to the east. Volumes on the north-south U.S. highway vary from approximately 15,000 VPD north of the interchange to 18,700 VPD between the interchange and the next intersection to the south, which is with a local major arterial. Volumes on the U.S. highway south of the major arterial are approximately 16,600 VPD. Volumes on this arterial vary from approximately 13,000 VPD west of the intersection to about 10,000 VPD to the east. The east-west highway is a grade-separated freeway design throughout the area and is posted at 55 mph. The north-south highway is an at-grade four-lane divided facility posted at 40 mph. The local arterial speed limit is posted at 30 mph. As shown in Figure 10, there are a variety of land uses within this study area. These uses include several big box retailers, a gas station/convenience store, hotels, various strip-development retailers, and a number of both sit-down and fast-food restaurants. Besides these commercial uses, the southeast area of the intersection is largely made up of residential uses.

## Access Characteristics

Access is well-managed throughout this area. The east-west freeway, by definition, is completely access-controlled. The north-south highway is also well-managed throughout the study area, with a continuous raised median and all access beyond the interchange limited to signalized intersections. North of the interchange, development in the northwest quadrant of the study area accesses a signalized intersection about 450 feet north of the northern ramp terminal. In the northeast quadrant, development accesses onto a two-lane supporting collector and this same intersection. South of the interchange, along the east-west minor arterial, access is managed through the use of raised medians. Along the west leg of the arterial, accesses serve development on both sides of the roadway approximately 400, 750, and 1,050 feet from its intersection with the U.S. highway. A median break is located at the drives 750 feet from the intersection to allow left turns onto the arterial. Development south of the arterial can also access the north-south U.S. highway at a signalized intersection farther south. Frontage roads and cross access between parcels provides internal circulation for development in this area.

On the eastern leg, a right-in, right-out only driveway is located about 300 feet from the intersection, with a

*Figure 10. Case Study 10*

median break and driveways on both sides of the roadway another 200 feet east. The median ends approximately 800 feet from the intersection, with more driveways accessing the minor arterial from this point east.

## Observations

As noted earlier, access is largely well-managed at this case study location. Positive applications of access management at this case study location include

+ Use of grade separation at the intersection of two major highways;
+ Use of raised medians throughout the study area to delineate travel lanes and remove most left turns from the through traffic stream;
+ Restriction of all direct driveway accesses along the very high-volume U.S. highways;
+ Use of left-turn bays at signalized intersections on the high-volume north and south legs;
+ Alignment of driveways across from each other at full-access (median break) locations;
+ Use of supporting roads and cross access between land uses to improve on-site traffic circulation off the main roadways;
+ Consolidation of access for several businesses into relatively few access points; and
+ Use of frontage roads and "jug handles" at intersection along the north-south U.S. highway south of the major arterial.

Negatives for this case study, as well as possible remedies, include

– Relatively short distance from the intersection to the first driveways on the east leg of the minor arterial—the westernmost driveway on the south side could be relocated farther west; and
– Access density along the minor arterial is somewhat high and could become problematic if traffic increases—driveways could be consolidated and/or cross access used to connect properties and businesses in this area.

In summary, this case study demonstrates mostly good access management practice. An analysis of crash data shows few access-related crashes throughout most of the study area. It can be noted that this case study location is very similar to Case Study 2, with one notable exception. A raised median is used along the entire U.S. highway, and as a result, access-related crashes are much less common at this location than at the Case Study 2 location. As with many locations, access management improvements could still be made, especially as traffic volumes increase with further development.

# Case 11

## Background

The last case study is located at the intersection of a state highway and an Interstate in a rapidly growing area of one of Iowa's larger metropolitan areas. The two roadways meet at a grade-separated partial cloverleaf interchange, as shown in Figure 11. This location is also within one of the community's largest commercial shopping areas, which includes a large regional mall.

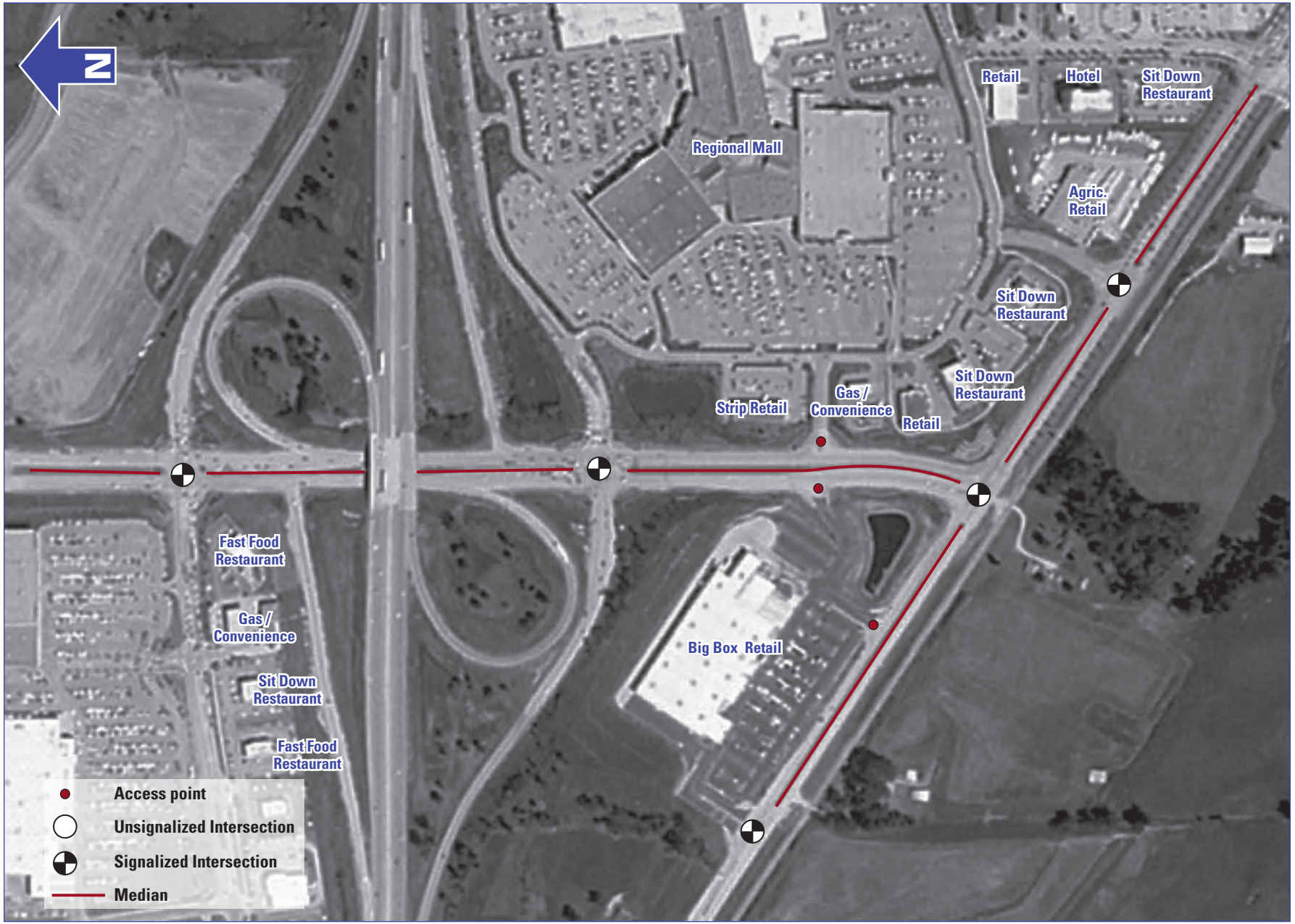
## Roadway and Land Use Characteristics

At this interchange, both ramp terminals that handle traffic exiting the Interstate end at signalized accesses. An additional intersection with a local major arterial is located farther to the south at the terminus of the state highway. Traffic volumes on the Interstate are around 46,000 vehicles per day (VPD) in the study area, while volumes on the state highway vary between nearly 17,000 VPD on the north end of the study area to approximately 14,100 VPD south of the interchange. Volumes along the aforementioned local major arterial, which runs east-west at the southern end of the study area, are approximately 6,000 VPD west of the signalized intersection and 17,100 VPD east of the intersection. All three roadways are four-lane divided facilities. In the study area, the Interstate has a posted speed of 65 mph, while the north-south state highway has a speed limit of 35 mph. The east-west local arterial speed limit is posted at 40 mph. As shown in Figure 11, land uses in the area include the large regional mall, big box retail, several restaurants, gas/convenience stores, various retail stores, and a hotel.

## Access Characteristics

Overall, access is very well-managed at this case study location. Access is well-managed throughout much of this area. The east-west Interstate is a freeway design and, by definition, is completely access-controlled. Along the state highway, north of the interchange, access is limited to the signalized intersection that connects the west-bound ramp terminal to a local minor arterial. This local minor arterial provides access to all development in the north-west quadrant of the study area. South of the interchange, a similar signalized intersection connects the east-bound ramp terminal to a major access for the regional mall. Approximately 750 feet farther south, two right-in, right out accesses serve the big box retailer to the west and the mall to the east. The state highway terminates at a signalized intersection with the major arterial another 500 feet farther south. A raised median runs the length of the major arterial with breaks at signals only. Approximately 550 feet west of this intersection along the major arterial is one right-in, right-out access to the big box retailer. Another 800 feet west, a signalized intersection provides access to the big box retailer and future development in this area. East along the major arterial, access is limited to a signalized intersection 850 feet from the state highway intersection.

*Figure 11. Case Study 11*



## Observations

As noted, access is very well-managed at this location. Positive applications of access management here include

- Use of grade separation at the intersection of two major highways;
- Consolidation of access for several businesses into relatively few access points;
- Use of raised medians throughout the study area to delineate travel lanes and remove most left turns from the through traffic stream;
- Restriction of all direct driveway accesses along the north leg;
- Use of protected left turns and dedicated left-turn bays at signalized intersections throughout the study area; and
- Use of supporting roadways and cross access between land uses to improve internal traffic circulation off the main roadways, creating development as a node, not a strip.

In summary, this case study demonstrates very good access management practice. In fact, an analysis of crash data at this location indicates that the access management techniques utilized at this location appear to have had a positive effect on safety. The analysis found that access-related crashes are relatively rare in this area. Nonetheless, as with many locations, access management improvements could still be made, especially as traffic volumes increase with further development.

# Lessons Learned

The Transportation Research Board (TRB) has defined ten access management principles that are necessary for achieving a good relationship between roadways and adjacent land uses.[1] These principles (at right) are thoroughly described in the *Access Management Manual*.

The previous case studies produced five important lessons that align with these access management principles. Three of the lessons are derivatives of the relationship between the roadway and the nearby land uses; the other two involve the execution of access management treatments.

**Roadway and Land Use Relationship**

1. Each road is part of a system
2. Properly plan for development
3. View developments holistically

**Access Management Treatments**

4. Minimize access points
5. Manage turns correctly

**Principles of Access Management:**

1. **Provide a specialized roadway system.**
2. **Limit direct access to major roadways.**
3. **Promote intersection hierarchy.**
4. **Locate signals to favor through movements.**
5. **Preserve the functional area of intersections or interchanges.**
6. **Limit the number of conflict points.**
7. **Separate conflict areas.**
8. **Remove turning vehicles from through-traffic lanes.**
9. **Use non-traversable medians to manage left-turn movements.**
10. **Provide a supporting street and circulation system.**

## The Roadway and Land Use Relationship

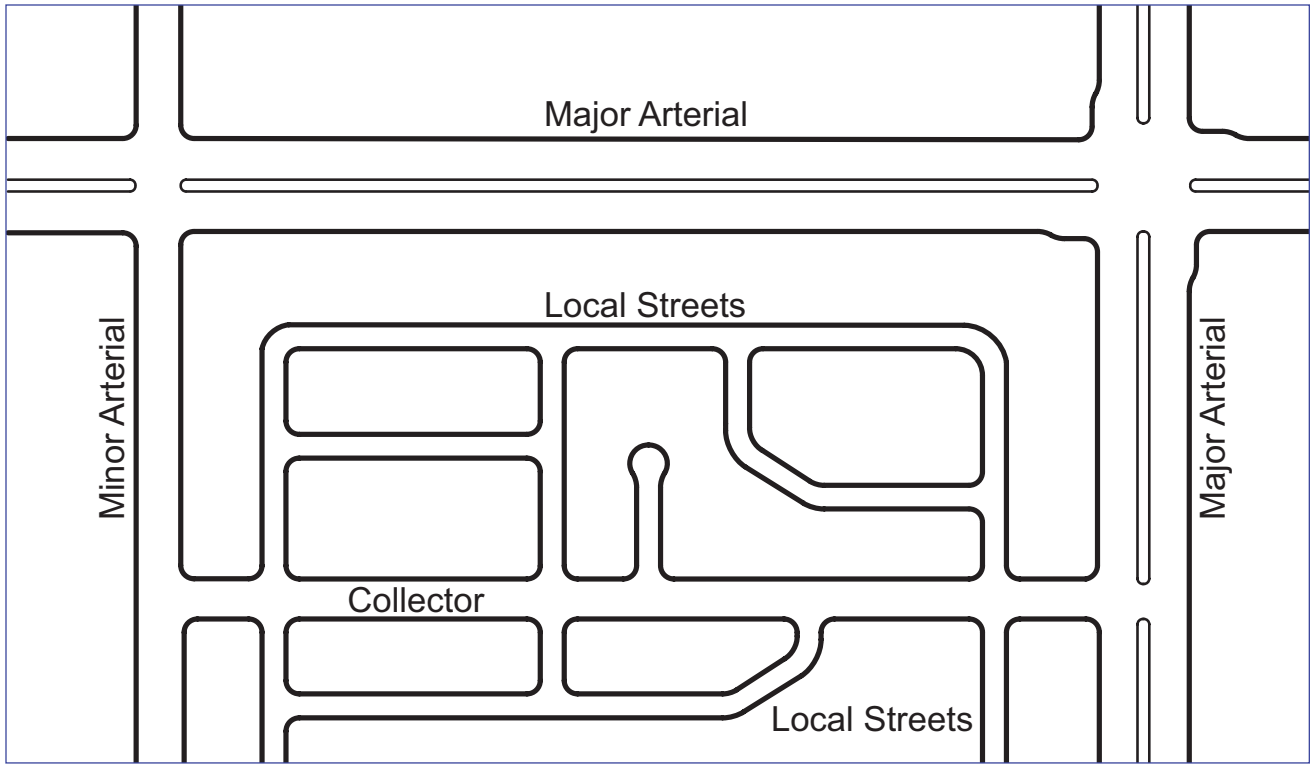
As discussed briefly in the introduction to this guidebook, Iowa's roadways play a dual role in serving through vehicle traffic while also providing access to adjacent land uses. For some roadways, such as cul-de-sacs and local residential streets, access to land is of higher relative importance. For freeways and expressways, movement of traffic is paramount. For arterial and collector roadways, access management provides a balance between land access and traffic flow. The movement of traffic is generally of higher importance for the major arterial roadways. Therefore, managing access at major arterial intersections should focus on allowing the roadways and intersections to serve through vehicular traffic foremost, while providing sensible, though not always direct, access to and circulation throughout adjacent developments.

### Lesson #1: A roadway should be viewed not as an individual, but as one piece of a system.

It is very important that each roadway be viewed as a portion of a hierarchical network of roads, rather than as an individual entity that is independent from its neighboring roads, as shown in Figure 12.[2]

Different types of roadways serve different functions within this system and, therefore, have differing levels of vehicular mobility and land access.[3] Access management seeks to limit and consolidate access points along major arterial intersections. This ensures that the roadways comprising and surrounding the intersection function harmoniously, with each providing its respective level of access to development and movement of traffic.

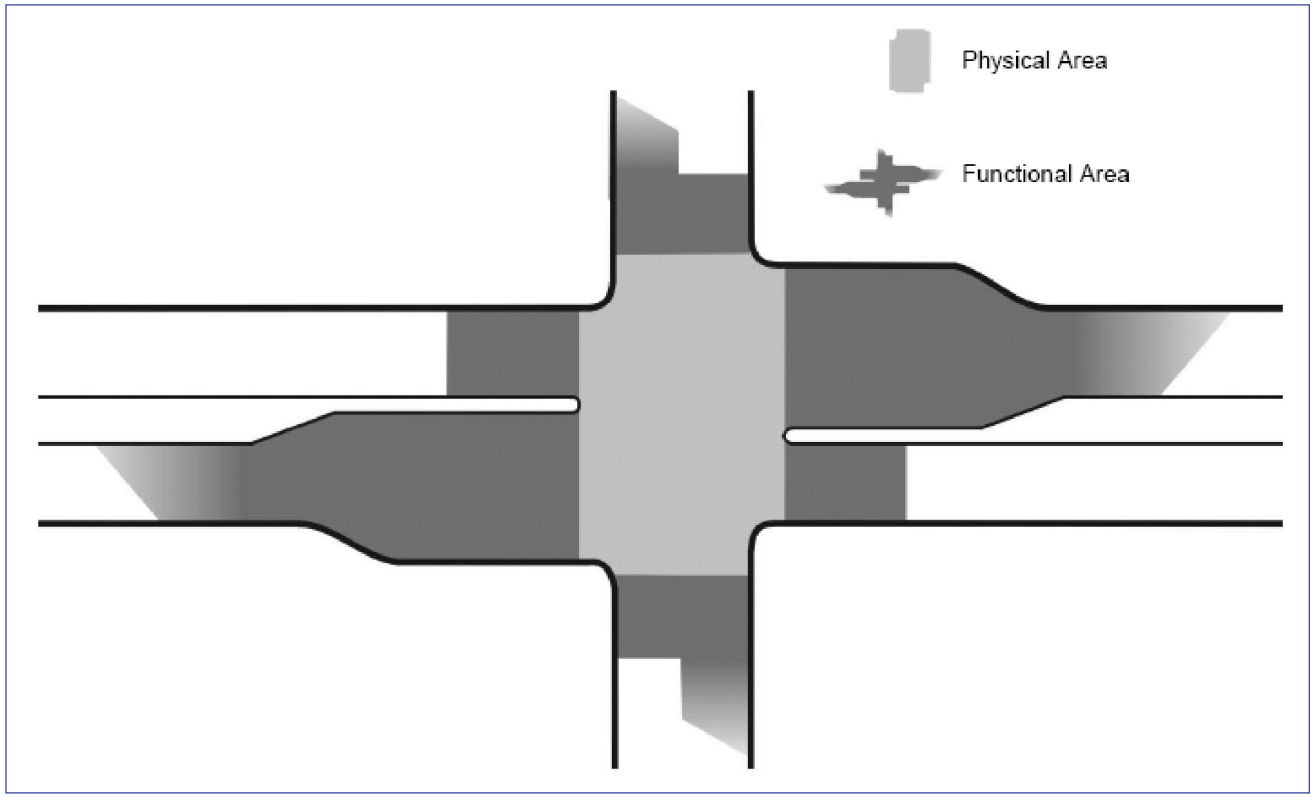
*Figure 12. Schematic of an Urban Roadway Network*



**Lesson #2:**
**Major arterial intersections are "crossroads" locations that often attract development; therefore, development should be expected and properly planned.**

In order to provide reasonable access to land development while adequately serving through arterial traffic, local land use and roadway networks also need to be planned in conjunction with each other. The appropriate degree of access control varies according to the function and traffic characteristics of a roadway, the nature of the abutting land, and the long-term planning objectives.[4] In the case of major arterial intersections, a key element of such a system should be the preservation of the functional integrity of the intersection. Figure 13 shows the physical area of an intersection as well as its functional area.[5] If development is not planned for and land access is allowed to negatively impact the intersection, the result can be an increase in crash rates, congestion, and delays for motorists.

***Figure 13. Functional Area of an Intersection***



**Lesson #3:**
**Much like the roadway system, developments should be viewed holistically (as nodes).**

Any development adjacent to or near a major intersection should consider the impact it may have on the roadway network during the planning phase. This development inevitably will change the distribution of and usually generate increases in traffic throughout the area; therefore, it is imperative to properly plan access points to determine how to best load the system. The best way to do this is to plan development as a node—not as a strip. Figure 14 shows two simple examples: one of a central, clustered development and one of development spread-out.[6] Developing as a strip generally requires that the arterial be used for each trip between different locations within the area, as shown in Figure 15. Nodal developments, however, provide internal circulatory roads with fewer access points to the arterial. This causes limited disruption to the through traffic, while continuing to allow for relatively good and easy access to the development, as is evident in Figure 16. Strip developments can be reconfigured as a node by providing cross and joint access or backage road systems between parcels.

***Figure 14. Preferred Location of Development***

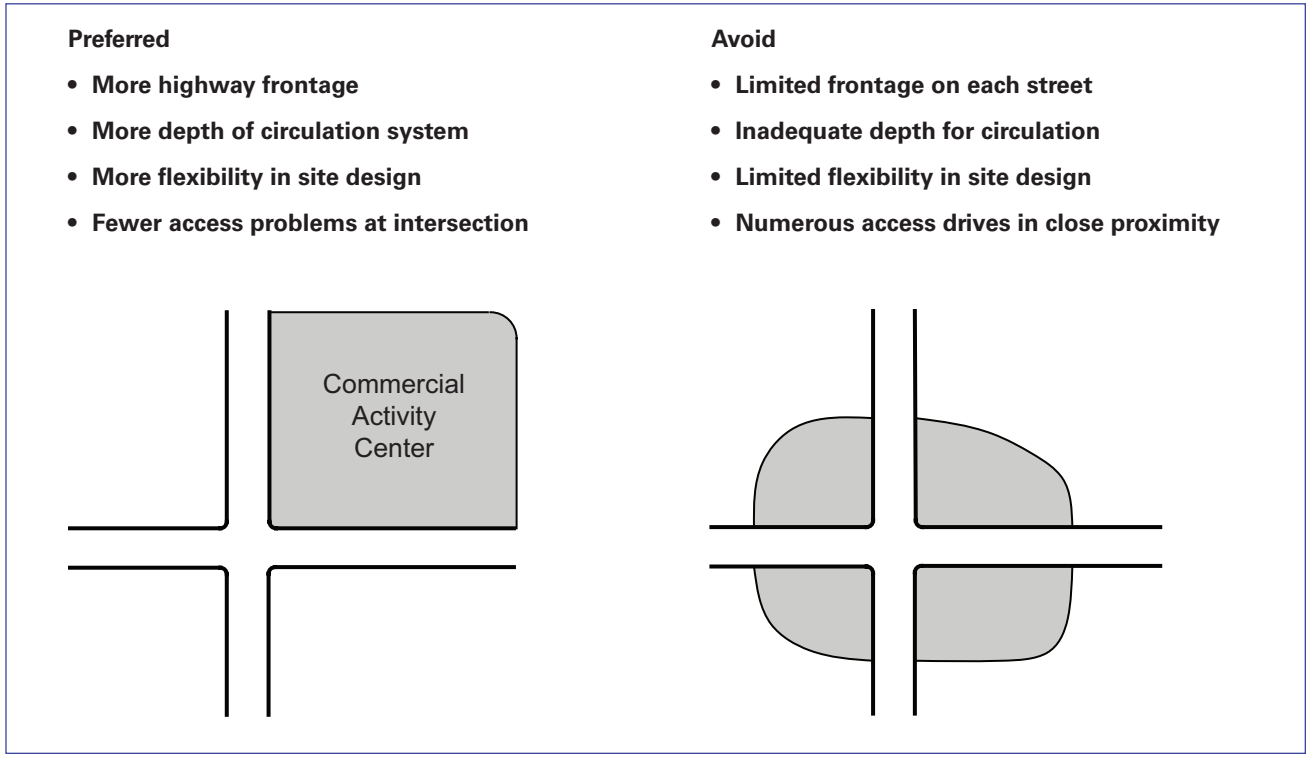


*Figure 15. Strip Development (Not Preferred)*

**Well-planned access points depend most on two things:**

- Strong local planning and subdivision review that coordinates transportation and land use decisions, and
- Limiting the number and type of driveways.

*Figure 16. Node Development (Preferred)*

## Access Management Treatments that Work

Because these major arterial intersections are not only important for moving traffic but are also attractive locations for commercial activities dependent on traffic, managing access in these areas can be a significant challenge. Many of the case studies reviewed in this guidebook have demonstrated positive applications of access management in such areas around Iowa. In addition, the examples of poor management of access can provide us with valuable insight into situations to avoid. The following are lessons learned from the case studies.

### Lesson #4: Minimizing the number of access points to major roadways and near intersections will maximize efficiency of the system while increasing the overall safety of the impacted area.

Moving access away from an intersection can be accomplished by:

#### Providing proper corner clearance at intersections

Corner clearance represents the distance provided between an intersection and the nearest access connection (i.e., a driveway). Inadequate corner clearances can result in inefficiencies in traffic operation through an intersection, such as backups caused by blocked driveways or conflicting turns. Locating local access points farther from the intersection (preferably outside the intersection's functional area, see Figure 14) will allow a turning driver more time to complete his/her maneuver before having to negotiate another movement. Additionally, moving an ingress point farther back should minimize the conflict presented by other vehicles traveling in the opposite direction, which may be backed up from the intersection.

#### Consolidating driveways

Driveway consolidation greatly improves the functionality of a major roadway. By limiting the ingress and egress points, the roadway will be able to operate more efficiently, channeling the turns into more predictable locations. Furthermore, such channelization works to reduce the potential for collisions. Additionally, having fewer drives will minimize the number of trips that a motorist needs to take using the arterial. This may be achieved through the utilization or creation of minor roadways and/or service roads (i.e., frontage/backage roads).

#### Aligning access points

Something to consider during the process of driveway consolidation is the alignment with entry points on opposite sides of the road. Where driveways are closely offset or have no offset at all, drivers may attempt to cross the busy road directly from one to another. Figure 17 shows examples of how entryways are commonly offset. The top shows a road with adequately spaced driveways—an arrangement that significantly reduces the potential for undesirable vehicle movements. Positioning entryways with no offset essentially creates minor intersections. While this does provide for more predictable movements, it still can generate traffic backups if high-intensity land uses are located across from one another. A benefit of this design is that it allows for future signalization if the demand should call for it. Drives with inadequate or improper offset, such as those shown, offer increased opportunity for unsafe crossing movements and should be avoided.

#### Promoting cross access and internal circulation within the development

As mentioned previously, when development occurs near a major intersection, it is important that it be planned

as a node. If this happens, it is possible to provide for cross access and circulatory roads within the development. Cross access is an easement or service drive that provides vehicular access between two or more contiguous sites. This allows a driver to use roads dedicated for development traffic, and he/she, therefore, does not need to re-enter the major roadway. Similarly, interparcel circulation offers the flexibility of traveling between any parcels within the development without re-entering the arterial roadway. Figure 18 shows an example of how this may be achieved.

***Figure 17. Aligning Access Points***

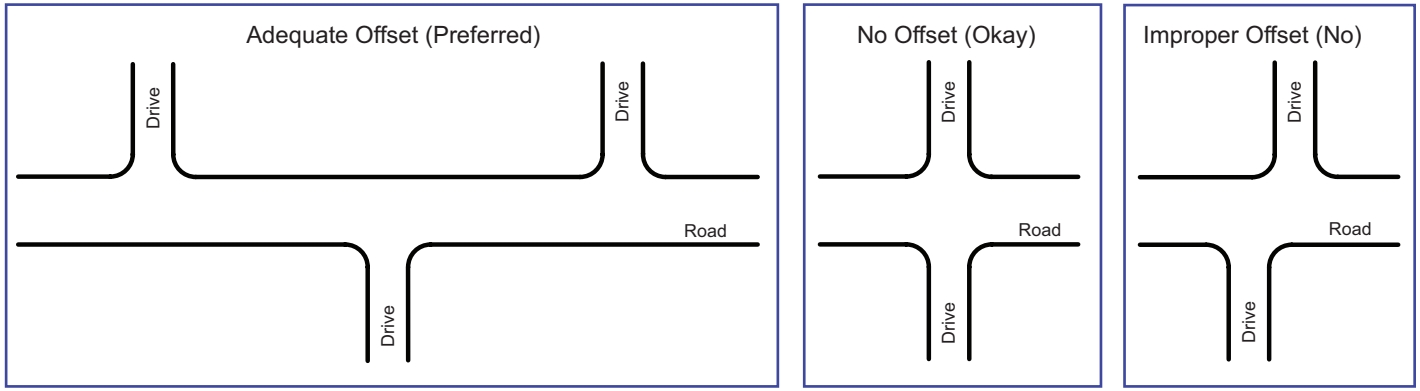
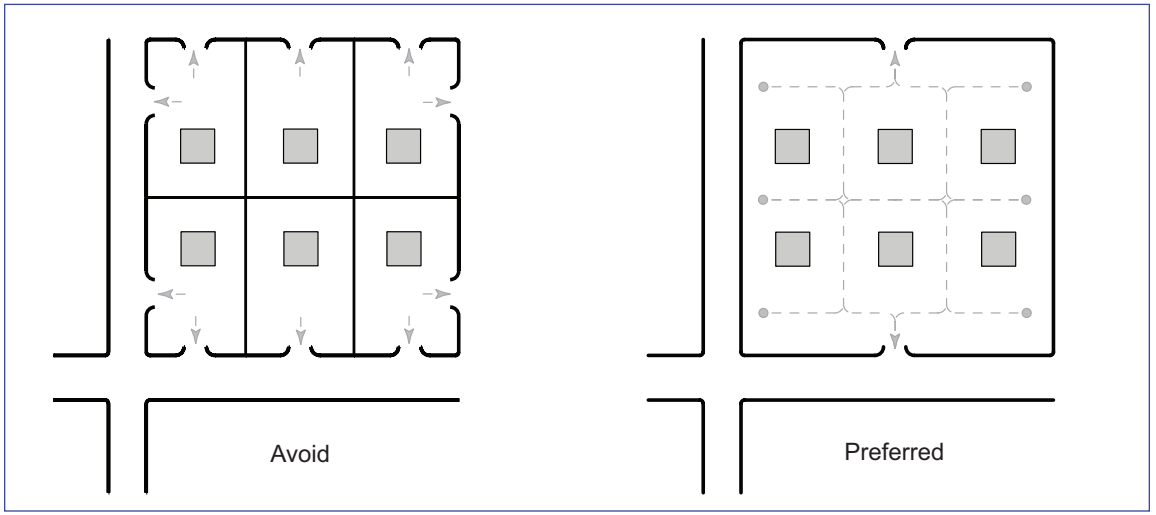



***Figure 18. Promoting Internal Circulation***

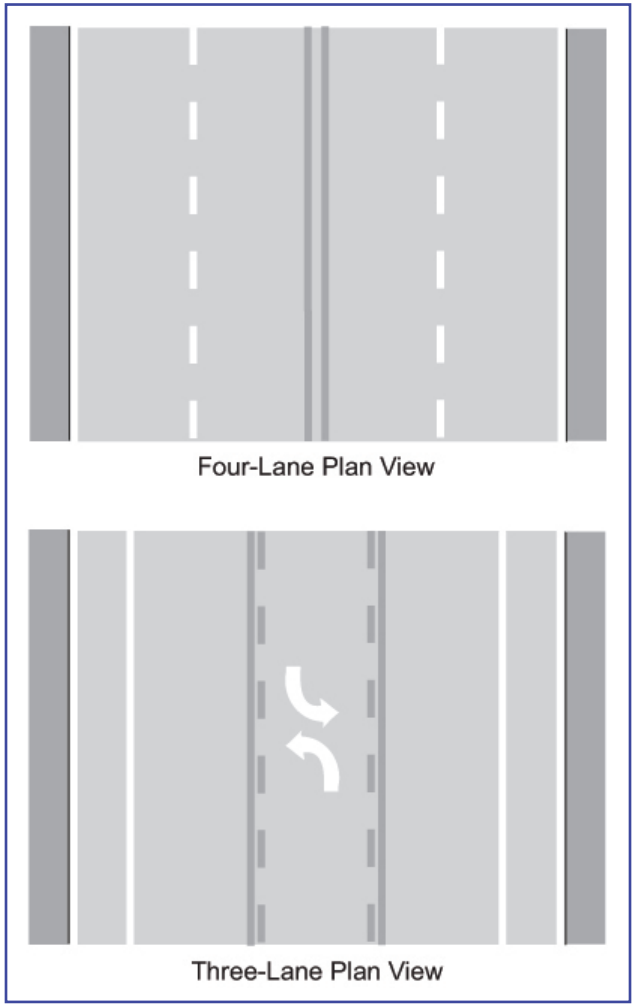


## Lesson #5: Managing turns will minimize negative impacts to through traffic.

**Two-way left-turn lanes help remove left turns from the through traffic stream.**

Studies show that where driveways are properly consolidated, a three-lane road with the center lane being a shared two-way left-turn lane (TWLTL), can function more efficiently than a four-lane road with no dedicated turn lanes. Converting a roadway from a four-lane to a two-lane with TWLTL, as shown in Figure 19, can reduce the number of turning-related crashes while allowing for the through traffic to freely move past turning vehicles.[7] In general, TWLTLs function well on arterials with low to moderate commercial driveway density, where the average annual daily travel is in the range of 10,000 to 28,000 vehicles per day (VPD).[8]

*Figure 19. Four-Lane to Three-Lane Conversion*



**The use of non-traversable medians helps delineate travel lanes, separating left turns from through traffic.**

As urban arterial traffic is expected to rise above 24,000 VPD in a design year, a TWLTL will begin to function poorly no matter how well driveways are managed. A raised median will function much better in place of a TWLTL. Dedicated left-turn bays and right-turn slip lanes separate turning traffic from through traffic, greatly increasing the flow and capacity of the route, as shown in Figure 20.

When such medians are used, signal spacing also becomes critical to traffic flow. Stop lights spaced less than ¼ mile apart will result in slow-speed routes. Ideally, traffic signals (and major intersections) should be spaced at least ½ mile apart to maintain desirable speeds.

*Figure 20. Non-Traversable Median*

## How is Access Management Accomplished?[9]

Access management is achieved through the systematic application of planning, regulatory, and design strategies. The following are the basic methods of accomplishing access management as listed in the TRB *Access Management Manual*:

1. **Policies, directives, and guidelines:** State and local agencies may adopt specific policies, directives, or guidelines that are directly or indirectly related to access management. A local government typically sets forth public policies in its comprehensive plan. State agencies may establish formal agency policies, procedures, and directives under their general administrative functions. Access management issues are sometimes addressed through guidelines, which do not require specific legislative authority but which lack the mandatory status and enforceability of regulations.

2. **Access management regulations:** Access management regulations may address various aspects of access management, such as the location and spacing of connections, design of access connections, spacing of median openings, spacing of traffic signals, joint and cross access requirements, interchange areas, and access permitting. These regulations may take the form of comprehensive statewide access codes or local access management ordinances, and they can be more effectively enforced than guidelines.

3. **Acquisition of access rights:** State transportation agencies and local governments have the authority to acquire access rights. This is how freeways, expressways, parkways, and in some cases, other types of arterial roadways are protected. The acquisition of access rights, while often costly and time consuming, is a strong and long-lasting solution.

4. **Land development regulations:** In addition to access management and driveway design requirements, local agencies establish a variety of land development regulations that affect access outcomes. Zoning regulations address lot dimensions (e.g., setback and lot frontage), lot coverage, parking, landscaping, site circulation, development intensity or density, and the permitted use of land. Subdivision regulations govern the division of land into lots, blocks, and public ways and can ensure proper street layout in relation to existing or planned roadways, adequate space for emergency access and utilities, and internal access to subdivision lots. State agencies rarely have these powers.

5. **Development review and impact assessment:** Some aspects of access management are addressed at the site review stage, in response to a request for a development or connection permit. This may be accomplished through the subdivision or site plan review process of local agencies or during the access permitting process of state agencies. Larger developments are often required to submit a traffic impact assessment to assist the agency in its review. Comments and requirements are usually based on policies already adopted.

6. **Geometric design:** Geometric design features, such as interchanges, frontage roads, medians, median openings, auxiliary lanes, driveway design, and intersection channelization are used to manage access and vehicular turning movements. Geometric design criteria are normally included in design manuals and are advanced through the roadway improvement process.

## Elements of a Comprehensive Program[10]

Methods from the previous section can be drawn together to form a comprehensive access management program. Access management programs include both systemwide and corridor-based programs. Systemwide programs involve the development and implementation of a comprehensive access management program for all roadways under state or local jurisdiction. Corridor-based programs focus on the development and implementation of corridor access management plans. Corridor-based programs are useful for retrofitting problem areas or addressing the needs of high-priority corridors and are often combined with a systemwide approach. Some systemwide programs, for example, contain or authorize corridor-based solutions. Comprehensive, systemwide access management programs involve the following key elements:

1. Classifying roadways into a logical hierarchy according to function;
2. Planning, designing, and maintaining roadway systems on the basis of functional classification and road geometry;
3. Defining acceptable levels of access for each class of roadway to preserve its function, including criteria for the spacing of signalized and unsignalized access points;
4. Applying appropriate geometric design criteria and traffic engineering analysis to each allowable access point; and
5. Establishing policies, regulations, and permitting procedures to carry out and support the program.

## Access Development Scenarios

Nearly all major intersections will fall under a general condition of being at-grade or grade-separated with either low or high levels of adjacent development. The level of access management necessary at the intersection will depend on its future characteristics of type of junction and intensity of development. The sidebar shows the potential current-to-future combinations for major intersections as well as their remedies. All other combinations are generally not feasible; thus, no plan or template is necessary for them.

Comprehensive access management programs act like overlay zones on a land use plan, providing uniform guidelines across a system. Problems within these programs most often arise from weak or loosely defined acceptable levels of access (Element 3 from previous page). Providing solid terms (distances) will strengthen the program, allowing for more successful access control and increasing safety and efficiency throughout an intersection's impact area. Figure 21 on the following page is an example of baseline dimensions for driveway and intersection spacing from the TRB *Access Management Manual*.

### Now: At-Grade, Low Development

**Future:**

- → No change = Manage Spacing
- → At-Grade with High Development = Overall Management Plan
- → Grade-Separated with High Development = Overall Management Plan

### Now: At-Grade, High Development

**Future:**

- → No Change = Improve Management
- → Grade-Separated with High Development = Overall Management Plan

### Now: Grade-Separated, Low Development

**Future:**

- → No Change = Manage Spacing
- → Grade-Separated with High Development = Overall Management Plan

### Now: Grade-Separated, High Development

**Future:**

- → No Change = Improve Management

***Figure 21. Example of minimum spacing guidelines for an interchange[11]***

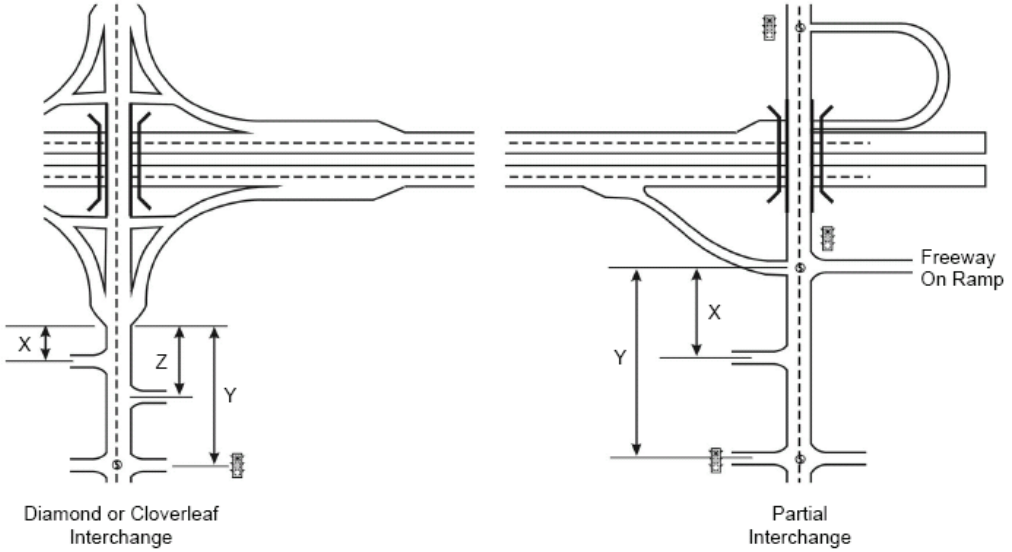



**TABLE 9-15** Minimum Spacing for Freeway Interchange Areas with Two-Lane Crossroads (*1*)

| Type of Area | Spacing Dimension | |
|---|---|---|
| | X or Z | Y |
| Fully developed urban | 750 ft (230 m) | 1320 ft (400 m) |
| Suburban/urban | 990 ft (300 m | 1320 ft (400 m) |
| Rural | 1320 ft (400 m) | 1320 ft (400 m) |

X or Z = distance to first access connection from the taper of the off-ramp or on-ramp. This dimension provides for either X or Z but not both, to avoid a four-way connection.

Y = distance to first major intersection. No four-legged intersections may be placed between ramp terminals and the first major intersection.

## Additional Considerations

### Pedestrians

Access management is generally promoted as a way to improve driving conditions for motorists. Clearly, its techniques can lead to roads and streets that are dramatically safer and much easier and more pleasant to drive. However, research also indicates that many of the key access management techniques are just as valuable to pedestrians as they are to vehicular traffic. The following are methods of managing access that also have implications on pedestrian safety:

- Driveway spacing: Each pedestrian path that crosses a road or driveway represents several potential points of conflict between a pedestrian and a vehicle. Pedestrians, like drivers, often face difficulties in mentally processing multiple conflict points. A greater driveway separation helps people concentrate on one problem at a time. Therefore, reducing the number of driveways will proportionally reduce overlap of the operational areas of driveways, further reducing the quantity of conflict points.
- Right-turn lanes: On high-volume driveways, providing a dedicated right-turn lane will allow vehicles to decelerate and turn using a minimum turn radius. This reduces turning speeds into driveways and allows narrower driveway crossings for pedestrians.
- Sidewalk setbacks and clear zones: Locating sidewalks away from the curb offers many operational and safety benefits. Sidewalks positioned several feet from the street protect pedestrians by separating them from the traffic flow. In addition, a landscaped or other clearly marked buffer helps to visually define sidewalk and driveway locations. If the buffer strip is of an adequate width, drivers can pull completely out of the traffic stream before yielding to a pedestrian. A corner clear zone—free of visual obstructions such as signs, large trees and bushes, or parked vehicles—allows pedestrians to be seen by drivers as well as any oncoming vehicles.
- Mid-block crosswalks: Where the distance between pedestrian crosswalks is large, a mid-block pedestrian crossing can improve safety by presenting a dedicated place for people to cross. This adds predictability to the route and can reduce crashes while making the area more convenient for pedestrians. Where necessary, it may prove additionally beneficial to provide signalized protection for these mid-block crossings.
- Medians: Medians offer areas of safe refuge to pedestrians. Pedestrian crash rates are lower on roads with raised medians than on undivided highways or those with continuous two-way left-turn lanes (TWLTLs).

### Aesthetics

Access management projects often involve widening existing roadways to add a raised median or altering the configuration by adding a two-way-left-turn lane. Such projects can lead to a wide expanse of concrete and asphalt. A more aesthetically pleasing treatment, however, does not need to run counter to sound access management practices. In fact, aesthetics can and should be incorporated into access management project plans. One reason for this is that access management projects are much more likely to be accepted by the public and by business owners of adjacent properties if they improve the aesthetic quality while also addressing safety and traffic flow.

In conjunction with access management improvements such as consolidating driveways, installing raised medians, or constructing TWLTLs, many aesthetic treatments are possible, including

- Landscaping a raised median;
- Adding pavement textures and designs to parking areas;
- Adding well-designed retaining walls (where needed) to prevent erosion;
- Planting street trees and other vegetation outside the clear zone;
- Removing signs from the clear zone and otherwise modifying commercial signs to make them less obtrusive;
- Adding uniform, well-designed street lights and other hardware; and
- Placing utility lines underground.

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