



Project Summary Report 0-4365-S

URL: <http://tti.tamu.edu/documents/0-4365-S.pdf>

Project 0-4365: Urban Intersection Design Guidance

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## Texas Urban Intersection Design Guide Now Available

Intersections are an important part of an urban roadway. The efficiency, safety, speed, cost of operation, and capacity of the facility is a function of its design and how it operates. The main objective of intersection design is to facilitate the convenience, comfort, and safety of people traversing the intersection while enhancing the efficient movement of motor vehicles, buses, trucks, bicycles, and pedestrians. In order to design urban intersections that are both functional and effective, designers need current information regarding intersection design that is easily accessible and in a user-friendly format.

### What We Did...

The goal of the Texas Department of Transportation (TxDOT) Project 0-4365 was to produce a reference document, the *Urban Intersection Design Guide*, to provide information about intersection design. The project's objective was to provide TxDOT and other interested parties with useful and practical information regarding operations and

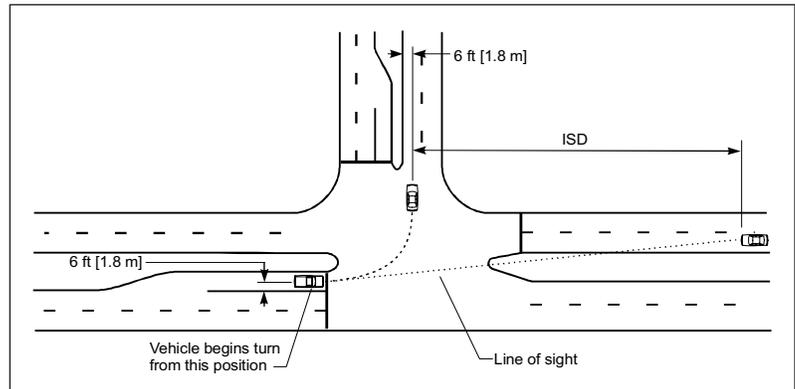


Figure 1. Sight Triangle for Left Turn from Major Road.

design for urban intersections. Objectives for the document included:

- relate geometric and operational issues,
- provide guidance versus policy,
- draw on strengths of other manuals, and
- produce an online document with links to other TxDOT manuals.

The project was a three-year effort and was structured in two phases. Phase I took place during the initial 12 months of the project and focused on gaining an understanding of the myriad of transportation-related issues associated with intersections through one-on-one interviews, focus groups, and a review of

current references regarding intersections. These efforts were used to generate a draft of the *Guide* and to set direction for Phase II.

A key direction for Phase II was to develop guidance material appropriate for new engineers and designers. The research team developed “applications” of intersection design principles that covered the following areas:

- innovative treatments,
- checklists,
- discussions of tradeoffs using real-world design scenarios, and
- step-by-step examples.

The applications were assembled into a second volume of the *Guide*. Therefore, the



*Urban Intersection Design Guide* document was developed as a two-volume report:

- Volume 1 – Guidelines and
- Volume 2 – Applications.

When assembled onto the TxDOT website, the two volumes will interlink so that the reader can quickly move from the guidelines to an application. The *Guide* will also be linked to other online documents.

### What We Found...

The material for the *Urban Intersection Design Guide* is divided into 11 chapters. [Table 1](#) lists the sections included in the *Guidelines* volume and the applications included in the *Applications* volume.

The *Guidelines* volume provides readers with information on intersection design elements together with related figures or tables needed for a design. In some cases, rather than repeating information, the link to the relevant TxDOT manual or reference to the *Green Book* chapter will be provided so that information is not duplicated between the documents.

As an example, when considering intersection sight distance (ISD), the reader can review a summary of intersection sight distance cases together with the potential adjustments that could figure in an intersection sight distance calculation. If information is desired on Case F (Left Turn from the Major Road), for example, the reader will find discussion along with a figure illustrating the situation (see [Figure 1](#)). If the reader wants step-by-step guidance for ISD Case B2, Application 3-3 can be reviewed. Other examples of material in the *Guide* are shown in [Figures 2 and 3](#).

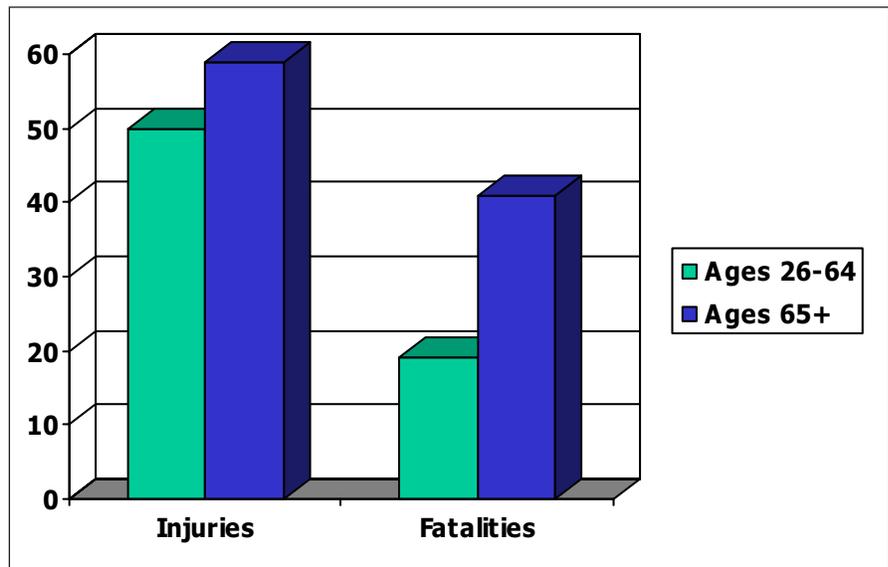


Figure 2. Percentage of Incidents Occurring at Texas Intersections for Younger and Older Drivers.

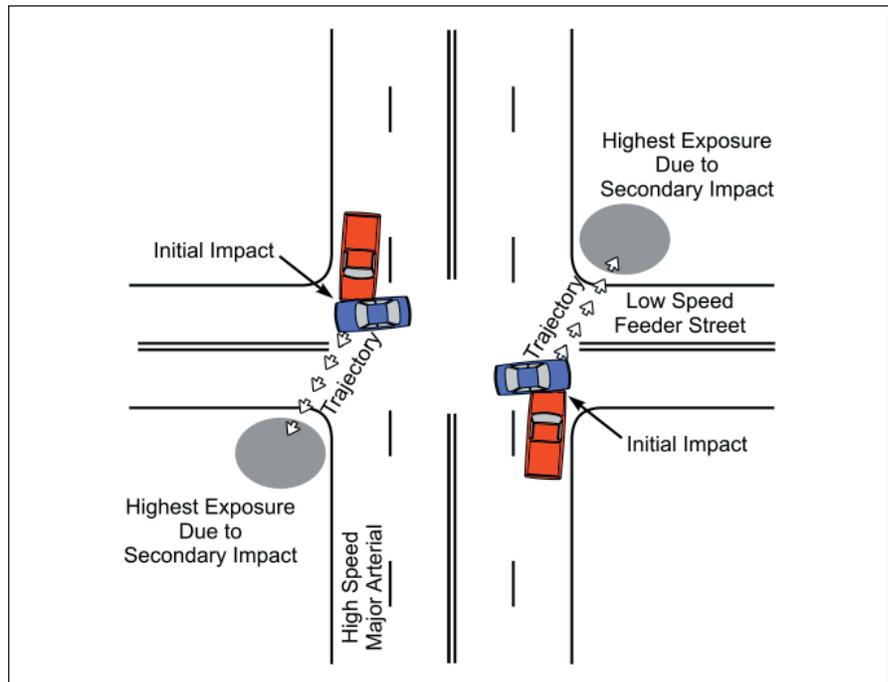


Figure 3. Intersection Zones Having Highest Exposure to Secondary Collisions. (Source: Transportation Research Board Committee on Utilities. *Utilities and Roadside Safety*. State of the Art Report 9. TRB, 2004.)

### The Researchers Recommend...

The *Urban Intersection Design Guide* serves as the implementation product from this project. It contains guidance, discussions, procedures, checklists, and

recommendations addressing many different aspects of intersection design. Publication of the document in TxDOT's online manual system will ensure widespread availability of the materials produced in this project.



Table 1. Sections and Applications within the *Urban Intersection Design Guide*.

Chapter	Guidelines Sections	Applications
1 Intersection Function	<ul style="list-style-type: none"> <li>• Intersection Planning and Development</li> <li>• Types of Intersections</li> <li>• Components of an Intersection</li> <li>• Utility Accommodation</li> </ul>	<ul style="list-style-type: none"> <li>• Subdivision Entrance</li> <li>• Roundabouts</li> <li>• Alternative Intersection Designs</li> </ul>
2 Design Control and Criteria	<ul style="list-style-type: none"> <li>• Modes of Travel</li> <li>• Users</li> <li>• Intersection Characteristics</li> <li>• Safety</li> </ul>	<ul style="list-style-type: none"> <li>• Pedestrian Features Checklist</li> <li>• Safety Study Example</li> </ul>
3 Design Elements	<ul style="list-style-type: none"> <li>• Intersection Sight Distance</li> <li>• Horizontal Alignment</li> <li>• Turning Radius</li> <li>• Angle of Intersection</li> <li>• Vertical Alignment</li> </ul>	<ul style="list-style-type: none"> <li>• ISD Cases A, B1, B2, B3, C1, C2, D, and F</li> <li>• Example of a Superelevation Design at an Intersection</li> <li>• Right-Turn Radius Selection Influences</li> </ul>
4 Cross Section	<ul style="list-style-type: none"> <li>• Through Lanes</li> <li>• Left-Turn Lanes</li> <li>• Right-Turn Lanes</li> <li>• Channelization</li> <li>• Island and Median Design</li> <li>• Bicycle Facilities</li> <li>• Shoulders and Parking</li> </ul>	<ul style="list-style-type: none"> <li>• Lane Drop after Intersection</li> <li>• Road Diets</li> <li>• Inclusion of Left-Turn Lane</li> <li>• Left-Turn Lane</li> <li>• Offset Left-Turn Lanes</li> <li>• Adding Right-Turn Lane</li> <li>• Auxiliary Lane Improvements</li> <li>• Island Offset</li> <li>• Median Design for Large Vehicles</li> <li>• Temporary and Ultimate Medians and Outside Curbing</li> </ul>
5 Roadside	<ul style="list-style-type: none"> <li>• Sidewalk</li> <li>• Horizontal Clearance</li> <li>• Landscaping</li> <li>• Street Furniture and Fixtures</li> <li>• Curb Extensions</li> <li>• Bus Stops</li> <li>• Lighting</li> <li>• Utilities</li> </ul>	<ul style="list-style-type: none"> <li>• Redevelopment near an Intersection</li> <li>• Addition of Bus Bay</li> </ul>
6 Drainage	<ul style="list-style-type: none"> <li>• Drainage Objectives</li> <li>• Cross Slope</li> <li>• Profile</li> <li>• Curb and Gutter</li> <li>• Ditches</li> <li>• Relationship to Pedestrian Facilities</li> </ul>	<ul style="list-style-type: none"> <li>• Warped Profile and Cross Section</li> </ul>
7 Street Crossing	<ul style="list-style-type: none"> <li>• Curb Ramps and Blended Transitions</li> <li>• Crosswalks</li> </ul>	<ul style="list-style-type: none"> <li>• Suggestions for Making an Intersection Accessible</li> <li>• Pedestrian and Bicyclist Accommodation</li> <li>• Alternative Treatments for Major Street Crossings</li> <li>• Alternative Treatments for Residential Street Crossings</li> <li>• Alternative Signal Control at Crossings</li> <li>• Alternative Treatments for Signalized Intersections</li> <li>• Alternative Treatments for School-Related Crossings</li> </ul>
8 Signals	<ul style="list-style-type: none"> <li>• General</li> <li>• Signal Faces</li> <li>• Signal Support Systems</li> <li>• Signal Cabinet Placement</li> <li>• Pedestrian Signals</li> <li>• Detectors</li> <li>• Right Turn on Red</li> </ul>	<ul style="list-style-type: none"> <li>• Signal Visibility</li> <li>• Traffic Signal Design</li> <li>• Signal Support Considerations</li> </ul>
9 Markings	<ul style="list-style-type: none"> <li>• General</li> <li>• Longitudinal Pavement Markings</li> <li>• Transverse Markings: Lines</li> <li>• Transverse Markings: Words and Other Symbols</li> <li>• Raised Pavement Markers</li> </ul>	<ul style="list-style-type: none"> <li>• Markings Checklist</li> <li>• Traffic Control Devices for a Bike Lane</li> </ul>
10 Signs	<ul style="list-style-type: none"> <li>• General</li> <li>• Street Name Signs</li> <li>• Pedestrian Signs</li> <li>• Regulatory Signs for Intersections</li> <li>• Warning Signs for Intersections</li> <li>• Guide Signs for Intersections</li> </ul>	<ul style="list-style-type: none"> <li>• Signs Checklist</li> <li>• Traffic Control Devices for Dual Left-Turn Lanes</li> </ul>
11 Influences from Other Intersections	<ul style="list-style-type: none"> <li>• Influences from Other Intersections</li> <li>• Highway Railroad Grade Crossings</li> <li>• Driveways</li> <li>• Midblock Median Treatment</li> <li>• Signal Interconnection</li> </ul>	<ul style="list-style-type: none"> <li>• Realignment of Intersection</li> <li>• Control of Access to Driveways</li> <li>• Turning Restrictions</li> </ul>



## For More Details...

The Guide is contained within the following two volumes:

Product 0-4365-P2, *Urban Intersection Design Guide: Volume 1 – Guidelines*

Product 0-4365-P2, *Urban Intersection Design Guide: Volume 2 – Applications*

The research procedure and findings are documented in:

Report 0-4365-1, *Issues to Consider in Developing an Intersection Design Guide*

Report 0-4365-2, *Summary of Issues in Intersection Design*

Report 0-4365-4, *Turn Speeds and Crashes within Right-Turn Lanes*

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## TxDOT Implementation Status—January 2005

The results of this research project are proposed for implementation as a new online manual in the Design collection, available on both Crossroads and the TxDOT Internet site. The *Guidelines* and *Applications* documents will be hyperlinked to each other and to other department manuals where appropriate. These documents must go through the standard TxDOT approval process before they can be issued as online manuals. In addition, there is an effort underway to develop training sessions based on these documents.

For information, contact Sharon Barta, P.E., Research and Technology Implementation Office, at (512) 465-7403 or email sbarta@dot.state.tx.us.

### YOUR INVOLVEMENT IS WELCOME!

## Disclaimer

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