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American Fork City

Access Management Manual

American Fork, Utah

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EXECUTIVE SUMMARY

As traffic volumes and congestion continue to grow on American Fork roads, it is important for American Fork engineers, planners, and decision makers to implement and enforce sound transportation policies to maximize the capital investments in transportation infrastructure. Well-managed (access-controlled) corridors can last years beyond a less restrictive access-controlled corridor as well as provide safety and economic benefits. Access management can help preserve the capital improvement dollars spent on infrastructure by preserving the capacity and prolonging the need for roadway widening projects with a well-crafted and managed plan for the various roadway cross-sections.

The purpose of this American Fork Access Management Manual is to provide access management recommendations to city staff and city decision makers so that appropriate and beneficial access control can be implemented throughout the city thus providing operational, safety, and economic benefits to American Fork City. This manual has been prepared to serve as a supplementary volume to the American Fork City Transportation Element of the General Plan.

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Chapter II of this manual provides a literature review of access management principles and techniques by drawing on past research at the international, national, and Utah levels. Operational, safety, and economic benefits of access management are included within this review. Chapter III provides a state-of-the-practice review of access management requirements including numerous cities in the Utah area as well as UDOT's access management program. Chapter IV presents the recommended access management requirements for several access related design criteria including their location, spacing, design characteristics. On-street parking and intersection lighting are also discussed. Chapter V outlines the recommended appeals process.

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I. INTRODUCTION

A. Background

As traffic volumes and congestion continue to grow on American Fork roads, it is important for American Fork engineers, planners, and decision makers to implement and enforce sound transportation policies to maximize the capital investments in transportation infrastructure. A well-managed (access controlled) corridor can last years beyond a less restrictive access controlled corridor as well as provide safety and economic benefits. Access management can help preserve the capital improvement dollars spent on infrastructure by preserving the capacity and prolonging the need for roadway widening projects with a well-crafted and managed plan for the various roadway cross-sections.

Access management is defined by the Transportation Research Board (TRB) as "the systematic control of the location, spacing, design, and operation of driveways, median openings, interchanges, and street connections to a roadway" (TRB *Access Management Manual*, 2003).

The purpose of this American Fork Access Management Manual is to provide access management recommendations to city staff and city decision makers so that appropriate and beneficial access control can be implemented throughout the city thus providing operational, safety, and economic benefits to American Fork City. This manual has been prepared to serve as a supplementary volume to the American Fork City Transportation Element of the General Plan.

B. Components of An Effective Access Management Plan

According to the National Cooperative Research Program (NCHRP) Report 548, *A Guidebook for Including Access Management in Transportation Planning* (2005), seven key components of an effective access management plan include the following:

1. Developing and applying an access classification system that assigns access management standards to roadways in accordance with their level of importance to mobility. This classification generally parallels the roadway functional classification.
2. Planning, designing, and maintaining road systems based on their access classification.
3. Defining the level of access permitted to each classification (e.g., full, limited turns, traffic control type, etc.).
4. Establishing criteria for the spacing of signalized and non-signalized intersections as well as corner clearance and intersection distances from interchanges.
5. Applying agreed upon engineering standards that include appropriate geometric design criteria and traffic engineering measures for each type of access.

6. Establishing policies, regulations, and permitting procedures to implement the listed components.
7. Ensuring coordination with and supportive actions by local jurisdictions exercising their land use planning authority as well as their development permitting and reviewing authority.

This manual will address the first five items listed above. A recommended ordinance of adoption will also be provided to adopt this document as a Guideline by Resolution. Beyond reviewing UDOT's current access management requirements, this document does not seek to coordinate with adjacent jurisdictions regarding access management. It is recommended that this type of coordination be done as part of the master planning process that is updated from time to time by American Fork City and other adjacent cities.

C. Outline

Chapter II of this manual provides a literature review of access management principles and techniques by drawing on past research at the international, national, and Utah levels. Operational, safety, and economic benefits of access management are included within this review. Chapter III provides a state-of-the-practice review of access management requirements including numerous cities in the Utah area as well as UDOT's access management program. Chapter IV presents the recommended access management requirements for several access related design criteria including their location, spacing, design characteristics. On-street parking and intersection lighting are also discussed. Chapter V outlines the recommended appeals process.

Included in Appendix A is the most recent American Fork Transportation Master Plan Map. Appendix B contains new intersection sight distance standard drawings.

II. ACCESS MANAGEMENT PRINCIPLES

A. Introduction

This chapter discusses several access management principles including access versus mobility, functional classifications, access management techniques, and benefits of access management. The purpose of this chapter is to provide sufficient background regarding access management so that the reader can understand the importance of access management principles and techniques.

B. Access Versus Mobility

The need for access management stems from the conflicting functions of any given roadway. All roads must provide some level of mobility, which means the ability to travel through a corridor (e.g., speed), and some level of access, which means the ability to access some land use at either end of the trip (usually driveways). Generally speaking, the more mobility a road has, the less direct access can be provided to adjacent land uses, and the more direct access that is provided to adjacent land use, the less mobility a given road will have. Extreme examples of this principle are a freeway and a residential cul-de-sac. A freeway typically has excellent mobility (high speeds and longer trips are possible) provided that demand does not exceed capacity. However, access is limited to grade separated interchanges only. Direct access to adjacent land use using driveways is prohibited. Conversely, a residential cul-de-sac has very little mobility (speeds are low and it is difficult to make longer trips) however full access is provided to every adjacent property.

Figure 1 demonstrates this principle. As is shown in Figure 1, arterial streets should have higher levels of mobility with lower levels of access, while local streets should have high levels of access. Collector streets have more of a balance between access and mobility providing more access than an arterial, but at the cost of having lower traveling speeds.

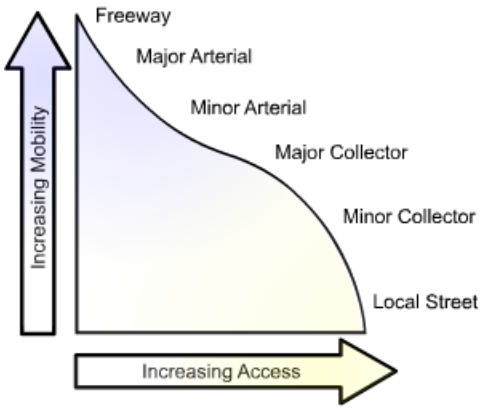

Figure 1 Competing functions of access and mobility (Source: FHWA).

C. Functional Classification

Roads are broken down into a hierarchal system and given a functional classification. This is done in order to determine the purpose of a given street as well as the appropriate access classification. The higher a street classification the more mobility it provides with limited access, whereas a lower street classification has less mobility, but more access. Currently, American Fork has classified its roads into five classifications of public roads, plus two classifications for private roads. Public roads include the following:

- Arterial
- Major Collector
- Minor Collector
- Local Road of Importance (Neighborhood Collector)
- Local Road

The two classifications for private roads include the following:

- Private Road
- Private Entry (Commercial access & Residential Access)

Each of these classifications are discussed in greater detail below.

a. Arterial Streets

An arterial street should have high mobility while offering little access to adjacent land use. Because of its high mobility and higher speeds, an arterial provides connection between communities and are used for longer trips. All of the state controlled roads in American Fork are considered arterial streets including State Street (US-89), 100 East (SR-74), West Main Street (SR-145), and 500 East (SR-180). However, several other city-operated roads are classified by

American Fork City as arterial streets (see most current edition of Master Transportation Plan). Most access to arterials should be provided at signalized intersections and some unsignalized public streets. Private access driveways should be discouraged where possible. Speed limits on arterials typically range from 35 to 50 mph. Figure 2 shows an example of an arterial street in American Fork that connects other arterial with the Interstate system. Little direct access is provided and high speeds allow for good mobility on the arterial streets.

Figure 2 Arterial street in American Fork (Source: Hales Engineering).

b. Collector Streets

A collector street provides some mobility and some access and provides connections between local streets and arterial streets. Collectors are often used for moderate length trips within a community. Several major and minor collector streets are found in American Fork City. Major collectors have three-lane cross sections although some may currently only have two-lane cross sections and minor collectors typically have two-lane cross sections. Commercial access and local street access to collector streets is common, however, residential driveway access should be limited where possible on major collectors as these types of streets often have higher volumes of traffic and higher speeds. Speed limits on collectors typically range from 30 to 35 mph. Figure 3 shows an example of a collector street in American Fork that connects adjacent residential and commercial areas to the arterial street network. Some direct access is provided to adjacent property and but reasonable speeds can also be obtained.

Figure 3 Collector street in American Fork (Source: Hales Engineering).

c. Local Streets

A local street can provide full access to all adjacent land use, and usually provides little mobility. Because of this, trips on local streets are typically short and usually are between one land use and the nearest collector street. Local streets are typically wide enough for two-way travel and many have space for on-street parking. The majority of local streets are residential streets which have speed limits of 25 mph. Figure 4 shows an example of a local street in American Fork that provides full access to adjacent property but little mobility.

Figure 4 Local street in American Fork (Source: Hales Engineering).

d. Private Roads

Private roads are often quasi public streets in that they provide circulation within a commercial development or within a multi-family residential complex. Because these streets may travel through parking areas, speeds are typically slow. The purpose of these streets is to provide access to developments and consolidated access to the public street network.

D. Access Management Techniques

The following subsections briefly discuss several access management techniques currently being utilized in Utah as well as around the country.

a. Traffic Signal Spacing

Traffic signals should be spaced evenly and generally no closer than one-half mile apart. Closely or irregularly spaced signalized intersections have shown to increase delay and crash rates as good coordination is not possible. Queuing from one signalized intersection can also interfere with another closely spaced intersection. While one-half mile spacing has been shown to be optimal, shorter spacing (as close as one-quarter mile) is also acceptable on minor arterials or collector streets.

b. Unsignalized Access Spacing

Unsignalized access spacing refers to the distance between two unsignalized intersections which can include public streets or private driveways. Research has shown that increasing the frequency of accesses (also referred to as access density) can increase the crash rate of a corridor as more conflict points are added. Average speeds can also be lowered as the additional accesses create “friction” from multiple vehicles entering and exiting the traffic stream at multiple locations.

c. Corner Clearance Criteria

The *TRB Access Management Manual* defines corner clearance as the distance from a public or private street to the nearest driveway (TRB 2003). The AASHTO Greenbook further states that driveways should not be placed within the functional area of an intersection which includes the queue storage distance, maneuver distance, and perception-reaction distance as these areas are critical areas for the safe and efficient operations of an intersection. Inadequate corner clearance can cause driveway blockages as well as decrease the overall safety of an intersection.

d. Median Treatments

The two most common types of medians include two-way left turn lane (TWLTL) medians and raised island medians. TWLTLs are more safe and efficient than no median at all; especially in commercial areas because they provide space for left turning vehicles to exit the through traffic stream and wait for on-coming gaps to complete the left turn movement. However, national and Utah research has shown that raised medians are even more effective because they provide a physical barrier to opposing directions of travel and help consolidate accesses and left turn movements to predetermined locations. Raised medians are very effective for commercial corridors with high access density and locations with poor corner clearances and are often used as a retrofit access management technique instead of trying to remove existing accesses.

e. Turn Lanes

Providing left turn lanes is recommended because it removes traffic waiting for gaps out of the main traffic stream. A TWLTL or raised median accomplishes this objective on the main road. Left turn lanes are also recommended on the minor street approaches or driveways, especially when the streets or driveways oppose another street or driveway. Opposing left turn lanes help improve site distance for the opposite left turn movement thus improving the safety of the intersection.

Exclusive right turn lanes are also a form of access management, especially along busy corridors where there are a lot of right turning vehicles. Because right turn movements are usually completed at low speeds (approximately 10 mph), an exclusive right turn lane provides

refuge while the vehicle decelerates to make the right turn. At signalized intersections where right-turn-on-red movements are permitted, an exclusive right turn lane decreases the delay for right turning vehicles.

f. U-Turns as Alternatives to Direct Left Turns

U-turns as alternative to direct left turns are usually operated in conjunction with raised medians. As mid-block access is limited to right-in/right-out (RIRO) access only, left turn ingress and egress movements must often make u-turns at other locations. These u-turns can be accommodated by having mid-block median opening with u-turns permitted, or by allowing u-turns at the next signalized intersection. When raised medians are present, some accommodation must be made for u-turns. Research has shown that u-turns as alternatives to direct left turns are safer than allowing the direct left turns.

g. Access Separation from Freeway Interchanges

Freeway interchanges generally have very high traffic volumes and often closely spaced signalized intersections. Research has shown that limiting access in close proximity to an interchange can reduce the need for complex signal timings, heavy weaving maneuvers, and queuing problems. Establishing good intersection spacing adjacent to freeway interchanges is crucial even if the interchange area is not very developed. Like most other interchanges along the Wasatch front, American Fork's two interchanges will become heavily developed as American Fork grows because economically, these areas are always prime locations for development.

h. Frontage/Backage Roads

Frontage roads are an effective access management alternative because they can provide increased access to property adjacent to an arterial or freeway with periodic access to the arterial at well spaced locations. Frontage roads act in principle like a collector street but allow good visibility to the adjacent corridor. Frontage roads are often referred to as backage roads when they are placed behind adjacent building, thus providing even better visibility to the corridor.

i. Roundabouts

Roundabouts are a form of access management because they can provide efficient and safe access to side streets as an alternative to signalized or stop-controlled intersections. While not necessarily the best solution for all intersections, roundabouts are especially effective where approach volumes are fairly balanced and where a signal or all-way stop-control would cause excessive delay most of the day. Safety benefits of roundabouts are well documented in the literature as crashes at roundabouts are generally much less severe than crashes at signalized intersections because they are usually rear-end or side-swipe collisions and not right-angle or

head-on collisions as is often the case at signalized intersections. Additionally, crashes at roundabouts typically occur at lower speeds, thus reducing the overall severity.

j. Shared (Cross) Access

In commercial corridors, an effective measure to consolidate access and limit access points on an arterial road is by providing shared access or cross access. Shared access is usually accomplished by straddling an access for two separate properties on the property line. This decreases the number of access points to the main road which improves operations and safety as discussed above as well as pedestrian safety as the number of sidewalk crossings are limited. Development and maintenance costs may also be reduced.

Cross access usually is accomplished by connecting the parking lots of two adjacent properties so that vehicles can cross between the two properties without using the public street. Cross access can be provided so that fewer access can be utilized for several adjacent properties, or, even if the number of accesses is not reduced, cross access can limit the number of trips on the adjacent roadway if vehicles are accessing multiple land uses. For example, trips could be reduced when an office building has cross access with a fast-food restaurant, or when a big-box retail establishment has cross access with a bank.

k. Access Alignment/Offset

Good access alignment and appropriate offsets are a form of access management. According to the AASHTO Greenbook, “regardless of the type of intersection, for safety and economy, intersecting roads [including driveways] should generally meet at or nearly at right angles. Roads intersecting at acute angles need extensive turning roadway areas and tend to limit visibility... Acute-angle intersections also increase the exposure time of for vehicles crossing the main traffic flow (AASHTO 2004, pg. 580).” In addition, acute-angle intersections are particularly difficult for elderly drivers because of the lack of flexibility in the neck of an elderly driver to check for gaps more than 90 degrees to the left or right. The AASHTO Greenbook states that 60 degrees should be the minimum angle of an intersection where 90 degrees is not feasible (AASHTO 2004, pg. 388).

Whenever possible, driveways or side streets should be aligned directly opposite from driveways or streets on the opposite side of the main road. This can increase safety as site distance is better for opposing left turns and as it can eliminate overlapping left turns on the main road. If intersection offset must occur, it should be designed such that a vehicle waiting to turn left into one access does not occupy the same space as a vehicle waiting to turn left into the other access. Figure 5 illustrates the recommended and non-recommended types of offset.

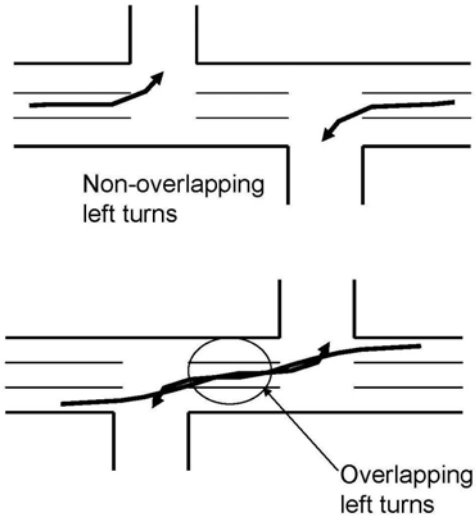

Figure 5 Non-overlapping intersections (shown above) are preferred to overlapping intersections (shown below) (Source: Hales Engineering).

Accesses should also be avoided near tight horizontal or vertical curves as appropriate site distance may be difficult to obtain.

I. Access Control

Certain movements of an access can be limited or controlled to reduce conflicts thereby increasing safety and reducing delay. The most common is to designate an access as a right-in/right-out (RIRO) access. A RIRO access allows only right turn ingress and right turn egress movements. Left turns in or out as well as crossing movements (if applicable) are not permitted. A similar, but less restrictive type of access is a three-quarter access, of which two configurations are possible. A three-quarter access can allow right ingress, right egress, and either left ingress or left egress movements, thereby eliminating only one of the four movements types (thus the name “three-quarter access”).

The effectiveness of a RIRO or three-quarter access is dependent upon the physical controls put into place for these types of accesses. Compliance is low when adequate signing and raised curbs are not present. The most effective way to enforce a limited access driveway is by use of a raised median. A raised median makes left turns physically impossible, and a directional median opening can allow either the left-ingress or left-egress movements when desired. Simply placing signs or even installing a “pork-chop” island will not prevent many drivers from making illegal turns, thus significantly reducing their effectives as access management techniques. Figure 6 shows a vehicle turning left into a RIRO access. Figure 7 shows a vehicle making a left turn out of a RIRO access. Figure 8 and Figure 9 show two RIRO accesses that are operating more effectively because of medians enforcing the desired access management.

Figure 6 Vehicle making an illegal left turn into a RIRO access (Source: Hales Engineering).

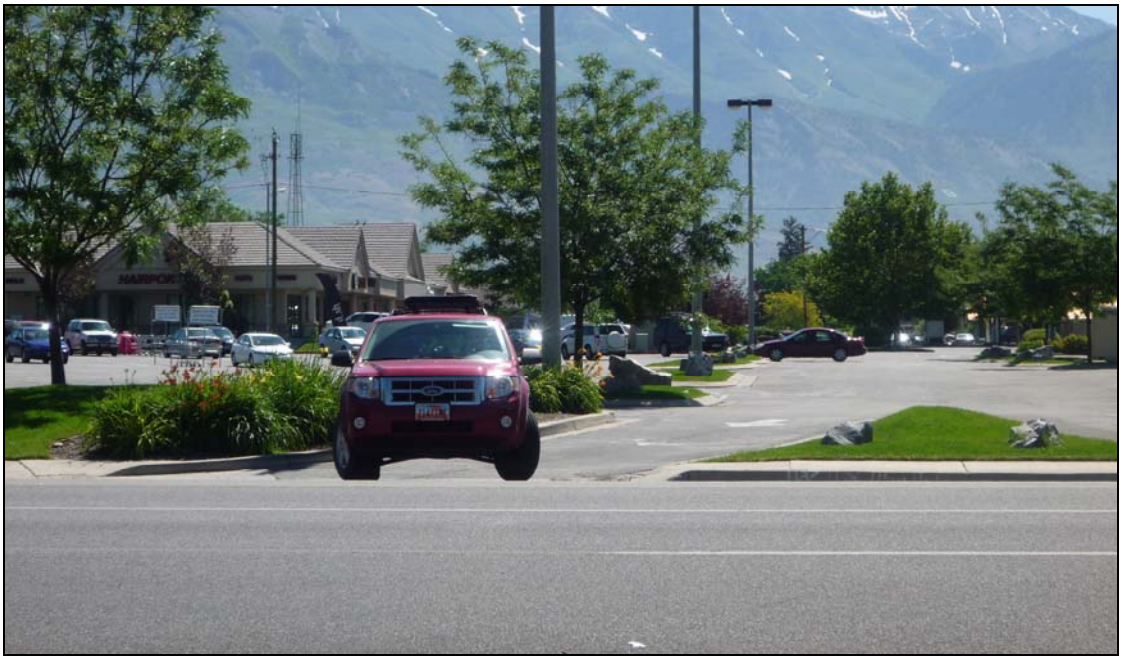

Figure 7 A vehicle making a left turn out of a RIRO (Source: Hales Engineering).

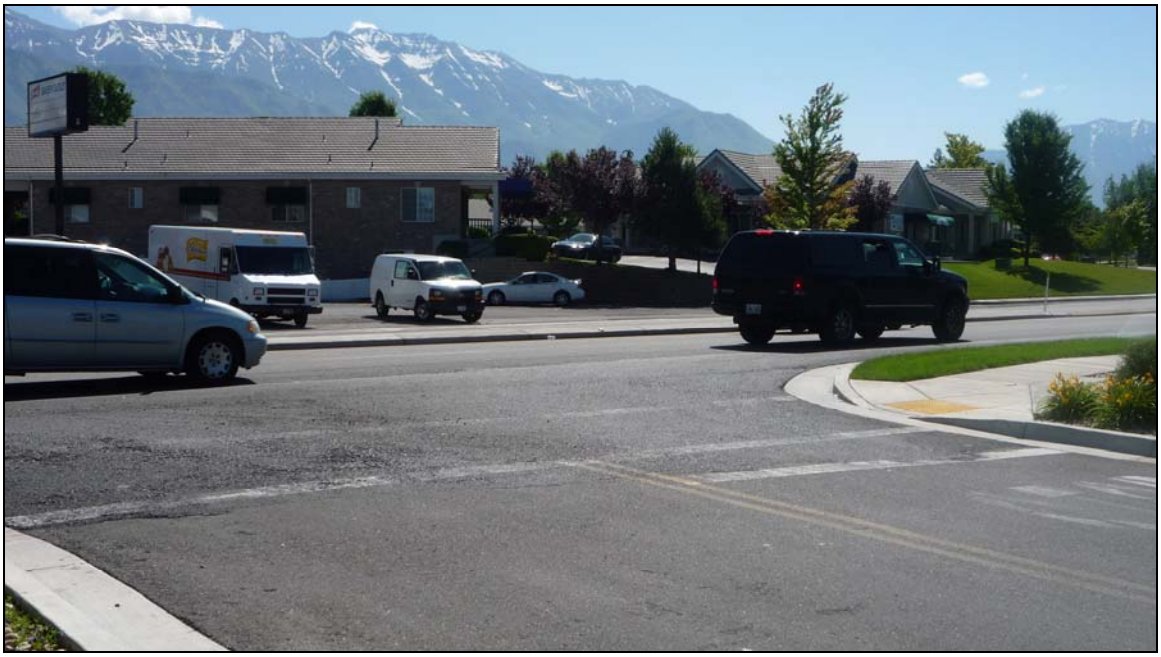

Figure 8 A raised island enforces this RIRO access (Source: Hales Engineering).

Figure 9 A channelizing island and delineators enforce this RIRO driveway (Source: Hales Engineering).

m. Access Characteristics

Appropriate design of accesses to a roadway is a critical component of access management. Poorly designed accesses can create safety and operational hazards along a corridor to both through traffic and turning traffic. The main design features of an access are the curve radii and the width of the access. Many factors influence the design including the design vehicle, design speed, traffic volume utilizing the access, and pedestrian presence.

The design vehicle used to create an access can greatly affect the width and corner radius, especially if a driveway is designed for large trucks. A smaller corner radius can cause vehicles entering an access to cross the centerline of the access road; therefore, when heavy volumes are present, smaller radii require wider driveways. The opposite is also true because with a large enough radius, even a large vehicle will not need to cross the center line of the driveway. However, large radii greatly increase the distance for a pedestrian to cross the access, therefore in areas with high pedestrian presence, a smaller radius may be ideal.

The type of curb opening can also effect traffic operations. The three main types of curb openings include curb returns, dropped curb, and dustpan curbs. However, dropped curb and dustpan designs usually require much larger driveway widths as their effective radii are relatively small.

The vertical profile of an access is important because when abrupt transitions occur between the cross-slope of the roadway and the slope of the driveway, the front or rear end of a vehicle can scrape the road when a vehicle enters or exits the driveway. This causes drivers to make turns into or out of driveways at angles larger than 90 degrees which in turn can cause safety hazards, especially if the driveway is well utilized. Care should be taken to avoid an abrupt change in slopes so that the driveway can be utilized as intended without damaging vehicles. Figure 10 shows an appropriate vertical curve provided for smooth transition on this sloped access driveway.

Figure 10 Smooth vertical curve to transition between cross-slope of adjacent street (not pictured) with the fairly steep slope of the driveway (Source: Hales Engineering).

The throat length of an access can also be a critical design element of an access that can impact safety and operations both on and off of the site. The driveway throat length refers to the distance of the driveway between the street and the first on-site parking area or intersection encountered. Insufficient throat length can create queuing both on- and off-site. The throat length must be long enough to handle queuing of vehicles attempting to exit the site as well as for queuing occurring as vehicles enter the site and wait for parking spots or make movements within the parking lot. Figure 11 shows an example of appropriate throat length for a driveway into a large development.

Figure 11 The throat length shown here is sufficiently long enough to avoid conflicts from ingress and egress movements from interfering with parking and internal circulation (Source: Hales Engineering).

n. Intersection Sight Distance

Appropriate intersection sight distance should be provided for at each access and intersection based on the type of control (signal, stop sign, yield sign, roundabout, etc.), the design speed of the roadways, the design vehicle, the permitted movements at the intersection, and the cross-sectional width of the road to be traversed. Pedestrian usage can also be a factor in required intersection sight distances. The AASHTO Greenbook provides guidance for calculating the appropriate intersection sight distances. Figure 12 and Figure 13 show examples of poor intersection sight distance because of bushes, trees, and other structures.

Figure 12 Sight distance to the right is obscured by landscaping features (Source Hales Engineering).

Figure 13 Sight distance to the left is made difficult by the curved road and the parts of the bridge structure (Source: Hales Engineering).

o. Intersection Lighting

Lighting can improve the safety and efficiency of intersections and the *AASHTO Greenbook* (2004) recommends that it be present in urban and suburban areas "where there are concentrations of pedestrians and roadside and intersection interferences (pg. 729)." Beyond traffic safety and operational benefits, street and intersection lighting can also benefit crime prevention and other community needs and should therefore be coordinated with the city agency responsible for these programs.

Intersection lighting is especially recommended when the intersection has channelized movements, large turning radii, wide cross sections, and high pedestrian volumes. Figure 14 shows typical intersection lighting.

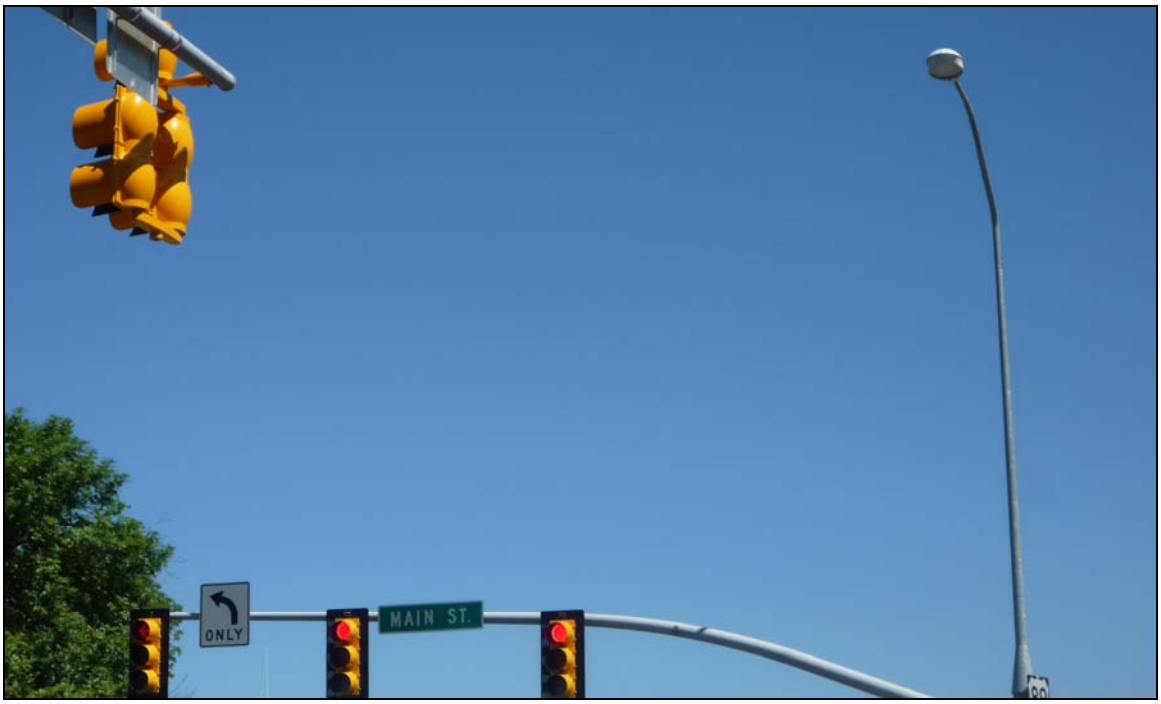

Figure 14 Typical intersection lighting (Source: Hales Engineering).

Three cities were surveyed to determine their intersection and street lighting requirements are. These requirements are summarized in Table 1 below.

Table 1 Intersection and Street Lighting Requirements				
	Lighting Required	**Spacing Required**		
Design Vehicle	**Intersections**	**Residential Streets**	**Collector Street**	**Arterial Streets**
Lehi, Utah	Yes	400' Staggered	400' Staggered	400' Staggered
Provo, Utah	Yes	Mid-Block	Per IES Guidlines[1]	Per IES Guidlines[1]
South Jordan, Utah	Yes	200'-250' Staggered	300'-350' Staggered	300'-350' Staggered

Notes:

1. Illuminating Engineers Society.

Source: Lehi City, Provo City, South Jordan City

E. Benefits of Access Management

The three primary benefits of access management include operational benefits, safety benefits, and economic benefits. These three are discussed in the following sections in greater detail.

a. Operational Benefits

Because access management decreases the frequency of driveways and signalized intersections, travel times and delay can be reduced, and the capacity of a road can be increased. Often this can result in a road functioning at appropriate levels of service despite increased traffic growth. This in turn can save money for the agency responsible for the road as capacity enhancing projects such as road widening can be pushed later into the future.

b. Safety Benefits

Because left turn maneuvers are typically associated with the more severe types of crashes minimizing these conflicts through access management can improve the overall safety of a corridor. Both the quantity and severity of crashes has been shown to be reduced through implementation of access management. Sometimes less-severe crashes such as rear-end crashes increase with certain types of access management, however, the benefits of reducing right-angle crashes far outweigh the cost of additional minor crashes.

Adequate access spacing in busy urban corridors also helps reduce the decisions and workload normally required as drivers pass driveways and other intersections. This allows drivers to be more vigilant to other conditions thus improving the overall safety of the corridor.

c. Economic Benefits

A large concern of business owners and developers is that reducing direct access of businesses to major roads will hurt sales because access management techniques will make access to businesses more inconvenient, thus reducing the number of customers that will patronize the businesses. In fact, the Federal Highway Administration (FHWA) found that the opposite was true. In a study released in 2006 (*Safe Access is Good for Business*), the FHWA reported that before and after studies in several states showed that "the vast majority of businesses do as well or better after the access management projects are completed" because the overall travel time to access the businesses are reduced due to reductions in delay. This in turn actually makes patronizing the establishments more convenient and can increase the market area as travel times are reduced. Developments that are difficult to enter and exit due to poor access management and congestion become less attractive to customers. Research conducted in Utah corroborated the results of the FHWA study at a local level.

III. ACCESS MANAGEMENT STATE-OF-THE-PRACTICE

A. Introduction

This chapter discusses the current state-of-the-practice for access management related standards including the current policies of the Utah Department of Transportation (UDOT) and several other cities in Utah.

B. Utah Department of Transportation (UDOT)

UDOT began a formal access management program in 2003 with Administrative Rule R930-6, *Accommodation of Utilities and the Control and Protection of State Highway Rights of Way*. Chapter 7 of this rule outlines the access management plan for all UDOT-owned roads. Several topics are coved by this program including:

- Access management classifications (Category 1 through 9)
- Access spacing requirements for each classification including signal spacing, street spacing, access spacing, and spacing from crossroads to freeway interchanges.
- Access design standards and specifications
- Turn lane requirements
- Permitting and variance processes

a. UDOT Access Location and Design Standards

Table 2 shows the access spacing requirements for UDOT roads. UDOT's access spacing requirements serve as a good starting point for American Fork's access spacing requirements, especially for American Forks' higher classification roadways. However, UDOT's requirements do not cover lower classified roads such as residential streets and collector streets.

Table 3 shows recommended minimum and maximum access widths for driveways on UDOT facilities based on land use type. Table 4 shows the recommended minimum and maximum radii for urban accesses on UDOT facilities. Table 5 shows the desirable and minimum approach angles of access to UDOT facilities, that is, the maximum allowable skew of an access.

Table 2 UDOT State Highway Access Management Standards

Category		Minimum Signal Spacing (feet)	Minimum Street Spacing (feet)	Minimum Access Spacing (feet)	Minimum Interchange to Crossroad Access Spacing (feet)		
					To 1st RIRO[1]	To 1st RIRO Intersection[2]	From last RIRO[3]
1	Freeway/ Interstate	Interstate/Freeway Standards Apply					
2	System Priority-Rural	5,280	1,000	1,000	1,320	1,320	1,320
3	System Priority-Urban	2,640	No Unsignalized Access Permitted		1,320	1,320	1,320
4	Regional-Rural	2,640	660	500	660	1,320	500
5	Regional-Priority Urban	2,640	660	350	660	1,320	500
6	Regional-Urban	1,320	350	200	500	1,320	500
7	Community-Rural	1,320	300	150	Not Applicable		
8	Community-Urban	1,320	300	150			
9	Other	1,320	300	150			

Notes:

1. The distance from the interchange off-ramp gore area (point of widening) to the first RIRO driveway intersection.
2. The distance from the interchange off-ramp gore area (point of widening) to the first major intersection.
3. The distance from the last RIRO driveway intersection to the interchange off-ramp gore area (point of widening).

Source: UDOT R930-6 Table 7.4-1 (2006)

Table 3 UDOT Access Width Guidance

Land Use	Direction Use	Minimum Access Width (feet)	Maximum Access Width (feet)
Commercial or Industrial	Two-way	25	50
	One-way	16	30
Residential	Two-way or one-way	12	20
Farm Land	Two-way or one-way	16	32

Notes:

1. If two one-way approaches are adjacent and separated by a non-traversable median between 4 and 25 feet wide, the access is treated as one access.

Source: UDOT R930-6 Table 7.4-2 (2006)

Table 4 UDOT Access Radii (Urban Areas)		
Land Use	**Minimum Radius (feet)**	**Maximum Radius (feet)**
Commercial or Industrial	30	60
Residential or Farms	10	15

Notes:

1. Examine the vehicle profile utilizing the subject access and design appropriate radii.

Source: UDOT R930-6 Table 7.4-4 (2006)

Table 5 UDOT Access Driveway Angles			
Land Use	**Direction Use**	**Desirable (degrees)**	**Minimum (degrees)**
Commercial or Industrial	Two-way	90	80
	One-way (right-in or right-out)	90	60
Residential or Farm Land	Two-way or one-way	90	80

Notes:

1. If two one-way approaches are adjacent and separated by a non-traversable median between 4 and 25 feet wide, the access is treated as one access.

Source: UDOT R930-6 Table 7.4-6 (2006)

b. UDOT Access Variance Process

A variance can be granted by UDOT officials to deviate from the access management process when certain criteria are met. A variance letter is submitted as an attachment of the permit application and is reviewed by the Region Permits Officer and Region Traffic Engineer of the appropriate region. Five key points are considered as the variance request is reviewed to ensure that no other reasonable alternatives exist and that the access will not degrade the state highway. The five points are as follows (UDOT Administrative Rule R930-6 7.2.14):

- "The applicant has considered all other feasible alternatives to provide reasonable access to the land use or development and can demonstrate that better alternatives in terms of highway operations are not feasible or does not exist.
- "The applicant has considered access through a shared-use driveway or access point with an adjacent land use and such a shared use access is not feasible.

- "The applicant is providing on-site or off-site traffic improvements that might offset the negative impacts of granting an access that does not meet standards.
- "The applicant has considered and demonstrated trip reduction strategies that allow the access to properly function without creating a negative impact to the highway.
- "The applicant has provided traffic engineering or other studies to determine that the access will not degrade the efficient flow of traffic on the highway in terms of safety, capacity, travel speed, and other functional features of the highway."

An appeals process is also provided for in the event that a variance is turned down.

C. City-Level Access Management Standards

This section reviews access management standards currently in practice for various municipalities within Utah. Access management standards were reviewed for the following cities:

- Draper (Transportation Master Plan, 2007)
- Provo (Transportation Master Plan, 2000)
- Spanish Fork (Transportation Master Plan, 2008)
- St. George (Access Management Policy, 2008)
- Washington City (Access Management Plan, 2005)
- West Jordan (Master Transportation Plan, 2003)

Access management standards for each of the municipalities were compiled into several tables. Table 6, Table 7, and Table 8 show recommended signal spacing, public street spacing, and access spacing, respectively, for each city by functional classification type. Table 9 and Table 10 show additional standards for RIRO accesses. Table 11 shows minimum offset requirements for each of the municipalities.

Table 12 and Table 13 show minimum and maximum access widths and curb radii, respectively.

Table 6 Signalized Intersection Spacing – Summary

Functional Class	Draper	Provo	Spanish Fork	St. George	Washington City[b]	West Jordan
Arterial	2,640					2,640
Major Arterial		[a]	2,640	2,640	1,320	
Minor Arterial		[a]	1,320	1,320	1,320	
Collector		[a]	1,320			
Major Collector	1,320				1,320	1,320
Major Collector (Res)				1,320		
Major Collector (Comm)				1,320		
Minor Collector	1,320					1,320
Residential Collector				1,320	n/a	
Local	n/a				n/a	n/a
Commercial Local			1,320	1,320		
Industrial Local				2,640		
Residential Local			1,320	1,320		
Residential Sub-Local			1,320			
Residential Standard				1,320		

Notes:

a. Depends on speed and cycle length.

b. Requires a traffic study.

Source: Draper (2007), Provo (2000), Spanish Fork (2008), St. George (2008), Washington City (2005), West Jordan (2003)

Table 7 Street Intersection Spacing – Summary

Functional Class	Draper	Provo	Spanish Fork[a]	St. George	Washington City	West Jordan
Arterial	660					660
Major Arterial		n/a	660	660	1,320	
Minor Arterial		n/a	500	500	650	
Collector		n/a	500			
Major Collector	660				650	330
Major Collector (Res)				250		
Major Collector (Comm)				500		
Minor Collector	300					250
Residential Collector				250	250	
Local	150				150	n/a
Commercial Local			660	400		
Industrial Local				500		
Residential Local			125	150		
Residential Sub-Local			100			
Residential Standard				150		

Notes:

a. Referred to as "minimum unsignalized full-movement access spacing" and is the same requirement for public streets and private accesses.

Source: Draper (2007), Provo (2000), Spanish Fork (2008), St. George (2008), Washington City (2005), West Jordan (2003)

Table 8 Private Access Spacing – Summary

Functional Class	Draper	Provo	Spanish Fork	St. George	Washington City	West Jordan
Arterial	200					300
Major Arterial		[a]	660	660	[b]	
Minor Arterial		[a]	500	500	[b]	
Collector		[a]	500			
Major Collector	200				150	150
Major Collector (Res)				250		
Major Collector (Comm)				400		
Minor Collector	150					85
Residential Collector				125	50	
Local	n/a				50	n/a
Commercial Local			660	400		
Industrial Local				500		
Residential Local			125	75		
Residential Sub-Local			100			
Residential Standard				75		

Notes:

a. Function of the driveway volume and speed limit of the roadway.

b. Requires a traffic study.

Source: Draper (2007), Provo (2000), Spanish Fork (2008), St. George (2008), Washington City (2005), West Jordan (2003)

Table 9 RIRO Public Street Spacing – Summary

Functional Class	Draper	Provo	Spanish Fork	St. George	Washington City	West Jordan
Arterial	n/a					n/a
Major Arterial		n/a	n/a	660	n/a	
Minor Arterial		n/a	n/a	500	n/a	
Collector		n/a	n/a			
Major Collector	n/a				n/a	n/a
Major Collector (Res)				150		
Major Collector (Comm)				250		
Minor Collector	n/a					n/a
Residential Collector				n/a	n/a	
Local	n/a				n/a	n/a
Commercial Local			n/a	200		
Industrial Local				250		
Residential Local			n/a	n/a		
Residential Sub-Local			n/a			
Residential Standard				n/a		

Source: Draper (2007), Provo (2000), Spanish Fork (2008), St. George (2008), Washington City (2005), West Jordan (2003)

Table 10 RIRO Access Spacing – Summary

Functional Class	Draper	Provo	Spanish Fork	St. George	Washington City	West Jordan
Arterial	n/a					n/a
Major Arterial		n/a	330	330	n/a	
Minor Arterial		n/a	250	250	n/a	
Collector		n/a	250			
Major Collector	n/a				n/a	n/a
Major Collector (Res)				125		
Major Collector (Comm)				200		
Minor Collector	n/a					n/a
Residential Collector				n/a	n/a	
Local	n/a				n/a	n/a
Commercial Local			300	200		
Industrial Local				250		
Residential Local			100	n/a		
Residential Sub-Local			75			
Residential Standard				n/a		

Source: Draper (2007), Provo (2000), Spanish Fork (2008), St. George (2008), Washington City (2005), West Jordan (2003)

Table 11 Minimum Offset Distances – Summary

Functional Class	Draper	Provo	Spanish Fork[a]	St. George	Washington City	West Jordan
Arterial	n/a					n/a
Major Arterial		n/a	600/300 [a]	600/300 [a]	[b]	
Minor Arterial		n/a	220	220	[b]	
Collector		n/a	200			
Major Collector	n/a				150/125 [c]	n/a
Major Collector (Res)				200		
Major Collector (Comm)				200		
Minor Collector	n/a					n/a
Residential Collector				150	50	
Local	n/a				50	n/a
Commercial Local			200	200		
Industrial Local				220		
Residential Local			n/a	n/a		
Residential Sub-Local			n/a			
Residential Standard				n/a		

Notes:

a. Streets with speeds greater than 45 mph require 600-foot spacing, otherwise 300 foot spacing.

b. Requires a traffic study.

c. 150 feet upstream and 125 feet downstream.

Source: Draper (2007), Provo (2000), Spanish Fork (2008), St. George (2008), Washington City (2005), West Jordan (2003)

Table 12 Width of Access Points – Summary

	Draper	Provo	Spanish Fork[a]	St. George	Washington City[a]	West Jordan
Commercial/Industrial						
Minimum Width	24			n/a	26	
Maximum Width	36			44	35	
Multi-Family Residential						
Minimum Width	24			n/a	26	
Maximum Width	36			n/a	35	
Residential						
Minimum Width	10			15	12	
Maximum Width	28			32	27	

Notes:

a. Commercial accesses onto a major arterial require a traffic study.

Source: Draper (2007), Provo (2000), Spanish Fork (2008), St. George (2008), Washington City (2005), West Jordan (2003)

Table 13 Access Curb Radii – Summary

	Draper	Provo	Spanish Fork	St. George	Washington City[a]	West Jordan
Commercial/Industrial						
Minimum Width	10			[a]	15	
Maximum Width	30			[a]	30	
Multi-Family Residential						
Minimum Width	10			[a]	15	
Maximum Width	30			[a]	30	
Residential						
Minimum Width	2.5			[a]	n/a	
Maximum Width	30			[a]	n/a	

Notes:

a. Passenger cars: 15 to 30; Trucks: 30 to 50.

Source: Draper (2007), Provo (2000), Spanish Fork (2008), St. George (2008), Washington City (2005), West Jordan (2003)

IV. RECOMMENDED ACCESS MANAGEMENT REQUIREMENTS

A. Introduction

The following sections discuss recommended access management related standards for American Fork City. These recommendations are based on national and local research, as well as the current state-of-the-practice by other DOTs and municipalities as previously discussed. Following adoption of this manual, these standards will become Chapter 16 of "American Fork City Standards, Drawings & Specifications" as adopted in ordinance # 07-07-31 and subsequent updates.

B. Access Provisions

This section discusses what types of accesses should be permitted on the various types of roadways within American Fork. The roadway network and land use are interconnected, therefore allowing certain types of land use and accesses adjacent to certain types of roadways will lead to the correct type of access and mobility that would be expected for a certain type of road. Table 14 shows recommended allowable accesses for each roadway classification.

Table 14 Access Provisions

Street Classification	Commercial Access	Multi-Family Residential Access	Residential Access	Public Street Access
Arterial Street	Yes[1]	No[3]	No	Yes
Major Collector	Yes	Yes	No[5]	Yes
Minor Collector	Yes	Yes	Yes[4]	Yes
Local Street	No[2]	Yes	Yes	Yes

Notes:

1. Preferably, commercial access to an arterial should be consolidated for several parcels and gained using a traffic signal or a public street. Where direct access is given to an arterial, if possible, the access should be a RIRO access.
2. Exceptions to this recommendation would be for small commercial developments or for secondary access to a development.
3. Very large multi-family developments may have private accesses that resemble public streets in form and function, and therefore would be an exception to this recommendation.
4. Direct access and frontage of residential properties to a minor collector may result in less-than-desirable livability for residents and should be avoided where practical.
5. Direct access and frontage of residential properties to a major collector may result in less-than-desirable livability for residents and should be avoided where practical; however, if base residential zoning allows access, then a traffic impact study showing acceptable operations and safety can be mitigated, then an engineering review will determine the applicability of this standard.

Source: Hales Engineering

Recommendations listed in Table 14 may not always be feasible depending on whether or not other access exists for a given parcel of land. The feasibility of these recommendations is also highly dependent upon land use and transportation planning for American Fork City.

C. Intersection and Access Spacing

Based on recommendations from the literature and from state-of-the-practice of other municipalities and DOTs, recommendations for minimum signalized, public street and private access spacing have been compiled and are shown in Table 15.

Table 15 Access Management Spacing Recommendations

Street Classification	Minimum Signal Spacing (feet)[1]	Minimum Street Spacing (feet)[1, 4]	Minimum Commercial Access Spacing (feet)[1, 4]	Minimum Residential Access Spacing (feet)[1]
Arterial Street	2,640	660	330[2]	n/a[3]
Major Collector	1,320	660	330	n/a[3]
Minor Collector	1,320	330	150	150
Local Street	1,320	150	150	50

Notes:

1. Measured center-line to center-line
2. Access to an arterial should only be granted when other reasonable access is not available to a collector or local street. If granted, the access should be limited to right-in/right-out only if possible.
3. Residential access should not be granted on arterials or major collectors.
4. Minimum Street Spacing refers to unsignalized intersection spacing; if a traffic signal is present a traffic impact study should determine if the minimum street spacing should be longer.

Source: Hales Engineering

D. Corner Clearance Requirements

The corner clearance requirements are the same as the minimum access spacing requirements as were shown previously in Table 15. In general, minimum corner clearance can be shorter on the downstream leg of the minor street at an intersection, especially if the access is s RIRO access. This distance can be as low as 120 feet. For all other corner clearance distances, the values in Table 15 for minimum access spacing apply.

E. Cross Access (Shared Access) Requirements

Access to private property from the public transportation network cannot be prohibited. However, when parcels have small frontages, especially along major collectors and arterials, it is highly recommended that the cross access and/or shared access be utilized where practical. Where adjoining parcels have the same ownership, American Fork City should require the use of cross or shared access in order to maintain the recommended access spacing requirements as previously discussed. When adjacent parcels do not have common ownership, incentives should be provided to promote shared and cross access.

F. Intersection Alignment / Offsets

Where possible, accesses on opposite sides of the street should be lined up directly across from each other. Sometimes this is not possible due to site restrictions or property lines. If accesses cannot be lined up across from one another, the preferable offset is so that left turns entering each respective access do not overlap, as was discussed previously in this document and shown in Figure 5. Table 16 shows the minimum offset for intersections on opposite sides of the street when the potential for overlap does occur. However, a traffic impact study may determine that a larger offset is required depending on the level of queuing that may occur at the intersections.

Table 16 Minimum Access Offset Requirements

Street Classification	Minimum Offset (feet)[1]
Arterial Street[2]	310
Major Collector	180
Minor Collector	120
Local Street	n/a

Notes:

1. These values are a minimum requirement and are subject to change based on the results of a traffic impact study.
2. Offset requirements are not applicable in the case of RIRO accesses such as when a raised median is present. Access should only be provided to arterial streets when reasonable alternative access is does not exist.

Source: Hales Engineering

G. On-Street Parking

Permitting on-street parking can be a tool to make a corridor more pedestrian friendly as parked vehicles provide a buffer between through traffic and pedestrians on the sidewalks. Vehicles

parking and un-parking along a roadway may cause side friction that can result in through traffic being slowed down or impeded. To determine whether or not a road should have permitted on-street parking depends primarily on what the function of the roadway is. As was discussed previously, the purpose of most arterial type roads is to provide mobility, not access, whereas the purpose of a local street is to provide access and not mobility. However, another important factor is adjacent land use. A roadway in a core business area, even if classified as an arterial, can benefit from having on-street parking, where a lower classified road, such as a minor collector within an industrial area, may not need on-street parking, therefore the cost to build and maintain this type of road will be less expensive by prohibiting on-street parking. Finally, the available cross section width should also be considered when determining whether on-street parking should be permitted. A minimum of seven feet of cross section width should be provided for on-street parking. Table 17 shows recommended on-street parking provisions based on functional classification. Figure 15 shows on-street parking on Main Street in American Fork. Although this road is classified as an arterial, the adjacent land use supports on-street parking. All parking within American Fork City should be parallel except for Church Street, Center Street and Merchant Street between Main Street and Pacific Drive and Main Street from 200 East to 460 East.

Table 17 On-Street Parking Recommendations

Street Classification	On-Street Parking Permitted[1]
Arterial Street	No
Major Collector	Yes
Minor Collector	Yes
Local Street	Yes

Notes:

1. These recommendations are based primarily on the function of the roadway. Adjacent land use and available cross section width are also important factors in determining whether on-street parking should be permitted.

Source: Hales Engineering

Figure 15 On-street parking is currently permitted on Main Street because of the adjacent land use and the available cross section width (Source: Hales Engineering).

H. Access Characteristics

Recommendations for access characteristics discussed in this section include the following:

- Driveway width
- Curb return radii
- Vertical profile of driveway
- Driveway throat length
- Minimum separation of gate on private access from public street

All recommendations in this section assume the following:

- The design vehicle for residential and commercial accesses is a passenger car
- The design vehicle for industrial accesses is a WB-50, with the exception of the North Pointe Business Park including the Price property, which will be designated by the City Engineer based on the type of anticipated vehicle usage.

Although some larger vehicles such as delivery vehicles do need access to commercial areas, these types of trips do not typically occur during the peak periods of the day. The entire access (ingress and egress side) can therefore be used by a larger vehicle during off-peak times. This is more efficient than utilizing more area to make larger radii and access widths and is also more ideal for pedestrians. Access driveways that will be heavily utilized by trucks and busses during peak periods should be designed to the industrial recommendations.

Table 18 shows driveway widths and curb radii for various intersection types depending on the functional classification of the adjacent roadway.

Table 18 Driveway Widths and Curb Return Radii

Access Type	Total Driveway Widths & (Ingress Lane Width) in Feet				Curb Return Radii in Feet			
	Arterial	Major Collector	Minor Collector	Local	Arterial	Major Collector	Minor Collector	Local
Residential (SFDU) 1 dwelling unit	n/a	n/a	12 (n/a[1])	12 (n/a[1])	n/a	n/a	n/a[2]	n/a[2]
Multi-Family (less than 3 units)	n/a	18 (n/a[1])	18 (n/a[1])	18 (n/a[1])	n/a	n/a[2]	n/a[2]	n/a[2]
Multi Family (more than 3 units)	26 (n/a[1])	26 (n/a[1])	26 (n/a[1])	26 (n/a[1])	20	20	20	25
Commercial (1 exit lane)	26 (14)	26 (14)	26 (14)	26 (14)	20	20	20	25
Commercial (2 exit lanes)	40 (16)	40 (16)	n/a	n/a	20	25	n/a	n/a
Industrial	36 (22)	36 (22)	36 (22)	n/a	45	45	45	n/a

Notes:

1. This type of access is not striped.
2. This type of access is a "dustpan" style access; therefore, no curb-return radius applies.

Source: Hales Engineering & *Transportation and Land Development* (ITE, 2002)

Table 19 shows the required curb radius measured from top back of curb (TBC) for the various street intersections within American Fork City. Deviation from these standards requires approval in writing from the City Engineer.

Table 19 City Street Curb Radii (feet)

Right-of-Way Width (feet)	Right-of-Way Width (feet)			
	60	**66**	**82**	**96**
60	25	25	30	30
66	25	30	35	35
82	30	35	45	45
96	30	35	45	45

Notes:

1. All measurements are in feet.
2. Based on currently adopted American Fork City standards.

Source: Hales Engineering

Table 20 contains maximum change in grade between the cross-slope of the roadway and the slope of the driveway. The maximum change in grade reported is the algebraic difference in slope. For example, if a negative 2 percent cross-slope connects to a positive 2 percent driveway slope, the algebraic change in grade is 4 percent. Likewise, if the cross-slope is negative 2 percent and the driveway slope is negative 6 percent, the algebraic change in grade is also 4 percent. Table 19 also shows the maximum change in grade where no vertical curves are required (rounding only) as well as the maximum change in grade with vertical curves provided.

Table 21 shows the recommended driveway throat lengths for various access types and based on what type of conflict is closest to the adjacent road. When an internal intersection will be the first conflict encountered when entering a driveway, a shorter throat is typically needed then for a site where the driver will encounter parking spots after entering the access.

Table 22 shows the minimum separation of a gate on a private access from the edge of traveled way for various design vehicles. This separation is necessary so that a vehicle can park in front of the gate while it is still closed without the rear of the vehicle obstructing the flow of traffic. Where the possibility of queuing exists, such as at a gated residential community, a traffic study should be completed to determine the 95th percentile queue length during the peak hour.

Table 20 Change in Driveway Vertical Profile

Access Type	Maximum Change in Grade – No Vertical Curve Required[1]				Maximum Change in Grade – Vertical Curve Required			
	Arterial	Major Collector	Minor Collector	Local	Arterial	Major Collector	Minor Collector	Local
Residential (SFDU)	n/a	n/a	8%	10%	n/a	n/a	10%	12%
Multi-Family (3 or less units)	n/a	8%	8%	10%	n/a	10%	10%	12%
Multi Family (4 or more units)	4%	7%	8%	10%	5%	7%	10%	12%
Commercial (1 exit lane)	4%	7%	8%	10%	6%	7%	10%	12%
Commercial (2 exit lanes)	4%	7%	n/a	n/a	5%	7%	n/a	n/a
Industrial	4%			n/a	5%			n/a

Notes:

1. Rounding by taking care to avoid abrupt change in grade.

Source: Hales Engineering & *Transportation and Land Development* (ITE, 2002)

Table 21 Recommended Driveway Throat Length (feet)

Access Type	First conflict within the site is:	
	Parking	Internal Intersection
Residential (SFDU)	n/a	n/a
Multi-Family (3 or less units)	n/a	n/a
Multi Family (4 or more units)	75	30
Commercial (1 exit lane)	75	30
Commercial (2 exit lanes)[1]	75	50
Industrial	75	75

Notes:

1. For signalized accesses with three egress lanes, throat length should be at least 200 feet long. For signalized accesses with four egress lanes, throat length should be at least 300 feet long. These lengths should also be verified by a traffic study.

Source: Hales Engineering & *Transportation and Land Development* (ITE, 2002)

Table 22 Minimum Setback of a Gate on a Private Access from a Private Street

Design Vehicle	Minimum Distance (feet)[1]
Passenger Car	25
Single Unit Truck	35
Bus	50
Recreational Vehicle	35
Recreational Vehicle Pulling a Trailer	60
WB-40	50
WB-50	60
WB-62	75
WB-67	80

Notes:

1. Measured form the edge of the sidewalk to the gate. Traffic study required if multiple vehicles are expected to use the gate.
2. For a gate controlled access from a public street an SU design vehicle should be able to complete a three-point turn within the throat, see St. Dwg. #15.38A.

Source: Hales Engineering & *AASHTO Greenbook* (2004)

I. Intersection Sight Distance

This section discusses recommended intersection sight distance for several intersection types and is based on *AASHTO Greenbook* (2004) recommendations. These recommendations are made for various intersection control scenarios as well as functional classifications of the intersecting roads. Additionally, sight distances to accommodate trucks have also been calculated. Scenarios discussed in the following sections include intersection sight distance for a full access stop-controlled intersection, a RIRO access, a yield-control intersection (four-leg and three-leg intersection), and an uncontrolled intersection. Sight distance requirements for a left turn from a major street onto a minor street are also given within the provided tables for illustrative purposes. All intersection sight distances should be calculated by a licensed traffic engineer and compared to the tables within this manual.

For all of the scenarios, the following assumptions have been made:

- Design Speeds:
  - Access: 15 mph
  - Local: 30 mph
  - Minor Collector: 35 mph
  - Major Collector: 40 mph
  - Arterial: 50 mph
- Intersections are flat (all slopes are assumed 3 percent or less)
- Cross Sections:
  - Local: 2 lanes
  - Minor Collector: 2 lanes
  - Major Collector: 3 lanes
  - Arterial: 5 lanes
- All calculations are based on *AASHTO Greenbook* (2004) assumptions

Because the grade of the major or minor street does affect sight distance, the values presented in the sections below should be adjusted when grades are more than 3 percent. These adjustments should be made on an individual case-case basis by consulting the *AASHTO Greenbook*. Additionally, alternative design speeds or cross sections will also require adjustments to these sight distances.

Once intersection sight distances have been determined for a given intersection, a “clear sight triangle” can be formed which should remain clear of anything that will obstruct the driver from seeing other vehicles within the intersection sight distance. The AASHTO Greenbook states that the minimum height of a driver’s eye is approximately 3.5 feet. The maximum height (which corresponds to the driver of a combination or single unit truck) is approximately 7.6 feet. Therefore, objects should not be placed in the clear sight triangle between 3.5 and 7.6 feet in

height. Objects such as buildings, fences, and parked cars are examples of objects that will block the intersection sight distance. Landscaping features such as shrubbery and decorative rocks are acceptable as long as they are less than 3.5 feet high. Trees are acceptable as long as the stump is located outside of the clear sight triangle and the lowest branches are at least 7.6 feet tall. These height standards apply to areas with flat grade. Intersections near slopes must be evaluated on a case-by-case basis.

a. Stop-Controlled Intersections

Intersection site distances for stop-controlled intersections include full movement intersections where the minor street is stop-controlled, but the major street does not stop. RIRO intersection sight distance is also presented. Table 23 shows the sight distance required for full-movement intersections. Table 24 shows the sight distance required for RIRO intersections. In both cases, the sight triangle for the minor leg should be 20 feet back from the edge of traveled way of the major street. The value shown in the table is how far to the left and right for which the stopped vehicle should have a clear sight triangle. Figure 16 illustrates these distances and the sight triangle.

Table 23 Intersection Sight Distance – Two-Way Stop-Controlled Full-Movement Intersection (feet)

Design Vehicle	Major Street			
	Local[1]	Minor Collector[2]	Major Collector[3]	Arterial[4]
Passenger Car	335	390	470	625
Single Unit Truck	420	490	600	805
Combination Truck	510	595	720	950

Notes:

1. Design Speed: 30 mph, 2-lane cross section.
2. Design Speed: 35 mph, 2-lane cross section.
3. Design Speed: 40 mph, 3-lane cross section.
4. Design Speed: 50 mph, 5-lane cross section.

Source: AASHTO Greenbook (2004) Case B1 (pp. 657-663)

Table 24 Intersection Sight Distance – Stop-Controlled RIRO Access (feet)				
	Major Street			
Design Vehicle	Local[1]	Minor Collector[2]	Major Collector[3]	Arterial[4]
Passenger Car	290	335	385	480
Single Unit Truck	375	440	500	625
Combination Truck	465	545	620	775

Notes:

1. Design Speed: 30 mph, 2-lane cross section.
2. Design Speed: 35 mph, 2-lane cross section.
3. Design Speed: 40 mph, 3-lane cross section.
4. Design Speed: 50 mph, 5-lane cross section.

Source: AASHTO Greenbook (2004) Case B2 (pp. 663-666)

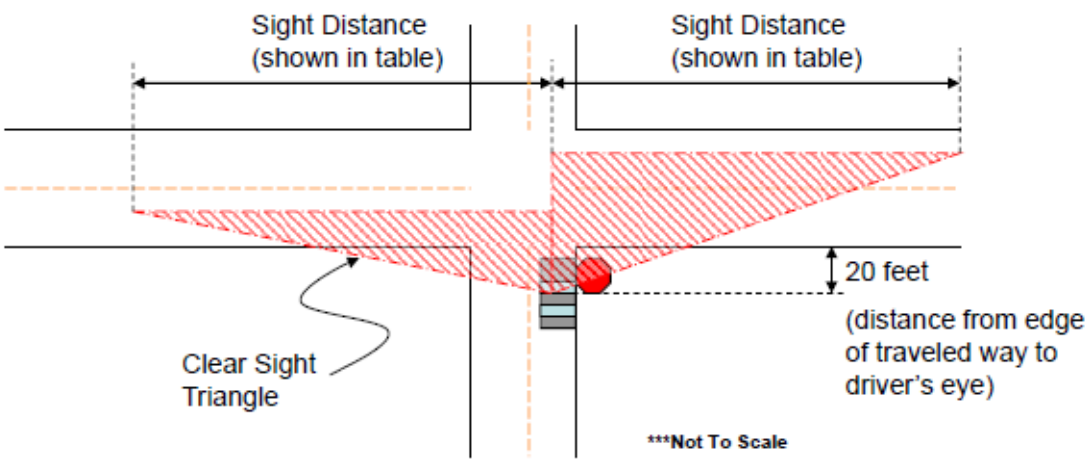

Figure 16 Intersection sight triangles for stop-controlled minor approaches (Source: Hales Engineering based on *AASHTO Greenbook* (2004) with modification by American Fork City for additional safety considerations).

b. Yield-Controlled Intersections

Intersection site distances for yield-controlled intersections include four-leg intersections where both minor street approaches are yield control as well as three-leg intersections where the

minor street is yield-controlled. In both scenarios, the major street does not stop. Other combinations of yield approaches must be evaluated on a case-by-case basis. Table 25 shows the sight distance required at four-way intersections with minor-street yield control. Table 26 shows the sight distance required at T-intersections with one yield-controlled leg. For the T-intersection scenario (Table 26), the site distance on the minor street is measured 82 feet back from the traveled way of the minor street approach. Figure 17 and Figure 18 illustrate these distances and the sight triangles for four-way and T-intersections, respectively. Sight distance values were only calculated for passenger cars as it is assumed that roads with significant truck traffic will not be yield-controlled intersections. Also, it was assumed that the major streets do not have classifications higher than minor collector, as these types of high classification streets should at least have stop control on the minor street.

Table 25 Intersection Sight Distance – Four-Way Intersection with Minor Street Yield Control (feet)

	Minor Street	**Major Street**	
		Local[1]	Minor Collector[2]
Minor Street Leg	Access[3]	75	75
	Local[1]	160	160
Major Street Leg	Access[3]	300	345
	Local[1]	290	335

Notes:

1. Design Speed: 30 mph, 2-lane cross section.
2. Design Speed: 35 mph, 2-lane cross section.
3. Design Speed: 15 mph, 2-lane cross section.

Source: AASHTO Greenbook (2004) Case C1 (pp. 666-670)

Table 26 Intersection Sight Distance – Three-Way Intersection with Minor Street Yield Control (feet)			
	Minor Street	**Major Street**	
		Local[1]	Minor Collector[2]
Minor Street Leg	Access[3]	82	82
	Local[1]	82	82
Major Street Leg	Access[3]	355	415
	Local[1]	355	415

Notes:

1. Design Speed: 30 mph, 2-lane cross section.
2. Design Speed: 35 mph, 2-lane cross section.
3. Design Speed: 15 mph, 2-lane cross section.

Source: AASHTO Greenbook (2004) Case C2 (pp. 671-672)

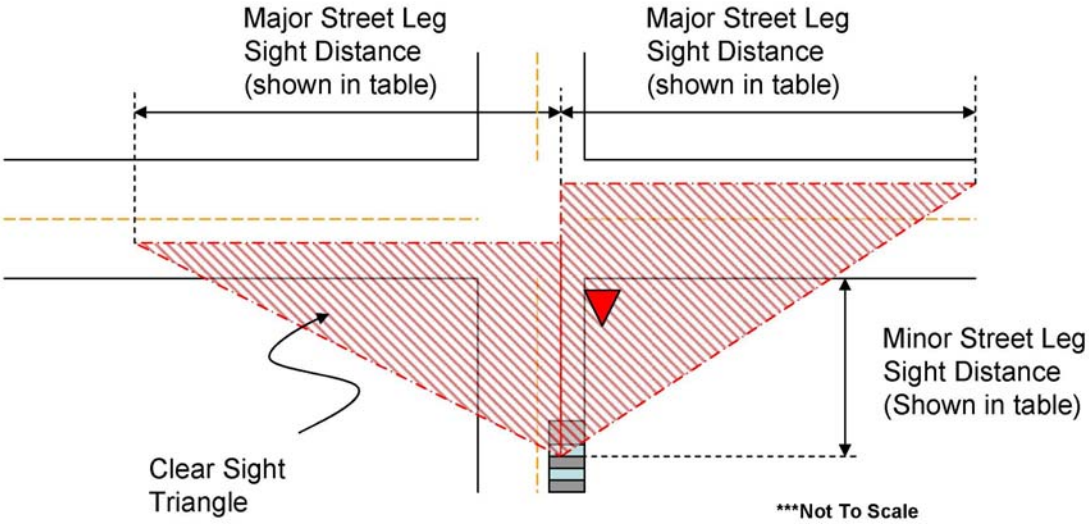

Figure 17 Intersection sight triangles for four-way intersections with yield control on the minor street approach (Source: Hales Engineering based on *AASHTO Greenbook* (2004)).

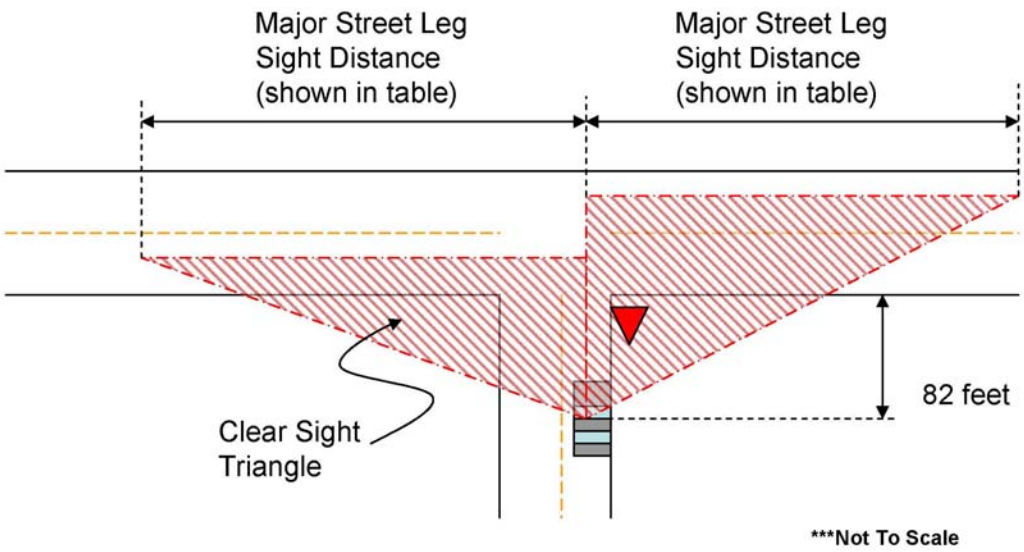

Figure 18 Intersection sight triangles for three-way intersections with yield control on the minor street approach (Source: Hales Engineering based on *AASHTO Greenbook* (2004)).

c. Uncontrolled Intersections

Uncontrolled intersection site distances are for those intersections where neither the minor nor the major street has any control. These streets are typically very low volume roads primarily in residential subdivisions. Table 27 shows the sight distance required at uncontrolled intersections. Only access roads and local streets were shown as any other higher classification road should have some intersection control. The distance shown in the table corresponds to the site leg of the site distance triangle for the respective type of road. Figure 19 illustrates the site distance triangle for this type of intersection. Sight distance values were only calculated for passenger cars as it is assumed that roads with significant truck traffic will not be yield-controlled intersections.

Table 27 Intersection Sight Distance – Uncontrolled Intersection (feet)

	Access[1]	Local[2]
Distance of Approach Leg	70	140

Notes:

1. Design Speed: 15 mph, 2-lane cross section.
2. Design Speed: 30 mph, 2-lane cross section.

Source: AASHTO Greenbook (2004) Case A (pp. 654-657)

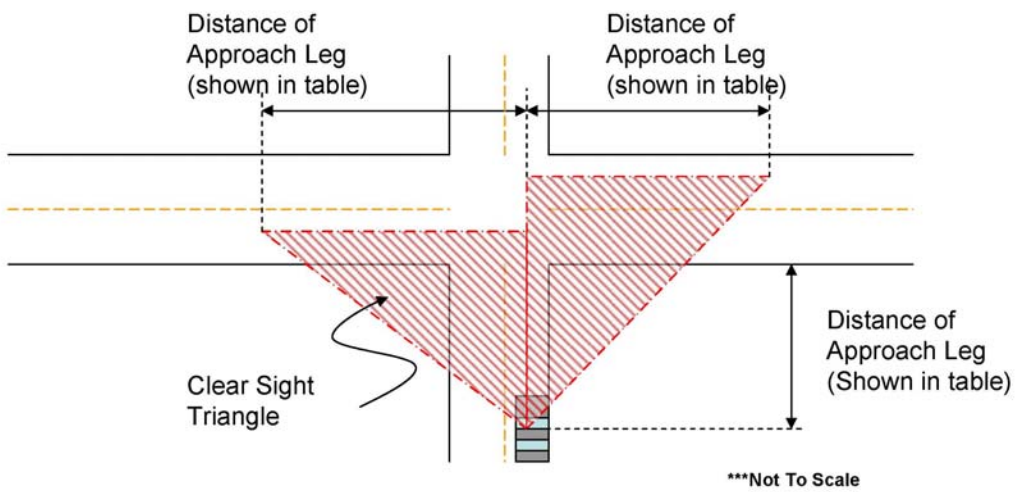

Figure 19 Intersection sight triangles for uncontrolled intersections (Source: Hales Engineering based on *AASHTO Greenbook* (2004)).

d. Left Turns from the Major Road

Intersection sight distance for left turns from the major road include any left turn movement where the driver must yield to oncoming traffic (through and right turning vehicles) before turning left onto the minor street. Table 28 shows the values for the sight distance triangles based as a function of design vehicle. Figure 20 illustrates the sight distance triangles for this type of movement.

Table 28 Intersection Sight Distance – Left Turns from Major Street (feet)

Design Vehicle	Major Street			
	Local[1]	Minor Collector[2]	Major Collector[3]	Arterial[4]
Passenger Car	245	285	325	445
Single Unit Truck	290	335	385	530
Combination Truck	335	390	445	605

Notes:

1. Design Speed: 30 mph, 2-lane cross section.
2. Design Speed: 35 mph, 2-lane cross section.
3. Design Speed: 40 mph, 3-lane cross section.
4. Design Speed: 50 mph, 5-lane cross section

Source: AASHTO Greenbook (2004) Case F (pp. 674-676)

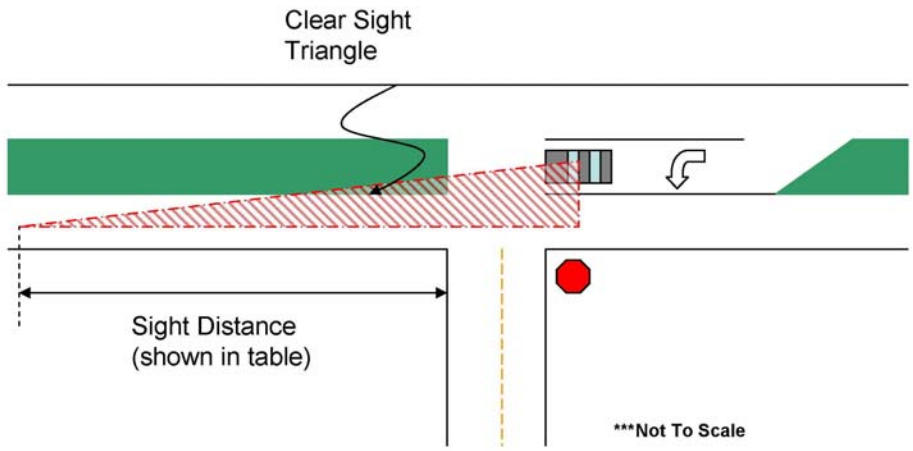

Figure 20 Intersection sight triangle for a left turn from the major street onto the minor street (Source: Hales Engineering based on *AASHTO Greenbook* (2004)).

J. Intersection Lighting

Table 29 shows recommendations for intersection lighting in American Fork City based on the type of intersection and/or access.

Table 29 Intersection Lighting Recommendations

Minor Street	Major Street			
	Arterial Street	Major Collector	Minor Collector	Local Street
Arterial Street	Yes			
Major Collector	Yes	Yes		
Minor Collector	Yes	Yes	Yes	
Local Street	Yes	Yes	Yes	Yes
Commercial Access[1]	Yes	Yes	Yes	Yes[2]
Residential Access	n/a	No	No	No

Notes:

1. For purposes of these recommendations, commercial accesses also include multi-family developments.
2. However, if this affects the project or the local subdivision negatively, then and appeals process can be initiated.

Source: Hales Engineering

In addition to intersection lighting, street lighting should also be provided, especially when roads are curved, or other design features make safely traveling the road at night more difficult without lighting. The type and frequency of lighting should be based on the context of the street including adjacent land use, architectural styles, and pedestrian usage. Making general recommendations for street lighting is beyond the scope of an access management plan. However, for reference in commercial areas street lights should be installed at 150-foot intervals on opposite sides of the road and in residential areas at 300-foot intervals on opposite sides of the road. Street lights should be installed at corners with at least one on every block. Mid-block street lighting is required if block lengths exceed 500-feet. Street lights should be installed on opposite corner from stop signs unless otherwise determined by the City Engineer. Figure 21 shows street lighting in a portion of the downtown core area that adds to the character of the street because of its aesthetics and pedestrian scale.

Figure 21 Street lighting such as this add to the character of the street and adds more to pedestrian safety than to traffic operations (Source Hales Engineering).

K. Level of Service Standard

American Fork City has determined that in order to provide desired operational characteristics and safety at new intersections, they should operate at an LOS C or better condition for new projects / areas within the City, and development / redevelopment projects in built-out areas of the City should maintain an LOS D or better.

V. APPEALS PROCESS

An access variance grants permission to depart from the standards and requirements of the American Fork City access management manual.

Applicants seeking a variance from the American Fork City access management manual will submit the written request as an attachment to the formal project submittal and application. A subsequent request for a variance may be allowed in accordance with the completeness check review procedure as a supplement to a previously submitted application if American Fork determines that it is in the public interest to do so. The City Engineer or Traffic Engineer will review all requests for variance.

The request for variance will specify in writing, why the variance is appropriate and necessary and should be completed and stamped by a licensed traffic engineer. Include in the request, documentation of conditions with and without the variance with the documentation showing that the applicant has considered all practical and reasonable mitigation alternatives. The variance request results from the application of the standard or requirement of this access management manual suffered directly and solely by the applicant, and is not self-created or self-imposed such as by the applicant acting with or without knowledge of the applicable standard or requirement. A variance will not be granted for procedural requirements.

The applicant is responsible for showing that the variance request meets minimum acceptable engineering, operation, and safety standards, the variance is not detrimental to the public health, welfare and safety, and the variance is reasonably necessary for the convenience and welfare of the public.

The City Engineer or Traffic Engineer will consider the following factors in determining that the granting of a variance will not negatively impact the current and proposed operation of the roadway:

1. The applicant has considered all other feasible alternatives to provide reasonable access to the land use or development and can demonstrate that better alternatives in terms of roadway operations are not feasible or does not exist.
2. The applicant has considered access through a shared use or cross access driveway or access point with an adjacent land use and such a shared use access or cross access is not feasible. A letter from the adjacent land owner stating that cross access or shared access is not feasible shall be provided.
3. The applicant is providing on-site or off-site traffic improvements that might offset the negative impacts of granting an access that does not meet standards.
4. The applicant has considered and demonstrated trip reduction strategies that allow the access to properly function without creating a negative impact to the roadway.

5. The applicant has provided traffic engineering or other studies to determine that the access will not degrade the efficient flow of traffic on the roadway in terms of safety, capacity, travel speed and other functional features of the roadway.

The review and final action of whether to approve or disapprove the variance will be completed within twenty (20) working days of the date of acceptance of the request for variance application.

Include the documentation of reasons for approving/denying the variance in the project files and records. State in terms and conditions of the approved permit and variance that the permittee may be required to improve, modify, eliminate, or correct the condition responsible for the variance when it is evident that the justification for the variance is no longer valid.

The permit may stipulate conditions and terms for the expiration of the permit when the necessity for the variance no longer exists, allowing direct access to a roadway when the access proposal cannot meet the standards of this access management manual, or when the property would otherwise be without reasonable alternative access if a variance were approved.

If a variance is denied, the applicant may initiate an appeal only after complete review and determination of the access permit application.

HALES ENGINEERING
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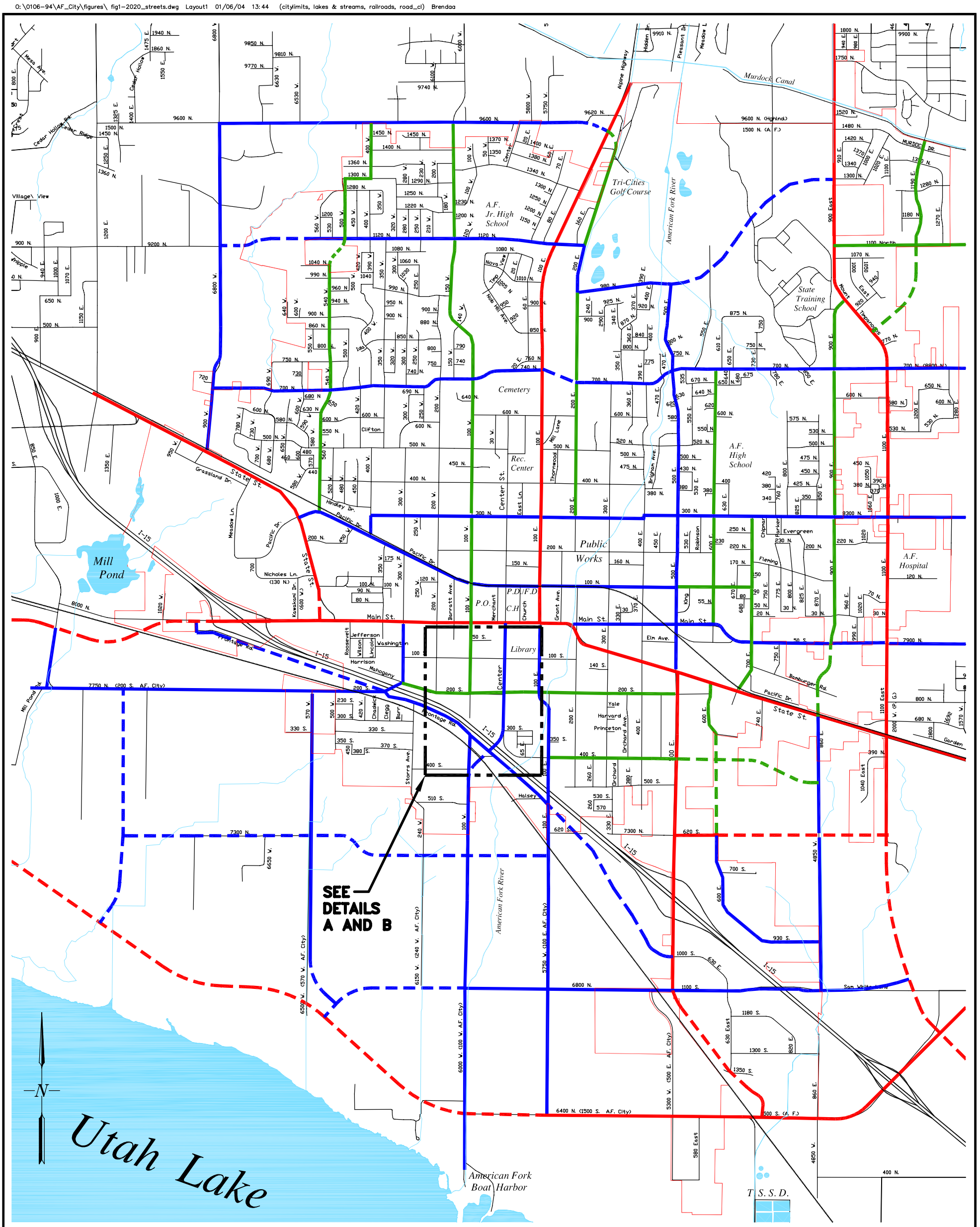
APPENDIX A

American Fork City

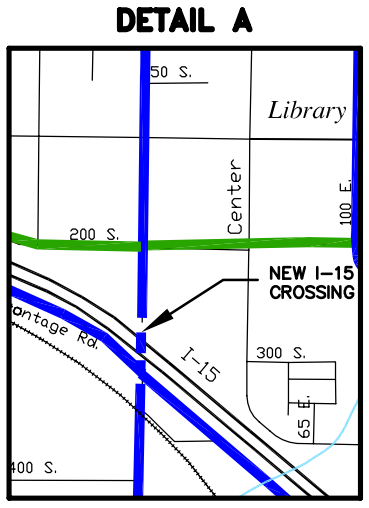
Transportation Master Plan 2004

0:\0106-94\AF_City\figures\ fig1-2020_streets.dwg Layout1 01/06/04 13:44 (citylimits, lakes & streams, railroads, road_cl) Brendaa



HORROCKS ENGINEERS

DETAIL A



100 WEST OPTION

OR

DETAIL B

CENTER STREET OPTION

LEGEND

- CITY LIMITS
- STREAMS AND CANALS
- RAILROAD
- ARTERIAL
- MAJOR COLLECTOR
- MINOR COLLECTOR
- LOCAL ROAD

NOTE:
FUTURE ROADS ARE DASHED AND SHOWN IN THE APPROXIMATE LOCATION.

FIGURE 1

AMERICAN FORK CITY
2030 MASTER PLAN
MAJOR STREET SYSTEM

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APPENDIX B

Intersection Sight Triangle Standard Drawings