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# Best Practices For Rural Entrance Policy

Minnesota Local Road Research Board

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Currently, many townships, cities and some rural counties do not have entrance policies and design standards. This report provides rationale on why access should be managed in rural areas. It also identifies fundamental planning principles, design guidelines and best management practices for lower-volume rural roadways. Additional information sources for developing or refining local policies are included.

The study reviewed literature, conducted a survey of rural Minnesota counties, townships and cities and identified the following best management practices (BMPs):

- Establish a formal access policy to determine the need and evaluate use, location and design of requested access points.
- Encourage coordination during the zoning and platting process.
- Adopt a policy that grants access for a specific use. If this use should change, a new access permit would be required.
- Encourage adequate spacing of access points.
- Protect the functional area of intersections in order to separate conflict areas (typically 480 to 820 feet from the intersection).
- Ensure adequate sight distance at entrances.
- Avoid offset or "dogleg" intersections and entrances.
- Encourage turn lanes and bypass lanes (on higher speed roadways).
- Consider providing shared access or relocating existing access.
- Encourage good driveway and intersection design characteristics.


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# Best Practices for Rural Entrance Policy

## Final Report

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## EXECUTIVE SUMMARY

### Best Practices For Rural Access Policy

The Minnesota Local Road Research Board identified a need to investigate access policies and design guidelines for lower-volume rural facilities. Currently, many townships, cities and some rural counties do not have entrance policies and design standards. This report provides rationale on why access should be managed in rural areas, and it identifies fundamental planning principles, design guidelines and best management practices for lower-volume rural roadways. This information may be shared with planning commissioners, local agencies and developers to improve decision-making and the understanding of rural access issues. In addition, this report provides references to other studies and information that can be used to develop or refine local policies.

Why manage access in rural areas? The rationale for managing access in rural areas is somewhat different than in urbanized centers or developing areas. Facilities in rural areas usually serve low-density land uses and have volumes that are well below capacity thresholds; therefore, capacity and disruptions to through traffic are less significant. As a result, the primary reasons for managing rural access are safety (e.g., sight distance, number of conflict areas, and severity of crashes when vehicles run-off-the-road) and operational/maintenance issues (e.g., snow removal, resurfacing, and drainage).

Agencies should consider the following best management practices (BMPs) for managing access on rural collector and rural local roadways. **It is important that the user keep in mind that these recommendations are, primarily, for rural applications that are not under any capacity constraints or planned urbanization.** Urban or developing areas will likely require additional policies and practices to adequately respond to issues that active development brings.

1. **Establish an access policy.** Agencies should develop a formal access policy so that it can evaluate the use, location, spacing and design characteristics of the requested access points more consistently. In addition, having a policy establishes an expectation for property owners and other agencies early in the access process.

2. **Encourage coordination during the zoning and platting process.** Agencies should encourage coordination between planning/zoning and highway departments early in the building and access permitting process.

3. **Access permits should be given for specific use.** It is recommended that agencies adopt a policy that grants access for a specific use. If this use should change, a new access permit would be required.

4. **Encourage adequate spacing of access points.** This report does not provide any single recommendation for access spacing; however, it does provide examples of what others have used and some suggestions of guidelines that are more restrictive versus less restrictive.

5. **Protect the functional area of intersections.** Agencies should protect the functional area of intersections in order to separate conflict areas. If access near an intersection is requested, the agency should encourage that the access be placed along the lowest volume approach and located as far from the intersection as possible.

6. **Ensure adequate sight distance at entrances.** Sufficient sight distance is needed to view potential approaching vehicles that may conflict with movements at the intersection. Access should not be provided where sight distance does not allow drivers to make decisions about approaching traffic.

7. **Avoid offset or "dogleg" intersections and entrances.** Agencies should encourage aligning access points directly across from other roads or entrances to minimize driver errors and impacts to mainline flow. In areas where offsetting access points cannot be avoided, the access points should be spaced using guidelines identified in Appendix A (see Table A-2).

8. **Encourage development of turn lanes and bypass lanes.** Turn lanes and bypass lanes separate conflicts by allowing through traffic to keep moving and providing a storage area for turning traffic, which reduces the potential for rear-end and sideswipe crashes. In addition, left turn lanes improve the driver's sight line, which allows the driver to select an acceptable gap in oncoming traffic.

9. **Consider providing shared access or relocating existing access.** Providing joint access and/or providing connections between individual developments, reduces conflicts and the number of local trips on the main roadway. If a parcel is subdivided in the future, agencies should encourage developers and/or landowners to provide access by using an existing access or by relocating an unused access point so that the net number of access points remains constant.

10. **Encourage good driveway and intersection design characteristics**. In order for access to function safely and efficiently, it should follow good design practices. Some of these practices are listed below:

    - Proper driveway width and turning radii to promote smooth flow in and out of access points.
    - Proper corner clearance so that a driver has the ability to complete the turn and anticipate conflicts on the side street.

- Adequate approach grade and landing area (either a flat spot or slight grade) so that vehicles can gain access to the main roadway with normal acceleration, ensuring that stopping and starting is not a problem.
- Intersection alignment is at right angles or near right angles (maximum 20 degree deviation from a right angle) to maximize sight lines, minimize the time a vehicle is in the conflict area and facilitate turning movements.
- Proper grading of entrance inslopes and culvert openings to minimize safety issues.
- Keep sight triangles and clear zones free of obstructions that impede sight distance and pose potential safety hazards if vehicles are involved in run-off-the-road crashes.

# CHAPTER 1: INTRODUCTION

The Minnesota Local Road Research Board (LRRB) identified a need to investigate access policies and design guidelines for lower-volume rural facilities. Currently, many townships, cities and some rural counties do not have entrance policies and design standards. A Minnesota Department of Transportation (Mn/DOT) survey completed in 1999 found that fewer than 50 percent of Minnesota cities require a permit for driveway entrances. The same survey found that less than 50 percent of Minnesota counties have written standards or guidelines for the evaluating entrance locations. In addition, approximately 65 percent of the responding rural cities, townships and counties that do not have an access management policy indicated that there is interest in developing one (Appendix C).

Mn/DOT has adopted a Technical Memorandum establishing an Access Management Policy for the state trunk highway system. The policy establishes a system of access categories and related spacing guidelines. While the Technical Memorandum has not been adopted as policy for County State Aid Highways or the Municipal State Aid system, Mn/DOT encourages cities and counties to use the Technical Memorandum as a resource. This LRRB study is intended to supplement what Mn/DOT has done and provide further guidance for the lower volume rural roads.

## Purpose of Report

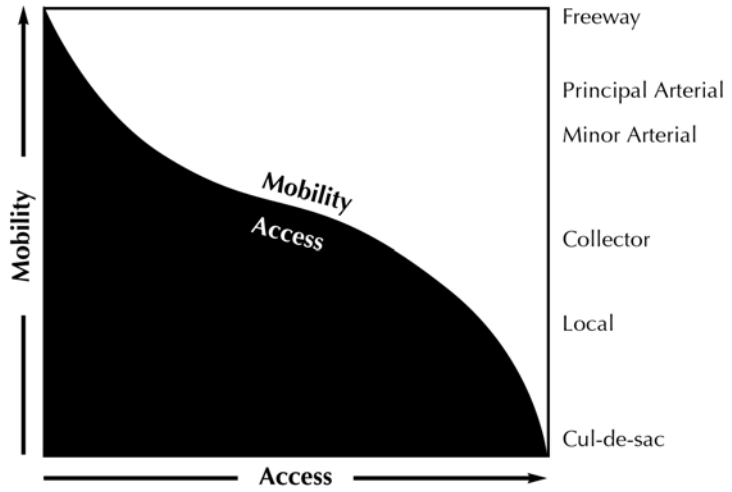
The purpose of this report is to identify fundamental planning principles, design guidelines and best management practices for lower-volume rural roadways. This information may be shared with planning commissioners, local agencies and developers to improve decision-making and the understanding of rural access issues. In addition, this report provides references to other studies and information that can be used to develop or refine local policies.

## Traditional Application of Access Management Principles

Highways and streets provide an important public function in our society and, as a result, significant efforts and resources are made to operate them in a safe and efficient manner. Access is one of the elements that impacts safety and the operation of these facilities. Access points are one of the main sources of crashes, and they can directly affect the functional integrity of facilities. For this reason, access management has traditionally been applied to high-level arterial facilities, where mobility is of greater importance.

Local roads and streets, on the other hand, are intended to provide access to properties and funnel traffic to roadways having a higher classification (Figure 1). These roadways are typically designed for lower speeds and volumes, and little or no through traffic. Collector roads provide both mobility and access functions, and their function falls somewhere between arterial and local roads.

**Figure 1: Mobility Versus Access**




While property owners have a right to reasonably suitable and convenient access to the general system of streets and highways, roadway users also have the right to expect reasonable movement, safety and efficient use of public funds that are used to maintain the facilities. The safe and efficient operation of facilities requires that transportation officials effectively manage access on all facilities; however, the management may be to different levels or degrees. This report focuses on approaches to managing access for lower-volume two-lane rural collectors and local roadways.

**What is Access Management?**

According to Mn/DOT's definition, "access management is the planning, design and implementation of land use and transportation strategies in an effort to maintain the safe flow of traffic while accommodating the access needs of adjacent land" (1). Another definition found in TRB Circular 456 states that access management is a process that manages access to land development while simultaneously preserving the flow of traffic on surrounding public road system in terms of safety, capacity and speed.

Specific traffic engineering and design principles that have been used to manage access include:

- Limiting the number of potential conflicts
- Separating conflict areas
- Reducing interference with through traffic
- Providing adequate storage areas at intersections
- Maintaining uniform speeds on main facilities
- Providing sufficient sight distance
- Providing good intersection geometry

Application of these principles will improve safety and operational efficiency of facilities; however, a careful balance must exist between preserving mobility and capacity and allowing access. Too many closely spaced access points can increase the potential for crashes; too few may inhibit land use and overload key intersections. In addition, if policies are too restrictive

and are seen as unreasonable by the public, agencies can lose support for them. This is especially critical in rural areas, where there is less growth, and where communities are generally more supportive of new development.

There are three important elements in developing an access management program. They include:

- Developing an access classification system. One cannot treat all roadways the same. For example, some Minnesota counties, such as Steele County, have separated rural low-growth areas from smaller urban areas.
- Providing a mechanism for variances in order to provide reasonably convenient and suitable access. If the policy is too inflexible or cannot be adjusted to address specific cases, then public support may be lost.
- Defining a means for enforcing access decisions and policies. This enforcement needs support from local elected officials, as well as legal staff.

## CHAPTER 2: RATIONALE FOR MANAGING ACCESS IN RURAL AREAS

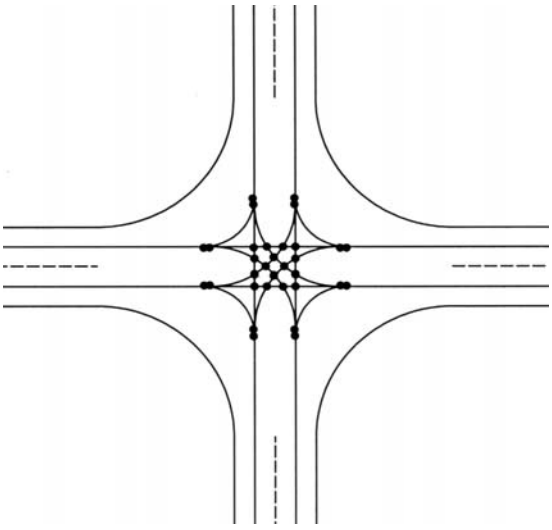
The rationale for managing access in rural areas is somewhat different than in urbanized centers or developing areas. Facilities in rural areas usually serve low-density land uses and have volumes that are well below capacity thresholds; therefore, disruptions to through traffic are less significant. As a result, the primary reasons for managing rural access are safety and operational and maintenance issues. These are examined in more detail below.

### Safety

One of the primary responsibilities for local transportation officials is to provide for the safety of the traveling public. They have a duty to responsibly manage transportation facilities and balance competing interests of access, safety and mobility.

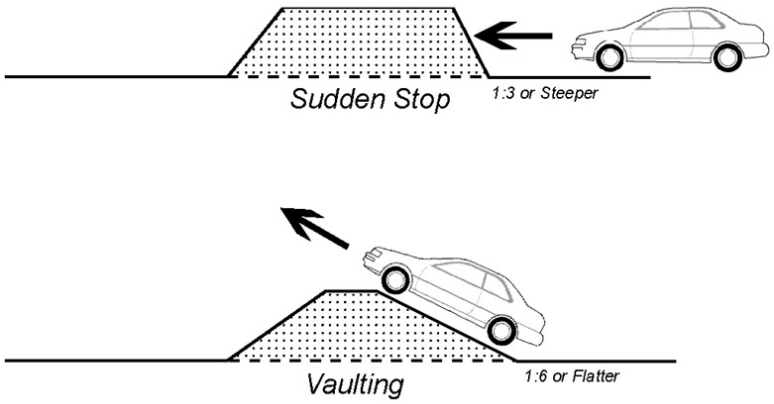
One of the basic safety elements is to ensure that each access has proper sight distance so that motorists can view and respond to approaching traffic. In addition, the number of access points should be scrutinized to balance the need with safety and other issues. Each access creates a point where the paths of vehicles can conflict. These are called "conflict points." For each four-legged intersection, there is the potential for 32 different conflicts to occur (Figure 2). Obviously, the more entrances there are, the more potential conflict points there will be, and the greater the potential for crashes to occur. High numbers or concentrations of access over shorter distances put increased responsibilities on drivers to correctly interpret the actions or intentions of all vehicle movements in this area. The general finding of many studies is that the more information drivers are required to process at one time, the higher the potential is for drivers to make poor decisions. Providing good access separation allows drivers sufficient time to more easily identify and react to changing conditions and vehicle maneuvers of other vehicles. Consolidating access points, providing greater separation and/or restricting the movements at access points can reduce the number of conflicts; however, restricting movements is typically a method used in urban or urbanizing areas.

**Figure 2: Conflicts at Intersections**



Another reason for local officials to limit access in rural areas is the potential for access points to cause higher severity crashes. Statistics indicate that 21 percent of rural crashes are run-off-the-road type crashes. The majority of these cashes can result in a good outcome if proper clear zones are provided (a forgiving roadside - no fixed objects and flatter slopes). Approaches to access points can be considered as a fixed object if the approach has steep inslopes (1:3 or less). These types of approaches have caused significant injuries to drivers and passengers (Figure 3). Flatter approaches, 1:4 to 1:6, are generally considered safer because the vehicle will not stop suddenly; however, depending on the vehicle's speed, these slopes can cause the vehicle to become airborne (vault).

**Figure 3: Entrances and Off-Road Crashes**




From an agency perspective, the greater the number of access points along a route, the more likely that vehicles running off the road will strike one, which could result in more severe injuries. While this risk is inherently small for any one-access point, it is a good management practice to ensure that the access points are needed (not duplicative) and that, if possible, they are developed off of the local roadway (side street) instead of the main road.

## Operational/Maintenance Issues

Another reason for managing access is due to operational and maintenance issues. Each individual access point requires ongoing maintenance (i.e., regraveling, culvert cleaning), and impacts the efficiency of other maintenance activities such as snowplowing and mowing. Therefore, to manage ongoing costs, agencies should carefully consider access requests. The specific operational issues are outlined below.

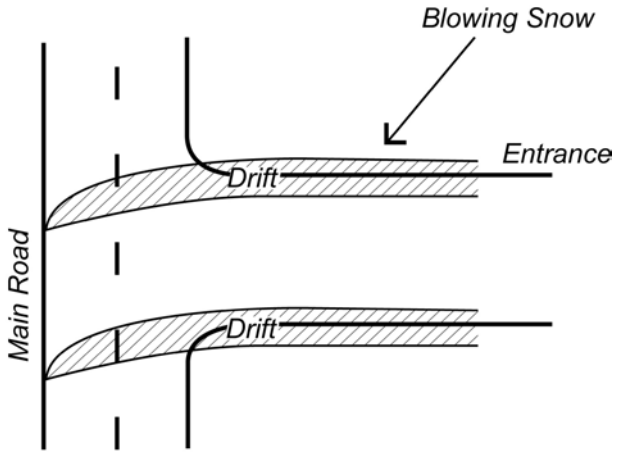
### *Snow Removal/Plowing Issues*

Access points in general cause additional operational issues for snowplow operators, particularly in rural areas where relatively few operators cover large, remote areas. These operational issues include the following:

- Hitting Compacted Snow - Rather than hauling or pushing snow to storage areas, some residents/businesses push snow across public roads and leave piles on the edge of access

points or on the edge of the main road's travel lanes (Figure 4). Motorists could potentially lose control of their vehicles if they hit piles, and if these piles freeze, they can severely damage plowing equipment. As a result, snowplow operators have to be more careful around access points, which ultimately increases the plowing times.

**Figure 4: Compacted Snow at Entrances**




- Snow Ridges/Drifting - One of the maintenance objectives when clearing snow is to remove snow ridges along the roadway. These ridges are plowed into the ditch areas so that any blowing snow sweeps across the road and does not accumulate on the roadway. Ridges left along the road can be the beginning of the next snowdrift. As winds increase, blowing snow travels over the ridges and is deposited on the backside of the ridge, potentially blocking travel lanes (Figures 5, 6 and 7). Access points are prime areas for the beginning of drifts because of these ridges. In rural areas, it is common that once plowing starts, it might take four to eight hours to complete a full pass on each roadway, depending on the size of the storm. As a result, there could be many locations where small drifts occur after the roadway has been plowed. These drifts could potentially cause drivers to lose control of the vehicle if a drift is struck.

**Figure 5: Drifting at Entrances**

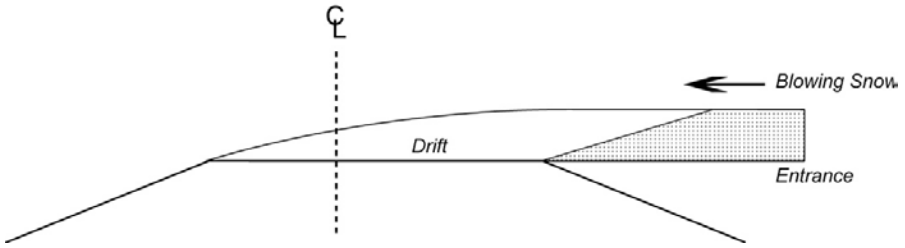


**Figure 6: Road Susceptible to Drifting**

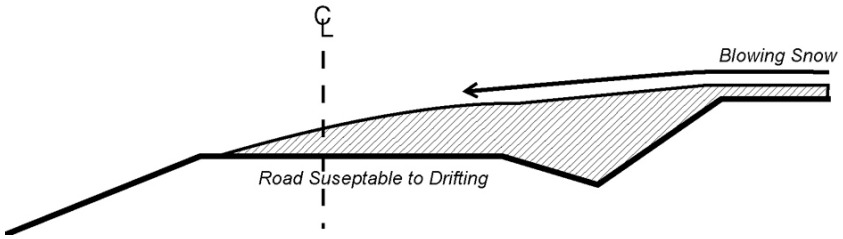
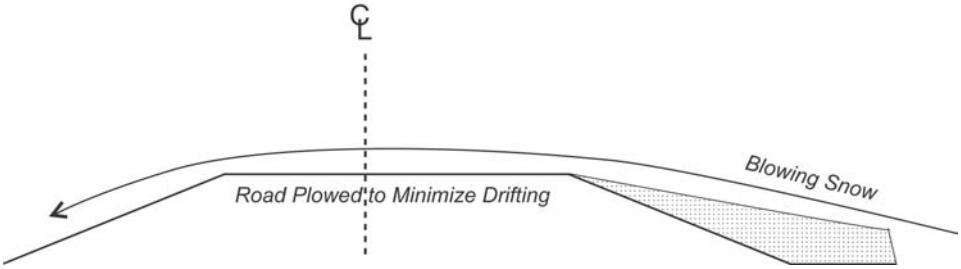


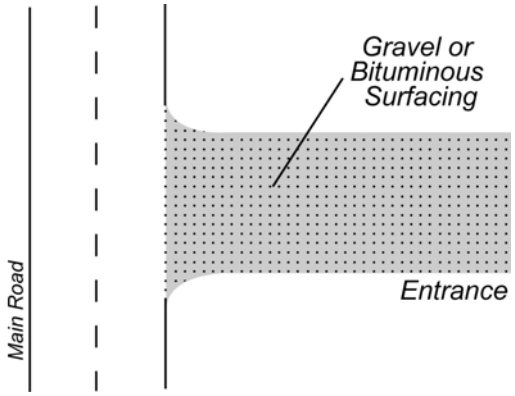

**Figure 7: Road Plowed to Minimize Drifting**




### *Ongoing Surfacing*

As the local agencies maintain their road system, periodic resurfacing occurs. As this occurs, access points are also resurfaced so that there are no drop-offs and the access points blend in or match roadway elevations. Each access point can take up to a load of gravel, and some agencies have policies that provide hard surfacing to various points (Appendix C). Providing additional access points (duplicative access) will obligate agencies to increased construction costs as future projects are developed (Figure 8).

**Figure 8: Additional Surfacing at Entrances**

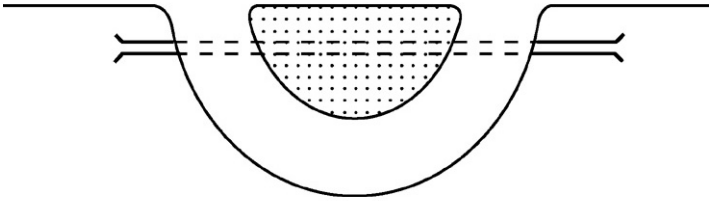


***Drainage***

Another ongoing maintenance issue is drainage. Most access points require an installation of a culvert to provide for drainage along the roadway. Local agencies have a variety of practices from furnishing the culvert to requiring that the user pay all costs of installation. However, the local agency is generally responsible for future costs. Again, initial access decisions obligate agencies for future replacement costs.

In addition, during spring thaws, culverts can easily be frozen shut, thus backing up water and potentially causing flooding problems. Local government crews are needed to monitor systems and steam culverts open if they become plugged. One particularly difficult problem is when the culvert is long and is underneath a number of access points, such as a horseshoe driveway (Figure 9). If the culvert becomes frozen or plugged, it can become particularly difficult and costly to unplug and/or repair.

**Figure 9: Example of a Culvert Underneath a "Horseshoe" Driveway**



## CHAPTER 3: BEST MANAGEMENT PRACTICES FOR RURAL ACCESS

The Technical Advisory Panel discussed issues related to *rural access* and developed a number of best management practices (BMPs) that agencies should consider for managing access on rural collector and rural local roadways. **It is important that the user keep in mind that these recommendations are, primarily, for rural applications that are not under any capacity constraints or planned urbanization.** Urban or developing areas will likely require additional policies and practices to adequately respond to issues that active development brings.

1. **Establish an access policy.** Agencies should develop a formal access policy (issue access permits) that ensures that when requests for access are made, the agency has processes in place to determine the need and evaluate the use, location, spacing and design characteristics of the requested access points. The policy should have the following elements:
   - Define access guidelines (where and how it applies).
   - Define a process for variances where guidelines cannot be achieved.
   - Establish a process for enforcement.
   - Receive board and/or council approval of access policy.

   If no access policy exists and the local agency is hesitant about developing one, that agency should consider documenting past practices/experiences to help in defining the current informal policy. This may assist in thinking through how access decisions are made and requests are handled.

2. **Encourage coordination during the zoning and platting process.** Agencies should encourage coordination between planning/zoning and highway departments early in the building and access permitting process. Sharing information will allow the departments and elected officials to make better decisions when developers or landowners request new accesses or modifications of an existing access.

3. **Access permits should be given for specific use.** The requirements for a low-level use access may not be as rigorous as requirements for higher use access points (i.e., a farm field entrance versus a gas station access). Therefore, it is recommended that agencies adopt a policy that grants access for a specific use. If this use should change in the future, a new access permit would be required.

4. **Encourage adequate spacing of access points.** There are numerous access spacing guidelines throughout Minnesota and the United States. Most of those policies typically involve categorizing roadways by functional class and traffic volume. This report does not provide any recommendations for access spacing; however, it does provide examples of what others have used and some suggestions of guidelines that are more restrictive versus less restrictive. These are provided in Appendix A.

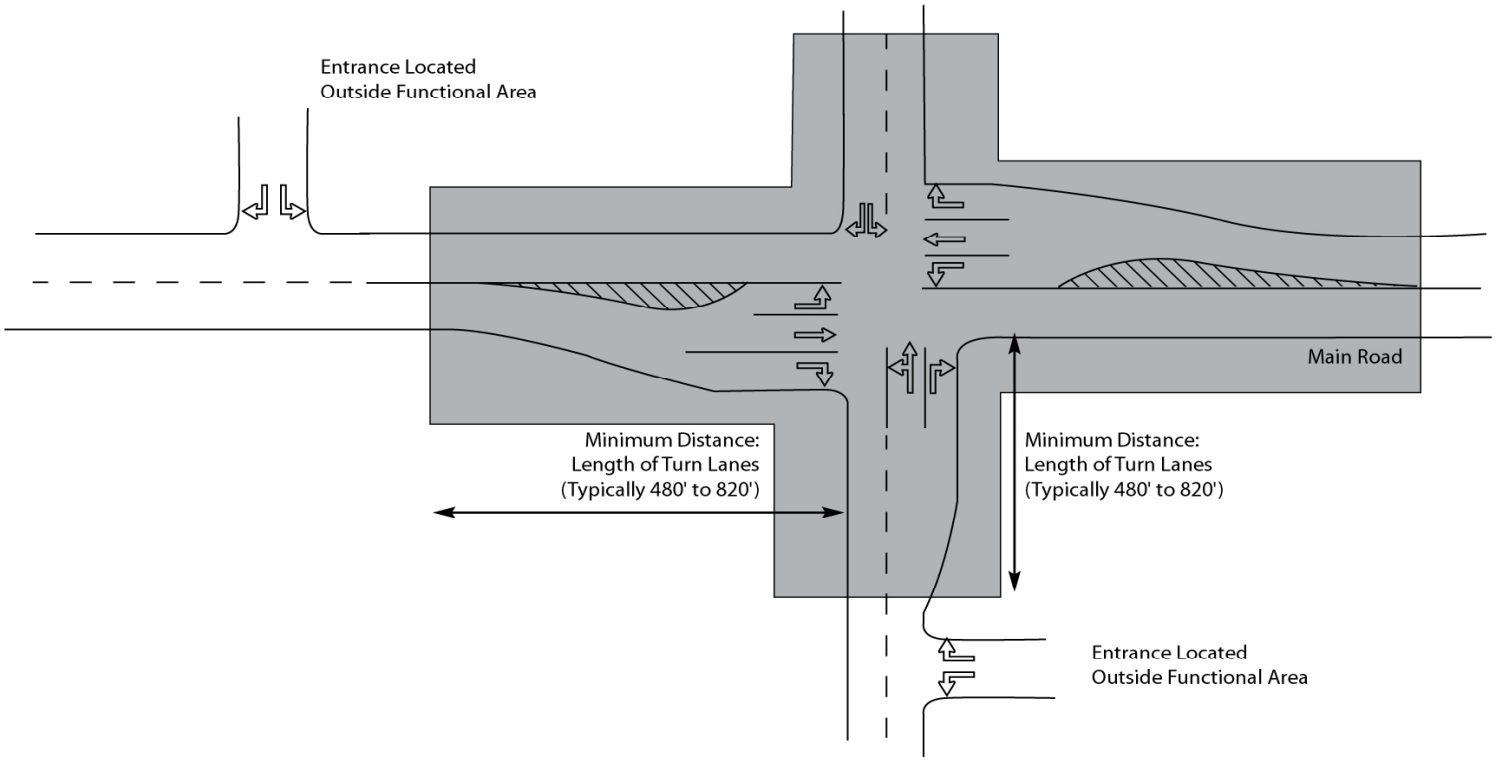
5. **Protect the functional area of intersections.** Protecting the functional area of intersections allows the motorist to complete their turn or through movement and adequately react to situations downstream from the intersection. Agencies should protect the functional area of intersections in order to separate conflict areas. If access near an intersection is requested, the agency should encourage that the access be placed along the lowest volume approach and located as far from the intersection as possible (Figure 10). Regardless of the design speed, the desired location is outside the turn lane areas (typically 480 to 820 feet from the intersection).

6. **Ensure adequate sight distance at entrances.** Sight lines at access points must be kept free of objects that might interfere with the ability of cross street/entrance drivers to see other vehicles. In addition, curves and the changes in elevation/grade should not obscure sight lines at entrances. Sufficient sight distance is needed to view potential approaching vehicles that may conflict with the movement at the intersection, such that the movement can be safely made (Figure 11).

   As a BMP, access should not be provided where sight distance is inadequate to allow approaching vehicles to come to a stop. In some *extreme* cases, agencies have reluctantly granted access where sight distance is less than the minimums. This situation typically occurs when:
   - No other access alternative is feasible due to topography.
   - The access point serves a *single residence*.

   In these cases, some agencies have required the private party to pay for the installation of a "hidden driveway ahead" warning sign. While a "blind intersection ahead" sign warns motorists of the conditions ahead, it does not ultimately solve the inadequate sight distance issue.

7. **Avoid offset or "dogleg" intersections and entrances.** While tee-intersections are advantageous from a conflict point of view (tee intersections have less conflicts than full-intersections), closely spaced tee-intersections that have a substantial interaction/usage between them would not be considered advantageous due to conflicts between through movements and turning movements. In this case, agencies should encourage aligning access points directly across from other roads or entrances to minimize driver errors and impacts to mainline flow (Figure 12). In areas where offsetting access points cannot be avoided, the access points should be spaced in order to provide a minimum of seven to ten seconds (depending on operating speed) between entrances (see Table A-2 in Appendix A).

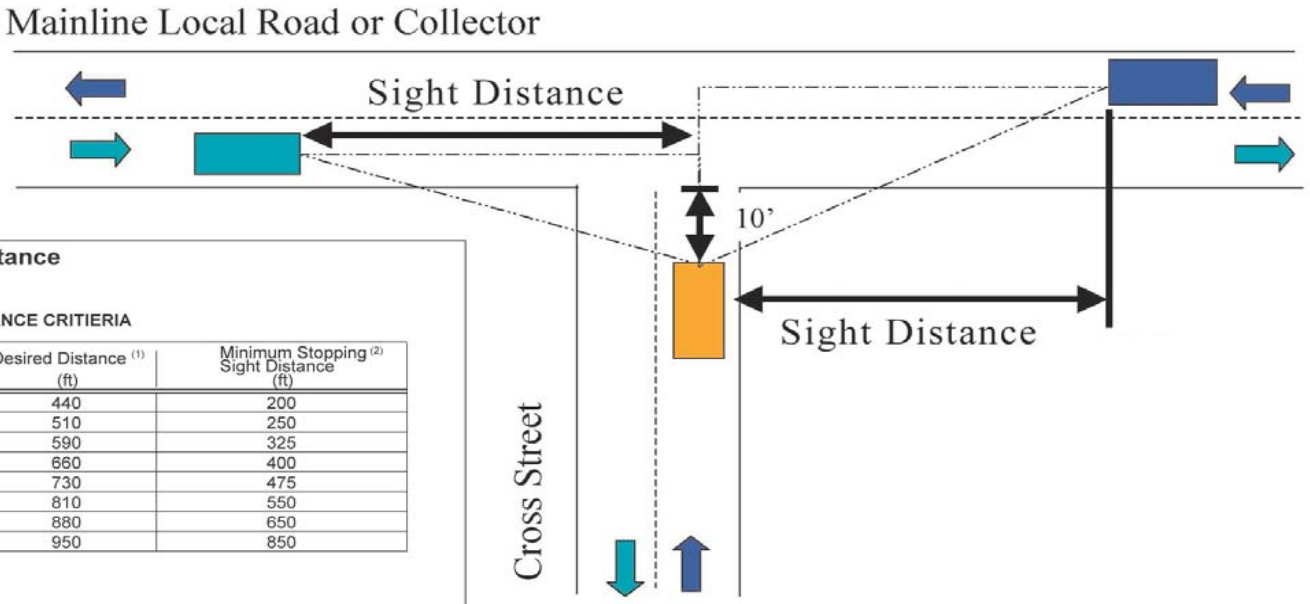



*Source: MnDOT Road Design Manual*

**Practice #3: Protect the Functional Area of the Intersections**

LRRB Task 5: Best Access Management Practices

**FIGURE 10**




**Sight Distance**

**TABLE**
**SIGHT DISTANCE CRITIERIA**

| Speed (mph) | Desired Distance (1) (ft) | Minimum Stopping (2) Sight Distance (ft) |
|---|---|---|
| 30 | 440 | 200 |
| 35 | 510 | 250 |
| 40 | 590 | 325 |
| 45 | 660 | 400 |
| 50 | 730 | 475 |
| 55 | 810 | 550 |
| 60 | 880 | 650 |
| 65 | 950 | 850 |

Notes:

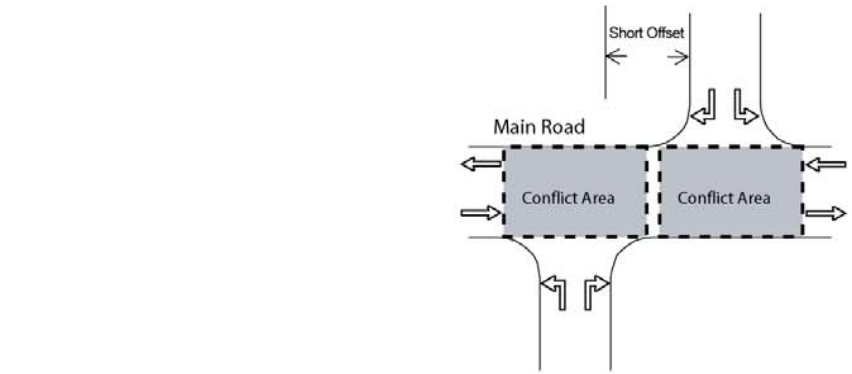
(1) Provides 10 seconds of intersection sight distance - *MnDOT Traffic Safety Fundamentals Handbook pg. C-03*
(2) Source: *MnDOT State Aid Manual,* Figure B(1) - 892.211

*Source: MnDOT Road Design Manual*

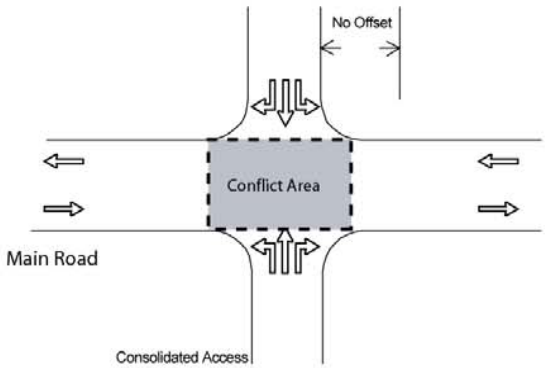
**Practice #6: Ensure Adequate Sight Distance**

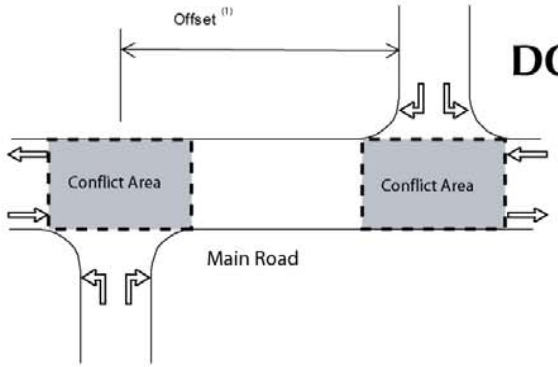
LRRB Task 5: Best Access Management Practices

**FIGURE 11**




**DON'T**




**DO**

**(1) Offset Provides a Minimum of Seven Seconds of Sight Distance (When offsetting cannot be avoided)**

*Source: South Dakota DOT*

**Practice #7: Avoid Offset Access Points**

LRRB Task 5: Best Access Management Practices

**FIGURE 12**

8. **Encourage development of turn lanes and bypass lanes.** Turn lanes and bypass lanes separate conflicts and provide storage areas for turning traffic, which reduce the potential for rear-end and sideswipe crashes. When contemplating the use of turn lanes and bypass lanes, agencies have generally weighed the potential safety and operating benefits of turn lanes and bypass lanes versus their initial and ongoing maintenance costs. Based on past practices, agencies have promoted right turn lanes on high-speed facilities (where speeds are greater than 40 miles per hour) with future mainline volumes greater than 1,500 Average Daily Traffic (ADT) and where one of the following conditions are met:
   - Access serves more than ten residential units.
   - Access serves retail/industrial area that generates more than 100 right turns per day.

   Right turn lanes allow turning traffic to decelerate and exit the main road safely. If these thresholds are not met for the access point, agencies may consider requiring the developer(s) to strengthen the shoulder to minimize pavement edge break-up and/or shoulder deterioration.

   Left turns can be more disruptive to mainline flow depending on their volume, the volume of opposing mainline traffic and the volume of mainline following traffic. The benefits of left turn lanes are shown in Figure 13. Many local agencies have used the following guidelines for determining the need for left turn lanes:
   - The number of correctable crashes over a three-year period is greater than three, and/or
   - Disruptions to mainline flow are based on mainline speed, through volume, turning volume and opposing volume (see Figures B-5, B-6 and B-7 in Appendix B).

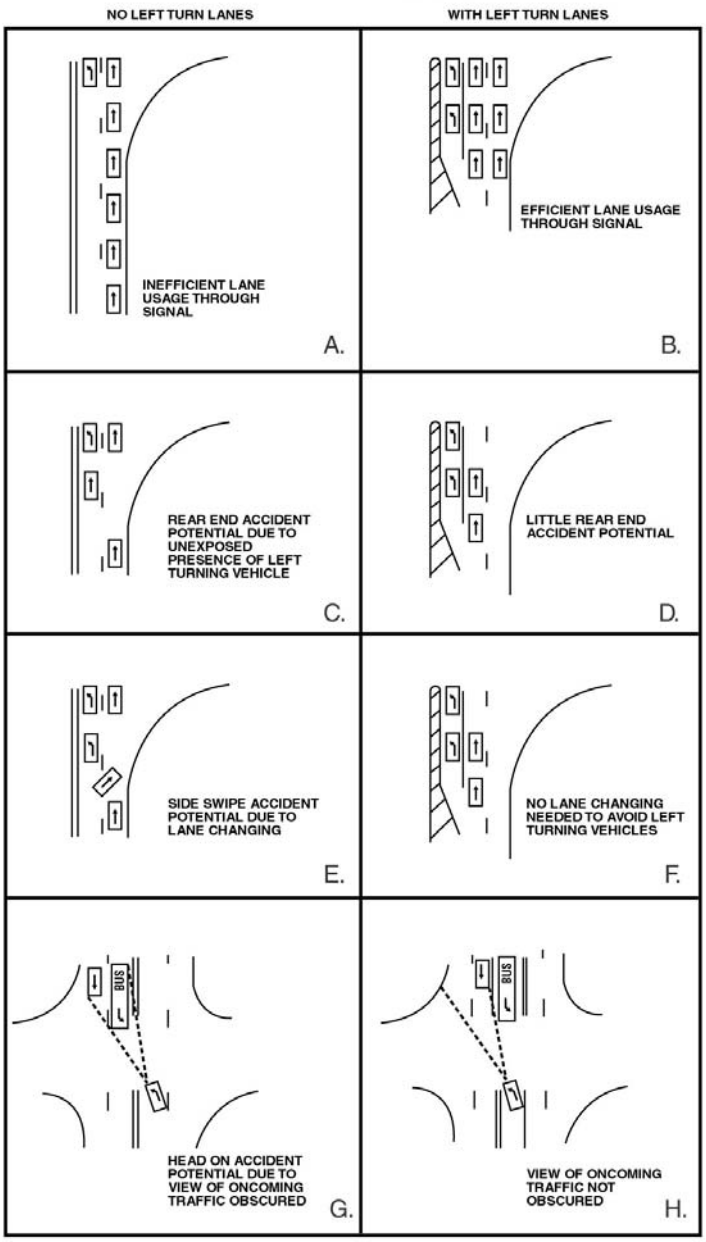
   In addition to the above, agencies should also consider driver expectancy issues. For example, if left turn lanes are present on all public access points throughout a corridor, then new public access points in that corridor should also be considered for turn lanes.

9. **Consider providing shared access or relocating existing access.** Low-growth rural areas most likely are not experiencing much development or parcel subdivisions; however, if some of this activity is occurring, many agencies require shared access or relocation of an existing access to serve the specific land use.

   This BMP may be implemented through the planning and permitting processes. Agencies may consider adopting policies that would reduce the number of non-conforming access points during construction projects or during change-of-use permitting.

   Providing joint access and/or providing connections between individual developments, reduces conflicts and the number of local trips on the main roadway through interparcel circulation (Figure 14). Additional benefits include more efficient mail delivery, garbage service and emergency response. In addition, agencies should encourage landowners located along rural roads with larger lots to develop turnarounds on their property. Turnarounds allow vehicles to turn onto the main roadway and achieve travel speeds more quickly versus vehicles backing out onto the highway.

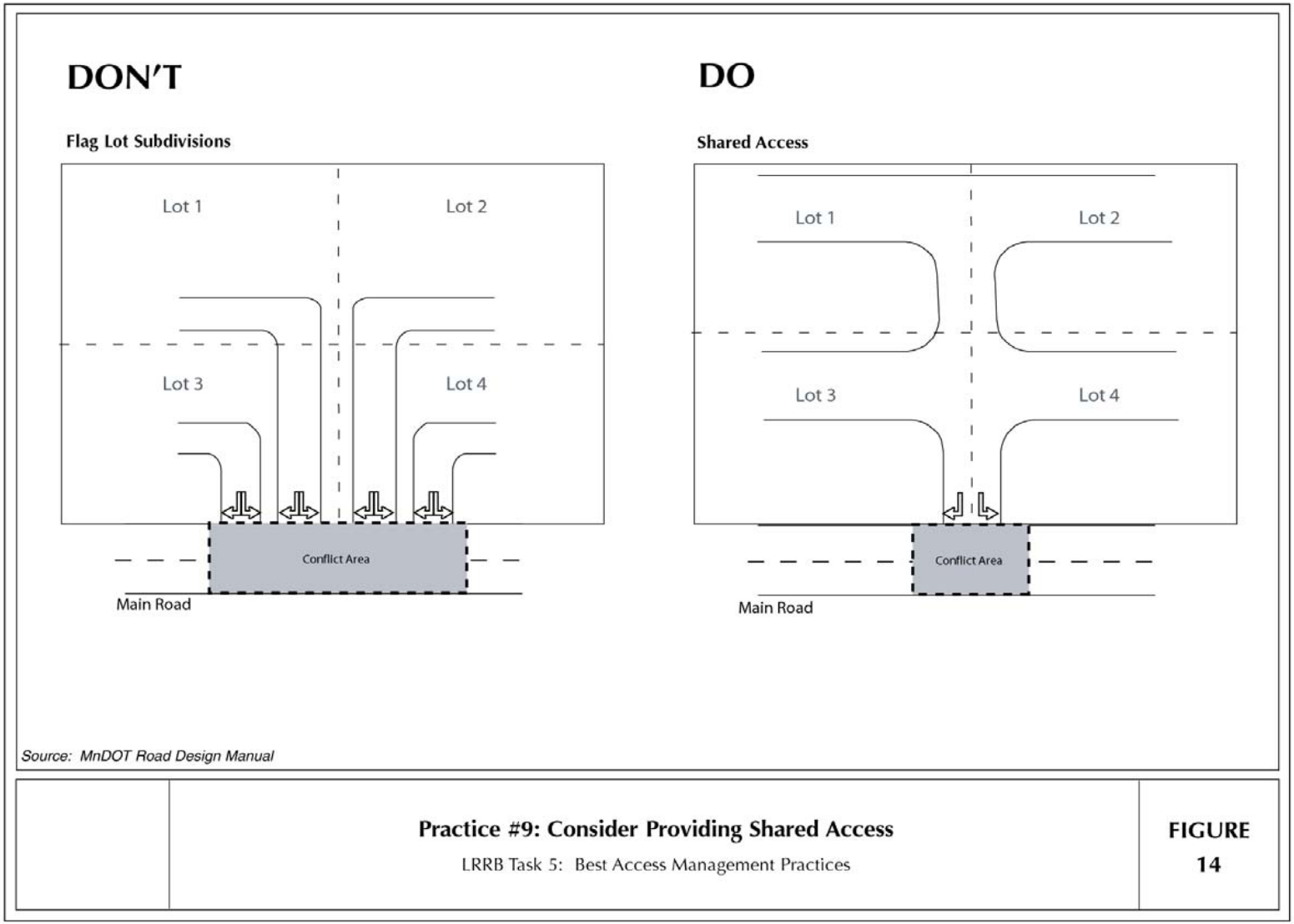
   Another tool that can be used to minimize the number of access points along a roadway is relocating existing access. If a parcel is subdivided in the future, agencies should encourage developers and/or landowners to provide access by relocating an unused access point (Figure 15) so that the net number of access points remains constant.




**Benefits of Left Turn Lanes**

LRRB Task 5: Rural Access Guidelines

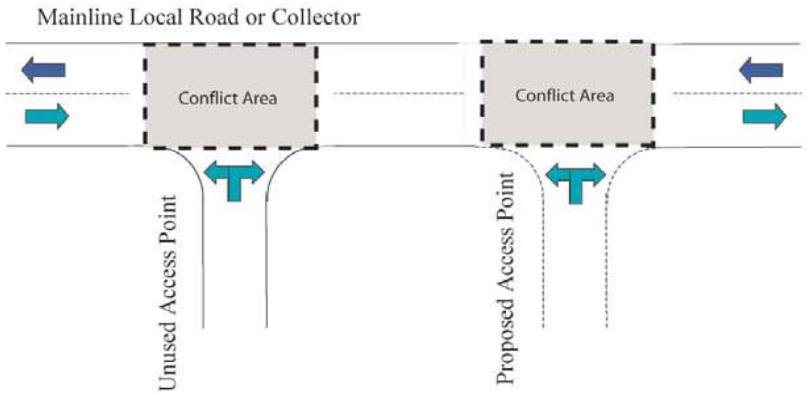
**FIGURE 13**




**Practice #9: Consider Providing Shared Access**

LRRB Task 5: Best Access Management Practices

**FIGURE 14**

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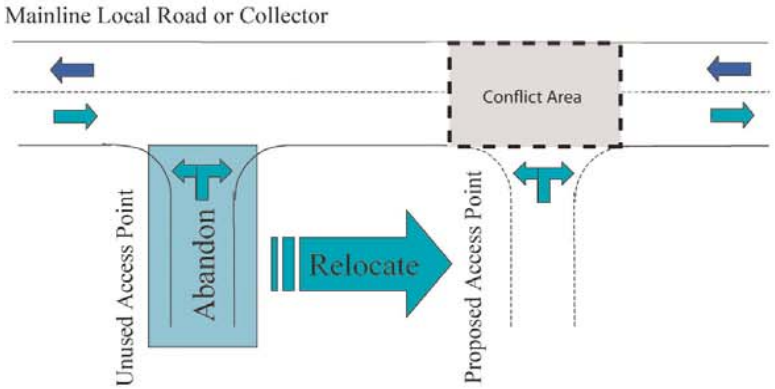



DO

**Practice #9: Consider Relocating Existing Access Points**

LRRB Task 5: Best Access Management Practices

**FIGURE 15**

10. **Encourage good driveway and intersection design characteristics**. In order for access to function safely and efficiently, it should follow good design practices. Some of these practices are listed below and discussed in more detail in Appendix B:

    - Proper driveway width and turning radii to promote smooth flow in and out of access points.
    - Proper corner clearance so that a driver has the ability to complete the turn and anticipate conflicts on the side street.
    - Adequate approach grade and landing area (either a flat spot or slight grade) so that vehicles can gain access to the main roadway with normal acceleration, ensuring that stopping and starting is not a problem.
    - Intersection alignment is at right angles or near right angles (maximum 20 degree deviation from a right angle) to maximize sight lines, minimize the time a vehicle is in the conflict area and facilitate turning movements.
    - Proper grading of entrance inslopes and culvert openings to minimize safety issues.
    - Keep sight triangles and clear zones free of obstructions that impede sight distance and pose potential safety hazards if vehicles are involved in run-off-the-road crashes.

# APPENDIX A

# ACCESS SPACING GUIDELINES

## APPENDIX A: ACCESS SPACING GUIDELINES

One of the fundamental principles of access management is access spacing between entrances or cross streets. Access spacing has been shown, through numerous studies, to directly affect safety and operational characteristics of facilities. This section discusses access spacing guidelines and introduces several methods that have been used to establish access policies. In addition, it provides some information on spacing guidelines being used in other states. However, this section does not go to the extent of recommending a specific set of spacing guidelines because of the variety of jurisdictions, volume levels and facility types. Each jurisdiction will need to make an assessment of its particular needs and level of support for the balancing of safety and operational issues with access.

### Guidelines from Other States

Access spacing guidelines for local and collector roadways were assembled from several other states (Table A-1). This table generally reflects the access spacing requirements; however, it should be noted that most states do not permit more than one access per parcel and that there are varying degrees of enforcement for requiring alternative access (access from adjacent side streets). For example, Minnesota requires alternative access if it is reasonably convenient and suitable. The table shows significant differences (i.e., Iowa has 100 to 200 feet, where Florida spacing guidelines are 125 to 1,320 feet). Other general findings from this review include the following:

- States, such as Ohio and South Dakota, have developed access spacing guidelines for the collector facilities based on stopping sight distance using the American Association of State Highway and Transportation Officials (AASHTO) rates for deceleration. The AASHTO deceleration rate is nine feet per second squared. This deceleration rate is acceptable to approximately 50 percent of drivers.

- States, such as New York and Wisconsin, have adopted "one per parcel" access guidelines for both rural collectors and local roads. One per parcel-type access control is then governed by subdivision ordinances that specify required lot frontage, and these may be subject to alternative access requirements/reviews.

- Ohio has developed spacing guidelines for private entrances on rural collectors and local roadways. Private entrances spacing on rural collector and local roads is based on AASHTO stopping sight distance. Ohio allows "one per parcel" spacing on local roads if the following conditions are met: the additional access would not adversely affect the safety and operation of the highway, the access is necessary for the safe and efficient use of the property and the access would not adversely affect access to adjacent properties.

**TABLE A-1**
**RURAL PRIVATE ENTRANCE SPACING GUIDELINES [1]**

| State | Speed (mph) | | | |
|---|---|---|---|---|
| | **Less than 35** | **35** | **45** | **Over 45** |
| New York | One Access Per Parcel; 100' from an Intersecting Roadway | | | |
| Iowa | 100-200 [2] | | | |
| Wisconsin | One Access Per Parcel | | | |
| South Dakota [3] | 150-350 | | | 350 |
| Florida | 125 | 440 | 660 | 1,320 |
| Oregon | 160 | 330 | 660 | 660 |
| Maine | 125 | 150 | 230 | 275 |
| Ohio<br>▪ Private Entrances on Collectors | 150-250 | 250 | 495 | 550-715 |
| ▪ Private Entrances on Local Roads | One Access Per Parcel; Stopping Sight Distance | | | |
| Minnesota [4]<br>▪ Private/Farm Access | One Access Per Parcel | | | |
| ▪ Low-Volume Entrance/Road | One Access Per Parcel; Stopping Sight Distance | | | |
| ▪ High-Volume Entrance/Road | One Access Per Parcel By Exception; Stopping Sight Distance | | | |

Notes:

(1) From selected states, all distances in feet.

(2) Collector and local roadways have an access spacing of 100 to 200 feet regardless of facility speed.

(3) South Dakota guidelines are specified for urban collectors that serve primarily through traffic. For low volume or non-urban collectors, access spacing guidelines are not specified.

(4) Allowance of access by Mn/DOT is subject to the following conditions: the roadway is not a controlled access facility; no reasonably convenient and suitable alternative is available; and the onsite access point meets intersection sight distance guidelines and gap analysis. If these conditions are not met, Mn/DOT will approve the access point through an exception and deviation process or purchase the access rights.

### Minnesota Trunk Highway Guidelines

The State of Minnesota (Mn/DOT) has also developed and adopted an Access Management Policy for the state trunk highway system. Mn/DOT recommends spacing guidelines between intersections and entrances for arterial and collector facilities in various area types. However, the policy does not address spacing guidelines for local roads. The collector spacing guidelines are based on the "…type of access connection, whether public or private, and the volume of traffic generated" (2).

Ideally, Mn/DOT's policy allows low-volume private accesses on collector roads in rural areas under the following conditions:

- Access rights have not been previously purchased (not an access controlled facility)
- No other reasonably convenient and suitable access alternatives exist.
- Identified onsite access location meets intersection sight distance requirements.
- The access meets gap analysis requirements (see Minnesota Access Management Policy, 2002).

When an access point does not meet the conditions listed above, Mn/DOT will either allow the access point (once approved through the exception/deviation process) or purchase the property rights. For higher-volume access points (entrances with more than 100 daily trips), the above criteria applies, as well as spacing between successive access points meeting stopping sight distances.

**Technical Criteria for Establishing Access Spacing**

Based on a review of access management in literature, a variety of methodologies have been used to support different access spacing guidelines. These methodologies usually focus on three common goals:

- Separating slower turning traffic from higher-speed through traffic.
- Minimizing the numbers of conflicts at entrances and approaches.
- Separating and spacing points of conflict to simplify driver decision-making.

A few of the methodologies in Table A-2 provide criteria that allow a mainline driver to focus on one entrance at a time (Right-Turn Conflict Overlap and Stopping Sight Distance). This is more important in areas with some commercial development, which typically generates higher volumes of vehicles exiting and entering the roadway. Some of the methodologies, such as Intersection Sight Distance, focus on the driver's "unobstructed view" upstream and downstream of the entrance. This has been used by agencies as a minimum safety requirement for locating access on a parcel (access is shifted to a point where sight distance is sufficient to allow safe entry/exit). The last two methodologies, Functional Intersection Area and Maximum Egress Capacity focus primarily on separating conflicts to simplify driver decision-making and on minimizing effects of access on mainline operations.

The methodologies range in their aggressiveness toward providing greater spacing. For presentation purposes, these methods have been arranged in order of least aggressive to most aggressive (Table A-2). For example, Maximum Egress Capacity and Protecting the Functional Intersection Area are two methodologies that suggest greater access spacing. The following provides a brief discussion of the methods identified in Table A-2.

**TABLE A-2**
**ACCESS SPACING CRITERIA FOR UNSIGNALIZED ROADS (IN FEET)**

| Spacing Criteria | Scenario | Posted Speed (mph) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 30 | 35 | 40 | 45 | 50 | 55 |
| Right-Turn Conflict Overlap | Local Roads and Divided Highways in Rural Areas | 100 | 150 | 200 | 300 | | |
| AASHTO Stopping Sight Distance: (9 feet per second squared Deceleration) (1) | Local Roads and Collectors in Rural Areas | 200 | 250 | 305 | 360 | 425 | 495 |
| Intersection Sight Distance: (Through Traffic Reduces Speed by 10 mph) (2) | Local Roads, Collectors and Arterials in Rural and Transition Areas | 325 | 400 | 475 | 550 | 650 | 725 |
| Stopping Sight Distance: (6 feet per second squared Deceleration) (3) | Local Roads, Collectors and Arterials in Rural Area Types | 275 | 350 | 435 | 530 | 640 | 750 |
| Functional Intersection Area: Length of Turn Lane - Turning Traffic to Leave Through Lane with a Speed Differential of: $\leq$ 10 mph (4) | Local Roads, Collectors and Arterials in Rural Area Types | | | 480 (3) | 590 | 700 | 820 |
| Maximum Egress Capacity | Collectors and Arterial in Rural Area Types | 320 | 450 | 620 | 860 | 1125 | 1500 |

Sources:

- "Toward an Access Classification Systems and Spacing Guidelines", Minnesota Department of Transportation, 1999
- "Circular Number 456: Driveway and Street Intersection Spacing", Transportation Research Board / National Research Council, 1996
- "Traffic Safety Fundamentals Handbook", Minnesota Department of Transportation, 2001
- *Geometric Design of Highways and Streets – 2001,* AASHTO, 2001

Notes:

(1) The AASHTO deceleration rates used are acceptable to only 50 percent of drivers (3).

(2) The values shown are functions of the major roadway operating speed. The size of the gap varies from seven seconds (at 30 mph) to ten seconds (at speeds of 65 mph or greater).

(3) Other studies indicate that the nine feet per second squared deceleration is acceptable to 85 percent of drivers.

(4) The Mn/DOT *Road Design Manual* recommends 480 feet as a minimum turn lane length.

### *Right–Turn Conflict Overlap*

The Right-Turn Conflict Overlap method minimizes the conflicts the driver must monitor at one time. At entrances and intersections that do not have exclusive turn lanes or bypass lanes, vehicles turning onto or off of the main road cause through traffic to slow. The Right–Turn Conflict Overlap method assumes that entrances and intersections are spaced such that drivers need to focus on one access at a time; through traffic may be forced to slow but will not be forced to stop.

### *AASHTO Stopping Sight Distance*

Stopping sight distance is the minimum distance required for a driver to stop a vehicle after seeing an object in the travel path. The goal of this method is to separate conflicts areas (entrances and intersections) so that drivers focus on one access at a time and have the ability to stop if an obstacle is present. This is one of the more common methods of establishing access spacing.

Table A-2 identifies two stopping sight distances. The first stopping sight distance is recommended by AASHTO and is based on braking rates that are acceptable to approximately 50 percent of drivers. The second stopping sight distance is acceptable to approximately 85 percent of drivers and is used for rural areas with higher percentages of elderly drivers, commercial trucks and heavy farm equipment. These guidelines are more conservative than the AASHTO guidelines and are based on a deceleration rate of six feet per second squared.

### *Intersection Sight Distance*

Intersection Sight Distance method refers to the "unobstructed view" at a given access point and is measured from the centerline of the intersecting side street to a vehicle approaching on the main road. Typical obstructions include curving roads, grades/elevations changes, fences, crops, trees, shrubs, signs or buildings.

Adequate intersection sight distance allows drivers to determine if the time between successive vehicles in oncoming traffic, or gaps, will allow successful turning or crossing maneuvers. The lengths shown in Table A-2 are based on operating speed and vary between seven seconds (at 30 mph) to ten seconds (at speeds of 65 mph or greater). In addition, the lengths assume that vehicles turning onto the main roadway may result in through traffic speeds decreasing by approximately ten miles per hour. This method is commonly used by agencies as a safety requirement for all access systems.

### *Functional Intersection Area*

The philosophy behind this principle is to focus the drivers' attention on one intersection area at a time and limit the need for drivers to worry about other conflicts as they approach an intersection. Constructing additional access points near other accesses or within turn lanes creates additional conflict zones and contributes to driver confusion.

The Functional Intersection Area guidelines are a more aggressive technique because the guidelines consider a larger area than the immediate approach to the intersection. The Functional Intersection Area guidelines state that *no additional access point* is allowed within the turn lanes or storage areas on mainline roadways and cross streets. Research indicates that right-turn, left-turn and other auxiliary lanes reduce the risk of crashes by separating the high-speed through movements from slower turning movements.

### *Maximum Egress Capacity*

The Maximum Egress Capacity method assumes that entrances and intersections may be spaced at distances greater than 1.5 times the distance required to accelerate from zero to the speed of through traffic. When compared to the other access spacing criteria in Table A-2, the egress capacity spacing method results in greater access spacing between entrances for speeds higher than 30 mph. This method may be more appropriate for higher-type minor arterials and expressway-type principal arterials versus lower collector routes.

# APPENDIX B

# ENTRANCE DESIGN GUIDELINES

## APPENDIX B: ENTRANCE DESIGN GUIDELINES

Many local agencies have adopted local access guidelines or policies to promote good access design and construction practices. However, some cities, townships and rural counties do not have entrance design guidelines, which have resulted in the installation of poorly constructed entrances. The guidelines and best management practices within this document provide information to local governments for enhancing existing policies or practices or establishing new policies.

Entrance design consists of physical design features (i.e., entrance angle, width, radius, grade, drainage and side slope), traffic considerations (i.e., sight distances, turn lanes and type of vehicles), and construction issues (i.e., structural integrity, traffic control and erosion control). This section will provide a discussion and a summary (Table B-1) of entrance design standards and practices developed by Mn/DOT and other local agencies.

### Physical Design Features

#### *Entrance Angle (Skew)*

The entrance angle is the angle at which an intersection or driveway connects with the main road (Figure B-1). Increasing the skew between the entrance and the main road can limit the driver's sight line, increase the amount of time in the conflict area, and force turning traffic on the main road to slow down significantly to complete turns. Good engineering practice recommends that driveways or cross streets should intersect the mainline at right angles (90 degrees); however, some skew is permitted up to a maximum of 20 degrees from a right angle (i.e., 110 degrees or 70 degrees).

#### *Width*

Adequate driveway width allows vehicles to turn off the mainline road with less encroachment into conflicting traffic lanes. This is especially important if the access serves a significant portion of large trucks. Consideration should be given to providing adequate turning radii to better accommodate high turning volumes rather than providing excessive driveway width. Excessive width results in greater driver confusion and increased risk for pedestrians who must cross a greater distance. Table B-1 and Figure B-2 show various entrance widths varying between 18 and 32 feet, depending on the type of approach and use. Heavy commercial vehicles, industrial equipment and farm equipment may require wider entrances to account for trailers or other implements. Commercial, industrial and farm entrances should be 32 feet wide; however, the width may be reduced to 24 feet depending on the radii of the access point.

**TABLE B-1**
**ENTRANCE DESIGN GUIDELINES FOR RURAL TWO-LANE COLLECTORS AND LOCAL ROADS**

| Design Criteria | Residential | | | Commercial – Industrial - Farm | | | Local Roads and Collectors | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Min** | **Max** | **Desired** | **Min** | **Max** | **Desired** | **Min** | **Max** | **Desired** |
| Entrance Angle / Skew (degrees) | 70 | 110 | 90 | 70 | 110 | 90 | 70 | 110 | 90 |
| Width (feet) | 18 | 24 | 24 | 24 | 32 | 32 | 24 | 32 | 24 |
| Corner Clearance [(1)] (feet) | 60 | 500+ | 500+ | 60 | 500+ | 500+ | 60 | 500+ | 500+ |
| Radius (feet) | 5 | 25 | 25 | 25 | 40 | 25 | 25 | 60 | 35 |
| Entrance Grade (percent) | 0 | ± 7 | 0 | 0 | ± 7 | 0 | 0 | ± 7 | 0 |
| Landing (feet) | 15 | 150 | 50 | 25 | 150 | 50 | 25 | 150 | 50 |
| Side Slope [(2)] (feet:feet) | 1:4 | 1:6 | 1:6 | 1:4 | 1:6 | 1:6 | 1:4 | 1:6 | 1:6 |
| Turn Lanes | | | | | | | | | |
| ▪ Length (feet) | 480 | | | 480 | | | 480 | | |
| ▪ Width (feet) | 12 | 14 | 12 | 12 | 14 | 12 | 12 | 14 | 12 |

Source:
Mn/DOT's *Road Design Manual* unless specified.

Notes:

(1) Minnesota counties' best management practices suggest that the first access point should be outside of the functional area of the intersection. The size of the functional area is dependant local geometric and traffic characteristics (typically 480 to 820 feet).

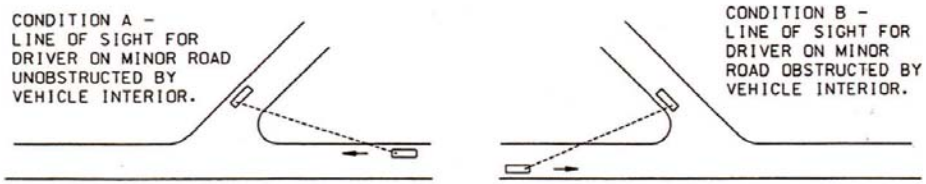
(2) As specified in the Mn/DOT *State Aid Manual*, approaches with ADT exceeding 400 must have side slopes 1:4 or flatter.

### *Radius*

The driveway turn radius is important because it affects how traffic maneuvers off the roadway into the local access point (Figure B-2). A larger turn radius or flare permits easier movement of larger vehicles and minimizes encroachment into adjacent lanes. Factors that typically require greater radii include the number of trucks and/or farm equipment using the entrance, the type of trucks and/or farm equipment, the encroachment of these vehicles on opposing lanes and the amount of through traffic on the mainline. Typical design standards are dependent on area type (urban or rural) and the type of development the access serves (Table B-1). In general, commercial, industrial, farm and other rural collectors and local roads may have larger radii in order to serve truck and farm traffic. Mn/DOT recommends that the minimum radius for an approach is 25 feet. Radii can increase to as much as 60 feet, depending upon the types of vehicles being accommodated.

### *Corner Clearance*

Corner clearance is the minimum distance measured from the end of the radius to the nearest edge of a driveway or other access point on the cross street (Figure B-3). The corner clearance decreases the likelihood for crashes and minimizes interruptions to the flow of traffic by separating conflict areas. Inadequate clearance creates additional conflicts near the intersection. These additional conflicts may not allow a driver to make proper decisions about changing traffic patterns. While some guidelines recommend a minimum of 60 feet from the end of the radius to the first access point, the Technical Advisory Panel recommends that the first intersection should be located outside the functional area of the intersection (typically 480 to 820 feet from the intersection for most roadways). The size of the functional area is dependant local geometric and traffic characteristics (i.e., higher design speed or high percentage of vehicles or trucks turning at the intersection may result in longer turn lanes).



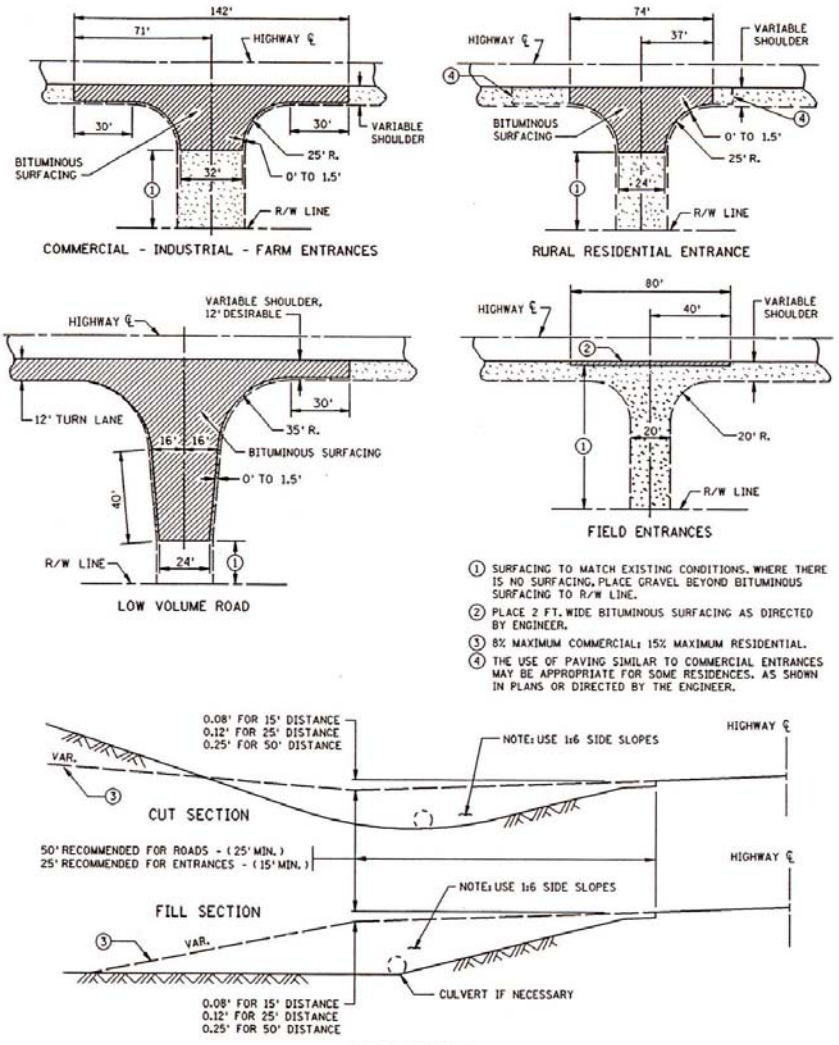

BECAUSE OF A MORE RESTRICTIVE FIELD OF SIGHT IN CONDITION B. SKEWED INTERSECTIONS OF THIS TYPE ARE MORE UNDESIRABLE THAN CONDITION A. THIS APPLIES TO INTERSECTIONS WHERE THE ANGLE IS 20° OR MORE FROM 90° ANGLE.

*Source: MnDOT Road Design Manual*

**Skewed Intersection - Line of Sight**

LRRB Task 5: Rural Access Guidelines

**FIGURE B-1**

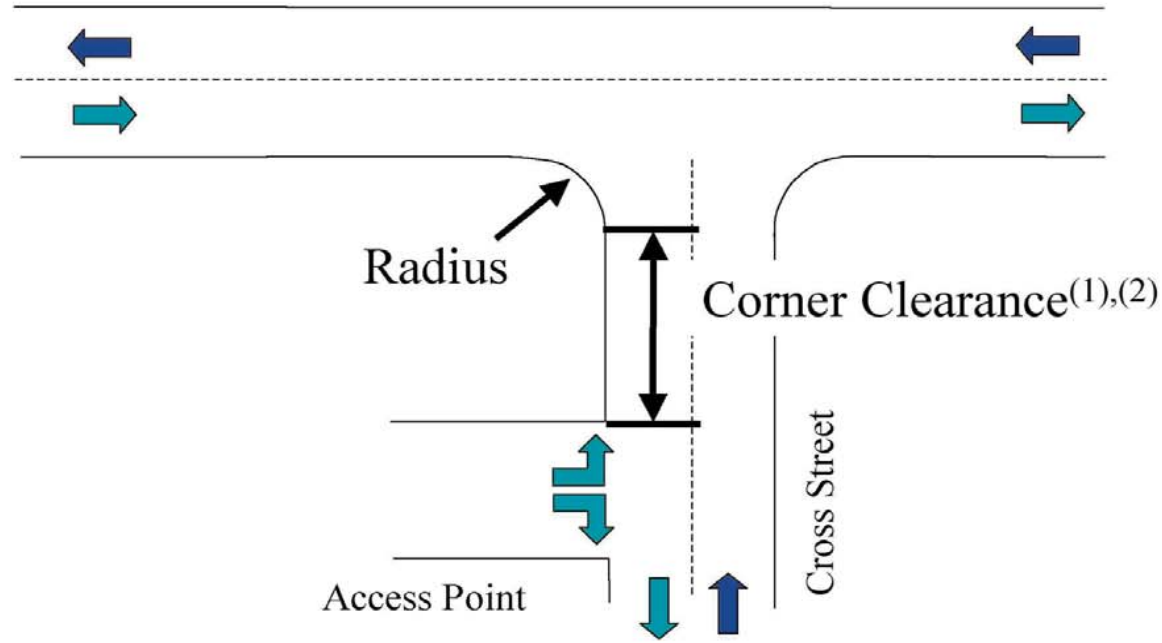



*Source: MnDOT Standard Plates (#9000)*

**Entrance Width and Radius**

LRRB Task 5: Rural Access Guidelines

**FIGURE B-2**




(1) Mn/DOT recommends a minimum corner clearance of 60 feet.
(2) For cross streets, it is desirable for other access points to be outside of the functional area of the intersection ( typically 480 to 820 feet).

*Source: MnDOT Road Design Manual*

**Corner Clearance Guidelines**

LRRB Task 5: Rural Access Guidelines

**FIGURE B-3**

### *Grades*

Mainline and side street approach grades and slopes are important in access design from both a safety and operation perspective. Good design practice is to locate entrances or intersections in flat areas with good sight distances. These locations provide the best sight lines for drivers to see approaching traffic, and they provide the best characteristics for vehicle movements and optimal acceleration (minimizes impact on mainline flows). The Mn/DOT *Road Design Manual* and *Standard Plates* indicate that the maximum grade for residential driveway entrances is ± 15 percent, and the maximum grade for commercial and industrial entrances is ± 8 percent (Figure B-4). In order to minimize the potential safety issues during winter months, a grade of ± 7 percent should be considered the maximum grade for all rural entrances approaches (Table B-1).

The entrance grade should tie into the mainline smoothly and permit drivers to maneuver comfortably at a speed of at least 10 miles per hour. For a minimum entrance or approach grade, the Mn/DOT *Road Design Manual* states, "flat grades (zero percent) are acceptable for non-curbed pavements with sufficient cross slope to drain the surface" (4).

It is also critical for agencies to provide a landing between the edge of the local road or collector and the beginning of the entrance grade (where possible). This landing will provide storage, allow drivers see oncoming traffic and allow for acceleration onto the local road or collector. The minimum recommended landing length is 50 feet.

### *Slopes*

According to the Mn/DOT *Road Design Manual*, "…inslopes (side slopes) are the part of the roadside region that slopes from the edge of shoulder to flat ground or to a ditch bottom" (4). Side slopes provide stability to the road, allow proper drainage and provide a recovery area for out-of-control vehicles. The Mn/DOT *State Aid Manual* states that "approach side slopes must be 1:4 (one foot vertical to four feet horizontal) or flatter when the annual daily traffic (ADT) exceeds 400" (5). Several counties such as Wright, Nobles, Crow Wing and Chippewa have adopted this as a minimum criterion for entrances and access points. As shown in Figure B-4, Mn/DOT recommends 1:6 (1 foot vertical to 6 feet horizontal) side slopes for approaches and entrances.

### *Mainline Turn Lanes and Bypass Lanes*

Turn lanes and bypass lanes separate conflicts and provide storage areas for turning traffic, which reduce the potential for rear-end and sideswipe crashes. When contemplating the use of turn lanes and bypass lanes, agencies have generally weighed the potential safety and operating benefits of turn lanes and bypass lanes versus their initial and ongoing maintenance costs. Based on past practices, agencies have promoted right turn lanes on high-speed facilities (where speeds are greater than 40 miles per hour) with future mainline volumes greater than 1,500 Average Daily Traffic (ADT) and where one of the following conditions are met:

- Access serves more than ten residential units.
- Access serves retail/industrial area that generates more than 100 right turns per day.

Right turn lanes allow turning traffic to decelerate and exit the main road safely. If these thresholds are not met for the access point, agencies may consider requiring the developer(s) to strengthen the shoulder to minimize pavement edge break-up and/or shoulder deterioration.

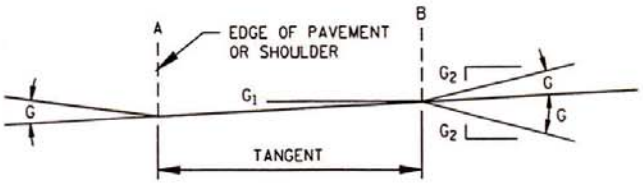
Left turns can be more disruptive to mainline flow depending on their volume, the volume of opposing mainline traffic and the volume of mainline following traffic. The benefits of left turn lanes are shown in Figure 13. Many local agencies have used the following guidelines for determining the need for left turn lanes:

- The number of correctable crashes over a three-year period is greater than three, and/or
- Disruptions to mainline flow are based on mainline speed, through volume, turning volume and opposing volume (see Figures B-5, B-6 and B-7).

In addition to the above, agencies should also consider driver expectancy issues. For example, if left turn lanes are present on all public access points throughout a corridor, then new public access points in that corridor should also be considered for turn lanes. Mainline turn lanes separate turning traffic from through traffic, which reduce conflicts and provides for smoother mainline flow. They are generally used on higher speed, higher volume routes or in locations where sight distance problems may exist. Left turn lanes particularly improve the driver's sight line, which allows the driver to select an acceptable gap in oncoming mainline traffic.

Mn/DOT has developed design guidelines for turn lanes as seen in Figures B-8 and B-9. Agencies should consider the following guidelines when designing and constructing turn lanes:

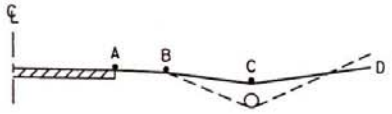
- On rural two-lane roadways, the typical width of turn lanes is 12 feet.
- The total length (including taper, deceleration and storage) of turn lanes varies between approximately 480 to 820 feet. The length may be increased if more storage is required to serve larger turning volumes or trucks.
- Right turn lanes are typically constructed by offsetting a lane next to the through lane and striping a taper (Figure B-8).
- In rural areas, left turn lanes are constructed by offsetting a lane next to the through lane and transitioning to a turn lane with a painted/striped taper (Figure B-9).




SUGGESTED MAXIMUM GRADE CHANGE ( G )

| | DESIRABLE | MAXIMUM |
|---|---|---|
| HIGH VOLUME DRIVEWAY | 0% | ± 3% |
| LOW VOLUME DRIVEWAY ON MAJOR OR COLLECTOR STREETS | ± 3% | ± 6% |
| LOW VOLUME DRIVEWAY ON LOCAL STREETS | ± 6% | CONTROLED BY VEHICLE CLEARANCE |

NOTE: THE CHANGE IN VERTICAL ALIGNMENT AT POINTS "A" AND "B" SHOULD NOT EXCEED THE VALUE OF "G" IN THE ABOVE TABLE. DESIRABLY, "G" SHOULD NOT EXCEED 7%.

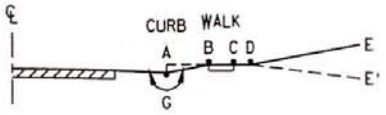



PROFILE IN CUT SECTION

A TO B = SAME PITCH AS SHOULDER SLOPE

B TO C = 8% MAX. ( MIN. PITCH SAME AS SHOULDER SLOPE )

C TO D = 8% MAX. FOR COMMERCIAL AND INDUSTRIAL DRIVEWAYS. 15% FOR RESIDENTIAL.

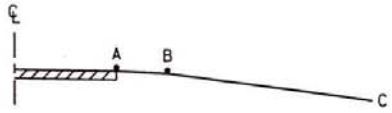



PROFILE WITH CURB AND SIDEWALK

A TO B = SLOPE FROM GUTTER TO MEET SIDEWALK

C TO D = VARIABLE DISTANCE

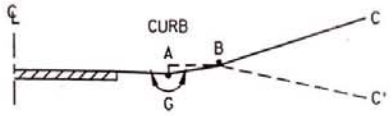
D TO E = ± 8% MAX. FOR COMMERCIAL AND INDUSTRIAL DRIVEWAYS. 15% FOR RESIDENTIAL.




PROFILE IN FILL SECTION

A TO B = SAME AS SHOULDER SLOPE

B TO C = 8% MAX. FOR COMMERCIAL AND INDUSTRIAL DRIVEWAYS. 15% FOR RESIDENTIAL.




PROFILE WITH CURB

A TO B = SLOPE UPWARD TO A MIN. HEIGHT EQUAL TO CURB HEIGHT

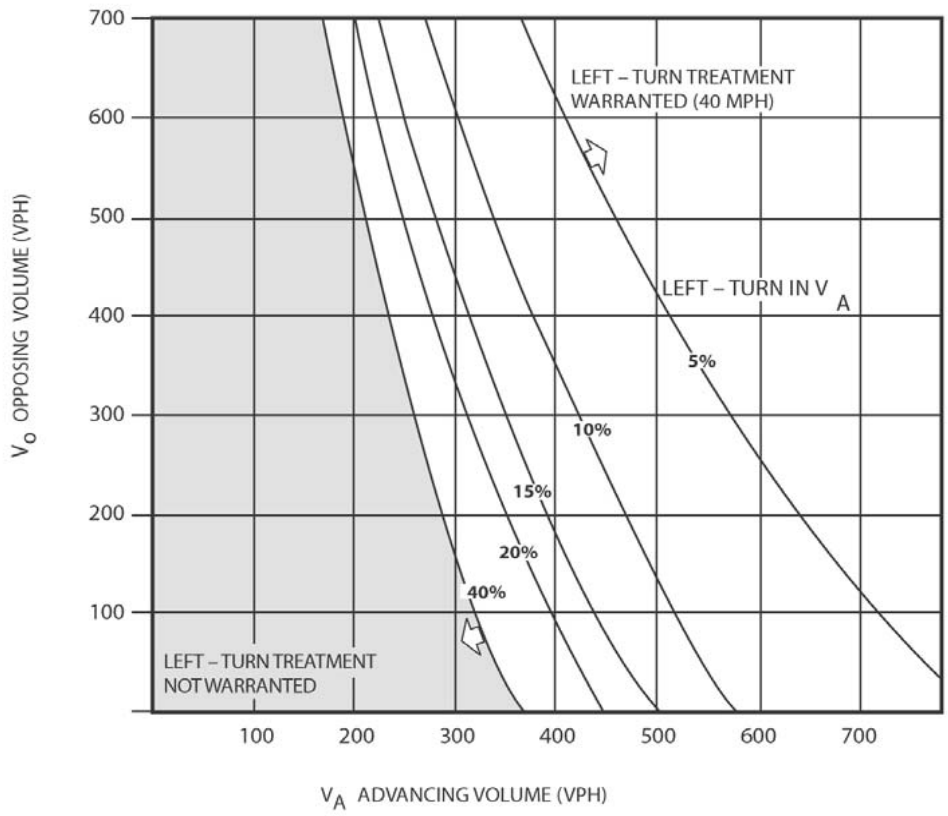
B TO C = ± 8% MAX. FOR COMMERCIAL AND INDUSTRIAL DRIVEWAYS. 15% FOR RESIDENTIAL.

*Source: MnDOT Road Design Manual*

**Entrance Grades**

LRRB Task 5: Rural Access Guidelines

**FIGURE B-4**

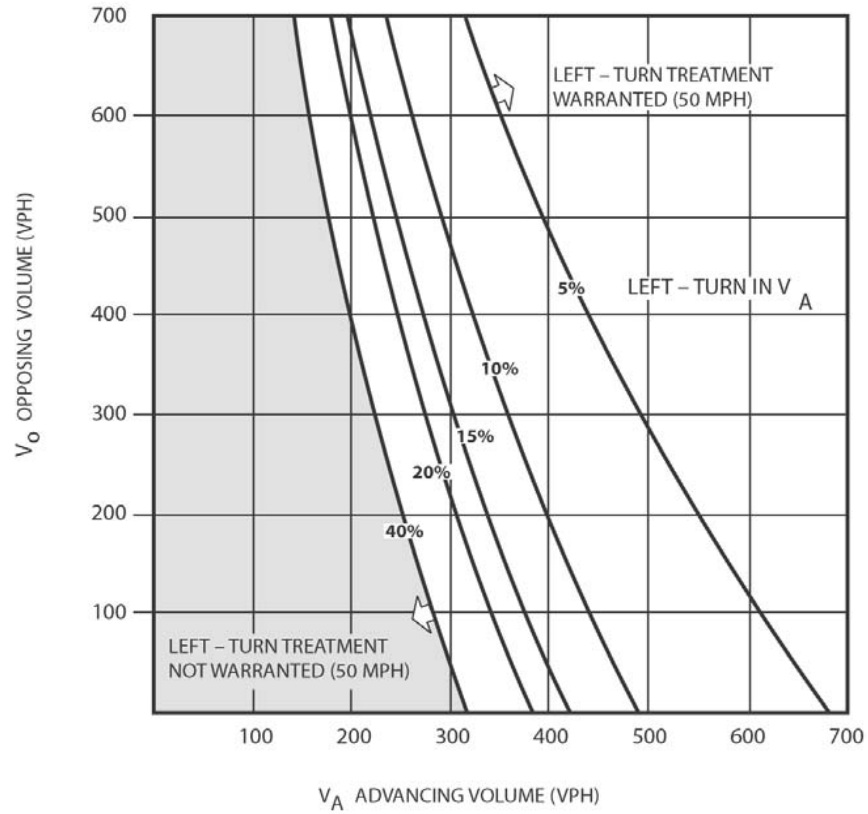



*Source: AASHTO*

**Volume Guidelines for Left-Turn Lanes on Rural Two-Lane Highways (40 MPH)**

LRRB Task 5: Rural Access Guidelines

**FIGURE B-5**

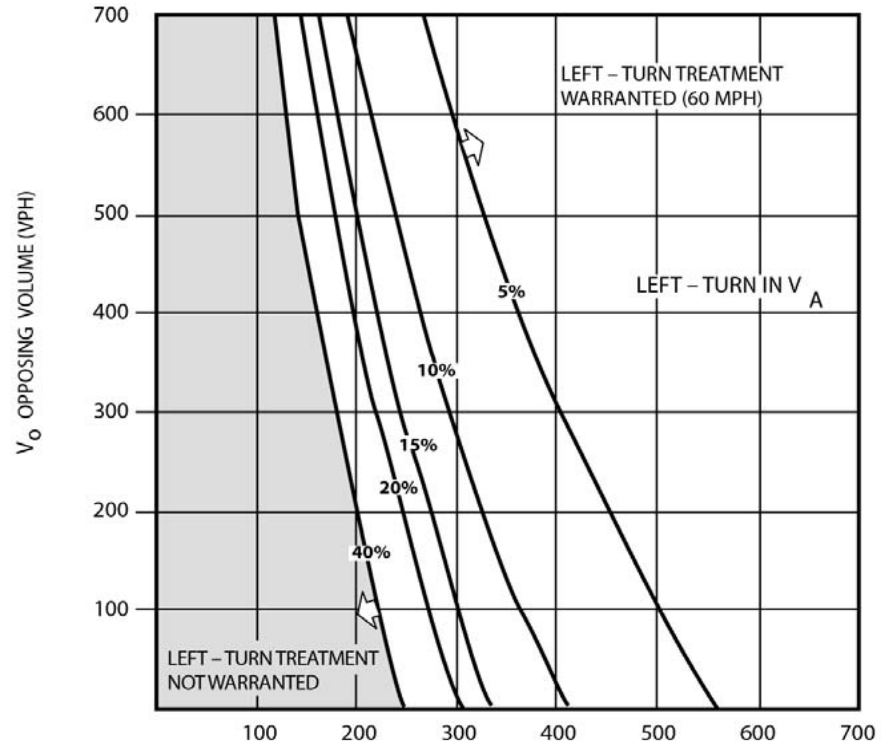



*Source: AASHTO*

**Volume Guidelines for Left-Turn Lanes on Rural Two-Lane Highways (50 MPH)**

LRRB Task 5: Rural Access Guidelines

**FIGURE B-6**

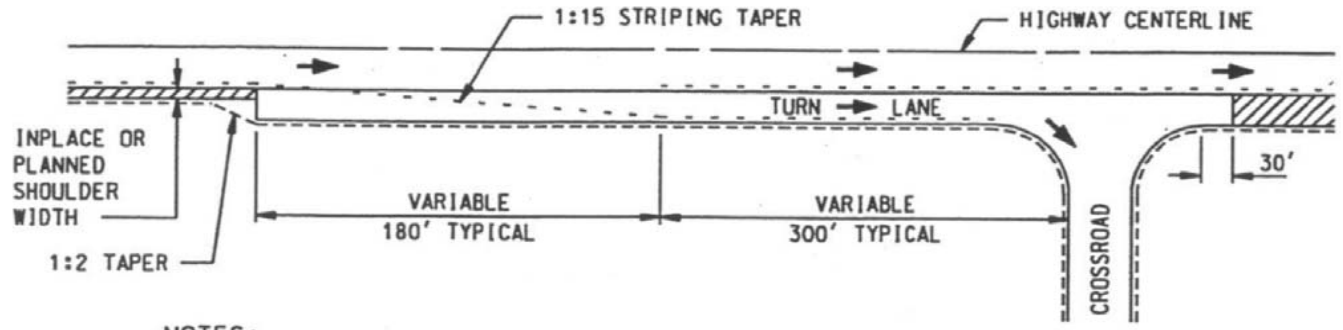



Source: AASHTO

**Volume Guidelines for Left-Turn Lanes on Rural Two-Lane Highways (60 MPH)**

LRRB Task 5: Rural Access Guidelines

**FIGURE B-7**



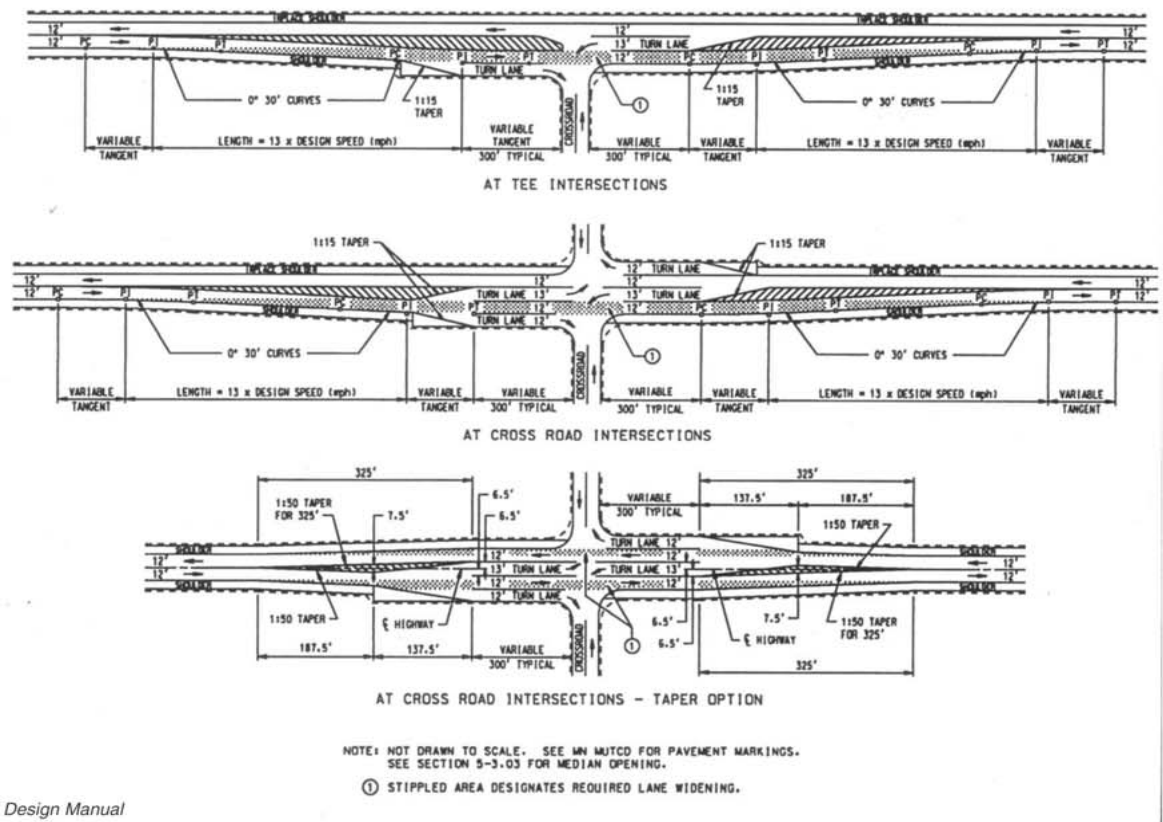

NOTES:
ON DOWNGRADES, THE TURN LANE MAY NEED TO BE EXTENDED. REFER TO SECTION 2-5.09.
TURN LANE WIDTH IS 14 FT. WHEN CURB AND GUTTER ARE PRESENT, 12 FT. OTHERWISE.

*Source: MnDOT Road Design Manual*

**Right Turn Lane**

LRRB Task 5: Rural Access Guidelines

**FIGURE B-8**




*Source: MnDOT Road Design Manual*

**Left Turn Lane Design**

LRRB Task 5: Rural Access Guidelines

**FIGURE B-9**

# APPENDIX C

# SURVEYS OF RURAL CITIES, TOWNSHIPS AND COUNTIES

## APPENDIX C: SURVEYS OF RURAL CITIES, TOWNSHIPS AND COUNTIES

Surveys are conducted in order to document current practices and policies of local agencies. This appendix will discuss the results of the following two surveys: the Best Practices for Rural Entrance Policy Survey and the Wright County Pavement Survey.

### Best Practices for Rural Entrance Policy Survey

As part of the data collection process, the Technical Advisory Panel developed a survey for rural city, township and county engineering and planning staff in order to determine the following:

- The number of rural cities, townships and counties that have established access guidelines and policies.
- The relative effectiveness of established access guidelines and policies.
- How often engineering and planning staff review established access guidelines and policies with elected officials.
- The demand for rural access guidelines in cases where rural cities, townships and counties have not developed access policies.
- The tools rural cities, townships and counties need to manage and design entrances.

This survey was conducted on the Internet through the LRRB-RIC website, and the results (summarized below) were automatically tabulated and provided to participants upon completion of the survey. The survey was made available to local agencies on August 8, 2001. By November 1, 2001, there were 56 responses. Significant findings from the survey are as follows:

- Of the 56 survey participants, approximately 40 percent had a written access management policy for rural roadways. It must be noted that this survey was conducted before Mn/DOT released its draft access management guidelines.
- Most participants that had a written policy thought that the policy was effective (approximately 95 percent) and would be useful to other agencies (approximately 58 percent).
- Approximately 82 percent of the agencies that had a written access management policy have standards for driveway width and approximately 73 percent have standards for access spacing and side slopes.
- Of the agencies that have implemented rural access standards, approximately 23 percent review the standards on a regular basis. The other respondents either do not review the standards regularly or review them on an "as needed" basis.
- Of the agencies that have not developed access management standards, approximately 59 percent have discussed developing one.
- Approximately 32 percent of the agencies that have not developed standards indicated that they have not adopted an access management policy because access has not been an issue; however, approximately 65 percent indicated that there is an interest in developing a policy.

- The most useful tools that could be used in developing an access management policy are access spacing guidelines for local roads and collectors and entrance design guidelines.

**Best Practices for Rural Entrance Policy Survey – Data and Results**

| 1. Does your agency have a written access management policy for rural roadways? | |
|---|---|
| Yes | 22 |
| No | 34 |
| Total Responses | 56 |

| A. If yes, do you feel your policy has been effective in helping you manage access issues? | |
|---|---|
| Yes | 21 |
| No | 1 |
| No Response | 0 |
| Total Responses | 22 |

| B. If yes, do you feel your policy would benefit other local government agencies? | |
|---|---|
| Yes | 15 |
| No | 4 |
| No Response | 3 |
| Total Responses | 22 |

| C. If you do have an access policy, does it include standards for the following (Check all that apply): | |
|---|---|
| Number of accesses per parcel | 14 |
| Access spacing criteria | 16 |
| Stopping sight distance requirements | 12 |
| Minimum flare or radius | 10 |
| Driveway width | 18 |
| Surface type | 5 |
| Access side slope | 16 |
| Culvert placement/type | 14 |
| Adding turn lanes | 6 |
| None of the Above | 0 |

**D. If you do have an access management policy, how regularly does your agency review the policy with elected/appointed officials? Newly elected/appointed officials?**

| | | |
|---|---|---|
| **Annually** | ▯ | 4 |
| **Biannually** | ▯ | 1 |
| **Never have updated/ reviewed the policy** | ▯ | 6 |
| **Other/Comments** | ▭ | 12 |

- Occasionally reviewed as prompted by issues brought to the County's Transportation Committee or County Board.
- We plan to update the policy in the near future.
- Enforced by staff committee. Council and planning commission review requests.
- Reviewed when an owner/applicant is dissatisfied with policy. Owner/applicant typically goes beyond dept - to the commissioner.
- Reviewed as needed - it's part of our subdivision ordinance, so it has the force of law in townships (not cities). We will be writing Chapter 2, Access Standards, of our Right-of-Way Ordinance pending the recommendations of the MN/DOT Access Management Committee.
- Update of Transportation Plan - 1992, 1995, 2001.
- Updated during last five years.
- Reviewed when the transportation plan is updated.
- Reviewed on an as-needed basis as part of the policies in the Hennepin County Transportation Systems Plan (HC-TSP).

**2. If "no" to Question 1, has your agency discussed developing access management policies for rural roads?**

| | |
|---|---|
| **Yes** | 20 |
| **No** | 14 |
| **Total Responses** | 34 |

**A. If no, why not?**

| | |
|---|---|
| **Access has not been an issue** | 11 |
| **Lack of support by City/Township/County Board** | 3 |
| **Lack of support by the public** | 3 |
| **Other/Comments** | 3 |

- Has not been a high enough priority. A written policy would be helpful.
- Lack of staff time to complete this kind of project.
- Steele County has an access policy for rural roads and county roads lying within the city limits.

**B. If you do not have an access management policy, do you think that there would be interest in developing an access management policy?**

| | |
|---|---|
| **Yes** | 22 |
| **No** | 5 |
| **No Response** | 7 |
| **Total Responses** | 34 |

### 3. What tools would be most helpful in developing an access management?

| | |
|---|---|
| **Model Access Ordinance** | 28 |
| **Entrance Design Guidelines** | 30 |
| **Access Spacing Guidelines for Local Roads and Collectors** | 34 |
| **Statistical and Background Information about Access Management** | 26 |
| **Access Checklist** | 29 |
| **FAQ about Access/Entrances** | 19 |
| **None of the Above** | 0 |
| **Other/Comments** | 10 |

- Please be sure it includes minimum highway sight distance criteria for various highway speeds. Try to get field entrances much further away from crossroad intersections than the current Mn/DOT guidelines.
- Information about costs (i.e., accidents, culvert maintenance and weed control) versus benefits (i.e., less travel distance to highway) is needed. It makes good economic sense to limit driveways to one per parcel/subdivision or one per 1/2 mile on rural highways in western Minnesota.
- How other counties handle access control.
- Spacing guidelines, sight distance guidelines, and flexibility for both in certain circumstances is needed.
- Technical analysis of the effects of certain restrictions is needed, i.e., U-turns necessitated by median closures and effects on crashes.
- Our policy is based on the size of the parcel needing access. I am in the process of trying to refine/improve the policy.
- Feel we need to update zoning regulations first.

**Wright County Pavement Survey**

In 2001, Wright County conducted a survey of Minnesota counties' driveway paving practices. This survey was prompted by the public's numerous requests/demands to have driveways paved to the right-of-way line during a recent rural highway-grading project. The survey generated 52 responses, and the findings are as follows:

- 44 percent of respondents indicated that driveway pavement is replaced in-kind for each surface disturbed on grading and overlay projects (Wright County's practice).
- 56 percent of respondents indicated that they pave all driveways; however, these respondents can be divided into the following distinct groups:
  - Eight respondents pave all driveways.
  - 11 respondents pave all driveways on "reconstruction projects" only (overlay projects are not included).
- The limits of driveway pavement varied as well. Counties pave to the right-of-way line, construction limits, driveway culvert or end of driveway radius.

# APPENDIX D

# MINNESOTA COUNTY ENTRANCE PRACTICES

## APPENDIX D: MINNESOTA COUNTY ENTRANCE PRACTICES

As part of a Minnesota Local Road Research Board (LRRB) project to identify access policies and design guidelines for rural collectors and local roads, a number of cities, townships and counties were asked to provide their current access policies, permits and design practices as background information. The purpose of Appendix D is to provide a resource "catalogue" of current access policies, permits and design practices from various agencies in the State of Minnesota. This appendix contains a brief summary of the practices in several counties that participated in development of the project.

It should be noted that the policies and practices contained in this appendix are constantly changing, and the intent of this document is to provide a snapshot of the variety of practices and policies existing in Minnesota.

### Summary of County Practices

The following section contains brief summaries of the access policies and practices currently practiced by the counties that participated in the LRRB "Best Practices for Rural Entrances Policy" project.

#### *Wright County*

- The traditional spacing guideline for rural collectors and local roads has been allowing one access per parcel or 40 acres (according to land use).
- The county has changed from the traditional guideline to using the recommendations in the Wright County Transportation Plan where functional class and future volumes are used to determine access spacing.
- For field accesses that are changing to residential or commercial accesses, the county will require a new permit for specific use.
- The county encourages sharing access; however, no "horseshoe" access points are permitted.
- Wright County uses the following Mn/DOT District 3 criteria for turn lanes: developments with ten or more homes, entrances with high volumes, or roads /entrances with limited sight distance.
- The county requires a 130-foot building setback from the roadway centerline.
- Access control is part of the plat review process.

#### *Carlton County*

- The existing spacing guideline for rural collectors and local roads is allowing one access per 40 acres (one per parcel).
- The county does not vary entrance standards for different land uses.
- The county identifies specific access spacing guidelines, although the county engineer may provide a variance on a case-by case basis.
- Safety is an issue, particularly in winter months. The county is not always able to sand and plow immediately after snowstorms, which may increase the chance for rear-end crashes in areas with closely spaced access points.

***Olmsted County***

- The existing spacing guideline for rural collectors and local roads is allowing one access per parcel (unless the parcel is divided by a natural barrier).
- The county prefers a 650-foot stopping sight distance; however, the minimum stopping sight distance for rural approaches is 563 feet.
- The access permit requires applicants to specify the type of land use the entrance will serve.
- The county encourages relocating existing access points to new locations or allowing shared access.
- Turn lanes and by-pass lanes are dependant on volumes.
- Access control is part of the plat process.

***Dakota County***

- <u>New Plats</u>
  - All plats contiguous to County roads must conform to County policy before plat can be recorded.
  - County spacing guidelines adopted as part of County Transportation Policy Plan.
  - Plat Commission meets every two weeks to review new developments.
  - 20-year traffic forecast used in spacing matrix.
    - Facilities with less than 3,000 ADT – use engineering judgment in determining the location, grades, speed, sight lines, proximity to other conflict points, etc.
    - Facilities between 3,000 and 15,000 ADT – access spaced 660 feet or greater.
  - Access dedicated to the public (access controls) made part of the recorded plat.
  - Permits not approved until plats are recorded.

- <u>Existing Parcels</u>
  - Permits required.
  - Every attempt is made to conform to same guideline used in approving new plats.
  - Turn lanes/by-pass lanes required for public streets as condition of permit.
  - Shared driveways are encouraged.
  - Developers are encouraged to circulate site traffic on the development – not on the highway (i.e., multiple access points to separate site traffic is discouraged).
  - Construction projects make every effort to improve/reduce/eliminate/ consolidate access.
  - Access is denied if available on lower-type roadway:

***Nicollet County***

- When right-of-way is purchased for local projects, the county also purchases access rights.
- The county prefers to move existing access points rather than build new access.
- The county tries to funnel traffic to local streets.
- Every parcel is entitled to an access point unless there is a safety issue.

***Otter Tail County***

- The existing spacing guideline for rural collectors and local roads is allowing one access per 40 acres (one access every quarter-mile).
- Based on previous experience and court decisions, the county does not encourage shared access.
- There are no access permits required in the county unless the entrance falls in a shoreline district.
- Each township in the county has its own policies regarding access; however, none of the townships have a uniform design standard. The townships need to adopt entrance design guidelines.
- The county collects a $250 deposit for private entrances and a $500 deposit for commercial access points (refundable).
- The county requires a 40-foot building setback from the edge of the right-of-way.
- Approaches decorated with rock formations or gardens are a problem for the county.

***Goodhue County***

- The county's desired sight distance is 750 feet. In rare cases as a last resort, the county requires the owner to put up a "blind approach" sign and sends the owner a letter informing of sight distance problems for access points with less than the 550-foot minimum sight distance. The owner is required to pay for the sign.
- The county provides a paved apron for entrances (through the radius of the approach).
- Goodhue County uses the following Mn/DOT District 6 criteria for turn lanes: developments with ten or more homes, entrances with high volumes, or roads /entrances with limited sight distance.
- The county requires a 60-foot setback from the edge of the right-of-way.
- The county charges a $50 fee for access points (nonrefundable).
- The county plans to revise the Land Use Plan and Transportation Plan in the near future.

# APPENDIX E

# REFERENCES

## APPENDIX E: REFERENCES


1. Minnesota Department of Transportation, "Mn/DOT Needs You! As Partners in Corridor Access Management" (undated).

2. Minnesota Department of Transportation, *Appendix A: Access Category System and Spacing Guidelines* (Minnesota Department of Transportation, January 2002).

3. American Association of State Highway and Transportation Officials, *A Policy on Geometric Design of Highways and Streets 2001* (American Association of State Highway and Transportation Officials, 2001).

4. Minnesota Department of Transportation, *Road Design Manual (English) I and II* (Minnesota Department of Transportation, June 2000).

5. Minnesota Department of Transportation, *State Aid Manual* (Minnesota Department of Transportation, August 2000).

6. Minnesota Department of Transportation, "Access Category Guidelines Summary" (Minnesota Department of Transportation, May 2001).

7. American Association of State Highway and Transportation Officials, *Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT $\leq$ 100) 2001* (American Association of State Highway and Transportation Officials, 2001).

8. Florida Department of Transportation, "Access Management; An Important Traffic Management Strategy" (Florida Department of Transportation, undated).

9. Center for Transportation Research and Florida Department of Transportation, "Model Land Development and Subdivision Regulations that Support Access Management for Florida Cities and Counties" (Florida Department of Transportation, January 1994).

10. Center for Transportation Research, "Land Development Regulations that Support Access Management" (Florida Department of Transportation, undated).

11. Michigan Department of Transportation, "Improving Driveway and Access Management in Michigan" (Michigan Department of Transportation, undated).

12. New York State Association of Metropolitan Planning Organizations and New York State Department of Transportation, "Best Practices in Arterial Management" (New York State Department of Transportation, 1997).

13. Center for Transportation Research and Education and Iowa Department of Transportation, "Access Management Handbook" (Iowa Department of Transportation, October 2000).

14. Center for Transportation Research and Education and Iowa Department of Transportation, "Access Management Toolkit" (Iowa Department of Transportation, undated).

15. Maine Department of Transportation, "Access Management: Improving the Efficiency of Maine Arterials; A Handbook for Local Officials" (Maine Department of Transportation, 1994).

16. TRB, *Impacts of Access Management Techniques* (Transportation Research Board National Research Council, NCHRP Report No. 420, 1999).

17. Clearwater County, "Access Management Driveway and Field Approach Guidelines" (Clearwater County, undated).

18. Chippewa County Highway Department, "Policy and Procedure Handbook" (Chippewa County Highway Department, July 2001).

19. Crow Wing County Highway Department, "Application for Access Driveway Permit" (Crow Wing County, undated).

20. Freeborn County Board of County Commissioners, "Authorization of Permit" (Freeborn County, undated).

21. Goodhue County, "Zoning Ordinances" (Goodhue County, September 2000).

22. Nobles County Highway Department, "Access Driveway or Entrance Permit" (Nobles County, undated).

23. Wright County Highway Department, "Access Driveways to County Highways" (Wright County, undated).

24. City of Hutchinson, McLeod County and Minnesota Department of Transportation "Hutchinson Area Transportation Plan" (City of Hutchinson, June 1998).

25. Minnesota Department of Transportation Districts 8 and 3, "TH 23 Corridor Study" (Minnesota Department of Transportation, July 1997).

26. Minnesota Local Road Research Board and Minnesota Department of Transportation, *Access Management – A Synthesis of Research* (Minnesota Local Road Research Board, MN RC - REV: 1999-21, February 1999).

27. Transportation Research, *Circular 456: Driveway and Street Intersection Spacing*, (Transportation Research Board National Research Council, ISSN 0097-8515, March 1996).

28. Minnesota Department of Transportation and Minnesota Local Road Research Board, *Statistical Relationship Between Vehicle Crashes and Highway Access* (MN/RC – 1998-27, August 1998).

29. Minnesota Department of Transportation, “Traffic Safety Fundamentals Handbook” (Minnesota Department of Transportation, April 2001).