

Welcome

Access Management At Intersections Part I

Originally Developed by:

Virgil G. Stover, Ph.D., P.E.

Kristine Williams, AICP

Revised and Updated by:

Marc Butorac, P.E., P.T.O.E.

Matt Hughart, AICP

Kittelson & Associates, Inc.



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Housekeeping

- Be prepared to respond to polls.
- All participant phone lines are muted to avoid distractions during presentations.
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Earning Course Credit

Successful completion of this Web seminar includes the following:

- Verification of attendance;
- Completion of course evaluation; and
- Verification of learning objectives

These requirements must be met to earn 1.5 PDH or .2 IACET CEU per course.

At the conclusion of the course you will receive an e-mail with directions to the free online evaluation.



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Meet Your Instructors



Marc Butorac, P.E., P.T.O.E.

Senior Principal Engineer

Kittelson & Associates, Inc.

Phone: 503-228-5230

email: mbutorac@kittelson.com



Matt Hughart, AICP

Associate Planner

Kittelson & Associates, Inc.

Phone: 503-228-5230

email: mhughart@kittelson.com



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Course Objectives

- Understand the principles that define access management techniques at intersections.
- Analyze the factors that should be considered when implementing access management at intersections.
- Identify and compare the physical and functional areas of a signalized intersection.



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Course Overview

1. Reasons for access management
2. Typical treatments
3. Determine functional distances
 - Upstream
 - Downstream
4. Example Exercises
5. Resources



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Access Management is

“..the systematic control of the location, spacing, design, and operation of driveways, median openings, interchanges, and street connections to a roadway.”

Source: TRB Access Management Manual, p. 3



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AASHTO

- “Ideally, driveways should not be located within the functional area of an intersection or the influence area of an adjacent driveway.”
- “The functional area extends both upstream and downstream from the physical intersection area...”

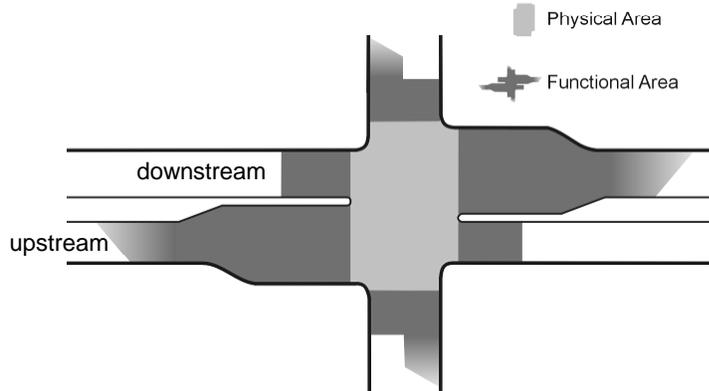
Source: AASHTO, 2011, p. 9-182



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Principles of AM at Intersections

- Preserve the functional area of intersections



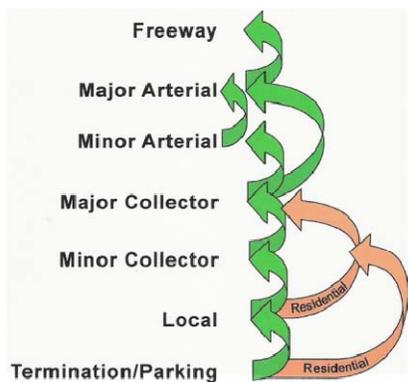
Source: Florida Department of Transportation



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Principles of AM at Intersections

- Promote intersection hierarchy



Avoid connecting a lower class roadway (or driveway) with a much higher class roadway.

Source: Vigil Stover



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Principles of AM at Intersections

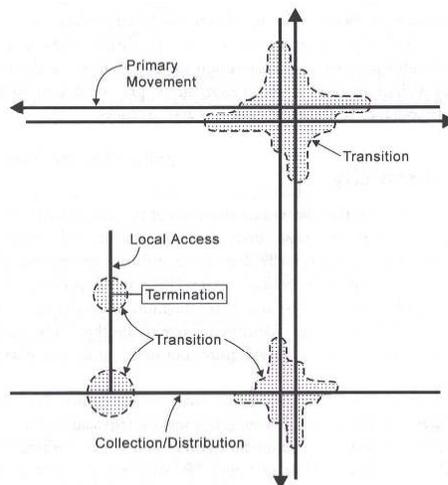
- Promote intersection hierarchy (cont.)
 - Provide transitions from one stage of a trip to the next
 - “The failure to accommodate each trip stage by suitable design is a prominent cause of highway obsolescence...” AASHTO
 - Driveways are at-grade intersections

TRB Access Management Manual p. 8, 126



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Access and Movement Hierarchy



Hierarchy of movement
in a functional circulation
system

Source: Transportation and Land Development, 2nd ed. ITE 2002



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Principles of AM at Intersections

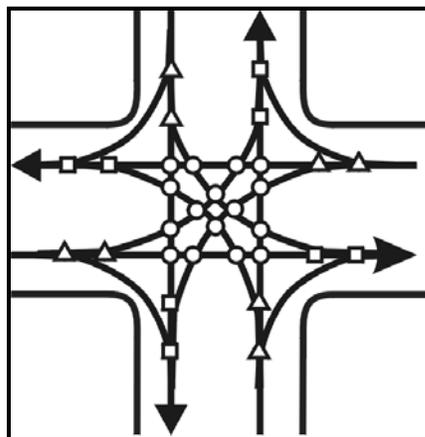
- **Limit and Separate Conflict Points**

Drivers have more collisions and are more likely to make mistakes when presented with complex driving situations



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Conflict Points



Conflict Points

○ 16 Crossing

△ 8 Diverge

□ 8 Merge

32 Total

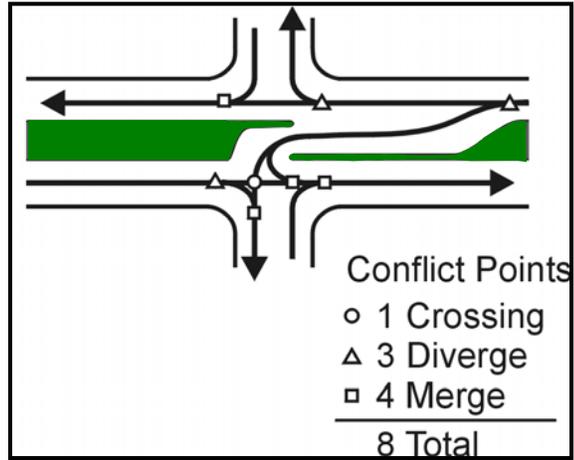


Source: TRB Access Management Manual p. 8



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Conflict Points



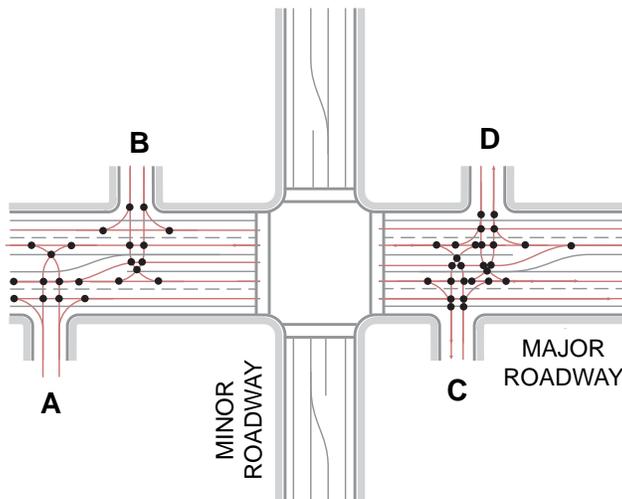
Source: TRB Access Management Manual p. 8



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Conflict Points

Full-Movement Driveways Without Median



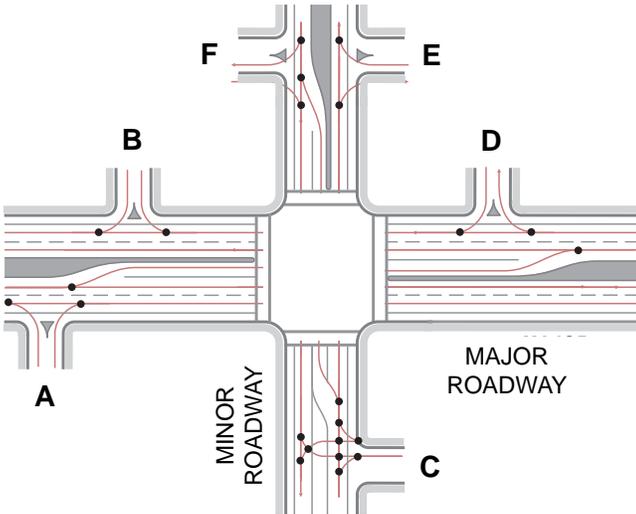
Source: Access Management in the Vicinity of Intersections, FHWA SA-10-002



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Conflict Points

Limited Access Driveways with Raised Median

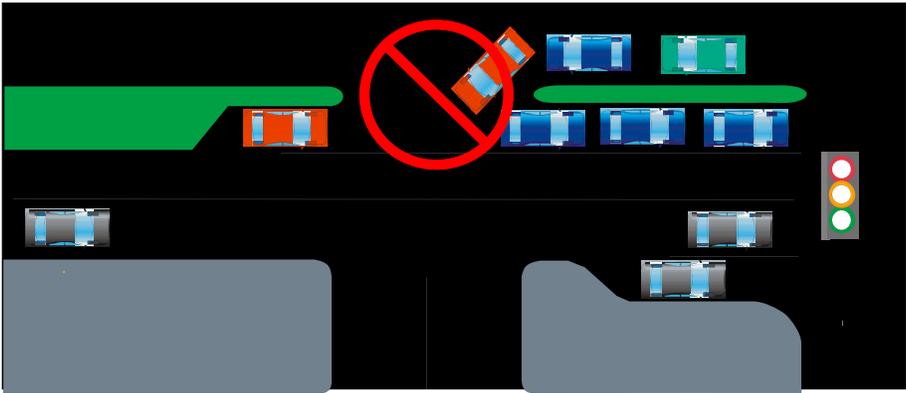


Source: Access Management in the Vicinity of Intersections (FHWA SA-10-002)



Conflict Points

No openings across left-turn lanes



Source: Florida Department of Transportation



Conflict Points

Yet it still happens, often because of political influence.



Photo: Chris Walsh

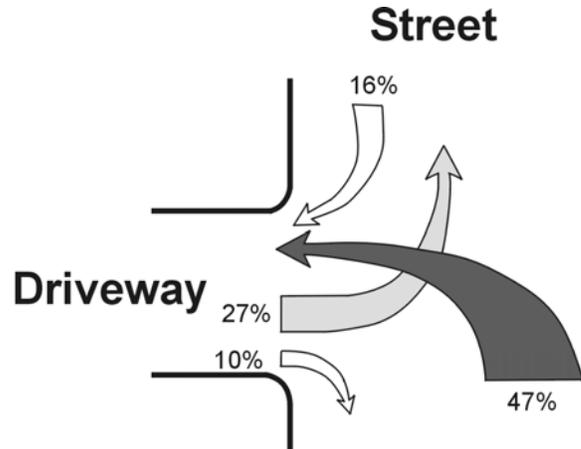


Reasons for AM at Intersections

- Safety
- Traffic operations
- Capacity



Percentage of Driveway Crashes by Movement



Source: S&K Transportation Consultants Inc. *Access Management, Location and Design*



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Signalized Intersection Capacity

- Corner clearance
- Percent of curb-lane traffic entering/exiting driveway
- Driveway geometrics



Photo: Kittelson & Associates, Inc.



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Factors to Consider

1. Category (level-of-importance) of the intersecting roadways
 - e.g. major arterial to collector, etc.



Source: Transportation and Land Development, 2nd ed. ITE 2002



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Factors to Consider (Cont.)

2. Availability of Alternative Access



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Factors to Consider (Cont.)

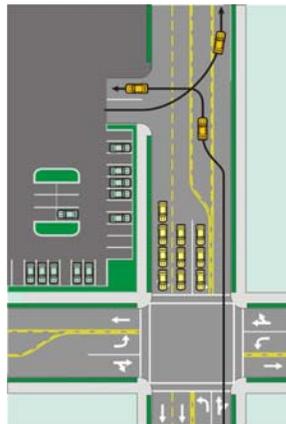
3. Functional intersection distance



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Factors to Consider (Cont.)

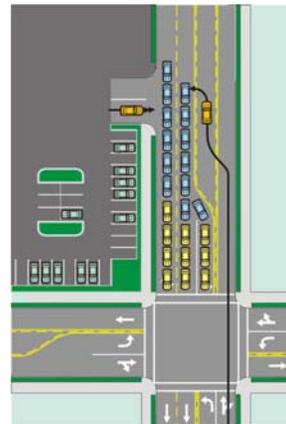
Existing Traffic Conditions



Source: Kittelson & Associates, Inc.



Future Traffic Conditions



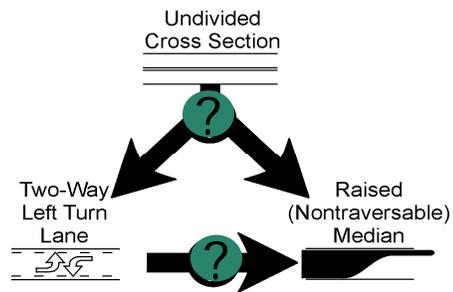
Source: Kittelson & Associates, Inc.



Factors to Consider (Cont.)

4. Cross-Section

- nontraversable median
- TWLTL
- undivided



Source: TRB Access Management Manual, pg. 202



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Factors to Consider (Cont.)

5. Frontage

- upstream on the major roadway
- downstream on the major roadway
- upstream on the minor roadway
- downstream on the minor roadway



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Factors to Consider (Cont.)

6. Conditions of the Permit
 - movements permitted
 - volume of entering and exiting traffic
 - type of vehicle(s)



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Typical AM Treatments at Intersections

- Nontraversable Median
- Deceleration Lane
 - left-turn
 - right-turn
- Driveway Location
 - upstream
 - downstream

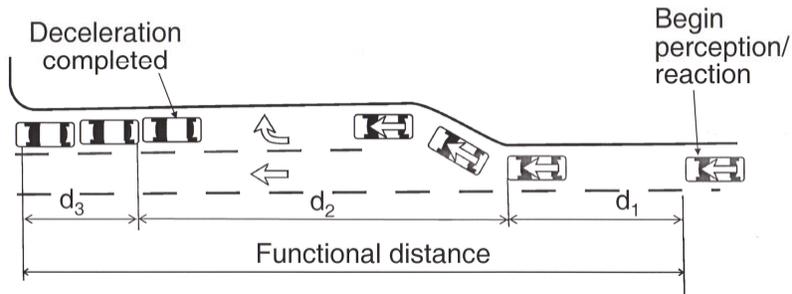


Photo: Kitchelson & Associates, Inc.



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Elements of Upstream Functional Distance



d_1 = distance traveled during perception-reaction time

d_2 = distance traveled while maneuvering laterally and decelerating to a stop

d_3 = queue storage length

Source: TRB Access Management Manual, pg. 132



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d_1 : Distance traveled during perception-reaction time

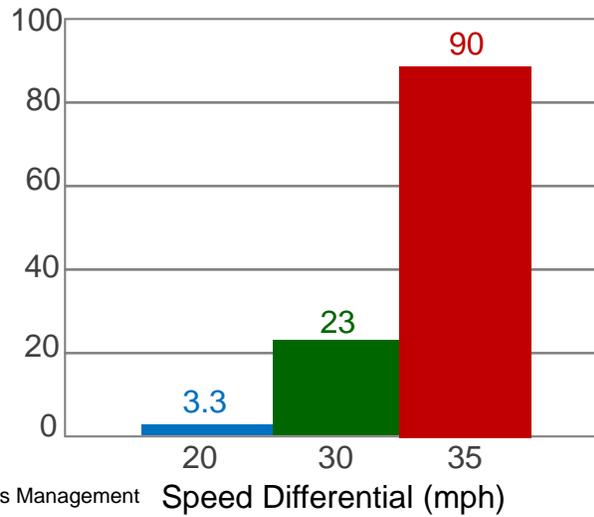
Speed (mph)	Distance traveled (feet) ⁽¹⁾	
	2.0 sec.	3.0 sec.
20	60	90
30	90	130
40	120	175
50	145	220
60	175	265

⁽¹⁾Rounded to 5.0 ft.



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Effect of Speed Differential on Crash Potential



Reference: TRB Access Management
 Manual, pg. 169

Speed Differential (mph)



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d_2 : Deceleration/maneuver distance method

Speed (mph)	Deceleration/Maneuver Distance (ft)
20	70
30	160
40	275
50	425
60	610



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d_3 = queue storage length

$$d_3 = \left(\frac{V}{N} \right) kl$$



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Example Problem

Conditions

- Left-turn volume = 175 vph.
- Cycle length = 90 sec.
- $\leq 5\%$ large vehicles



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Example Problem (Continued)

Solution

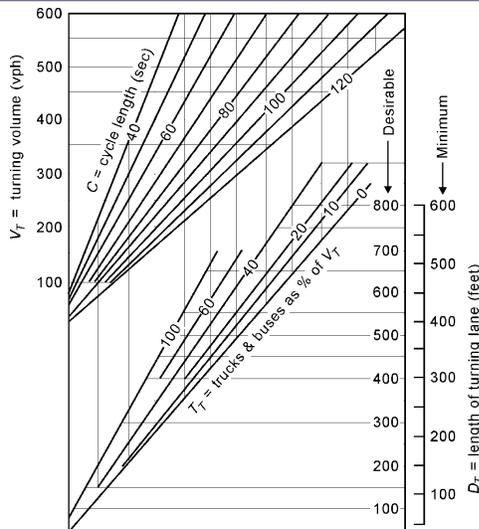
$$d_3 = \left(\frac{175}{\frac{3600}{90}} \right) (2.0)(25)$$

$$= \left(\frac{175}{40} \right) (2.0)(25) = 218.75 \sim 225 \text{ft.}$$



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Left-turn Queue Storage at Signalized Intersections



Desirable: 95% probability of storing all left-turn vehicles

Minimum: 85% probability



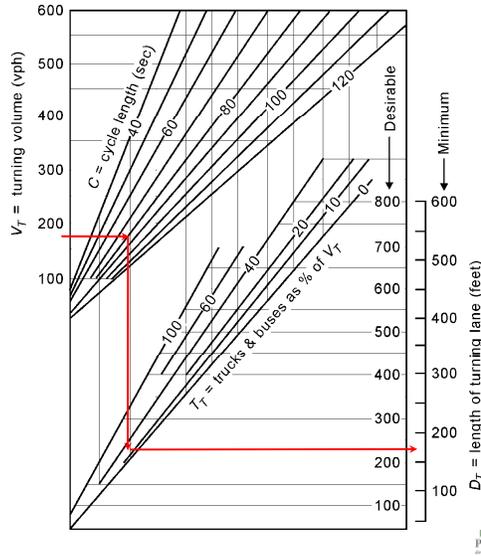
Reference: At Grade Intersections: Planning and Design Guide



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Example Problem

- **Conditions:**
 - Left-turn volume = 175 vph
 - Cycle length = 90 sec.
 - No large vehicles
- **Solutions:**
 - Desirable storage = 225 ft.
 - Minimum storage = 175 ft.



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Comparison

Method	Queue Storage
Equation	225 ft.
Nomograph, desirable	225 ft.
minimum	175 ft.

ITE

Professional Engineering

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Downstream Functional Distance

- Stopping Sight Distance SSD
(Driver in through lane)
- Right-Turn Conflict Overlap (RTCO)
(Driver entering roadway from a driveway)



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Stopping Sight Distance (SSD)

Speed (mph)	AASHTO (ft.)	Brake to Stop at an Intersection (ft.)	
		50 th percentile	85 th percentile
20	115	105	125
30	200	195	235
40	305	305	385
50	425	440	560
60	570	600	775
70	730	780	1020

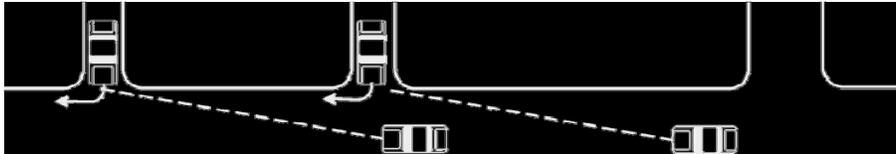


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Right-Turn Conflict Overlap

Driveway #2

Driveway #1



Single Right-Turn Conflict

TRB Access Management Manual, pg. 152



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Right-Turn Conflict Overlap (RTCO) Distances

Speed (mph)	Distance (ft.)
30	185
35	245
40	300
45	350



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Exercise

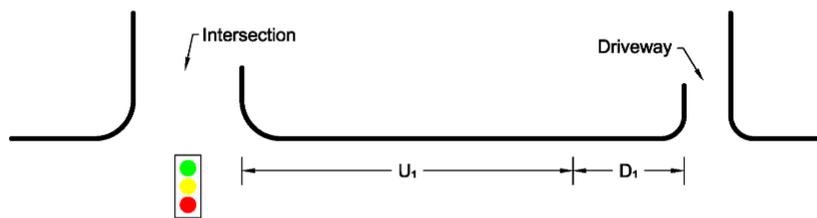
Compare the RTCO distances with SSD

Speed (mph)	RTCO (ft.)	SSD	
		AASHTO (ft.)	85 th percentile Distance (ft.)
30	185	200	235
40	300	305	385



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Ideal Upstream Spacing



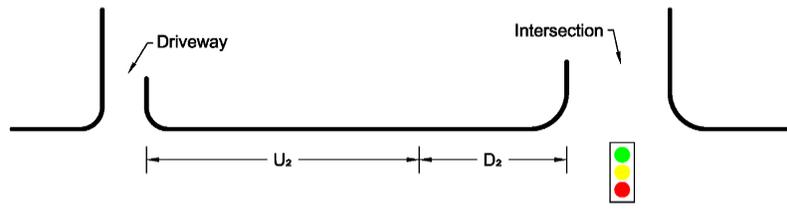
U_1 = upstream functional distance of the intersections

D_1 = downstream functional distance of the driveway



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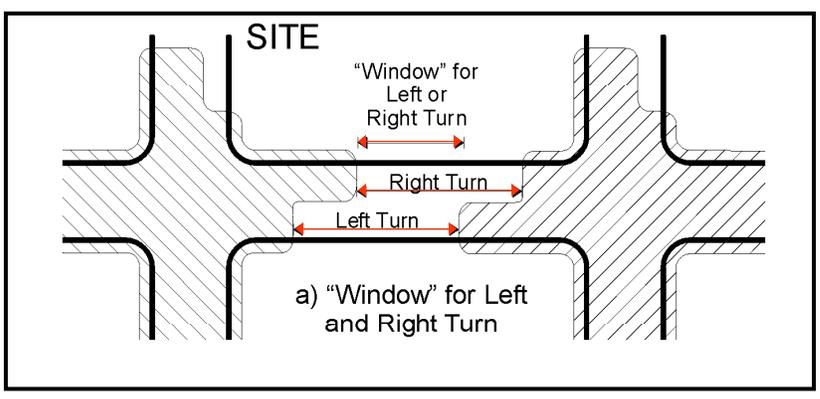
Ideal Downstream Spacing



U_2 = upstream functional distance of the driveway
 D_2 = downstream functional distance of the intersection



Site Plan



Resources

- TRB, Access Management Manual
- ITE, Transportation and Land Development
- NCHRP Report 420, Impacts of Access Management Techniques
- AASHTO, A Policy On Geometric Design of Highways and Streets, 2011
- Access Management in the Vicinity of Intersections (FHWA SA-10-002)



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Resources

- TRB Access Management Committee Website
<http://www.accessmanagement.info>

Conferences, presentations, etc.



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Questions



Thank You

Please provide your feedback. A link to an online Web seminar evaluation and quiz will follow in an e-mail to Web seminar registrants. Please distribute this email to participants at your site. The quiz and survey will close in one week.

Questions/Comments
Professional Development Department
ITE
1627 I Street, NW, Ste 600
Washington, DC 20006
202-785-0060 or pdinfo@ite.org

