AN INTEGRATED COMPUTER SYSTEM FOR ANALYSIS, SELECTION, AND EVALUATION OF UNCONVENTIONAL INTERSECTIONS

Problem

Unconventional intersections such as continuous flow intersections (CFI) and diverging diamond interchanges (DDI), have emerged as popular strategies for contending with recurrent and arterial congestion. Extensive results from simulation-based studies and limited field data from existing unconventional intersections, support widespread belief that such intersections can (1) increase the capacity for primary traffic movements while reducing total delay; (2) decrease the number of conflict points in an intersection by rerouting turning movements; and (3) produce more cost-effective solutions than conventional designs. However, despite growing interest in recent years, traffic engineers still lack efficient and reliable tools to assist with identifying potential design deficiencies.

Objective

The objective of this project was to develop a beta version software program that engineers can use for analyzing continuous flow intersections (CFI) and diverging diamond interchanges (DDI), two of the most popular unconventional intersection designs among traffic engineers.

Description

In order to accomplish the objective, the research team reviewed existing research and used calibrated traffic simulators using VISSIM to study and evaluate the operational strengths and deficiencies of CFI and DDI designs; reviewed CFI and DDI sites currently in operation in the United States and other countries; and developed queue and delay models for the evaluation of the design quality at the preliminary design or planning stage for both CFI and DDI.

The final stage of the project was to integrate the research team’s models and analytical results into an interactive computer program that can be used by SHA engineers and other potential users. This included developing basic guidance for each of the program’s modules.
Results

As a result of this project, a beta version software program, the Maryland Unconventional Intersection Design Tool (MUID), for planning and analyzing CFI and DDI designs, was developed. Building on the results of extensive simulation statistical experiments, the software includes 16 calibrated queue estimation models and four equations for computing total delay. The user-friendly interface makes it easy for users to perform a preliminary evaluation of any CFI or DDI design. To create a foundation for the future development of its operational modules for the final design stage, this study also investigated several critical issues that may affect the precise estimate of a design’s effectiveness, including the complex interrelationship between the spatial distribution of queue lengths at different bays; the effects of time-varying demand patterns on the resulting queues and delays; and the effects of intersection spacing, as well as signal control strategies, on the overall performance of a CFI or DDI design.

Because this project was the first to look at the production of effective tools for evaluating and designing unconventional intersections, much remains to be done including both theoretical development and field evaluation. Priority areas needed to enhance the capability of the MUID and to expand its scope of applications are summarized in the final report.

Report Information

Dr. Gang-Len Chang
University of Maryland
Department of Civil and Environmental Engineering
College Park MD 20742
gang@umd.edu