PUBLIC ROAD ACCESS RIGHTS AND RESPONSIBILITIES

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DIBBLE

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INTRODUCTION

Private and public access points are an important part of any roadway or street network. It is important to consider both the access rights on public roadways and the responsibilities of landowners and the public jurisdiction with authority over the road or street from which access is achieved. Arizona Revised Statutes (ARS) Title 33. Property § 33-2401. Access to Private Property states:

> "A. Notwithstanding any other law, reasonable access to private property shall not be denied by this state or any political subdivision of this state."

Political subdivisions of the state are counties or incorporated cities or towns. Access to a private property from a public street is commonly achieved by a private driveway or private street intersection. For the purposes of this paper, private driveways and street intersections are treated the same.

While access is a legal right, it also introduces challenging considerations related to traffic operations and safety. Vehicle access points, such as driveways and minor street intersections, can increase vehicle-to-vehicle conflicts, particularly those that result in angle, turning, and high-speed rear-end (RE) crashes. These types of crashes are among the most dangerous and can result in serious injuries or fatalities. Therefore, it is essential that access management strategies balance the right to access with public safety considerations and efficient traffic operations. This paper explores this balance, not only for new accesses but also for existing accesses that were previously granted.

THE DEFINITION OF REASONABLE ACCESS

A key provision of ARS § 33-2401 is the interpretation of what constitutes "reasonable access." While the statute affirms that access to private property cannot be unreasonably denied or altered, it also implicitly recognizes the authority of the state and its subdivisions (i.e., counties, incorporated cities/towns) or jurisdictions to regulate how that reasonable access is provided. This reasonable access is typically codified in local municipal ordinances or codes in a chapter titled "Private Driveway Access to Public Roads" or something similar, then further supported by that jurisdiction's development processes, design manuals, and standard drawings. These documents outline the technical and procedural requirements for accesses, including the configuration (allowed traffic movements), driveway spacing, traffic control, sight distance, and geometric design requirements that work together to provide reasonably efficient and effective access.

Both new accesses for new developments and existing accesses for redevelopments often require a traffic study to determine how that access might operate and what improvements might be needed to balance the legal right of access with safe, effective, and efficient traffic operations. Depending on the size of the development or redevelopment and the amount of traffic it might generate, the study might also analyze other driveways and street intersections.

The scope of these traffic studies is typically set by the jurisdiction that has control of access authority based on their specific criteria. For most municipal streets such as arterials, collectors, and local streets, an incorporated city or town is typically the control of access authority. In unincorporated areas, the control of access authority may be the county, state, tribal, or federal government or a combination thereof, depending on who owns and operates the roadway being accessed. If the roadway is within tribal lands, it may be subject to the specific requirements of the tribe or the Bureau of Indian Affairs (BIA); ARS § 33-2401 does not apply in these situations, as the tribe has sovereignty. A discussion of tribal and BIA requirements is beyond the scope of this paper.

An important exception to this authority is for portions of highways (especially freeways) that are under the jurisdiction of the State of Arizona. For Arizona state highways and freeways, this authority belongs to the Arizona Department of Transportation (ADOT). Typically, ADOT requirements prevail over municipal requirements within ADOT right-of-way (ROW) unless otherwise approved by ADOT. When gaining new access, it is important to confirm which governmental jurisdiction(s) have the control of access authority.

It is also important to note that reasonable access does not mean that the location and configuration of existing driveways are permanently exempt from future changes, especially if the driveway presents safety or operational issues. Under ARS § 33-2401, the State of Arizona and its political subdivisions retain the authority to re-regulate new and reregulate existing driveways to help them meet current planning and engineering safety and operations standards. This right is granted through Provision D of ARS § 33-2401, which states:

> "D. Following reasonable consultation with the owner of the private property, this state or any political subdivision of this state shall determine the appropriate location and width of the right-of-way to be granted and may relocate the right-of-way after the grant at the discretion of this state or the political subdivision of this state."

This means that existing driveways will not necessarily be grandfathered in and can be changed if there is a good reason to change it. The full ARS § 33-2401 can be found at this link https://www.azleg.gov/ars/33/02401.htm or by scanning the QR code below.

DRIVEWAY MOVEMENTS AND CONFLICTS

Driveways create conflicts for traffic entering and exiting them, which impact the effectiveness and efficiency of traffic on the street. Not only do the State of Arizona and its subdivisions have a duty to maintain the reasonableness of driveways' right to access, but they also have a basic duty to keep its roadways reasonably safe for ordinary travel and without an unreasonable traffic operations impact to new or existing streets or other accesses.

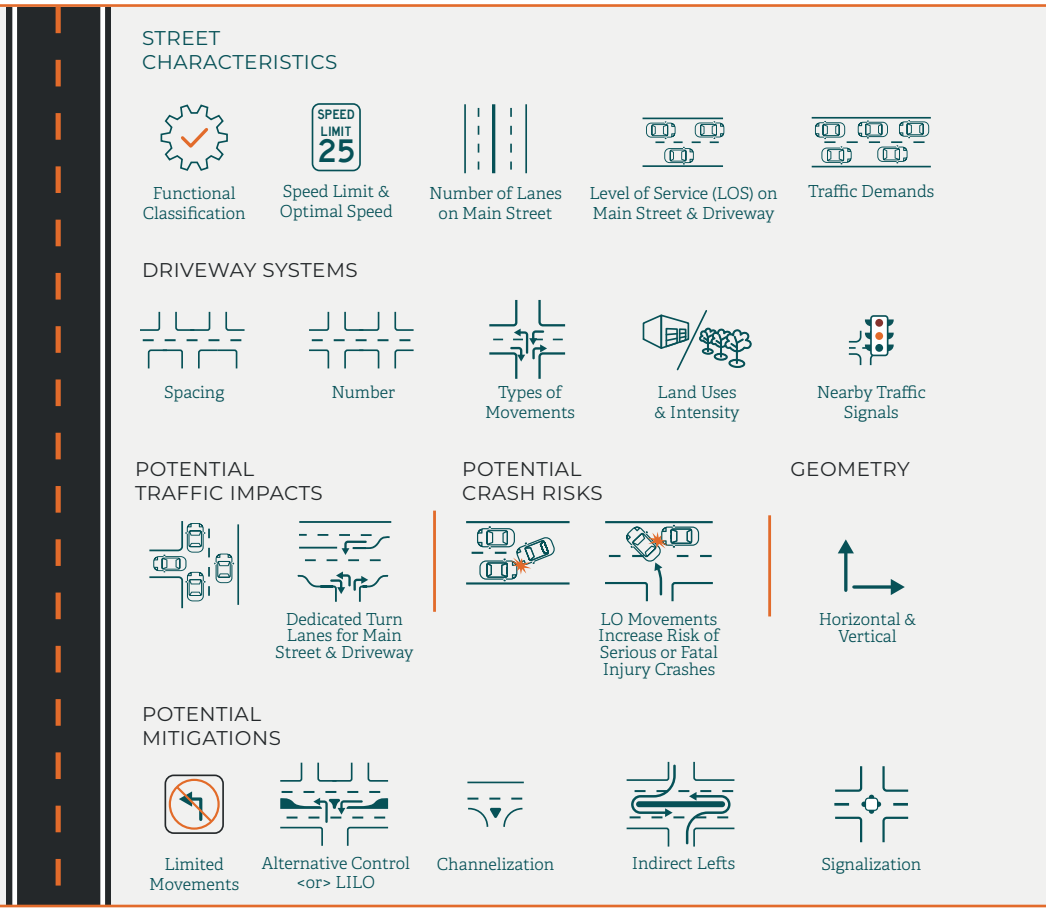
While the jurisdiction's duty to provide reasonable access and reasonably safe roadways should go hand in hand, unfortunately that is not always the case. Even though this basic duty to provide reasonably safe roadways should be considered within the definition of reasonable access, ARS § 33-2401 does not mention safety at all. The challenge with driveway design is to keep these impacts to a reasonable level that meets the need for private property access while maintaining the basic safety, effectiveness, and efficiency of the street.

The spacing, number, and type of driveways and the movements allowed to and from the street largely depend on the functional classification of that street and the potential impacts of the driveway on the street. Thus, the need for access and the amount of access allowed must be carefully balanced so the integrity of the public street and other existing accesses is not compromised by the amount of access (or movements) allowed at that driveway. Key factors include the posted speed limit, number of lanes, traffic demand, and functional classification of the street.

Access is a function of driveway spacing and the number of access points along a given portion of a street. The amount of access allowed refers to the movements allowed in and out, specifically at that driveway. Each driveway can have up to five direct movements: Right in (RI), right out (RO), left out (LO), left in (LI), and cross movements (CMs). Full-access driveways allow all possible movements and can be problematic due to their crash potential, especially on multi-lane arterial streets.

A restricted-access driveway may limit one or more of these movements, thereby reducing some potential conflicts. The restricted movements often depend on the location of the driveway and the functional classification of the street to which the driveway provides access. Additionally, how much access is allowed may depend on the timing of other adjacent improvements. For example, a full-access driveway might be allowed during an interim period until one or more movements may need to be restricted due to adverse impacts those movements might create to the new development that has just been built. New full-access driveways should be avoided wherever possible, and existing full-access driveways should be retrofitted to eliminate the CM at a minimum.

TRAFFIC EVALUATIONS FOR DRIVEWAYS



THE IMPORTANCE OF TRAFFIC AND SAFETY ANALYSES

When new driveways are planned or existing ones are revised, many in the traffic engineering field focus primarily on the vehicle trip generation and traffic volume impacts while overlooking the potential safety implications of the new access and the additional traffic it will generate—including pedestrians and other vulnerable road users (VRUs).

Traffic Impact Statements and Analyses

A typical traffic impact statement (study) or analysis (TIS or TIA) estimates the number of vehicle trips generated by the proposed development, how those trips will be distributed and assigned across the surrounding roadway network, and what operational impacts this new vehicle traffic demand may have. New pedestrian and VRU demand is rarely included, especially in rural communities.

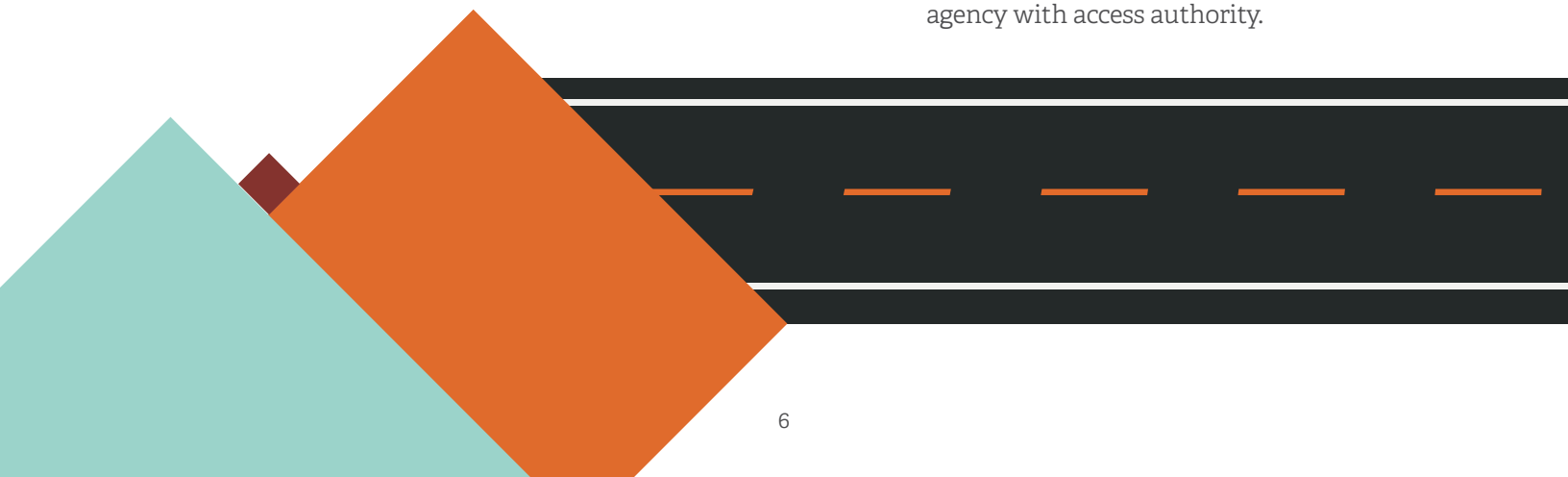
To support these vehicle-focused studies, existing traffic volume data are collected—typically during peak weekday morning and afternoon periods—to establish a baseline of current traffic conditions. This allows for a comparison between existing (background) conditions and the projected impact of the new development. The analysis includes capacity and delay metrics, often expressed in terms of queued vehicles, added delay, and LOS ratings for key intersections and roadway segments. These quantitative outcomes often serve as triggers to identify what improvements are needed to address existing deficiencies or to mitigate the impacts of new traffic. Defining background conditions is a critical component of any TIS or TIA, as it helps distinguish between mitigation responsibilities related to the development versus those related to existing conditions.

These analyses are conducted using methodologies from the Transportation Research Board's (TRB's) Highway Capacity Manual (HCM), which sets the national standard for evaluating traffic operations. Additionally, the Institute of Transportation Engineers (ITE) provides essential resources such as the Trip Generation Manual and Trip Generation Handbook, which are used to estimate trip generation based on land use type, size, and other characteristics. ITE also offers guidance on trip distribution, assignment, and mitigation strategies. These resources, along with applicable state, county, and municipal requirements, form the foundation of TIS/TIA methodology. In Arizona, ARS § 33-2401 establishes the legal foundation allowing state and local agencies to require these studies, as it specifies that reasonable access cannot be denied; therefore, the studies are used to determine what reasonable means.

Following the operational analysis, a before-and-after comparison—sometimes including future growth scenarios—is conducted to assess how additional traffic will affect roadway and intersection performance. Based on these findings, an improvement evaluation is performed to identify any necessary on-site and off-site mitigation measures to maintain acceptable traffic operations and LOS.

The Safety Gap

While the operational impacts of driveways are thoroughly analyzed in the TIS/TIA, the traffic safety impacts are often underemphasized. Only a few local jurisdictions in Arizona require a formal safety analysis or crash history review as part of the TIS/TIA process. Even when such reviews are conducted, they often result in a simple reporting of crash counts and types, rarely leading to the recommendation or implementation of proven safety countermeasures unless explicitly required by the agency with access authority.



Currently, ADOT and most jurisdictions in Arizona do not have a formal safety evaluation requirement as part of their TIS/TIA processes. As a result, it often falls to regional traffic engineers, district engineers, local traffic engineers, or proactive engineering consultants to take the initiative to recommend safety countermeasures. However, these efforts are frequently met with resistance from developers. Those advocating for safety improvements are sometimes overruled, which allows developments to proceed with minimal or no safety mitigations.

This reliance on initiative is not a sustainable approach to integrating safety into access decisions. There is a clear need for a formalized process that places safety on equal footing with traffic demand when determining reasonable access.

Proven Safety Countermeasures and the Safe System Approach

Dedicated turn lanes are an example of a measure that has been shown to improve safety at driveway intersections. However, the decision to require dedicated turn lanes is often based solely on volume warrants. If the volume threshold has not been met, turn lanes may not be required, even though the Federal Highway Administration (FHWA) has identified dedicated left- and right-turn lanes at intersections as a proven safety countermeasure (PSC). According to FHWA, these treatments can significantly reduce crashes, especially rear-end and angle crashes.

Even more compelling is FHWA's PSC on corridor access management, which demonstrates how strategic control of access points can reduce crash frequency and severity while improving traffic flow. This countermeasure is part of a broader initiative of 28 PSCs that FHWA encourages agencies to implement as part of the Safe System Approach (SSA), which is the U.S. Department of Transportation's framework to design roadway systems to prevent fatal and serious injuries even when human error occurs.

It is difficult to imagine how Arizona can fully achieve the goals of the SSA, the Arizona Strategic Highway Safety Plan, or other safety initiatives without requiring formal safety evaluations in all TIS/TIA processes, especially given that much of the state's new roadway infrastructure is being built or rebuilt through development-driven projects.

Best Practices and Standard of Care

Best practices and standard of care in traffic and civil engineering increasingly recommend incorporating safety performance evaluations using tools such as the American Association of State Highway and Transportation Officials (AASHTO) Highway Safety Manual (HSM), TRB Access Management Manual, and TRB Access Management Application Guidelines. These resources demonstrate how new access points should be planned and designed to result in reasonable safety for all road users, including pedestrians, cyclists, and other VRUs.

This delicate balance of reasonable access and reasonable traffic operations and safety should be based on quantitative reasoning. This is why it is so important to analyze both traffic and safety operations through the applicable TIS or TIA processes. While a jurisdiction with access authority cannot deny reasonable access, it can regulate access to ensure reasonable traffic flow and safety for both the driveway and the street it accesses. The next section discusses general guidelines for driveway design, specific criteria and requirements, and potential driveway impacts in light of these reasonable traffic flow and reasonable safety principles.

General Guidelines

As already discussed, access rights are not unlimited. Each driveway that accesses a street needs to meet certain criteria and requirements. These are first divided by the type or functional classification of the street from which it will gain access, then by the development's or site's land use type. In cases where exceptions may be desired, the involved jurisdiction must discuss and approve the criteria.

- **The main street functional classifications are local streets, collector streets, and arterial streets.**
- **The main land use divisions are residential and commercial/industrial.**

Sometimes a street functional classification system may differentiate between major and minor collectors and arterials; if the jurisdiction makes this distinction, some of the requirements discussed here may vary. Regardless, for street classification divisions, the type of driveway, location, spacing, allowed movements, and potential required mitigations are the main criteria. For land use, the two designations are further divided based on the basic intensity of those types of developments or sites (e.g., single-family, multifamily, single business, multiple businesses).

Driveway access on local streets with single-family homes is fairly straightforward. Depending on the type of residential development, the single-family home criteria can be used for duplex, triplex, or similar density residential housing with access provided off a local street. The multi-family requirements are targeted at low-intensity townhouses, condominiums, or apartment buildings that are typically fewer than five stories high and where traffic generation can be handled by local streets. High-density residential development (five or more stories, with or without parking garages) is treated similarly to the single or multiple business criteria, given these sorts of developments typically gain their access from collector and arterial streets. For planned industrial or commercial developments that use a local street configuration, the driveway spacing and locations can vary.

General guidelines for driveway planning and design are as follows:

GENERAL GUIDELINES FOR DRIVEWAY PLANNING AND DESIGN

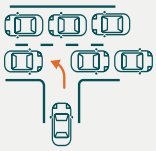
SPACING: Along main streets, especially arterials, it is always good practice to limit and space out the number of access points. Often the best, most functional access is achieved from secondary streets like collector and local streets.

BACKUP ACCESS: One carefully located and well-designed driveway per site is often more than adequate. However, some form of redundancy is important in case the driveway is blocked or emergency-only access is needed. Alleys can often be used as emergency or restricted secondary accesses.

POSSIBLE JOINT ACCESS: For two lower-volume adjacent sites, it is often effective to provide access from a joint use driveway. Such joint use driveways should be implemented via a formal agreement and easement.

OVERALL SYSTEM CONSIDERATIONS: Site circulation, driveway locations, and access movements allowed at the driveway need to be coordinated as a system that meets expectations and is easily understood by the driving, walking, and riding public, both on-site and on the street.

SAFEST ACCESS (RIRO): RI and RO driveways are the safest, most effective, and most efficient types of driveways. They have fewer conflicting movements and require a minimal amount of traffic control, which allows for less restrictive spacing and location criteria and requirements. On wide arterial streets with heavy traffic, this is often the only form of access that makes sense. In these instances, drivers often prefer this type of access and will plan their trips so they only have to make RI and RO movements for access.



PROBLEMATIC LO MOVEMENTS: LO movements for driveways on arterials are sometimes problematic during peak traffic times in terms of the LOS provided and crash risk.

SIGNALIZATION FOR FULL ACCESS: Full-access driveways on arterials are the most effective and efficient if they are signalized and are spaced out per standard street grid network principles. This is typically a one-quarter or one-half mile (or more) to the next traffic signal.

GEOMETRY: Driveways need to have an appropriate horizontal and vertical geometric configuration that allows for a smooth, traversable transition. Connection angles at the driveway's connection to the street should be as close to 90 degrees as practicable, but no less than 70 degrees.

VRU CROSSINGS: Driveways need to provide for pedestrian and bicycle crossings. Also, the configuration of a driveway should not present a tripping hazard to pedestrians or risk catching the wheels of wheelchairs, bicycles, and micro-mobility devices. Driveways with wrap-around curbs that taper into the sidewalk area should not be used if they are part of that sidewalk and are in the path of pedestrian travel; if they are used, the end should be painted hazard yellow.

DEDICATED LEFT-TURN LANES (LTLS): Dedicated LTLs should always be provided for left-turn movements (both on the street and on the driveway, as applicable to the type of driveway) unless specifically approved by the city traffic engineer.

DECELERATION AND ACCELERATION LANES: Deceleration and Acceleration (or merge) lanes for all turning movements off and on high speed roads should always be considered, especially if the speed limit is 55 mph and higher.

EMERGENCY ACCESS: Providing for emergency vehicle ingress and egress should always be a consideration.

ACCESS FROM SIDEWALKS: Driveways should provide designated and separate site access to and from sidewalks and paths, as applicable.

These are just some of the general considerations for driveway access that help preserve the functionality of the street while still providing reasonable access for all traffic (i.e., vehicles, pedestrians, bicyclists, and VRUs).

Specific Criteria and Requirements

The following table and sections present more specific criteria and requirements for driveways on collector and arterial streets, including the types of access allowed (designations), potential impacts, and potential requirements/mitigations.

COLLECTOR AND ARTERIAL DRIVEWAY DESIGNATIONS, IMPACTS, REQUIREMENTS, AND MITIGATIONS

DESIGNATIONS		POTENTIAL IMPACTS			POTENTIAL REQUIREMENTS			
Allowed Movements	Acronym – Allowed Access Designations	Traffic Impacts	Crash Risk	Queue Needs (TL)	Spacing and Location Requirements	Opposite Side of Street Offset	Channelization and Other Features	Mitigations
 Right in	RI – ¼ access allowed	Lowest	Lowest – SDSS, RE	40'+	✓	✗	✓	CI, DTL
 Right out	RO – ¼ access allowed	Lowest	Lowest – SDSS, RE	40'+	✓	✗	✓	CI, AML or space
 Right in and right out	RIRO – ½ access allowed	Low	Low – SDSS, RE	40'+	✓	✗	✓	CI, DTL, AML or space
 Right in, right out, and left in	RIROLI – ¾ access allowed	Medium	Medium – SDSS, RE, angle, LT	40'+ for RIRO; 80'+ for LI depending on demand	✓	✓	✓	CI, DTLs, two lanes in, RIRO with indirect LI, control with traffic signal/roundabout/ similar
 Right in, right out, and left out	RIROLO – ¾ access allowed	High	High – SDSS, RE, angle, LT	40'+ for RIRO 60'+ for LO depending on demand	✓	✓	✓	CI, DTLs, two lanes in, RIRO with indirect LO, control with traffic signal/roundabout/ similar
 Right in, right out, left in, and left out	Full access allowed	Highest	Highest – SDSS, RE, angle, LT, head-on	40'+ for RIRO 80'+ for LI and LO depending on demand	✓	✓	✓✗ (Sometimes)	DTLs, two lanes in/two lanes out, RIRO with indirect LI, control for a LILO with traffic signal/roundabout/ similar

RI = right in | **RO** = right out | **LI** = left in | **LO** = left out | **SDSS** = same direction sideswipe crash | **RE** = rear-end crash
LT = left-turn crash | **TL** = throat length | **CI** = channelization island | **DTL** = dedicated turn lane | **AML** = acceleration/merge lane

Note that Cross Movements (CM) should only be allowed on Collector streets which are three lanes or less. They should typically not be allowed on arterial streets that are more than four lanes (two lanes in each direction).

Potential Impacts

Traffic Impacts

Traffic impacts refer to the impacts of the driveway on the collector or arterial street's traffic flow and how much control might be needed at the driveway if traffic demand is high. These traffic impacts largely depend on the amount of traffic the site generates, the peak times for that traffic, and the background traffic on the street being used for access. The criteria for the rankings in the table (lowest to highest) are based on the following requirements:

IMPACT LEVEL	DESCRIPTION OF IMPACT	KEY CONCERNS	MITIGATION MEASURES
Lowest / Low	Driveway affects traffic in one direction only	• Right-turning vehicles slow down arterial flow • Vehicles entering the arterial must accelerate to match pace • Degrades capacity of the outside lane	N/A
Medium	Adds LI movements	• LI movements worsen one-direction flow • Lack of a dedicated LTL increases delays • Inadequate LTL storage, especially when there are medians in the road, harms arterial capacity and LOS	 Provide a dedicated LTL or TWLTL and properly size queue storage
High / Highest	Adds LO movements affecting both directions	• LO movements degrade flow both ways • Heavy demand requires traffic controls • LOS suffers during peak times without proper design	 Add traffic controls and street configurations (e.g., signals, medians) to maintain LOS

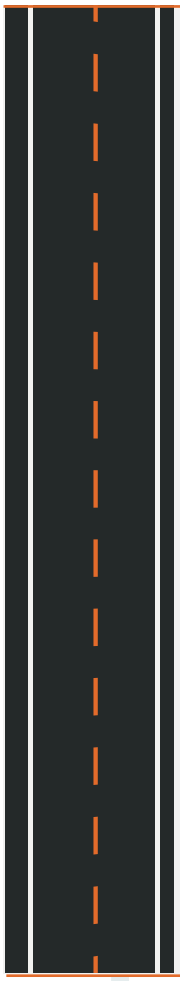
LI = left in | **LO** = left out | **LTL** = left-turn lane | **LOS** = level of service | **TWLTL** = two-way left-turn lane

Cross Movements (CM) should typically not be allowed on arterial streets that have two through lanes in each direction. Allowing a CM in a situation like this is typically presents an unacceptable crash risk. Collector streets or local streets with one lane in each direction allowing a CM is typically acceptable.

It is important to complete a traffic capacity analysis using principles from the TRB HCM or a similar guideline, which better quantifies the potential traffic impacts and what movements will function at an acceptable LOS. The traffic capacity analysis also determines whether each movement should be allowed or whether it needs to be mitigated with some form of traffic control, such as channelization.

Crash Risk Impacts

Crash risk impacts are caused by the vehicle-to-vehicle, vehicle-to-pedestrian, and vehicle-to-bicyclist conflicts that the allowed movements create. The more movements allowed, the higher the crash risk potential. The type of conflict increases the potential severity of the crash risk; for example, left-turn movements that involve potential angle, turning, and head-on crashes have the highest potential severity, especially if they happen at high speeds. Thus, it is important to provide needed access without unduly creating more potential crash risks than necessary. For driveways, the primary crash types are same direction sideswipe (SDSS), rear-end (RE), angle, and turning crashes, while head-on crashes are less likely. The criteria for the rankings in the table (lowest to highest) are based on the following requirements:



DRIVEWAY ACCESS AND CRASH RISK LEVELS

Low/Lowest Impact

Movements Involved: RI, RO
Potential Conflicts: SDSS and RE
Crash Risk: Low frequency
Key Takeaway: These movements create basic turning conflicts with manageable safety concerns

Medium Impact

Movements Involved: RI, RO, LI or LO
Additional Conflicts: Angle and turning conflicts
Crash Risk: Increased risk for serious injuries or fatalities with right-angle crashes
Key Takeaway: Full access increases crash risk especially when there is not a traffic signal

High/Highest Impact

- **Movements Involved:** All directions – RI, RO, LI, LO
- **Additional Conflicts:** All conflicts are compounded
- **Crash Risk:** Highest risk
- **Key Takeaway:** Full-access uncontrolled intersections are the most dangerous intersections especially on high speed multi-lane arterials.

Some form of safety evaluation is highly beneficial to quantify crash risk and evaluate potential mitigations, especially on arterial streets. Crash frequency is a function of traffic demand—the higher the traffic volumes, the higher the likelihood of more crashes. Likewise, crash severity is a function of speed—the higher the speed, the higher the likelihood that some of those crashes will be more severe. Certain mitigations such as roundabouts, reduced movements, raised medians, and channelization reduce the right-angle collision potential, thus enhancing safety. Despite evidence-based industry guidelines for safe and effective access control, these guidelines are sometimes ignored for new intersections, and existing full-access interactions are grandfathered in regardless of a poor crash history. Uncontrolled intersections and driveways adjoining higher-speed, higher-volume, multi-lane arterials present the most dangers, especially when full access is allowed from the driveway.

Queue Needs

Given that left-turn access in and out of a driveway is typically important, that left-turn access will sometimes need a sufficient queuing area so vehicles can properly wait to turn in or out of the development. This queue length depends on the type of traffic control at the intersection. A minimum throat length (TL)—which is the distance between the edge of the pavement of the adjacent street and the end of the driveway inside the development—must also be provided for all driveways. The minimum for RIRO driveways is 40 feet or more, unless analysis shows the need for more. A queueing analysis will determine the queueing needs for turn lanes and TLs for all driveways.

Potential Requirements

Possible mitigations to address the traffic and crash risk impacts of a driveway include the following:

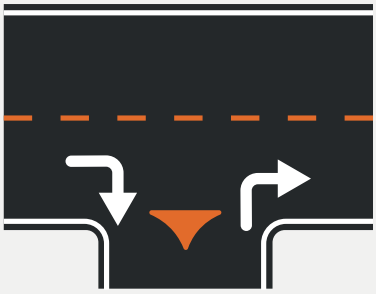
These requirements can be applied to both on-site and off-site improvements. The jurisdiction with authority has the final say in approving the mitigations, including determining the driveway location, final configuration of the driveway and street, and traffic controls (if any).

Though many municipalities do not have standards for these potential mitigations, other municipalities and ADOT do have standard details for these requirements. Any custom designs needed under special circumstances will be subject to review and approval by the jurisdiction with authority.

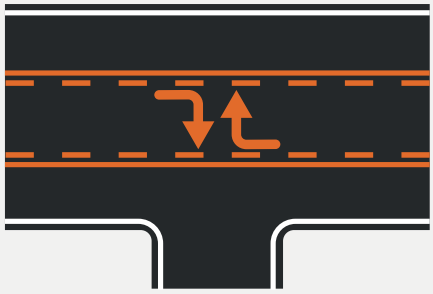
Benefits of Deceleration Lanes

Deceleration lanes or right-turn lanes (RTLs) offer proven safety benefits. AASHTO's 2010 version of the HSM states that RTLs can significantly reduce crashes, as detailed in the crash modification factors (CMFs)

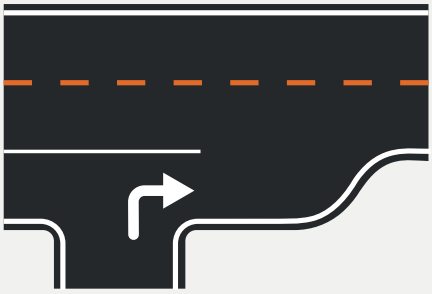
TRAFFIC AND CRASH RISK IMPACT MITIGATIONS



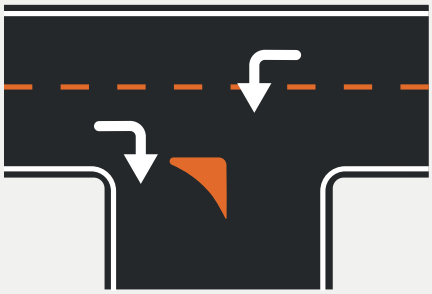
Channelization island (CI)



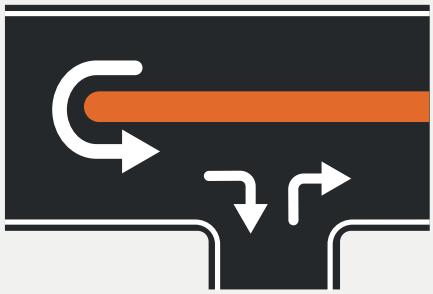
Dedicated turn lanes (DTLs)



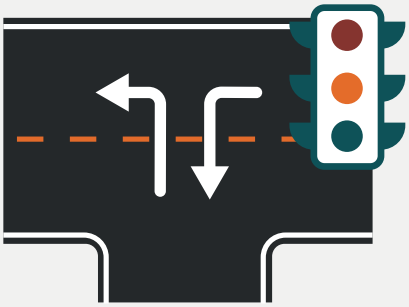
Acceleration/merge lane (AML) or space



Two lanes in, with channelization that allows right in and left in to happen at the same time



RIRO with indirect LI



Control for a LILO with a traffic signal, roundabout, or similar intersection configuration that eliminates or reduces the angle and left-turn crash risk

on the FHWA-sponsored Crash Modification Factors Clearinghouse website. RTLs typically reduce the occurrence of RE crashes. Various CMFs can be applied to the safety benefits gained by RTLs. Per the CMF Clearinghouse, the CMF used for RTLs is 0.7, which means that RTLs have the potential to reduce RE crashes of all severities by 30%.

Although RE crashes are often less severe (most are property damage only), the risk of a high-speed-differential RE crash is very much a danger and can be very severe on higher speed arterial streets. Thus, providing RTLs at driveways on arterials needs to be evaluated from both traffic demand and safety viewpoints.

RTLs can also help reduce delay and keep a street at a better LOS. Less delay and better LOS are advantageous to road users (less time stuck in traffic) and the environment (less air pollution). RTLs also help mitigate side friction to traffic flow in the outside lanes caused by vehicles slowing to turn right onto side streets or driveways. This can become an issue if a high percentage of the turning traffic is large vehicles such as buses, delivery trucks, and freight trucks.

Another potential benefit of dedicated RTLs is that they can be used for bus stops. The National Association of City Transportation Officials (NACTO) recommends that RTLs be considered on streets that do not have dedicated transit lanes per their Transit Street Design Guide, calling these "shared transit/RTLs."

DECELERATION LANES

- Reduce RE crashes
- Reduce traffic delays
- Enhance LOS
- Reduce air pollution
- Increase safety

FINAL WORDS ON ALLOWED MOVEMENTS

The bottom line for providing a driveway which provides reasonable access and safety is to keep in mind what risks those movements bring and how important those movements are as it is often more effective and efficient to take a route that might be a little longer, but in reality will involve less risk and perhaps less wait time (e.g. Level of Service).

Cross Movements Are the Most Dangerous

These movements involve multiple angle conflict points, exposure to high-speed traffic, and require drivers to make split-second decisions to judge gaps and execute maneuvers safely. According to human factors research, gap acceptance and decision-making under time pressure are highly error-prone, especially when visibility is limited, speeds are high, and there are a lot of lanes to cross. At night, visual perception and reaction time degrade, increasing the likelihood of misjudging speed and distance, a key contributor to angle crashes, which are among the most severe in terms of injury and fatality risk. These movements also suffer from poor level of service due to long wait times, which can pressure drivers into unsafe decisions (shoot a gap without fully assessing the risks).

Left Turns (Especially Left Out) Are Next in Severity

These movements often require drivers to cross multiple lanes of fast-moving traffic, demanding accurate gap judgment and timing. Studies show that older drivers, fatigued drivers, and those under stress are more likely to make errors in left-turn decisions, particularly when headlights or glare reduce visibility and ability for drivers to judge gaps and the oncoming speed of opposing vehicles. These movements also suffer from poor level of service due to long wait times, which can pressure drivers into unsafe decisions (shoot a gap without fully assessing the risks).

Right Out Movements Can Be Deceptively Risky

While they may seem simple, RO movements onto high-speed highways without acceleration lanes expose vehicles to rear-end crashes and side-swipe risks. Human factors research highlights that drivers entering high-speed traffic from a stop face cognitive overload, especially when merging under pressure. Without acceleration lanes, drivers must rapidly accelerate while scanning for gaps, a task that becomes significantly harder at night or in poor weather. Acceleration lanes can also be important for large vehicles, vehicles with trailers and heavy trucks.

Right In Movements Are Generally Safer

These movements typically involve fewer conflict points and occur at lower speeds, especially when entering from local roads from a dedicated right turn lane. However, even these can pose risks if sight distance is limited or if the receiving lane is congested. Nighttime conditions can still impair visibility, hence why it is good idea to provide lighting not only in the intersection area but on the approaches as well, but the relative simplicity and lower speed of RI movements reduce the severity of potential crashes or the chance the crash will even happen.

CONCLUSION

Public access between streets and driveways is a complex and important subject that directly impacts residents' and commuters' safety, well-being, and quality of life. Jurisdictions have a responsibility to provide access from arterial, collector, and local streets to businesses and residential areas. The goal is to provide reasonable access that minimizes traffic and safety impacts while meeting queueing needs.

Determining the location, spacing, and number of driveways and the access allowed at each one is a delicate balance guided by the jurisdiction's guidelines, industry standards, and current recognized best practices. This is especially true with existing driveways—just because a driveway exists in a certain configuration in terms of its location and allowed movements does not mean it has to stay that way if there is good reason to change it. Key factors include the characteristics of the adjacent street, such as the posted speed limit, number of lanes, traffic demand, functional street classification, and peak traffic. It is also imperative to consider the site as a whole, including the driveway access system, site circulation, surrounding land uses, pedestrian/bicyclist crossings, and geometric configuration.

Driveway design must carefully consider how the driveway would cause resistance to the flow of traffic in one or more directions and the crash risk impacts of different movements. Mitigations are a key component of the design process, leveraging strategies such as channelization, DTLs, traffic controls, and limited movements to enhance safety for drivers and VRUs alike. Deceleration lanes (RTLs) are a proven strategy for improving LOS and safety on arterials with numerous driveways.

Though driveway design may appear to be simple on the surface, in reality, it requires an intricate attention to detail and street design principles. The goal is to balance reasonable access with reasonable safety while preserving the function of the adjoining street.