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APPENDIX A Relevant Clark County Area Uniform Standard Drawings

APPENDIX B Access Management Sample Checklist for Site Design

APPENDIX C Access Management Sample Checklist for Driveway Design
1. INTRODUCTION

The document has been prepared to provide information on standards and policies that will encourage a unified approach for implementing consistent access management measures across the suburban and urban areas of Clark County, Nevada. This access management document was prepared in cooperation with the Regional Transportation Commission’s (RTC) partner agencies through the Operations Subcommittee. The Operations Subcommittee assists the Executive Advisory Committee on traffic management and roadway operation issues and is comprised of representatives from:

- Regional Transportation Commission
- City of North Las Vegas
- City of Boulder City
- City of Henderson
- City of Las Vegas
- Clark County
- Nevada Department of Transportation
- Freeway and Arterial System of Transportation
- Metropolitan Police Department

The standards and recommended practices summarized and discussed in this access management document are primarily adapted from local policies, codes and practices. Many of the access management elements described in this document relate to the Clark County Area Uniform Standard Drawings (1). The relevant Standard Drawings are located in Appendix A. These local standards and practices have been supplemented with “best practice” applications and research from other states, municipalities, the Transportation Research Board and other federal agencies. This document is the first step in a larger effort by the RTC to work with their partner agencies and elected officials to address legislative and policy barriers to implementing unified access management standards and policies in Clark County, Nevada. Consistent implementation of access management policies and strategies will aid in the planning and development of future capital improvement projects; protect the integrity and public investment in the roadway infrastructure; provide guidance for establishing and/or redeveloping access to the roadway network; and; improve safety and mobility throughout the transportation system.

The provided access management materials are intended to be used by the RTC and their partner agencies as a reference during the planning and design of capital improvement and private development projects. This document is also intended for use as a reference tool for others involved in planning and development; including developers, policy makers, architects, engineers, entitlement consultants, and other parties interested in access management concepts.

2. WHAT IS ACCESS MANAGEMENT

According to the Transportation Research Board, “Access management is the systematic control of the location, spacing, design, and operation of driveways, median openings, interchanges, and street connections to a roadway” (2). Access management is a set of proven tools and techniques that provide access to and between other roadways and to adjacent land development in a manner that preserves the safety and efficiency of the overall transportation system. Access management works to balance competing objectives between mobility, safety and the type and location of access connections. To date, there has been a substantial amount of research conducted on access management with regard to:

- safety benefits;
- operational benefits;
- economic impacts;
- land use; and
- environmental effects.

“Access management is the systematic control of the location, spacing, design, and operation of driveways, median openings, interchanges, and street connections to a roadway.” (2)

Effort was made to provide a general “best practice” summary of basic access management concepts, objectives, and benefits and their relation to local standards, practices and codes. Additional and more detailed information on access management can be found in the resources and references listed at the end of this document.

2.1 History of Access Management

Access management is not a new concept. Recent years have seen a targeted focus on awareness and implementation of access management policies and techniques but the concept of access management has been around for over 100 years. The following timeline highlights the evolution and understanding of access management and its impact on safety and roadway operation.

1902 New Jersey enacts the first access control state statute. This statute allowed the counties to establish “speedways” for horses and bicycles. Once the location of the speedway was established, no intersections were allowed without government approval.

1907 The US Supreme Court ruled that states should set laws determining property access rights.

1914 Westchester County, New York began establishing “parkways”. These parkways were comprised of roadways surrounded by parks to limit access.

1937 New York and Rhode Island create statutes authorizing “freeways”. These freeways included the full or partial acquisition of access rights to ensure long-term performance of the roadways.

1950s The effects of frequently spaced driveways on county and state roads across the United States were being studied.

1962 The American Association of State Highway Officials notes: “Many of the conventional highways have become functionally obsolete in some cases solely or largely because of lack of access control” (3).
2.2 Street Hierarchy

Roadways within the transportation network have a hierarchy or priority level that translates into varying degrees of mobility and access. This priority establishes a functional hierarchy or classification system. The Transportation Research Board states, “From a planning perspective, contemporary access management is a systematic way to carry out the roadway functional hierarchy that is implicit in state, regional and local transportation plans” (2). Good access management practices help maintain the functional integrity of the roadway network by limiting access on certain types of roadways and promoting it on others.

A typical functional classification includes four main categories. These categories can be subdivided as necessary to provide greater distinction between roadways within each category or accommodate specific roadway types within a particular area or municipality.

- **Interstate/Freeway** – Provides for the highest level of mobility and lowest levels of access. Characterized by uninterrupted travel over long distances at high speeds. Direct access is not provided to adjacent property. Access is only provided at highly controlled entrance and exit locations – typically grade separated interchanges.

- **Arterial (Major) Roadway** – Provides the next highest level of mobility. Arterials are also characterized by high vehicle volumes and speeds but travel distances are generally less than interstates/freeways. Mobility is favored on arterials but direct access is provided to adjacent properties and intersecting roadways.

- **Collector (Minor) Roadway** – Provides for equal levels of mobility and access. Access or mobility can be favored depending upon the location of the roadway within the network.

- **Local Roadway** – Provides the lowest level of mobility and the highest level of access. Local roadways are characterized by low vehicle volumes, low speeds and short distance travel.

The relationship between access, mobility and functional classification is illustrated in the following graphic.

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2.3.1 Safety

Human factors, geometric design components and environmental influences can work individually or combine to create the potential for incidents at any point along a roadway corridor. Every intersection and driveway along a roadway creates points of conflict for vehicles, cyclists and pedestrians. As the number of access points increases so does the number of conflict points and the frequency of crashes. This trend has been documented in numerous studies, including a study by the Federal Highway Administration (6). A figure from the study is shown below. When applied properly, access management measures work to limit these conflict points and reduce crash potential. Studies have consistently shown lower crash rates on roadways with access management measures in place.

![Access Point Density and Crash Rate](source6)

A study on the impacts of access management in the mid 1990s at seven locations was conducted by the Center for Transportation Research and Education at Iowa State University(7). The study investigated impacts to safety and operations that resulted from various access management improvements including driveway consolidation and the installation of full medians. The results of the study showed a decline in the overall number of traffic crashes and a decrease in the rate of crashes. Table 1 illustrates the results of the study by crash type and severity.

Left turn movements into and out of driveways account for the highest percentage of driveway crashes. Research suggests that approximately 72 percent of crashes at a driveway involve a left turning vehicle(5). These crashes are comprised of three main movements:

- 34 percent - Outbound vehicle turning left across opposing through traffic
- 28 percent - Inbound vehicle turning left across opposing through traffic

### Table 1 – Iowa Crash Summary

<table>
<thead>
<tr>
<th>Crash Type</th>
<th>Before Projects</th>
<th>After Projects</th>
<th>Numeric Change</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear-End</td>
<td>74 (29%)</td>
<td>44 (29%)</td>
<td>-30</td>
<td>-40.5%</td>
</tr>
<tr>
<td>Broadsid/Left Turn</td>
<td>38 (16%)</td>
<td>22 (16%)</td>
<td>-16</td>
<td>-42.1%</td>
</tr>
<tr>
<td>Right Angle</td>
<td>32 (12%)</td>
<td>20 (13%)</td>
<td>-12</td>
<td>-37.5%</td>
</tr>
<tr>
<td>All Other</td>
<td>106 (42%)</td>
<td>66 (43%)</td>
<td>-40</td>
<td>-37.7%</td>
</tr>
<tr>
<td>Total (All Types)</td>
<td>250 (100%)</td>
<td>152 (100%)</td>
<td>-98</td>
<td>-39.2%</td>
</tr>
</tbody>
</table>

### Average Annual Crash Statistics

<table>
<thead>
<tr>
<th>Crash Type</th>
<th>Before Projects</th>
<th>After Projects</th>
<th>Numeric Change</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Injury Crashes</td>
<td>73</td>
<td>55</td>
<td>-18</td>
<td>-24.7%</td>
</tr>
<tr>
<td>Fatalities</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Injuries</td>
<td>108</td>
<td>89</td>
<td>-19</td>
<td>-17.6%</td>
</tr>
<tr>
<td>Property Damage Only</td>
<td>177</td>
<td>91</td>
<td>-86</td>
<td>-48.6%</td>
</tr>
<tr>
<td>Total Vehicles Involved (All Crashes)</td>
<td>529</td>
<td>313</td>
<td>-216</td>
<td>-40.0%</td>
</tr>
</tbody>
</table>

Source (7)

One access management technique for improving safety is the controlling and limiting left turn movements with the installation of non-traversable medians. Non-Traversable medians typically yield an overall crash reduction of approximately 35 percent(8). This statistic is supported by recent projects in southern Nevada where non-traversable medians were installed on Cheyenne Avenue between Durango Drive and Tenaya Way in 2005 and on Durango Drive east of El Capitan Way in 2009. The RTC indicated that crashes on Cheyenne Avenue were reduced from 87 before the median to 52 after the median, and crashes were reduced on Durango Drive from 73 before the median to 54 after the median. The results indicate a reduction in crashes of approximately 40 percent on Cheyenne Avenue and 26 percent on Durango Drive. Non-traversable medians have also been shown to reduce pedestrian-vehicular crashes. A study by the Federal Highway Administration concluded that installing a raised median has statistically led to a 25% reduction in pedestrian-vehicular crashes(9).

2.3.2 Traffic Operations

Studies have consistently shown increases in capacity and travel speeds on roadways with access management measures in place. These studies have found that reducing the number of driveways and conflicting movements along a roadway simplifies the driving task and improves overall roadway operations. Virtually all access management measures provide some level of operational improvement by directly eliminating...
conflicts that slow or impede the flow of traffic on the roadway or at driveways. These measures do not always include the physical installation or modification of a roadway or driveway. Establishing a uniform traffic signal spacing and minimizing the number of signal installations is an effective access management strategy that can significantly improve roadway operations and potentially eliminate the need for other physical roadway modifications.

In Iowa, studies of corridors before and after implementation of access management projects have resulted in Level of Service (LOS) improvements of up to one level during the peak hour(10). LOS is a ranking system used by engineers and planners that assigns a letter grade to roadway operations ranging from A to F, with A being the most desirable (least delay) and F being the least desirable (long delays).

2.3.3 Economics

The economic benefits of access management are realized by local governments, the traveling public and business owners. Roadway infrastructure is costly to build, maintain and replace. By managing access agencies can extend the functional life of a facility and preserve the public investment. “In a revenue-constrained environment, effective management of the transportation system is not an option – it is essential. It is simply not practical to allow major arterial roadways to deteriorate under the assumption that they will be replaced or reconstructed in the future”(2). Generally, access management measures are a relatively inexpensive way to preserve and in some cases increase capacity of a roadway as compared to the cost of securing right-of-way and adding additional travel lanes. Access management ultimately results in improvements in roadway operation that translate to a reduction in associated environmental and economic impacts caused by vehicle delay. These savings are realized by individual motorists and businesses in the form of decreased vehicle operating costs.

Studies have shown that the impacts of access management on adjacent businesses are neutral to positive. Many studies have also been conducted on the economic impacts of access management on adjacent business. Most studies have focused on owner and customer perceptions of the impacts of access management to business since private sales data can be difficult to obtain. Studies in Iowa, Kansas, Texas, and Florida all found that the vast majority of businesses do as well or better after access management projects are completed. These studies have also found that the owner’s perceived impacts are generally much worse than the actual impacts and that the impacts of access management on adjacent businesses are neutral to positive.

2.3.3.1 Iowa

A business vitality study was conducted on nine different corridors in nine different cities in Iowa (7). A majority of business owners (over 85 percent) indicated that their sales had been stable or increased after the addition of access management treatments on their corridor.

### Business Vitality

<table>
<thead>
<tr>
<th>Impact</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased</td>
<td>33%</td>
</tr>
<tr>
<td>Same</td>
<td>53%</td>
</tr>
<tr>
<td>Decreased</td>
<td>5%</td>
</tr>
<tr>
<td>Uncertain</td>
<td>9%</td>
</tr>
</tbody>
</table>

**Source (7)**

The Iowa study also documented and compared the average business turnover rate statewide to the turnover rate for businesses in the corridors that received access management treatments. The turnover rate in the access management corridors ranged from 2.6 percent to 10 percent per year, compared to the average statewide business turnover rate of 10 percent. This finding suggesting that businesses located along the study corridors were less likely to change ownership or business type than the average business in Iowa. The study also found that retail sales along the access management study corridors outpaced sales in their respective communities.

### Retail Sales

<table>
<thead>
<tr>
<th>Year</th>
<th>Access Corridors</th>
<th>Communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>1991</td>
<td>105%</td>
<td>95%</td>
</tr>
<tr>
<td>1992</td>
<td>110%</td>
<td>85%</td>
</tr>
<tr>
<td>1993</td>
<td>115%</td>
<td>80%</td>
</tr>
<tr>
<td>1994</td>
<td>120%</td>
<td>70%</td>
</tr>
<tr>
<td>1995</td>
<td>125%</td>
<td>65%</td>
</tr>
</tbody>
</table>

**Source (7)**

2.3.3.2 Kansas

A study conducted by the Kansas Department of Transportation investigated 15 businesses that had filed inverse condemnation lawsuits relating to access management.

- In 13 of the 15 cases, the claimant was either still the property owner, the property was still being used for the same use by a different owner, or the property had been improved.
- In 2 of the 15 cases, the businesses (gas stations) closed after the implementation of the access management measures.

Based on the Kansas findings, the changes in access did not adversely impact the properties, except in two extreme cases (11). In these two cases, land use and the access
management measures applied to the roadway network were not compatible. In some cases these incompatibilities are unavoidable due to large scale changes in the roadway network. Usually, significant impacts can be avoided through cooperative efforts between business owners and government.

2.3.3.3 Texas

A study conducted by the Texas Department of Transportation focused on business owners’ general perceptions relating to business activity during construction and after construction of access management measures. The study included on-site interviews with business owners that yielded the following(12):

- Perceptions of how a non-traversable median would impact business were worse than the actual impacts.
- Businesses were most affected during construction.
- Employment in the corridors increased after construction.
- Businesses ranked the following in order of importance of attracting customers: (1) Customer service, (2) product quality and price, (3) accessibility to store, (4) store hours, and (5) travel distance.
- Ninety-four percent of the business owners felt that their customers were as likely or more likely to continue to come to their business after the improvements.

2.3.3.4 Florida

A study was conducted along Oakland Park Boulevard in Ft. Lauderdale, Florida after full-movement median openings spaced at 330 foot intervals were closed and converted to directional openings at 600 foot intervals(13). The study found the following:

- 80 percent of the corridor users liked the access management project.
- 70 percent of business owners indicated that the median modifications had no impact on deliveries.
- 60 percent of business owners indicated no change in business after construction.

2.3.4 Land Use

Land use is commonly defined in engineering terms as the general functional category of the developed uses on an individual property or group of properties. Residential, retail, office, and gaming are examples of different land use types. As communities and roadway infrastructure matures and changes, so do the surrounding land uses.

Often times when roadways are modified to include improved access management, adjacent land uses change to more dense development with increased property values.

For example, single family housing might have been developed along a minor roadway, but as time passed the roadway expanded, speeds and volumes increased and now the single family housing is no longer compatible with the roadway functionality. When land use and adjacent roadway operations are no longer compatible, changes in land use typically occur. This is an example of the transportation and land use cycle which results in the functional obsolescence of a roadway (2). Access management policies, in cooperation with supporting land development regulations, can slow and even stop the cycle of functional obsolescence. Slowing or stopping this cycle protects the public investment in the roadway infrastructure and allows for an increased level of sustainability in private land development.
### 2.4 How Can Access Management be Accomplished

Access management requires a combination of design, planning and regulatory strategies to fully encompass and achieve the desired results. According to the Federal Highway Administration(14), access management can be achieved through the application of the following planning, regulatory, and design strategies:

- Policies, directives, and guidelines issued by state and local agencies having permit authority on development and roadway infrastructure.
- Regulations, codes, and guidelines that are enforceable.
- Acquisition of access rights by states and local jurisdictions that serve to protect transportation interests to enable sufficient infrastructure to be built.
- Land development regulations by state and local jurisdictions that address property access and related issues.
- Development review and impact assessments by state and local jurisdictions.
- Good geometric design of transportation facilities.
- Understanding of access implications by developers, businesses, and property owners.

To aid in the implementation of the Federal Highway Administration strategies, the Center for Urban Transportation Research developed the “Ten Ways to Manage Roadway Access in Your Community”(15) which include the following measures:

- Lay the foundation for access management in your comprehensive plan.
- Restrict the number of driveways per lot.
- Locate driveways away from intersections.
- Connect parking lots and consolidate driveways.
- Provide residential access through neighborhood streets.
- Increase minimum lot frontage on major roads.
- Promote a connected street system.
- Encourage internal access to outparcels.
- Regulate the location, spacing and design of driveways.
- Coordinate with the State Department of Transportation.

The recommended practices in this document are consistent with these strategies. However, implementing consistent access management policies and strategies across jurisdictional boundaries is a challenging process as different agencies, and even divisions within the same agency, have differing priorities, missions and codified requirements. The stakeholder process used to develop this document recognized these challenges and created a systematic approach to access management based on current Clark County area uniform standards. The uniform standards do not cover all areas of access management but they do provide a level of consistency for basic access management implementation across jurisdictional boundaries. As access management principles and their benefits become better understood and accepted by the public, development community and governing bodies, additional access management policies and strategies should be developed and incorporated into local codes and standards.

### 3. The Basics of Access Management Implementation

Clark County provides a number of unique challenges in the selection and implementation of access management treatments. Clark County is comprised of multiple area types including rural, suburban and urban. Access management treatments must be tailored to these area types to match variations in the types of roadway facilities, the level of development and types of land uses, vehicle speeds and the environment. Roadways in rural areas are typically characterized by higher travel speeds, lower volumes and a smaller number of access points, and generally have fewer access management needs than urban and suburban areas. This document does not specifically address rural access management. The majority of the rural roadways in Clark County are owned and/or maintained by the State of Nevada through the Nevada Department of Transportation. Access management in the rural environment should be based on the policies and standards in the Nevada Department of Transportation’s Access Management System and Standards (16).

This document is intended for use on roadways in the suburban and urban areas of Clark County. The Federal Highway Administration states “Suburban areas offer the greatest opportunity to positively impact safety through access management treatments for several reasons. New development and redevelopment often occurs on large parcels of land, providing planners with more flexibility and options for implementing optimal access management treatments. This can provide the opportunity for access to be considered from a systematic perspective, from the outset of a project, where stakeholders have the opportunity to plan for the appropriate number of driveways and optimum types of access”(6). Suburban areas are located on the outer edges of the urban core and are typically characterized by large-scale residential, commercial or industrial uses. The roadway network in suburban areas typically includes a mixture of fully developed and partially developed roadways. Urban areas are generally characterized by high-density development surrounded by a fully developed roadway network. Urban areas can have shorter block lengths, on-street parking, limited right-of-way and aging infrastructure that can make access management much more challenging.

Successful implementation of access management strategies in the suburban and urban environments requires: identifying the roadway functional classification; consideration of the functional area of intersections along the roadway; and an understanding of roadway users (vehicles, pedestrians, cyclists and transit) and how they interact with each other and the roadway.

#### 3.1 Roadway Functional Classification

The RTC, Nevada Department of Transportation (NDOT) and local agencies all have a functional classification system defined in their statutes, regulations, codes or other master planning documents. Ideally, all agencies would use the same functional classification system to establish and maintain consistent access priorities. However, classification systems vary by agency depending on right-of-way width, location, multi-modal
capabilities and character of the roadway. In general, each system includes the four commonly recognized functional categories (1. Freeways/Limited Access Roadways; 2. Arterial (Major) Roadways; 3. Collector (Minor) Roadways; and 4. Local Roadways) but stratification of these categories varies widely by agency. To provide consistency across jurisdictional boundaries this document defines a functional classification system based on number of travel lanes and posted speed.

- **Interstates/Freeways/Limited Access Roadways** – Roadways with a minimum of one lane of travel in each direction and posted speeds greater than 50 miles per hour.
- **Arterial (Major) Roadways** – Roadways with two or more lanes of travel in each direction and posted speeds greater than 35 miles per hour and up to and including 50 miles per hour, or roadways with three or more lanes of travel in each direction and posted speeds greater than 40 miles per hour and up to and including 50 miles per hour.
- **Collector (Minor) Roadways** – Roadways with one or two lanes of travel in each direction and posted speeds greater than 25 miles per hour and up to and including 35 miles per hour.
- **Local Roadways** – Roadways with one lane of travel in each direction and posted speeds of 25 miles per hour or less.

The focus of this document is on the Major and Minor roadway classifications. These classifications can provide varying levels of access and mobility and can benefit the most from the thoughtful application of access management. Limited access roadways and local roadways are at the extreme ends of the spectrum where balancing access and mobility is not a priority.

### 3.2 Functional Area of an Intersection

Intersections are comprised of both physical and functional areas. The physical area is the area bounded by the corners of the intersection. The functional area varies and extends upstream and downstream of the physical intersection. The functional area of an intersection is often referred to as corner clearance. The American Association of State Highway and Transportation Officials (AASHTO) defines the upstream functional area of an intersection as a variable distance that is influenced by:

- distance traveled during driver perception-reaction time;
- deceleration distance as the driver maneuvers to a stop, and;
- vehicle queuing (backup or stopped vehicles) at the intersection(17).

The downstream functional area includes the area necessary for a driver to clear the intersection, perceive and react to a conflict and either brake to a stop or maneuver around the conflict. Stopping sight distance is one measure that can be used to determine the downstream functional area. Identifying the functional area of an intersection is critical in managing access and determining the proper location of driveways. The following figure illustrates the physical and functional areas of an intersection.

Prohibiting driveways within the functional area of an intersection improves safety by eliminating turning movement conflicts between the roadway and driveway and by reducing the number of decisions motorists must make while approaching and traveling through an intersection. Prohibiting driveways or roadway connections within the functional area is recommended but not always practical or possible in the urban and suburban environments. The functional area of intersections should be considered when evaluating potential access locations. There are four different measures of the function area (or corner clearance) that should be evaluated:

- Upstream on the major roadway
- Downstream on the major roadway
- Approach side on the minor roadway
- Departure side on the minor roadway

The Transportation Research Board’s Access Management Manual outlines the following methodology for determining the functional area of an intersection (2).

Functional area calculations should be performed on a case by case basis evaluating the actual or anticipated posted speed limit (whichever is greater) and storage requirements for the appropriate intersection control.

#### 3.2.1 Minimum Upstream Functional Area on Major Roadways

The minimum upstream functional area varies based on the speed of the roadway and queuing requirements. The minimum upstream functional area or upstream corner clearance is comprised of three different components:

- \(d_1\) = distance traveled during perception-reaction time
- \(d_2\) = distance traveled while the driver moves laterally and comes to a stop
- \(d_3\) = storage length
3.2.2 Minimum Downstream Functional Area on Major Roadways

The minimum downstream functional area is calculated using the distance traveled during perception-reaction time, distance traveled while the driver comes to a stop, influence area, and stopping sight distance. The downstream functional area must be greater than or equal to the larger of:

- \( d_1 + d_2 \) (distance traveled during perception-reaction time plus distance traveled while the driver moves laterally and comes to a stop)
- Influence distance (combination of speed, functional class of roadway, and acceptable spill back rate from Table 9-8 in the Transportation Research Board’s Access Management Manual (2))
- Stopping distance (from A Policy on Geometric Design of Highways and Streets Exhibit 3-1 Stopping Sight Distance(17))

3.2.3 Minimum Upstream Functional Area on Minor Roadways

The minimum upstream functional area on a minor road is based on queuing requirements for the upstream intersection, and the probability of queues at the intersection blocking the adjacent access connection. Based on information contained in the Transportation Research Board’s Access Management Manual, it is recommended that a minimum upstream distance of 125 feet be provided (2). If 125 feet cannot be provided, the minimum upstream functional area on the minor roadway can be calculated using the procedures outlined in the Access Management Manual (2).

3.2.4 Minimum Downstream Functional Area on Minor Roadways

The minimum downstream functional area on a minor road is based on the separation distance from the intersection to the nearest downstream access connection. The minimum values for downstream functional area on a minor road were obtained from the Transportation Research Board’s Access Management Manual and vary depending on the intersection geometrics (2).

3.2.5 Functional Area Guidelines

The functional area (or corner clearance) for various types of intersections is summarized in Table 2 by facility type and roadway speed. These values are based on the following parameters:

- Urban perception-reaction time – 1.5 seconds
- Urban storage queues – 150 feet (6 vehicles)
- 10% spill-back rate
- Level terrain
- Right turn lanes are present on the major approach

The functional area guidelines provided in Table 2 are intended to provide the practitioner a general understanding of the areas in which driveways may be limited or prohibited. The actual functional area should be calculated based on the procedures in the Transportation Research Board’s Access Management Manual and the site specific conditions (2).
Table 2 – Urban Corner Clearance Examples

<table>
<thead>
<tr>
<th>Posted Speed (mph)</th>
<th>Major Roadway</th>
<th>Minor Roadway</th>
<th>Departure (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Upstream (A)</td>
<td>Downstream (B)</td>
<td>Approach (C)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Departure (D)</td>
</tr>
<tr>
<td>25</td>
<td>320'</td>
<td>170'</td>
<td>125'</td>
</tr>
<tr>
<td>30</td>
<td>375'</td>
<td>290'</td>
<td>125'</td>
</tr>
<tr>
<td>35</td>
<td>450'</td>
<td>310'</td>
<td>125'</td>
</tr>
<tr>
<td>40</td>
<td>515'</td>
<td>365'</td>
<td>125'</td>
</tr>
<tr>
<td>45</td>
<td>600'</td>
<td>450'</td>
<td>125'</td>
</tr>
<tr>
<td>50</td>
<td>685'</td>
<td>535'</td>
<td>125'</td>
</tr>
<tr>
<td>55</td>
<td>785'</td>
<td>635'</td>
<td>125'</td>
</tr>
</tbody>
</table>

Note: Table is provided for reference only. Actual corner clearance calculations should be performed on a case by case basis. Calculations included in the Table are based on the following parameters: urban perception-reaction time – 1.5 seconds, storage queues – 150 feet (6 vehicles), 10% spill-back rate, level terrain, right turn lanes are present on the major approach.

3.3 Complete Street Concepts

The access management recommendations discussed in this document specifically address interactions between vehicles and the roadway but they also provide direct benefits to other road users. The implementation of access management is one component in the safe and efficient use of roadway corridors for all users and is integral to the Complete Street concept. The National Complete Streets Coalition states “Complete Streets are streets for everyone. They are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and transit riders of all ages and abilities must be able to safely move along and across a complete street. Complete Streets make it easy to cross the street, walk to shops, and bicycle to work” (18). When evaluating access management treatments, consideration should be given to their impacts and benefits on all anticipated roadways users.

4. Public Road Access Elements

The Las Vegas Valley road network has generally been developed using a one mile grid. This grid network generally consists of:

- Six (6) lane roadways at one mile spacing. These roadways have a combination of median treatments including two-way left turn lanes and raised medians.
- Four (4) lane roadways on one half-mile spacing. These roadways also have a combination of median treatments including two-way left turn lanes and raised medians.
- Two (2) lane roadways are located on one quarter-mile and one eighth mile spacing. There is typically no two-way left turn lane or median on these roadways.

The typical street grid network configuration and traffic signal locations are shown on the following figure. For locations outside of the Las Vegas Valley different driveway patterns and roadway spacing may exist. Care should be taken in these
areas to understand the network characteristics and how the proposed improvements or access locations can be developed, recognizing the aspects of access management.

4.1 Intersections and Median Control

The type of intersections along a public road will largely be dictated by the roadway type and location within the network. In general, the following spacing and access guidelines should be followed when developing new roadway corridors, reconstructing existing roadways, or developing new public road intersections:

- Full access (signalized) intersections – 2,640 feet
- Full access (unsignalized) intersections – 1,320 feet
- Left-in/right-in/right-out (S-Island) intersections – 660 feet from a full access intersection
- Right-in/right-out intersections – 330 feet from all other intersections

The intersection spacing and median control guidelines are illustrated below.

Controlling access at intersections is important because it can improve safety along the roadway, increase driving speeds, and decrease delay. Controlling access can also result in improved traffic coordination and overall traffic operations. Limiting access improves intersection safety because it reduces the number of vehicle to vehicle and vehicle to pedestrian conflict points.
4.1.1 Signalized Intersections

The preferred spacing for full access signalized intersections is at 2,640 foot intervals. This spacing allows for optimum progression and coordination of traffic signals. Traffic signals can be installed at both public and private road intersections meeting this spacing criterion if the traffic volumes and good engineering judgment support the installation of a traffic signal. A progression analysis and warrant analysis should be submitted and approved by the reviewing agency for intersection spacing or signalized intersection locations that do not conform to the spacing guidelines outlined in this document. The conflict points for a signalized intersection vary based on the lane configuration and signal phasing provided at the intersection, but since the traffic signal assigns right-of-way for vehicle movements, conflicts are typically minimized.

4.1.2 Full Access Unsignalized Intersections

Full access unsignalized intersections can be located at 1,320 foot intervals. A single lane full access unsignalized intersection has a minimum of 32 vehicle to vehicle conflict points. The number of conflict points increases based on the number of lanes at the intersection.

4.1.3 Left-in/Right-in/Right-out Intersections

Left-in/right-in/right-out intersections are located at 660 foot intervals from a full access intersection. Left turn movements from the intersecting roadway or driveway approach are restricted through the use of a raised median. A single lane left-in/right-in/right-out intersection has a minimum of eight vehicle to vehicle conflict points. The number of conflict points increases based on the number of lanes at the intersection.

4.1.4 Right-in/Right-out Intersections

Right-in/right-out intersections are located at 330 foot intervals from all other intersections. Left turn movements from the intersecting roadway or driveway approach are restricted through the use of a raised median or directional islands approach. A single lane right-in/right-out intersection has a minimum of four vehicle to vehicle conflict points. The number of conflict points increases based on the number of lanes at the intersection.

4.2 Median Alternatives

According to the Transportation Research Board’s Access Management Manual, more than two-thirds of access-related crashes involve left turning vehicles (2). The installation of medians limits the number and location of left turn movements and reduces vehicle to vehicle and vehicle to

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pedestrian conflict points. There are three general types of median treatments: traversable, two-way left turn lane, and nontraversable medians. The following sections describe when these median treatments should be considered for installation.

4.2.1 Traversable Median
A traversable median refers to a median that vehicles can drive over, such as a painted double yellow stripe. A traversable median does not physically restrict vehicles from crossing into or across the path of opposing traffic. Traversable medians are not considered an effective access management alternative.

4.2.2 Two-Way Left Turn Lane
A two-way left turn lane is located between opposing traffic flows. Two-way left turn lanes provide a location for vehicles to move out of through traffic while waiting to make a left turn across the opposing traffic flow. According to the Transportation Research Board’s Access Management Manual, two-way left turn lanes have the following benefits over traversable medians:

- In general, roadways with two-way left turn lanes are safer than roadways with traversable medians. Crash rates are roughly 35% less on roadways with two-way left turn lanes than roadways with traversable medians.
- Roads with two-way left turn lanes have higher capacity than roads with traversable medians.
- Roads with two-way left turn lanes have less delay than roads with traversable medians (2).

Although two-way left turn lanes have benefits over traversable medians, they are not effective as an access management tool. Two-way left turn lanes allow unrestricted access to driveways and connecting roadways. Two-way left turn lanes are most problematic along corridors that have been developed without restrictions on the number of driveways and/or inadequate driveway spacing, leading to overlapping left turn movements and an increase in the number of pedestrian, bicycle and vehicle conflicts.

4.2.3 Nontraversable Median
A nontraversable median refers to any physical barrier that separates traffic flows and restricts left turn movements. Nontraversable medians can be a hard-curbed raised median, landscaped median, or any type of median that provides a physical barrier. According to the Transportation Research Board’s Access Management Manual, nontraversable medians have several advantages over two-way left turn lanes and are an effective access management technique.

- Roads with a nontraversable median are safer than roads with a two-way left turn lane. The average crash rate on roads with a nontraversable median is 30% less than those with a two-way left turn lane.
- Generally, roads with nontraversable medians have less delay than roads with two-way left turn lanes.
- The locations where left turns can occur are clearly defined.
- Nontraversable medians physically separate vehicle flows and can be designed to reduce head-on collisions.
- Proper left turn deceleration and left turn storage can be incorporated into the design of the median.
- Left turn vehicular conflicts with pedestrians and bicycles are reduced.
- Nontraversable medians can be designed to incorporate a pedestrian refuge (2).

4.2.4 When to Apply Median Alternatives
Studies have shown that the use of a two-way left turn lane should be considered in the following situations:

- Roads with an ADT less than 24,000 vehicles per day.
- Collector roads in a developed urban area where there is no crash pattern that could be corrected by a nontraversable median.
- Collector streets in residential areas.

A nontraversable median should be installed under the following circumstances:

- All new six lane roadways regardless of volumes.
- All new four lane roadways that will ultimately have six lanes of travel.
- All new four lane roadways with projected traffic volumes greater than 20,000 ADT.
- High crash locations where the restriction of left turn movements can reduce crashes.
The following is an example of new roadway construction with a non-traversable median in Clark County, Nevada. This roadway is ultimately planned to provide three lanes of travel in each direction, but currently has sections with fully developed half streets (five lanes) and partially constructed four lane sections. Constructing the median in advance has the benefit of clearly defining full and partial access locations and maintaining the functional integrity of the roadway.

In a reconstruction/rehabilitation situation, where a nontraversable median is proposed to replace an existing two-way left turn lane or traversable median, the following items should be considered:

- Aligning median openings to provide access to both sides of the road.
- Closing median openings that do not meet the public road access spacing described in this document.
- Installing left turn lanes designed to handle anticipated traffic volumes.
- Lengthening left turn lanes where applicable to address increased left turn volumes due to increases in U-turn movements.
4.3 U-Turn Movements

U-turn movements can improve intersection and overall roadway operations when combined with non-traversable median treatments. The location of U-turn movements will depend on roadway type and functional operational characteristics, traffic volumes, and street considerations. Providing access through a combination of right turn lanes and U-turns can be safer than direct left turn access at undesirable locations and can reduce delay at upstream and downstream intersections. Access can be provided by a right turn followed by a U-turn or by a U-turn followed by a right turn.

U-Turn Flair on Four Lane Roadway

In some instances it may be beneficial to collect U-turns upstream or downstream of a traffic signal (mid block U-turns) if capacity constraints exist, signal spacing is irregular and lengthy, or signal efficiency dictates restricting or eliminating left turn movements at the intersection. Downstream U-turn movements can be utilized if capacity constraints exist for left turn movements and they can collect U-turning vehicles downstream from the intersection.

U-Turn Movements

Typically, four lane roads are not wide enough to accommodate U-turn movements. In these instances, U-turn flair options can be explored. These options include allowing a U-turn to occur within the shoulder, flaring a road at an intersection to allow for the U-turn movement, or providing provisions for the U-turn movement to occur within a bus turnout. U-turn flair options should be approved on a case by case basis and must accommodate pedestrians, sight visibility, and ADA requirements.

4.4 Intersection Sight Visibility

All intersections and access points along a roadway have the potential for vehicle and pedestrian conflicts. Providing clear, unobstructed views of the intersection or driveway, traffic control devices, and approaching vehicles helps to reduce the chance of a potential conflict. The area of unobstructed view is typically referred to as a sight triangle or sight visibility zone. Each quadrant of an intersection should contain a sight visibility zone that is free of obstructions. The sight visibility zone can vary and is a function of stopping sight distance and is determined by the roadway geometrics, vehicle speeds and location of vehicles on the roadway. When obstructions such as landscaping, walls, on-street parking or above ground utilities are located within the sight visibility zone, sight visibility is reduced and the potential for conflict increases. The following graphic illustrates how a driver’s line of sight can be blocked at an intersection by an obstruction.
The following graphics illustrate how a slight roadway curvature at the intersection can significantly increase the size of the sight visibility zone. These variations can significantly impact the developable area adjacent to an intersection and dictate the location of utility installations and landscaping.

Each intersection represents a unique situation, and approach and departure sight visibility should be calculated and designed in accordance with the procedures outlined in the most recent version of the AASHTO Policy on Geometric Design of Highways and Streets for the following types of intersections(17):

- **Case A** – Intersections with no control
- **Case B** – Intersections with stop control on the minor road
  - **Case B1** – Left turn from the minor road
  - **Case B2** – Right turn from the minor road
  - **Case B3** – Crossing maneuver from the minor road
- **Case C** – Intersections with yield control on the minor road
  - **Case C1** – Crossing maneuver from the minor road
  - **Case C2** – Left or right turn from the minor road
- **Case D** – Intersections with traffic signal control
- **Case E** – Intersections with all-way stop control
- **Case F** – Left turns on the major road

The calculated sight visibility zones for an intersection should be compared to the values identified in Clark County Area Uniform Standard Drawing 201.2 (1). The larger of the two calculations should be used for design.

In addition to the AASHTO requirements, Clark County Area Uniform Standard Drawing 201.2 also calls for an additional clear zone from the Point of Curvature (PC) to Point of Tangency (PT) of each curb radius (1).

Several important considerations in calculating sight visibility zones include the geometry of the intersecting roadways and the speed of the approaching vehicles. Consideration should be given to unique approach geometry such as an intersection along a curved roadway. The speed of approaching vehicles and intersection geometry can significantly impact the size of the sight visibility zone.

### 4.5 **Right Turn Lanes at Intersections**

The purpose of a right turn lane is to allow vehicles to slow (decelerate) and complete a turning movement without impacting the through movements on the roadway. Right turn lanes improve roadway operations along congested corridors, at locations with high right turning volumes or a high percentage of heavy vehicles, and along corridors with high travel speeds. Right turn lanes, when applied properly, typically reduce the potential for rear-end and side swipe crashes at intersections. To realize these safety and operational benefits, right turn lanes are typically recommended at all intersections on major roadways and limited access roadways where traffic volumes, vehicle speeds, or operational issues are a concern.

Clark County Area Uniform Standard Drawings 201.1 and 245.1 provide right turn lane design requirements (1). The minimum storage requirement shall be 150 feet (plus applicable transitions) at public road intersections. The governing agency may require additional storage based on existing or anticipated traffic volumes.

### 4.6 **Left Turn Lanes at Intersections**

Dedicated left turn lanes at intersections provide left turning vehicles the ability to move out of the through traffic stream and wait for a gap in opposing traffic or wait until the left turn movement is assigned priority by a traffic signal. Dedicated left turn lanes can improve roadway operations and reduce accident potential as long as the storage capacity meets or exceeds the left turn demand. If the storage is inadequate, left turning vehicles spill back into the through travel lanes, disrupting the flow of traffic and creating the potential for a rear-end or sideswipe crash. Dedicated left turn lanes are typically recommended at all public road intersections and should be designed to accommodate the existing or anticipated left turn volumes. This could include single, double or triple left turn lane configurations. Clark County Area Uniform Standard Drawings 201.1 and 245.1 provide left turn lane design requirements (1).
4.7 Utility Conflicts

The location of overhead and/or underground utilities can impact the ability to construct both left and right turn lanes. Construction of dual left turn lanes and right turn lanes at all major and minor intersection combinations should be done in accordance with Clark County Area Uniform Standard Drawing 201.1 (1). However, there are exceptions when the agency with jurisdiction over the roadway should determine, or have the design engineer to determine, if the operational and safety benefits associated with the construction of the turn lane(s) outweighs the cost of relocating a utility in conflict. This determination should also consider the need, and ability to acquire additional right-of-way to accommodate a utility relocation. If relocation of the impacted utility is deemed not feasible by the controlling agency, construction of the right turn lane or dual left turn lanes can be deferred until such time as the utility can be relocated. If construction is deferred, right-of-way should be dedicated or an easement should be provided to facilitate future construction of the left turn lanes and/or right turn lane.

5. Driveway Access Elements

As defined by the American Association of State Highway and Transportation Officials (AASHTO), a driveway is an intersection and should be placed in a manner to minimize conflicts with the roadway and sidewalk. In addition, driveways should be designed with their intended use and anticipated traffic volumes in mind and should not be located within the functional area of an intersection or within the influence area of an adjacent driveway(17). Determining the appropriate number, location and geometric design of driveways is fundamental to achieving and maintaining good access management. Driveway design parameters that can be grouped into two general categories: location and geometrics.

The following driveway design parameters influence the location of driveways along a roadway segment and are discussed with respect to access management in this document:

- Corner Clearance
- Driveway Separation
- Driveway Sight Distance
- Other Considerations (such as utility conflicts)

The following driveway geometric design parameters are directly influenced by the amount and type of vehicles anticipated to use the driveway. The following geometric design parameters are discussed:

- Driveway Curb Radius
- Driveway Width
- Driveway Throat Depth
- Driveway Angle
- Driveway Grade
- Right Turn Lanes at Driveways
- Driveway Lane Configuration

5.1 Driveway Location

The first consideration when planning access to a parcel is the number and location of driveways. A driveway should be located so that it maintains a minimum separation from adjacent driveways and is outside of the functional area of adjacent intersections. In many cases this is not feasible or practical. The importance of the functional area and challenges associated with locating driveways outside of the functional area are discussed in Section 3 of this document.

The location and number of driveways that can be developed per parcel is also a function of the parcel size, length of parcel frontage along the adjacent roadway, functional classification of the adjacent roadway, type and intensity of uses on the parcel and geometric constraints. The following sections describe the recommended methodology to determine the number and location of driveways.

5.1.1 Corner Clearance

Corner clearance is the distance from a driveway to an adjacent roadway intersection and should typically coincide with the limits of the functional area of an intersection (see Section 3). Providing adequate corner clearance between driveways and adjacent roadway intersections reduces the number of vehicle conflicts, improves safety, helps maintain the functionality and operational integrity of the roadway and provides adequate separation for vehicles to turn into or cross travel lanes. Inadequate corner clearance results in a degradation of intersection and roadway operation and increased crash potential because drivers experience multiple conflicts and complex decisions near the intersection. In addition, vehicle queues from the intersection can back up and block driveways that are located within the functional area. The following graphic illustrates the impact of corner clearance on driveway, roadway and intersection operations.
In many instances it is not feasible or practical to locate a driveway outside of the functional area of an intersection due to parcel size, location or other conflict. In these circumstances, a minimum corner clearance should be established using the requirements defined in Clark County Area Uniform Standard Drawing 222A (1). The standard defines two different measures of corner clearance: approach and departure. Approach corner clearance is measured from the radius point of curvature (PC) at the intersecting roadway to the curb return point of tangency (PT) at the upstream driveway. Departure corner clearance is measured from the radius point of tangency (PT) at the intersecting roadway to the curb return point of curvature (PC) at the downstream driveway. It is important to note that driveways should not be located within a right turn lane or within a bus turnout. In these cases, it may be necessary to provide a greater corner clearance than the minimum requirements shown in Clark County Area Uniform Standard Drawing 222A (1).

5.1.2 Driveway Separation

Driveway separation (S) is the distance between two adjacent driveways measured from the curb return point of tangency (PT) to the curb return point of curvature (PC) along the roadway.

Stopping distance is the key element for determining appropriate driveway separation along major and minor roadways. Driveway separation is important because it provides drivers adequate time to perceive and react to a possible conflict at a driveway and stop or maneuver safely in advance of the conflict. The stopping distance is the minimum driveway separation that should be provided. Other, more subjective factors (including on-site constraints at adjacent driveways that may limit turning speed or create queuing on the roadway) should also be considered and may increase the minimum driveway separation distance.

Stopping distance is comprised of two different components:

- **brake reaction distance**: the distance a vehicle travels during the perception-reaction time
- **braking distance**: the distance traveled while the vehicle breaks and comes to a complete stop
Travel speed on a roadway has the greatest influence on stopping distance and ultimately the location and separation of driveways along that roadway. The distances outlined below were calculated using AASHTO recommended practices (16) and provide general guidance on driveway separation based on travel speed. (17).

### Stopping Distance

<table>
<thead>
<tr>
<th>Speed (mph)</th>
<th>Calculated Stopping Distance (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>91.9 ft 60.0 ft 155 ft</td>
</tr>
<tr>
<td>30</td>
<td>110.3 ft 86.4 ft 200 ft</td>
</tr>
<tr>
<td>35</td>
<td>128.6 ft 117.6 ft 250 ft</td>
</tr>
<tr>
<td>40</td>
<td>147.0 ft 133.6 ft 305 ft</td>
</tr>
<tr>
<td>45</td>
<td>165.4 ft 159.4 ft 360 ft</td>
</tr>
<tr>
<td>50</td>
<td>183.8 ft 240 ft 425 ft</td>
</tr>
<tr>
<td>55</td>
<td>202.1 ft 290.3 ft 495 ft</td>
</tr>
</tbody>
</table>

The values for Table 3 were developed assuming the 85th percentile speed of the roadway is consistent with the posted speed limit; a perception reaction time of 2.5 second; a vehicle deceleration rate of 11.2 ft/s²; and a level surface. It should be recognized that stopping distance should be calculated using the actual operating and geometric conditions of the roadway being evaluated. Table 3 summarizes the driveway spacing guidelines for major and minor roadways. The values in Table 3 were derived from the perception reaction distance and braking distances outlined in the graphic. In the event that the minimum driveway separation cannot be met, a system of joint use driveways and cross access easements should be considered.

### Driveway Separation

<table>
<thead>
<tr>
<th>Anticipated Full Build-Out</th>
<th>Driveway Separation ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>155 feet</td>
</tr>
<tr>
<td>30</td>
<td>200 feet</td>
</tr>
<tr>
<td>35</td>
<td>250 feet</td>
</tr>
<tr>
<td>40</td>
<td>305 feet</td>
</tr>
<tr>
<td>45</td>
<td>360 feet</td>
</tr>
<tr>
<td>50</td>
<td>425 feet</td>
</tr>
<tr>
<td>55</td>
<td>495 feet</td>
</tr>
</tbody>
</table>

Note: Brake Reaction Distance predicted on a perception reaction time of 2.5 s; deceleration rate of 11.2 ft/s²; and level surface

As an example, if a development has frontage on a level road with a posted speed of 45 miles per hour, the driveway separation (according to Table 3) should be a minimum of 360 feet to allow for the breaking reaction distance followed by the stopping distance. If 360 foot driveway spacing cannot be met, then a system of joint use driveways and cross access easements should be developed as an alternative.

### 5.1.3 Driveways Per Parcel

The number of driveways allowed per parcel will ultimately be determined by the controlling agency. A procedure to use to determine the number of driveways for a parcel is to base the number of driveways on the roadway trips anticipated to be generated by development on the parcel. Driveway trips should be calculated using the most current edition of the Institute of Transportation Engineers Trip Generation Manual or an agency-accepted equivalent. Site constraints or other development considerations may be cited as justification for multiple driveways on small parcels. However, from a traffic engineering standpoint, developments with less than 1,250 trips per day or 125 trips per hour can operate successfully from one driveway. On the other hand, large retail shopping centers and developments that generate more than 5,000 trips per day or 500 trips per hour typically have significant roadway frontage on multiple roads and are able to develop multiple driveways that can meet the separation and sight visibility criteria previously discussed.

Developments between 1,251 and 5,000 trips per day or between 126 and 500 trips per hour are typically the most common development types. The number of driveways allowed per parcel for these developments can vary based on the amount of frontage, ability to share driveways with adjacent parcel owners, and cross access agreements. Table 4 summarizes the number of driveways per parcel, based on the expected number of driveway trips, if adequate corner clearance and driveway separation can be met.

### Table 4 – Driveways Per Parcel

<table>
<thead>
<tr>
<th>Expected Development Trips</th>
<th>Example Land Use</th>
<th>Driveways Per Parcel</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1,250 trips/day</td>
<td>Small apartment</td>
<td>1</td>
</tr>
<tr>
<td>&lt; 125 trips/hour</td>
<td>complex, small</td>
<td></td>
</tr>
<tr>
<td></td>
<td>business or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>specialty shop</td>
<td></td>
</tr>
<tr>
<td>1,251 – 5,000 trips/day</td>
<td>Convenience store, gas stations, fast food restaurant, or small shopping center</td>
<td>1 or 2 as determined in a traffic study</td>
</tr>
<tr>
<td>126 – 500 trips/hour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;5,000 trips/day</td>
<td>Large shopping center, regional mall, resort/casino</td>
<td>2 or more as determined in a traffic study</td>
</tr>
<tr>
<td>&gt;500 trips/hour</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Even if the expected development trips justify multiple driveways, corner clearance, driveway separation, and the parcel size/configuration may limit the number and location of driveways. Every intersection and driveway along a roadway creates points of conflict for vehicles, cyclists and pedestrians. As the number of access points increase so does the number of conflict points and the frequency of crashes. This trend has been documented in numerous studies that have shown lower crash rates on roadways with fewer access points per mile. To limit access points and improve safety, driveways should be consolidated on and between adjacent parcels.

In general, for all new development projects (new development or redevelopment) the developer has the burden of proof to show that attempts have been made to coordinate a shared driveway with neighboring parcels. Documentation should be submitted during the planning and entitlement process showing that the developer contacted the adjacent parcel owners in an attempt to share access and the results of
that contact. During this process, the developer, as part of the coordination effort, is normally required to notify adjacent property owners that their future driveway options may be limited if they choose not to coordinate a shared access driveway. The following scenarios provide a methodology that should be used to identify the appropriate number and location of driveways per parcel.

5.1.3.1 Shared Access Scenario #1

Adjacent parcel owners are able to coordinate shared access driveways along parcel boundaries. An additional driveway may be constructed, if the following conditions are met:

- The second driveway can meet corner clearance guidelines.
- The second driveway can meet separation guidelines (Table 3).
- The anticipated trip generation meets the threshold for two or more driveways (Table 4).

This scenario may provide a parcel with two driveways when the trip generation in Table 4 only allows for one driveway. The following graphic illustrates how shared access could be configured between adjacent parcels.

5.1.3.2 Shared Access Scenario #2

Only one adjacent parcel owner will develop a shared access driveway. An additional driveway may be constructed, if the following conditions are met:

- The second driveway can meet corner clearance guidelines.
- The second driveway can meet separation guidelines (Table 3).
- The anticipated trip generation meets the threshold for two or more driveways (Table 4).

In this scenario, Parcel #2 is able to coordinate a shared access driveway with Parcel #1, but is unable to coordinate with Parcel #3. If Parcel #2 had an anticipated trip generation greater than 1,251 trips per day or greater than 126 trips per hour, and a second driveway could meet the spacing guidelines outlined in Table 3, an additional driveway could be allowed.

When parcel owners fail to coordinate shared access, driveways should not be allowed within one half of the minimum separation distance of their respective parcel lines. Table 5 illustrates the minimum separation distance (as described in Section 5) and the separation distance from the parcel line. The inability to coordinate shared access between Parcel #2 and Parcel #3 limits driveway options on both parcels.

Table 5 – Driveway Separation from Property Line

<table>
<thead>
<tr>
<th>Anticipated Full Build-Out Posted Speed Limit (mph)</th>
<th>Driveway Separation (S)</th>
<th>Driveway Separation from Property Line (S/2)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>155’</td>
<td>80’</td>
</tr>
<tr>
<td>30</td>
<td>200’</td>
<td>100’</td>
</tr>
<tr>
<td>35</td>
<td>250’</td>
<td>125’</td>
</tr>
<tr>
<td>40</td>
<td>305’</td>
<td>155’</td>
</tr>
<tr>
<td>45</td>
<td>360’</td>
<td>180’</td>
</tr>
<tr>
<td>50</td>
<td>425’</td>
<td>215’</td>
</tr>
<tr>
<td>55</td>
<td>495’</td>
<td>250’</td>
</tr>
</tbody>
</table>

* Rounded to the closest 5 feet.

Note: Brake reaction distance predicted on a perception reaction time of 2.5 s; deceleration rate of 11.2 ft/s²; and level surface

5.1.3.3 Shared Access Scenario #3

A shared access driveway cannot be coordinated with either adjacent parcel. Only one driveway should be allowed per parcel unless the following conditions are met:

- The second driveway can meet corner clearance guidelines.
- The second driveway can meet separation guidelines (Table 3).
- The anticipated trip generation meets the threshold for two or more driveways (Table 4).
For this scenario, Parcel #2 was unable to coordinate a shared access driveway with Parcel #1 or Parcel #3. Parcel #2 cannot construct their driveway within half of the driveway separation distance (Table 5) from either property line. The inability to coordinate shared access could also limit future driveway options on both Parcel #1 and Parcel #3, in order to maintain the minimum separation distance from each parcel line.

**Shared Access – No Coordination (Example A)**

In this scenario, the preferred driveway location based on driveway separation may not be achievable due to parcel size and location. In this case, one driveway should be allowed per parcel. The driveway location should be determined by the controlling agency’s traffic engineer based on an analysis of the driveway impacts on the adjacent public roadways. The driveway location for each parcel should be at a location determined to have the least impact on the adjacent roadway network and most closely meet the guidelines described in this document.

The following graphic illustrates this scenario. Parcel #2 was unable to coordinate a shared access with Parcel #1 or Parcel #3. Additionally, the roadway frontage of Parcel #2 is not long enough to accommodate the minimum driveway separation from the adjacent property lines. The driveway is located to minimize impacts on the adjacent public roadway and most closely meet the spacing guidelines. The driveway location is subject to review and approval by the controlling agency.

**Shared Access – No Coordination (Example B)**

The shared access driveway exhibits have been provided to illustrate different scenarios that could result as parcels develop. The examples outlined above are not all inclusive, and different scenarios could occur throughout the development or redevelopment of a corridor. In situations where access driveways are not shared and driveway spacing guidelines cannot be met, the driveway location should be determined by the controlling agency’s traffic engineer based on an analysis of the driveway impacts on the adjacent public roadways.

**5.1.3.4 Shared Access Scenario #4**

In this scenario, the preferred driveway location based on driveway separation may not be achievable due to parcel size and location. In this case, one driveway should be allowed per parcel. The driveway location should be determined by the controlling agency’s traffic engineer based on an analysis of the driveway impacts on the adjacent public roadways. The driveway location for each parcel should be at a location determined to have the least impact on the adjacent roadway network and most closely meet the guidelines described in this document.

The following graphic illustrates this scenario. Parcel #2 was unable to coordinate a shared access with Parcel #1 or Parcel #3. Additionally, the roadway frontage of Parcel #2 is not long enough to accommodate the minimum driveway separation from the adjacent property lines. The driveway is located to minimize impacts on the adjacent public roadway and most closely meet the spacing guidelines. The driveway location is subject to review and approval by the controlling agency.

**Shared Access – No Coordination (Example C)**

The shared access driveway exhibits have been provided to illustrate different scenarios that could result as parcels develop. The examples outlined above are not all inclusive, and different scenarios could occur throughout the development or redevelopment of a corridor. In situations where access driveways are not shared and driveway spacing guidelines cannot be met, the driveway location should be determined by the controlling agency’s traffic engineer based on an analysis of the driveway impacts on the adjacent public roadways.

**5.1.4 Driveway Sight Visibility**

Every driveway along a roadway has the potential for vehicle and pedestrian conflicts. Providing clear, unobstructed views of the driveway and approaching vehicles helps to reduce the chance of a potential conflict. The area of unobstructed view is typically referred to as a sight triangle or sight visibility zone. The sight visibility zone can vary and is a function of stopping sight distance and is determined by the roadway geometrics, vehicle speeds and location of vehicles on the roadway. When obstructions such as landscaping, walls, on-street parking or above grade utilities are located within the sight visibility zone, sight visibility is reduced and the potential for conflict increases. All driveways should be designed and/or located so that adequate site visibility is provided for vehicles on the roadway approaching the driveway or for vehicles departing the driveway and entering the roadway. The procedures for determining driveway sight visibility are the same as those discussed for roadway intersections in Section 4.

Each driveway represents a unique situation. Calculating sight visibility should be based on the latest edition of *A Policy on Geometric Design of Highways and Streets* by American Association of State Highway and Transportation Officials (AASHTO) (17) and comparing the results to the values identified in Clark County Area Uniform Standard Drawing 201.2 (1). The larger of the two calculations should be used for design. In addition to the AASHTO requirements, the Clark County Area Uniform Standard Drawings also call for an additional clear zone from the Point of Curvature (PC) to Point of Tangency (PT) of each curb radius.
5.1.5 Other Considerations

Driveways should not be located within right turn lanes as vehicles wishing to exit the property must cross the right turn lane to merge into traffic. This crossing maneuver increases the crash potential in the vicinity of the driveway.

Driveways Should Not be Located in Right Turn Lanes

When locating a driveway that has the ability for full access, it is important to consider how that driveway aligns with driveways or intersections on the other side of the roadway. In order for a driveway to have full access the driveway must align with the opposing driveway or intersection. When driveways cannot be aligned directly across from each other, slight variations may be accepted on a case by case basis as long as the variation does not allow for overlapping left turns. Clark County Uniform Standard Drawing 222A provides guidance on maximum offset for full access driveways. Overlapping left turn movements occur when driveways are offset in the downstream direction.

Driveway Curb Radii

Driveway curb radii should be designed to accommodate the types of vehicles anticipated to utilize the driveway. Properly designed radii allow turning vehicles to efficiently transition from the roadway to the driveway, minimizing impacts to the through movements on the roadway and eliminating encroachment on the opposing driveway lanes. Properly designed curb radii also reduces pedestrian conflict and damage to curb, gutter, and sidewalk that can occur when large vehicles are forced to use a driveway that has not been designed to accommodate such vehicles.

5.2 Driveway Geometrics

After the driveway location has been established, the geometric design parameters of the driveway can be evaluated. The first step should be to identify the volume and types of vehicles expected to utilize the driveway. Understanding and designing for the anticipated user will minimize impacts to the adjacent roadway and improve overall driveway functionality. For example, driveways with higher vehicle volumes and/or heavy truck movements will have different design requirements and impacts to the adjacent roadway than low volume driveways. Driveway design parameters to be considered include:

- Driveway Curb Radius
- Driveway Width
- Driveway Throat Depth
- Driveway Angle
- Driveway Grade
- Right Turn Lanes at Driveways
- Driveway Lane Configuration

5.2.1 Driveway Curb Radii

The driveway curb radius (curb return) refers to the radial length of the curved approach and departure of a driveway. Both are measured from the back of curb to the center point of the radius.

Driveway Curb Radii

Driveways should be located to avoid conflicts with existing utilities. Above ground utilities can limit sight visibility and utilities close to driveways can become knock-down hazards during driveway crashes or for vehicles with a large turning radius. Clark County Area Uniform Standard Drawing 222A provides guidance on driveway clearance from light poles, fire hydrants, mailboxes, above-grade electrical transfer boxes, and block walls higher than 2 feet (1).
When the driveway approach radius is too small, vehicles are forced to encroach on the opposing driveway lanes. This encroachment generally leads to reduced turning speeds and possible vehicle conflicts. The reduced entering speed causes vehicles that are following the turning vehicle to slow down, stop or encroach into the adjacent through lane to avoid a collision. This increases the potential for crashes and degrades the overall operation of the roadway.

When the driveway departure radius is too small, vehicles are not able to complete their turning movement within the adjacent travel lane and are forced to encroach into the second through lane as they exit the driveway and merge into traffic. In this scenario drivers are forced to wait for larger gaps in oncoming traffic that allow the use of two lanes or risk a conflict with an oncoming vehicle. Inadequate departure radii generally degrade operations on both the driveway and roadway.

Clark County Area Uniform Standard Drawing 222A and supporting standard drawings provide guidance on curb radii design (1). The driveway approach and departure radii should be designed such that the identified design vehicle can maintain a two foot clearance from the traveled way, face of curb, and median or opposing lane during a right turn maneuver. Proper driveway width and curb radii should be evaluated by overlaying vehicle turning templates for the identified design vehicle on the driveway design. It is important to note that as driveway curb radii increase, so does the width of the driveway. This increase in width can adversely impact pedestrians and bicyclists at a driveway (see next section on driveway width). Large curb radii should be avoided unless necessary to accommodate the identified design vehicle.

In situations where a significant amount of truck traffic is anticipated at a driveway, the driveway can be designed with a compound curve. A Policy on Geometric Design of Highways and Streets provides guidance for design of compound curves (17). Compound curves better match the off-tracking of tractor-trailers and can minimize the impacts of a large radius curb return.

The width of a driveway is the distance measured from face of curb to face of curb at the narrowest point. The width of a driveway should be designed to accommodate the expected traffic volumes, anticipated vehicle types, and necessary turning movements. Clark County Area Uniform Standard Drawing 222A provides minimum and maximum driveway width requirements (1). Driveway widths should also meet current fire department standards for the jurisdiction in which the driveway is to be constructed.

Recognizing that wide driveways can pose a safety concern for bicyclists and pedestrians, maximum driveway widths have been outlined in Clark County Area Uniform Standard Drawing 222A (1). If a wider driveway is required, a pedestrian refuge island should be considered.
5.2.3 Driveway Throat Depth

Driveway throat depth is the distance from the point of tangency (PT) of approach curb return to the first on-site access, decision or conflict point.

Driveways that lack proper throat depth do not prevent vehicles that experience conflicts onsite from queuing into the adjacent roadway. On-site conflicts can include parking maneuvers and drive isle connections in the immediate vicinity of the driveway. Inadequate throat depth and the resulting conflicts can impact operations at the driveway and on the adjacent roadway and increase the potential for collisions between vehicles and between vehicles and pedestrians.

There are a number of factors that are used to determine the appropriate throat depth for a driveway. These factors include the type of access being provided (right-in/right-out, left-in/right-in/right-out, full access, etc.), traffic volumes on the adjacent roadway, and the number of vehicles anticipated to utilize the driveway. The best way to assess all of these factors is through a site specific traffic study for the development that includes a queuing analysis for each driveway. However, during the planning and entitlement phase of a project, detailed traffic impact studies may not be available. In these instances, Clark County Area Uniform Standard Drawing 222A should be used to determine the appropriate throat depth (1). This standard provides a table indicating minimum throat depth as a function of on-site parking. Each driveway must...
meet the minimum throat depth for the total on-site parking spaces. Under no circumstance should a driveway throat depth be less than 25 feet (the length of one vehicle). If the throat depth requirements identified in Clark County Area Uniform Standard Drawing 222A cannot be provided, the developer is usually responsible to analyze the needed throat depth as part of a site specific traffic impact study that should be submitted for review during the planning and entitlement phase.

5.2.4 Driveway Angle
Driveways should generally be designed at or near right angles to the adjacent roadway. Driveway angle is measured from the face of curb on the roadway to the face of curb on the driveway. The angle of a two-way driveway should always be designed at or near a right angle. In some instances a one-way inbound or outbound driveway may be desired. In these cases, the driveway angle should be between 70 degrees and 90 degrees. If a one-way inbound driveway is desired, additional analysis should be completed to address pedestrian conflicts due to higher vehicle entry speeds. Visibility and varied curb radii should also be considered when designing a driveway at an angle other than 90 degrees. The limited visibility created by angled driveways can be dangerous for pedestrians and bicyclists. Special consideration should be given when designing an angled driveway where pedestrian and bicycle traffic is anticipated.

5.2.5 Driveway Grade
Driveway grade is a measure of the slope, up or down, from the adjacent roadway. Driveway grade is an important access management design parameter because as algebraic difference in grade (or grade break) between the roadway and driveway increases, vehicle speeds must decrease to enter and exit the driveway. Vehicles entering driveways with large grade breaks must slow down substantially, thus increasing the possibility for a rear-end collision as well as slowing vehicles on the public roadway. Vehicles exiting the driveway must wait for a larger gap because they must maneuver across the grade break and enter traffic at slower speeds. In addition, drivers of low profile vehicles may need to enter and exit the driveway at an angle, encroaching on the other travel lanes, to avoid bottoming out. Driveways grades shall conform to Clark County Area Uniform Standard Drawing 225 (1).

5.2.6 Right Turn Lanes at Driveways
The purpose of a right turn lane is to allow vehicles to slow and complete a turning movement into a driveway without impacting the through movements on the roadway. Right turn lanes should be provided when there are large anticipated turning volumes, congested roadways, large vehicles, and/or high travel speeds. Clark County Area Uniform Standard Drawing 245.1 provides guidance on right turn lane design (1). There is a considerable amount of research that indicates right turn lanes increase safety at intersections as well as improve operations on the adjacent roadway. To this end, right turn lanes are generally recommend at all driveways on major and minor roadways. Right turn lanes should be designed with a minimum of 100 feet of storage (plus appropriate transitions) or the anticipated storage requirement determined in a traffic study for the specific access driveway, whichever is greater.

In the instance where there is insufficient parcel frontage to develop the entire length of a right turn lane, the controlling agency may require a modified version of the right turn lane. If anticipated driveway volumes do not support the construction of a right turn lane the controlling agency may still require the developer to provide an easement for a future right turn lane.

5.2.7 Driveway Lane Configuration
The lane configuration of the driveway approach will largely be dictated by where the driveway is located along the roadway and how the driveway coincides with the roadway intersection access and spacing in Section 4. For example, driveways that meet the spacing guidelines for full access roadway intersections will have lane configurations that support full access movements and possibly signalization. The roadway corridor graphic illustrates the possible access scenarios associated with the roadway grid network spacing.
5.2.7.1 Signalized Driveways

Signalized driveways should be located 2,640 feet from adjacent upstream or downstream signalized intersections or signalized driveways. A signalized driveway approach should have a minimum of two inbound lanes and a minimum of three outbound lanes. The outbound lanes could be configured to provide dual left turn lanes and one through/right turn exiting lane or one left, through and right turn lane. Additional lane requirements should be determined by a site specific traffic study.

Full Access Signalized Driveway

5.2.7.2 Full Access Unsignalized Driveways

Full access unsignalized driveways are located 1,320 feet from adjacent upstream or downstream full access intersections or driveways. These driveways should be constructed with a minimum of one inbound lane and two outbound lanes and a maximum of two inbound lanes and three outbound lanes. The actual lane configuration should be determined based on the number of vehicles anticipated to utilize the driveway.

Full Access Unsignalized Driveway

5.2.7.3 Left-in/Right-in/Right-out Driveways

Left-in/right-in/right-out driveways are located at 660 feet from full access intersections. A median should be constructed to restrict the exiting movement to right-out only. These driveways should be constructed with a minimum of one inbound lane and one outbound lane.

Left-in/Right-in/Right-out Access
5.2.7.4 Right-in/Right-out Driveways

Driveways in all other locations are limited to right-in/right-out. For locations where a two-way left turn lane is present along the roadway channelizing islands should be provided on the driveway approach to limit the outbound movement to right-out only and discourage left-in movements. On roadways where a nontraversable median is present right turn channelizing islands would not be required. These driveways should be constructed with one inbound lane and one outbound lane.

6. SITE DESIGN ELEMENTS

The following sections outline site design elements for redevelopment and new development projects in the urban and suburban areas of Clark County. During the planning phase of any project, it is important to identify critical on-site design parameters that improve adjacent roadway operations and provide access management benefits. These parameters include:

- Shared access
- Cross access
- On-site circulation
- Drive-through queuing
- Gated access queuing

These parameters are all interrelated and can be used in combination to have a positive impact on roadway operations and accessibility for the traveling public, customers and business owners. It is important to note that this section refers to site design and its direct influence on access management. Local agencies may have additional development and design standards that impact site design.

6.1 Shared Access

Shared access refers to two or more parcels sharing a access driveway connection to the roadway. Shared access driveways are key access management elements because they reduce the number of driveway connections to the roadways, thus increasing mobility and safety. Typically, shared access driveways are located on a property line. They can also be located entirely on one parcel with cross access connections to adjacent parcels as may be found in commercial subdivisions. Additional information on shared access is located in Section 5.

6.2 Cross Access

Cross access refers to direct access connections between neighboring properties across property lines. Cross access connections can be developed in conjunction with individual shared access driveways or can span multiple parcels and driveways in the form of on-site service or circulation routes for large commercial or mixed-use developments. The following graphic illustrates the difference between a shared access driveway and cross access. It is important to note that shared access and cross access are not mutually exclusive, and ideally a combination of both can be provided for neighboring developments.
If cross access is not provided, patrons wishing to shop in neighboring developments must access each development individually from the roadway, even though they may be located right next door to each other. These additional driveway trips increase congestion and the potential for incidents on the roadway and reduce the on-site operational efficiency of each development. The lack of cross access also increases vehicular-pedestrian conflicts at the driveways.

### Development with No Cross or Shared Access

If patrons desire to visit each of the parcels identified above they would be required to make six turning movements (three entering and three exiting) to and from the adjacent roadway. Providing cross access allows patrons to travel from one development to another without traveling on the adjacent roadway. In the next graphic, patrons wishing to visit all three parcels make only one entering and one exiting movement from the adjacent roadway, as opposed to the six movements that would be required without cross access.

### Benefits of Cross Access

Cross access can be developed in a variety of ways. Simple connections between parking fields and on-site roadway networks can be used to link adjacent developments. There are multiple ways to position on-site roadway links to provide cross access between parcels. When planning cross access, adequate throat depth should be provided at all driveways accessing the roadway to accommodate the anticipated land uses, parking spaces, and trip generation as described in **Section 5**. The following graphics illustrate how internal roadways can also be used to link adjacent parcels and minimize impacts to the adjacent public roadway.

Providing cross access reduces the need for vehicles to travel on the public roads, thus decreasing vehicular conflicts, improving system efficiency and increasing vehicular and pedestrian safety. Cross access also provides positive business benefits and improved patron satisfaction by allowing easy and convenient access from one development to another. Cross access can also benefit individual parcels by balancing parking demands which can allow for more intense development. Cross access can be particularly beneficial for corner lots, where left turn access is generally not allowed due to the access restrictions within the functional area of the adjacent intersection. By creating cross access connections, patrons are able to access an adjacent development and travel to their destination on-site without being required to make U-turns or other complex maneuvers on the public roadway. In some cases, shared driveways or interconnected driveways can be located in such a way as to take advantage of gaps from adjacent traffic signals. This broadens the access choices of patrons and maintains the operational efficiency of the public roadways. There are numerous locations within Clark County where multiple privately owned parcels have been interconnected through a series of shared driveways and internal cross access connections. One example is illustrated below.
Interconnecting parcels by providing cross access and shared access driveways can eliminate complex routes to isolated parcels.

When a new development is proposed, the developer is generally required to show that attempts have been made to coordinate shared access and cross access connections with neighboring parcels. Documentation in the form of a certified letter have commonly been required by some agencies to be submitted during the planning and entitlement phase and with the traffic impact study showing the results of the coordination efforts. If attempts to develop a shared access driveway or cross access connection are unsuccessful, the developer should orient internal access roadways and parking fields so as to facilitate future cross access connections by adjacent parcels.

Providing cross access between developed parcels can be challenging, especially when parcels are narrow and/or shallow. Cross access may not be feasible due to grade changes or building orientation. In the event that an individual parcel or grouping of parcels redevelops, opportunities to provide cross access should be investigated. These opportunities may be as simple as removing a few parking stalls and creating a drive isle or as complex as regarding an entire parking field. Roadway improvement projects also provide opportunities to consolidate driveways and develop cross access. In all these situations the ability to provide adequate throat depth from the roadway should be weighed against the benefits of driveway consolidation and internal access connections. Redeveloping a grouping of parcels to
include shared and/or cross access can provide a variety of community benefits, including:

- Reduced driveways along the public road
- Reduced vehicle/pedestrian conflicts
- Increased on-site parking
- Improved customer satisfaction

6.3 On-Site Circulation

Access locations, building locations, on-site roadways, drive isles, and parking are all interrelated and part of the on-site circulation system. Good on-site circulation is needed within private developments to protect the operational efficiency of the adjacent public roads. Properly designed on-site circulation is a concern for local agencies because on-site operations near roadway connections have a direct impact on the safety and operation of the roadway.

On-site circulation roadways need to be designed for the anticipated design vehicle characteristics and roadway use. The following geometric features should be considered when planning and designing on-site circulation roadways:

- Horizontal and vertical curves;
- Appropriate grades;
- Drainage considerations;
- Sight distance and/or sight visibility;
- Vehicle turning radii; and
- Manual on Uniform Traffic Control Devices (MUTCD) signing and striping requirements (19).

New development and redevelopment projects should provide circulation routes between and around buildings. This facilitates separation of patrons and loading dock/delivery operations, and can improve emergency response. Regardless of the configuration of the on-site roadways, the site should be designed such that all vehicle maneuvers (including deliveries) can be completed on-site so as not to impact the flow of traffic on the adjacent roadway.

On-site circulating roadways are a key component of access management policy because they allow the site generated traffic to be conveyed and processed on site as opposed to the adjacent public road network. They also provide opportunities to direct site generated traffic to side street intersections that meet intersection spacing requirements for traffic signalization. There are many examples of retail centers within Clark County where good on-site circulation systems have been developed. One example is illustrated below.

It is common to see commercial centers that are constructed with large parking fields between the roadway and the buildings. Although this may serve as the most convenient access for vehicles, it can create on-site conflicts with vehicles and pedestrians that have the potential to impact adjacent roadway operations. Commercial centers that are oriented with buildings adjacent to the roadway and parking in the back can minimize driveway conflicts and typically provide longer driveway throats with more on-site storage between the roadway and the first on-site intersection or conflict point.
6.4 Drive-Through Queue Distance

Businesses that provide drive-through services, such as banks, fast food restaurants and coffee shops, must provide adequate on-site storage for vehicles waiting to be served. This storage is commonly referred to as drive-through queue distance. Adequate queue distance should be provided so vehicles waiting to be served do not queue (back up) into the adjacent roadway. Drive-through operations should be oriented so vehicle queuing does not block on-site parking or the circulating roadways supporting the business. Queuing areas should also be separated from other internal drive isles by raised medians.

As shown in the following example, an improperly designed drive-through can impact the adjacent public road. When this occurs, vehicles traveling on the roadway are delayed and the risk of rear-end and sideswipe crashes increases. The example also shows that the drive through queue is blocking parking spaces and it is difficult for vehicles to circulate around the property.
Local Examples of Properly Designed Drive-Throughs

To ensure that drive-through operations do not impact the adjacent roadway, the drive through queue length needs to be determined based on analysis of the service rate and patron demand for the identified use. The length of the queue storage area is measured from the first point of service to the end of the last vehicle in queue. The first point of service shall be considered the first point at which a patron interacts with the service provider or initiates a self-directed transaction. This includes menu boards at fast food restaurants, service windows at banks and drug stores and entrances to car washes. Table 6 summarizes the typical minimum vehicle queuing for various activities requiring a transaction.

Table 6 – Typical Vehicle Queuing

<table>
<thead>
<tr>
<th>Activity Type</th>
<th>Minimum Queuing Spaces per Lane</th>
<th>Minimum Queuing Distance (Feet)</th>
<th>Measured From</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank Teller Lane</td>
<td>6</td>
<td>120</td>
<td>Service Window or Callbox</td>
</tr>
<tr>
<td>Automated Teller Machine (ATM)</td>
<td>6</td>
<td>120</td>
<td>ATM</td>
</tr>
<tr>
<td>Restaurant, Drive-Through</td>
<td>8</td>
<td>160</td>
<td>Order Board</td>
</tr>
<tr>
<td>Car Wash Stall, Automatic</td>
<td>6</td>
<td>120</td>
<td>Entrance</td>
</tr>
<tr>
<td>Car Wash Stall, Self-Service</td>
<td>3</td>
<td>60</td>
<td>Entrance</td>
</tr>
<tr>
<td>Gasoline Pump Island</td>
<td>3</td>
<td>60</td>
<td>Each End of Pump Island</td>
</tr>
<tr>
<td>Drive-Through Stand-Alone Drugstore</td>
<td>6</td>
<td>120</td>
<td>Service Window</td>
</tr>
<tr>
<td>Dry Cleaner, Drive-Through</td>
<td>6</td>
<td>120</td>
<td>Service Window</td>
</tr>
<tr>
<td>Other</td>
<td>Determined by local agency based on traffic or queuing study</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6 is not a comprehensive listing of all uses that require on-site queue storage. The controlling agency may require the submittal of a queuing analysis as part of the traffic study for the development. If a queuing analysis is required, the following equation from the Transportation and Land Development Handbook can be used to calculate queuing requirements (20).

\[ M = \left[ \ln P(x > M) - \ln E(w) > 0 \right] - 1 \]

Where:

- \( n \) = number of customers in the drive-in system
- \( M \) = number of customers in the queue waiting to be served (number of customers in the system minus the number being served)
- \( P(n) \) = steady-state probability that exactly \( n \) customers are in the queuing system
- \( P(0) \) = probability that zero vehicles are in the queuing system
- \( N \) = number of parallel service positions
- \( q \) = mean average arrival rate of vehicles into the system (vehicles/hour)
- \( Q \) = mean average service rate per service position (vehicles/hour/position)
- \( \text{Avg}(t) = 60/Q \) = mean service time expressed in minutes per vehicle
\[ \rho = \text{coefficient of utilization} \]
\[ \rho = \frac{q}{NQ} \]

E(m) = expected (average) number of customers in the system

\[ E(m) = \left[ \frac{\rho \left( \frac{q}{Q} \right)^N}{N!(1-\rho)^2} \right] p(0) \]

E(n) = expected (average) number of customers waiting in the queue

E(t) = expected (average) waiting time in the system (includes service time)

E(w) = expected (average) waiting time in the queue (excludes service time)

\[ E(w) = \frac{E(m)}{q} \]

The minimum queuing length that should be provided can then be determined by multiplying the number of customers (M) generated by the formula by 20 feet. Twenty feet is the estimated length of the average car plus the gaps before and after each car in the drive-through queue.

6.5 Gated Access Queuing

There are two general types of gated access in Clark County: residential and non-residential (commercial). The most important consideration when designing a gated access is to provide adequate throat depth such that vehicles do not queue onto the adjacent roadway while waiting to pass through the gate. The following sections describe the two different types of gated access and design requirements that are typically incorporated into each gated access design.

6.5.1 Residential Gated Queuing

Residential gated access can be manned or unmanned. In the event that gated access is proposed for a residential development, the following should be met:

- **Vehicle turnaround** after the callbox (or guardhouse) and before the gate.
- Adequate width for emergency vehicle ingress and egress.
- **Vehicle detection** (loop detectors or other means).
- **Remote entry**, such as a garage door type opener for residents. This reduces the need for each vehicle to stop at the entrance. A card reader does not fulfill this requirement as vehicles must stop to place their card into or on the card reader.
- **Pedestrian refuge** area in islands, if required due to increased driveway width.
- **Throat depth** requirements must be met. Throat depth is measured from the guard house or callbox to the edge of travel way or public roadway.

Clark County Area Uniform Standard Drawing 222A provides minimum throat depth requirements for unsignalized gated access (1).

- If the gate is located at a traffic signal the required throat depth should be calculated as part of a traffic impact study. However, the throat depth should be a minimum of 300 feet. The appropriate vehicle length for the queuing analysis at a gated entry is 25 feet.
- If minimum agency requirements cannot be met then a traffic study may be required. The appropriate vehicle length for the queuing analysis is 25 feet.

Residential gated access should be designed in accordance with Clark County Area Uniform Standard Drawing 222A (1).

Examples of residential security gate design in which adequate on-site storage is provided are shown below.

6.5.2 Non-Residential Gated Queuing

Non-residential gated access design should be reviewed on a case by case basis by the controlling agency. The gated access design should consider the type of commercial development, peak hour trips, and anticipated vehicle types. Non-residential gated access design should include the following:

- **Accommodate**, at a minimum, the largest vehicle anticipated to access the site between the callbox and edge of travel way or public roadway.
- If practical, a vehicle turnaround should be designed for the largest vehicle anticipated to access the site. This vehicle type and size should be accepted by the controlling agency.
- In any case, a passenger car should be able to turn around on-site without backing out into the roadway.
7. POLICIES AND REGULATIONS

This document has been prepared to provide information on standards and policies that will encourage a unified approach for implementing consistent access management measures across the suburban and urban areas of Clark County, Nevada. The standards and recommended practices summarized and discussed in this access management document are primarily adapted from local policies, codes and practices. Many of the access management elements described in this document relate to the Clark County Area Uniform Standard Drawings (1). The relevant Standard Drawings are located in Appendix A. These local standards and practices have been supplemented with “best practice” applications and research from other states, municipalities, the Transportation Research Board and other federal agencies.

The provided access management materials are intended to be used by the RTC and their partner agencies as a reference during the planning and design of capital improvement and private development projects. This document is also intended for use as a reference tool for others involved in planning and development; including developers, policy makers, architects, engineers, entitlement consultants, and other parties interested in access management concepts.

7.1 Project Entitlements

When a new development is proposed, the developer is normally required to show that attempts have been made to coordinate shared and/or cross access with neighboring parcels. Documentation, in the form of a certified letter, has been required by some agencies to be submitted with the zoning application along with the results of the coordination efforts. If attempts to share a driveway or develop a cross access connection are unsuccessful, the developer should orient internal access roadways and parking fields so as to facilitate future cross access connections by adjacent parcels.

It is important to note that a site plan can be approved from a zoning and entitlement standpoint, but the final access locations and design are still subject to approval during the traffic study process.

7.2 Design Development

During the planning and design development phases of a project, access management measures should be recognized for the driveway locations. After the driveway location has been established, the geometric design parameters of the driveway can be evaluated. The first step should be to identify the volume and types of vehicles expected to utilize the driveway. Understanding and designing for the anticipated user will minimize impacts to the adjacent roadway and improve overall driveway functionality. For example, driveways with higher vehicle volumes and/or heavy truck movements will have different design requirements and impacts to the adjacent roadway than low volume driveways. All driveways should be designed in a similar fashion to a public roadway intersection.

During the design development phase of any project, it is important to pay attention to critical on-site design parameters that impact access management. These parameters are all interrelated and can be used in combination to have a positive impact on roadway operations and accessibility for the traveling public, customers and business owners. Local agencies may have additional development and design standards that impact site design in addition to those measures included in this document. Table 7 provides a summary of the methodology to apply to each element of site design as it pertains to access management. Relevant Clark County Area Uniform Standard Drawings are located in Appendix A.
### 7.3 Traffic Study

A traffic study may be completed in advance of zoning/entitlement actions so that the controlling agency has the benefit of assessing the project’s impacts on the roadway network. Additionally, this allows the controlling agency the ability to make recommendations regarding access management that can be incorporated into the entitlements for the proposed development. Currently, a process is used for projects located in unincorporated Clark County that requires traffic studies to be submitted 30 in advance of the zoning application for projects of regional significance.

All traffic studies and traffic mitigation reports should include a section on access management. This section should address the following items as they relate to the proposed site design and the adjacent roadway:

- Shared access
- Cross access
- On-site circulation
- Drive-through
- Gated Access

A sample Access Management Checklist for Site Design is included in **Appendix A**. This form could be filled out and included as an attachment to an agency required traffic study.

If an access management section is included in a traffic study, it should address the following items as they relate to each individual driveway and the adjacent roadway:

- Corner clearance
- Driveway separation
- Driveways per parcel
- Sight Distance
- Grade
- Curb Radii
- Width
- Throat depth
- Angle
- Right turn lane
- Lane configuration and access control

A sample Access Management Checklist for Driveways is included in **Appendix B**. This form should be filled out and included as an attachment to the traffic study.
7.4 Waiver of Standards

Situations may exist where the recommendations of this document cannot be met. In these instances a waiver of standards may be requested. The controlling agency may require additional information or analysis be provided as part of the waiver request so they can fully assess the impacts of the waiver on roadway safety and operations.
8. **WORKS CITED**


APPENDIX A

Relevant Clark County Area Uniform Standard Drawings

The Drawings included in this Appendix are current as of March 2011. Please check the RTC Website for current Standard Drawings at:
http://www.rtcsnv.com/mpo/streets/.
NOTE:
SEE STANDARD DRAWING NO. 245.1 (2 SHEETS) FOR TYPICAL LANE CONFIGURATIONS AND DIMENSIONS

* AT THE INTERSECTIONS OF 80 FT. AND 100 FT. STREETS, ADDITIONAL RIGHT-OF-WAY MAY BE REQUIRED FOR THE 80 FT. STREET. TYPICALLY, THESE 80 FT. STREETS WILL BE IDENTIFIED AS ARTERIALS IN THE REGIONAL TRANSPORTATION PLAN.

RIGHT-OF-WAY (BEYOND STANDARD 100' ACQUISITION) NECESSARY FOR INTERSECTION
ADDITIONAL RIGHT-OF-WAY NECESSARY FOR EXCLUSIVE RIGHT TURN LANE AT INTERSECTION

---

**SPECIFICATION REFERENCE**

**UNIFORM STANDARD DRAWINGS CLARK COUNTY AREA**

**ADDITIONAL RIGHT-OF-WAY REQUIRED AT MAJOR INTERSECTIONS**

DATE 7-10-03 | DWG. NO. 201.1 | PAGE NO. 7.1
INTERSECTION SIGHT VISIBILITY ZONE

TYPICAL INTERSECTION CORNER

NOTE: FOR SIGHT ZONE DIMENSIONS, SEE SETBACK TABLE ON SHEET 2 OF THIS STANDARD DRAWING.
### Setback Table

#### General Notes

1. Each corner of every intersection shall have a sight visibility easement regardless of right-of-way width.

2. No walls, fences, trees, shrubs, utility appurtenances or any other object, other than traffic control devices and street light poles, may be constructed or installed within the sight visibility zone unless said object is maintained at less than 24 inches in height, measured from top of curb, or where no curb exists, a height of 27 inches measured from the top of adjacent asphalt, gravel or pavement street surface.

3. At intersections where the classification of major and minor streets cannot be permanently established, each leg of the intersection must be analyzed as if the approach leg is a minor street intersecting a major street. The portions of the sight visibility zone labeled "N/A" in the setback table are not required. At "T" intersections, the terminating leg will always be the minor street.

4. Curving roadways and roadways with intersecting angles greater than 10 degrees must be analyzed using D1, D2, the eye position, and the car position as shown in the information above.

5. Use of a sight visibility zone different than that shown herein shall require a sight visibility analysis prepared and submitted for approval to the local entity engineer by a civil engineer registered in the state of Nevada.

6. The area within the limits of the arc and the chord at the curb return shall be added to the sight visibility zone at each corner of every intersection, except for 100' x 100' intersections or greater.

7. On-street parking shall be prohibited within areas designated by dimensions "A" and "D" on sheet 1 of this drawing, subject to the approval of the traffic engineer or designated representative of the entity having jurisdiction.

### Basis for Analysis

The following criteria was and shall be used as the basis for design of sight visibility zones:

- AASHTO publication of "A Policy on Geometric Design of Highways and Streets", 1995 edition, chapter IX, using the most restrictive sight line derived from each of the three possible crossing maneuvers (stopped condition):
  - Case 3A - Crossing Maneuver
  - Case 3B - Left Turn Maneuver
  - Case 3C - Right Turn Maneuver

The analysis should use the greater of the following:

- Design speed = posted speed limit plus five
- Design speed = posted speed limit divided by 0.85

Car and eye positions are as shown on sheet 1 of this drawing.

<table>
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<th>Uniform Standard Drawings Clark County Area</th>
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<td>201.2 (2 of 2)</td>
<td>7.2A</td>
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NOTES:
1. COMMERCIAL AND MULTI-FAMILY DRIVEWAYS SHALL BE CONSTRUCTED IN ACCORDANCE WITH STANDARD DRAWING NUMBERS 224, 225, 228, 235 AND 235.1.
2. LOCAL ORDINANCES AND POLICIES MAY APPLY AND SHALL HAVE PRECEDENCE. SEE NDOT ACCESS POLICY FOR STATE ROADWAYS.
3. THE TOTAL WIDTH "W" OF DRIVEWAY CURB OPENINGS SHALL NOT EXCEED 65% OF FRONT FOOTAGE.
4. NO DRIVEWAY SHALL BE LOCATED WITHIN 6 FEET OF A LIGHT POLE (UNLESS APPROVED BY THE ENTITY TRAFFIC ENGINEER), FIRE HYDRANT, MAIL BOX, ABOVE-GROUND ELECTRICAL TRANSFER BOX, OR BLOCK WALL HIGHER THAN 2 FEET.
5. THE CENTERLINES OF THE DRIVEWAYS ON OPPOSITE SIDES OF THE STREET AT A MEDIAN OPENING SHOULD BE WITHIN 10' FROM EACH OTHER AT THE MEDIAN OPENING.
6. GEOMETRICS APPLY TO NEW CONSTRUCTION ONLY, AND EXCEPTIONS MAY BE GRANTED BY THE APPROVAL OF THE AGENCY TRAFFIC ENGINEER BASED ON SITE CONSTRAINTS.
7. HANDICAPPED ACCESSIBLE SIDEWALKS SHALL BE PROVIDED ADJACENT TO DRIVEWAYS TO THE P.C. OF THE ONSITE CURB RETURN, MINIMUM, OR AT AN ALTERNATE LOCATION.
8. WHEN A PROPERTY LINE FALLS IN A MEDIAN OPENING A JOINT DRIVEWAY AGREEMENT SHALL BE REQUIRED OR NO DRIVEWAY WILL BE ALLOWED.
DIMENSIONS

J. THROAT DEPTH FOR SECURITY GATE
50' MINIMUM FOR 1 TO 49 HOMES OR APT. UNITS TO VISITOR CALL BOX.
100' MINIMUM FOR 50 TO 100 HOMES OR APT. UNITS TO VISITOR CALL BOX.
GREATER THAN 100 HOMES OR APT. UNITS REQUIRE TRAFFIC STUDY

DIMENSIONS FOR SECURITY GATE
CONTROLLED DRIVEWAY DETAIL

D. ISLAND: LENGTH-20' MINIMUM
WIDTH- 4' MINIMUM

G. 15' MINIMUM
E. 48' MINIMUM
H. 8' MINIMUM & 15' MAXIMUM

DETAIL FOR SECURITY GATE
CONTROLLED DRIVEWAYS
NOTES:

1. SEPARATION OF PEDESTRIAN AND VEHICLE TRAFFIC MUST BE MAINTAINED ON SITE.

2. FOR GRADE CHANGES GREATER THAN 3\%, VERTICAL CURVES OF AT LEAST 10 FEET MUST BE USED.

3. WHEELCHAIR RAMP SHALL BE CONSTRUCTED IN THE CURB RETURN IN ACCORDANCE WITH STANDARD DRAWING NO. 235.
300' TYP. STORAGE

BIKE LANE

EXCLUSIVE RIGHT TURN LANE
ADDITIONAL 10' RIGHT-OF-WAY DEDICATION REQUIRED FOR EXCLUSIVE RIGHT TURN LANE

100' RADIUS

62.45' TYP. FOR REVERSE CURVE TAPER

SIDESWALK

STORAGE VARIES (150' TYP.)

3' OFFSET

* SYMMETRICAL REVERSE CURVE (STRAIGHT LINE TAPER MAY BE SUBSTITUTED AS APPROVED BY ENGINEER)

200' RADIUS

99.5' TYP. TAPER

250' RADIUS

SYMMENTRICAL REVERSE CURVES

115.37' TYP. TAPER

NOTES:
1. SIDEWALK SHOULD BE OFFSET THROUGH THE INTERSECTION WITH A CURB RAMP CONNECTING THE SIDEWALK TO THE CROSSWALK. NO ABOVE GROUND OBJECTS SHALL BE PLACED WITHIN THE SIDEWALK. CONTACT THE LOCAL JURISDICTION FOR DEVELOPMENT REQUIREMENTS FOR THE AREA BETWEEN THE CURB AND SIDEWALK.

SPECIFICATION REFERENCE

UNIFORM STANDARD DRAWINGS
CLARK COUNTY AREA

TYPICAL LANE CONFIGURATION FOR
MAJOR STREET INTERSECTIONS
AND MEDIAN DETAIL
CASE I - WITH OFFSET SIDEWALK

DATE 7-10-03  DWG. NO. 245.1 ALT (1 OF 2)  PAGE NO. 51.1ALT
NOTES:
1. SIDEWALK SHOULD BE OFFSET THROUGH THE INTERSECTION WITH A CURB RAMP CONNECTING THE SIDEWALK TO THE CROSSWALK. NO ABOVE GROUND OBJECTS SHALL BE PLACED WITHIN THE SIDEWALK. CONTACT THE LOCAL JURISDICTION FOR DEVELOPMENT REQUIREMENTS FOR THE AREA BETWEEN THE CURB AND SIDEWALK.
**TYPICAL LANE CONFIGURATION FOR MAJOR STREET INTERSECTIONS AND MEDIAN DETAIL**

**CASE I - WITH CURBSIDE SIDEWALK**

DATE: 7-10-03  DWG. NO.  245.1 (1 OF 2)  PAGE NO.  51.1
APPENDIX B

Access Management Sample Checklist for Site Design
Access Management Checklist for Site Design

**Project Name:**

**APN:**

**Tracking Number:**

**Project Trip Generation:**

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<tr>
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<th>AM Peak Hour Trips</th>
<th>PM Peak Hour Trip</th>
<th>Daily Trips</th>
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<tbody>
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</table>

**Shared Access:**

- Is a shared driveway proposed?  
  - Yes  
  - N/A

- Has documentation been provided showing effort to contact neighbor for shared and/or cross access?  
  - Yes  
  - No

**Cross Access:**

- Is cross access proposed?  
  - Yes  
  - N/A

- Has documentation been provided showing effort to contact neighbor?  
  - Yes  
  - No

- If cross access cannot currently be developed, have provisions been made in case it is feasible in the future?  
  - Yes  
  - No

**On-Site Circulation:**

- Are all parking, site circulation, and delivery movements able to occur on-site?  
  - Yes  
  - No

**Drive-Through:**

- Is there a drive-through?  
  - Yes  
  - N/A

- What land use is the drive-through serving?  
  -               
  - Spaces

- Does the drive through queue length meet those outlined in Clark County Area Access Management – Table 6?  
  - Yes  
  - No

**Gated Access:**

- Is there a gated access?  
  - Yes  
  - N/A

- What is the calculated queue depth requirement?  
  -               
  - Feet

- Has adequate queuing been provided?  
  - Yes  
  - No

**Other Requirements:**

If there is a “No” Response to any of the above questions a specific traffic impact study for the project may be required by the reviewing agency.
APPENDIX C

Access Management Sample Checklist for Driveway Design
Access Management Checklist for Driveways
(Use one form per Driveway)

Project Name:__________________________

APN:__________________________

Tracking Number:__________________________

Project Trip Generation: AM Peak Hour Trips
PM Peak Hour Trip
Daily Trips

Driveway Name/Identification:__________________________

Driveway Location:
(Street name of Access and distance from major cross street)

DRIVEWAY DESIGN

Corner Clearance:
- What is the corner clearance? __________ Feet
- Does corner clearance meet 222A? Yes No

Driveway Separation:
- What is the driveway separation from the property line? __________ Feet
- What is the driveway separation distance from Table 3 in Clark County Area Access Management? __________ Feet
- Have driveway separation distances from Table 3 in Clark County Area Access Management been met? Yes No
- Does the driveway meet separation requirements from other above ground features as outlined in CCAUSD 222A? YES No

Driveways per parcel:
- How many driveways are proposed? __________ Driveways
- Is the number of driveways proposed in conformance with Table 4 in Clark County Area Access Management? Yes No

Sight Distance:
- Was sight distance calculated based on the AASHTO Green Book Calculations? Yes No
- Was the sight distance calculation from the AASHTO Green Book compared to the CCAUSD Calculations? Yes No
- Is the sight distance provided the greater of the two calculations? Yes No

Grade:
- Does the driveway grade conform to CCAUSD 225? Yes No
DRIVEWAY GEOMETRY

Curb Radii:
- Was the radii designed to handle the types of vehicles expected to utilize the driveway? Yes No
- What is the departure radius? __________ Feet
- Does the departure curb radii meet CCAUSD 222A? Yes No
- What is the approach radius? __________ Feet
- Does the approach curb radii meet CCAUSD 222A? Yes No
- What is the design vehicle for the driveway? (P, SU, Bus, WB-50, etc.)

Driveway Width:
- What is the driveway width? __________ Feet
- Does the driveway have an island? Yes No
- Does the width conform with CCAUSD 222A? Yes No

Throat Depth:
- How many parking spaces are there for the entire project? __________ Spaces
- Does the throat depth meet CCAUSD 222A? Yes No

Driveway Angle:
- What is the angle of the driveway? __________ Degrees
- Does the angle meet Section 5.2.4 of Clark County Area Access Management? Yes No

Right Turn Lane:
- Is the driveway located on a major or minor road? Yes N/A
- Has a right turn lane been provided? Yes No
- If “No” above, please circle one of the following:
  o a partial right turn lane will be constructed
  o right-of-way for a future right turn lane is being dedicated as part of the project
  o an easement is being provided for a future right turn lane
  o a traffic study has been prepared to address the right turn (typically only very low right turn volumes <25 per hour do not require a right turn lane)

Lane Configuration:
- What type of driveway is being proposed? (circle one)
  o Right-in/right-out
  o Left-in/right-in/right out
  o Full access
  o Signalized
- Does the driveway meet the lane configuration requirements outlined in Section 5.2.7 of Clark County Area Uniform Access Management? Yes No

Other Requirements:
If there is a “No” Response to any of the above questions a specific traffic impact study for the project may be required by the reviewing agency to justify the proposed driveway design.