**Intersection Design**

**Effects on road safety of converting intersection to roundabouts.**

A meta analysis of studies reported outside the United States was performed to evaluate the effects on road safety of converting intersections to roundabouts. State-of-the-art techniques of meta analysis were applied to synthesize evidence from the evaluation studies. A meta regression analysis was performed and the possible presence of publication bias was tested and adjusted using the trim and fill method. The results show that roundabouts are associated with a 30% to 50% reduction in the number of injury accidents. Fatal accidents are reduced by 50% to 70%. Effects on property damage accidents are highly uncertain, but in three leg intersections an increase will often occur. Evidence from the evaluation studies, although highly uncertain, suggests that the effect of roundabouts on injury accidents is greater in four leg intersections than in three leg intersections, and is greater in intersections previously controlled by yield signs than in intersections previously controlled by traffic signals. Few studies have evaluated in detail the effects on safety of design parameters for roundabouts. Findings are inconsistent but majority of studies prove that roundabouts with small diameter are safer than the roundabouts of large diameter.

**Model for Sight-Distance Analysis of Uncontrolled Intersections**

The American Association of State Highway and Transportation Officials (AASHTO) model of calculating sight distance at intersections without control (Case I) has been modified to explicitly incorporate the design speeds of both intersecting roads in computing the required sight distance for each road. It is shown in this paper that using design speeds of both roads in the modified model will result in an inadequate sight distance for most vehicles. To address this issue, this paper presents a revised model that is based on a small percentile speed of the intersecting road (such as the 1 or 5 percentile). Using the revised model, design requirements of intersection sight distance (ISD) are established for passenger cars and trucks. The results show that the practice of using design speed in ISD analysis may result in significant underestimation of ISD requirements, particularly when the speed of the approaching vehicle on the intersecting road is extremely low. Furthermore, the amount of underestimation increases with an increase in the difference between the design speeds of the intersecting roads. For intersections with sight-distance restrictions, the standard solution is to reduce vehicle speed. However, it is interesting that, for some obstruction locations, it is necessary to increase the speed to satisfy sight-distance needs. An analytical method and a worksheet for finding the required (reduced or increased) speed are presented.

**Freeway and Interchange Design: A Historical Perspective**

**Summery:** This paper mainly discusses the freeway and interchange design. Controlled-access facilities for vehicular traffic first came into being during the 1920s. Since that time, their design has continually evolved as transportation professionals have gained increased experience in their operation, direction from research, and expanded knowledge.
of human factors related to driver characteristics and expectations. The need for such facilities was much as it is today--capacity and safety for highways to move people efficiently. By the late 1930s and early 1940s, freeways of significant length were constructed as part of a planned system of controlled-access facilities. A variety of different interchange forms came into being as well; the cloverleaf, diamond, and trumpet were the predominant types. By the late 1950s, every basic interchange form had been constructed. Although those basic types have not changed, geometric variations have been developed, constructed, and operationally tested. The following topics were discussed. They are the development and evolution of freeway and interchange design and the safety, operational, and human factors research over the last 30 years that has contributed to recognition of the interchange forms and design elements that produce safe and efficient operations consistent with driver characteristics and expectations.

**Intersection Diagnostic Review Module: Expert System For Geometric Design Review Of Intersections On Rural Two-Lane Highways**
Transportation Research Board

The Federal Highway Administration has sponsored the development of an expert system for diagnostic review of at-grade intersections on rural two-lane highways as a component of the Interactive Highway Safety Design Model (IHSDM). This system, the Intersection Diagnostic Review Module (IDRM), has been developed because conventional design practices and design review procedures often fail to explicitly address the safety consequences of geometric design decisions. In particular, combinations of geometric features may pose safety problems that current design policies do not address (e.g., an intersection in combination with a sharp horizontal curve and a steep grade). The expert system allows such problems to be identified and evaluated in an automated and organized fashion. The structure and knowledge base of this expert system are presented. The system identifies potential safety problems in an intersection design by applying decision rules based on models that quantify the extent to which particular problems may or may not be present. Established geometric design models (such as the sight distance models used in current design policies) as well as new models that have been developed from literature synthesis and judgments by geometric design and safety experts are included. The models that IDRM uses to identify potential safety problems and the threshold values used to determine whether particular problems exist are described. IDRM provides a series of advisory messages indicating design features that should be reviewed for potential safety-related concerns. The advisory messages are based on the nature and extent of concerns identified by comparison with established threshold values.

**The Need for Adequate Intersection Sight Distance In Roadway Design**
ITE Journal. 1988

The author states that the design of roadways often proceeds with little or no attention given to visibility at intersections of streets and driveways. He emphasizes the need for adequate sight distance at intersections and stresses the need to strictly adhere to standards set forth in the AASHTO Green Book. The article discusses further the
intersection of minor streets and through streets and the intersection of two through streets. He also discussed sight distance requirements for cross maneuvers. He concluded by stating that exceptions to the standards may sometimes be made but this should only be after careful consideration and evaluation and when cost, right-of-way, topography and other factors are important enough to dictate design. Also he concluded that special engineering studies would be required when the number of trucks entering the major roadway is anticipated to be large or when grades on the minor roadways are steep. Wooldridge, MD, Fambro, DB, Brewer, MA, Engelbrecht, RJ, Harry, SR, Cho, H.

At-Grade Intersections Near Highway-Railroad Grade Crossings

This paper examines the current state of the practice with regards to rail-road crossings, and suggests changes to the Texas DOT design manual. Considered in the recommendations are variations in the distance between different rail-road crossings, warning signs, the effect of “hump” crossings, and illumination to name a few. Unfortunately the recommended changes are not located in the document. The document's conclusion points to another online location to visit to view the suggested changes.

Lengths of (Double) Dual Left Turn Lanes
Transportation Research Board 2004

The Double Left Turn Lane (DLTL) is a relatively new feature in highway design, so information on its design parameters is limited. However, one of the critical design parameters in determining its effectiveness is the length. This paper develops a method to determining the length of the DLTL based on: (1) how drivers choose a lane with DLTL’s, (2) the probability that all left-turning vehicles arriving during the red phase can enter the left-turn lanes, eliminating overflow into through lanes and subsequent blockage, and (3) expressing sufficient lane length in number of vehicles which is later translated into distance based upon mixed types of vehicles. This method is performed using a practical application as a test subject.