CHAPTER 1
INTRODUCTION AND RESEARCH APPROACH

RESEARCH PROBLEM STATEMENT

Geometric design refers to the selection of roadway elements that include the horizontal alignment, vertical alignment, cross section, and roadside of a highway or street. In general terms, good geometric design means providing the appropriate level of mobility and land use access for motorists, bicyclists, and pedestrians while maintaining a high degree of safety. The roadway design must also be cost effective in today’s fiscally constrained environment. While balancing these design decisions, the designer needs to provide consistency along a roadway alignment to prevent abrupt changes in the alignment that do not match motorists’ expectations. Speed is used both as a design criterion to promote this consistency and as a performance measure to evaluate highway and street designs. Geometric design practitioners and researchers are, however, increasingly recognizing that the current design process does not ensure consistent roadway alignment or driver behavior along these alignments.

A design process is desired that can produce roadway designs that result in a more harmonious relationship between the desired operating speed, the actual operating speed, and the posted speed limit. The goal is to provide geometric street designs that “look and feel” like the intended purpose of the roadway. Such an approach produces geometric conditions that should result in operating speeds that are consistent with driver expectations and commensurate with the function of the roadway. It is envisioned that a complementary relationship would then exist between design speed, operating speed, and posted speed limits.

RESEARCH OBJECTIVES

The goals of this research were to reevaluate current procedures, especially how speed is used as a control in existing policy and guidelines, and then develop recommended changes to the design process.

To accomplish these goals, the following objectives were met:

- Review current practices to determine how speed is used as a control and how speed-related terms are defined. Also identify known relationships between design speed, operating speed, and posted speed limit.
- Identify alternatives to the design process and recommend the most promising alternatives for additional study.
- Collect data needed to develop the recommended procedure(s).
- Develop a set of recommended design guidelines and/or modifications for the AASHTO A Policy on Geometric Design of Highways and Streets (commonly known as the Green Book).

RESEARCH APPROACH

The research project was split into two phases. Within Phase I, the research team conducted the following efforts:

- reviewed the research literature to identify known relationships between design, operating, and posted speed limit;
- determined current state and local practices using a mail-out survey;
- traced the evolution of various speed definitions and identified how they are applied;
- critically reviewed current design elements to determine if they are or need to be based on speed;
- prepared the interim report that summarized the findings from Phase I that included alternative design procedures; and
- prepared a revised work plan for Phase II.

At the conclusion of Phase I, the panel for this project reviewed the alternative design procedures and provided feedback on which alternatives should be investigated as part of Phase II of the project. The following alternatives were selected by the panel members for investigation:

- change definitions and
- develop roadway design class approach.

These alternatives were not selected for additional investigation, although the panel indicated interest in them:

- define intermediate speed class,
- add regional variation consideration,
- add consistency check-speed,
• add speed prediction, and
• add driver expectancy.

Within Phase II, the research team conducted the following efforts:

• facilitated the inclusions of similar speed definitions into key reference documents that were being revised during this project (i.e., Green Book and MUTCD),
• collected field data to more fully develop the recommendations on changes to the design process,
• investigated whether a driver simulator could be used to supplement the collected field data,
• collected data on the distribution of roadway and roadside characteristics for existing roadways,
• reviewed how design speed is selected,
• investigated how the 85th percentile speed influences the selection of the posted speed limit value,
• developed recommended changes to the AASHTO Green Book, and
• prepared the final report.

ORGANIZATION OF THIS REPORT

This report includes the following chapters and appendixes:

Chapter 1. Introduction and Research Approach. Presents an introduction to the report and summarizes the research objectives and approach.

Chapter 2. Findings. Contains the findings from the various efforts conducted during the project.

Chapter 3. Interpretation, Appraisal, Applications. Discusses the meaning of the findings presented in Chapter 2.

Chapter 4. Conclusions and Suggested Research. Summarizes the conclusions and suggested research from this project’s efforts.

Appendix A. Suggested Changes to the Green Book. Contains suggested changes to the Green Book based on the findings from the research project.

Appendix B. Mailout Survey. Provides the individual findings from the mailout survey and a copy of the original survey.

Appendix C. Design Element Reviews. Discusses the relationship between speed and geometric design elements that were evaluated in three areas: use of design speed, operations, and safety. Also summarizes various definitions for design speed and operating speed.

Appendix D. Previous Relationships Between Design, Operating, and Posted Speed Limit. Identifies the relationships between the various speed terms from the literature.

Appendix E. Field Studies. Presents the methodology and findings from the field studies.

Appendix F. Driving Simulator Study. Presents the findings from a small preliminary study on driver speeds to different functional class roadway scenes.

Appendix G. Selection of Design Speed Values. Identifies approaches being used to select design speed within the states and discusses approaches that could be considered for inclusion in the Green Book.

Appendix H. Operating Speed and Posted Speed Relationships. Investigates how 85th percentile speed is being used to set posted speed limit.

Appendix I. Distributions of Roadway and Roadside Characteristics. Identifies the distribution of design elements in two cities and for the field data (see Appendix E) by posted speeds and design classes.

Appendix J. Alternatives to Design Process. Presents the alternatives to the design process identified in Phase I of the research.