PART B—ROADWAY SAFETY MANAGEMENT PROCESS

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PART B INTRODUCTION AND APPLICATIONS GUIDANCE

B.1. PURPOSE OF PART B

Part B presents procedures and information useful in monitoring and reducing crash frequency on existing roadway networks. Collectively, the chapters in *Part B* are the roadway safety management process.

A roadway safety management process is a quantitative, systematic, process for studying roadway safety on existing transportation systems, and identifying potential safety improvements.

The six steps of the roadway safety management process are:

- *Chapter 4 – Network Screening*: Reviewing a transportation network to identify and rank sites based on the potential for reducing average crash frequency.
- *Chapter 5 – Diagnosis*: Evaluating crash data, historic site data, and field conditions to identify crash patterns.
- *Chapter 6 – Select Countermeasures*: Identifying factors that may contribute to crashes at a site and selecting possible countermeasures to reduce the average crash frequency.
- *Chapter 7 – Economic Appraisal*: Evaluating the benefits and costs of the possible countermeasures and identifying individual projects that are cost-effective or economically justified.
- *Chapter 8 – Prioritize Projects*: Evaluating economically justified improvements at specific sites, and across multiple sites, to identify a set of improvement projects to meet objectives such as cost, mobility, or environmental impacts.
- *Chapter 9 – Safety Effectiveness Evaluation*: Evaluating effectiveness of a countermeasure at one site or multiple sites in reducing crash frequency or severity.

Part B chapters can be used sequentially as a process; or they can be selected and applied individually to respond to the specific problem or project under investigation.

The benefits of implementing a roadway safety management process include:

- Systematic and repeatable process for identifying opportunities to reduce crashes and identifying potential countermeasures resulting in a prioritized list of cost-effective safety countermeasures.
- A quantitative and systematic process that addresses a broad range of roadway safety conditions and tradeoffs.
- The opportunity to leverage funding and coordinate improvements with other planned infrastructure improvement programs.
- Comprehensive methods that consider traffic volume, collision data, traffic operations, roadway geometry, and user expectations.
- The opportunity to use a proactive process to increase the effectiveness of countermeasures intended to reduce crash frequency.

There is no such thing as absolute safety. There is risk in all highway transportation. A universal objective is to reduce the number and severity of crashes within the limits of available resources, science, technology and legislatively-mandated priorities. The material in Part B is one resource for information and methodologies that are used in efforts to reduce crashes on existing roadway networks. Applying these methods does not guarantee that crashes will decrease across all sites; the methods are a set of tools available for use in conjunction with sound engineering judgment.

B.2. PART B AND THE PROJECT DEVELOPMENT PROCESS

Exhibit B-1 illustrates how the various chapters in Part B align with the traditional elements of the project development process introduced in *Chapter 1*. The chapters in *Part B* of the HSM are applicable to the entire process; in several cases individual chapters can be used in multiple stages of the project development process. For example:

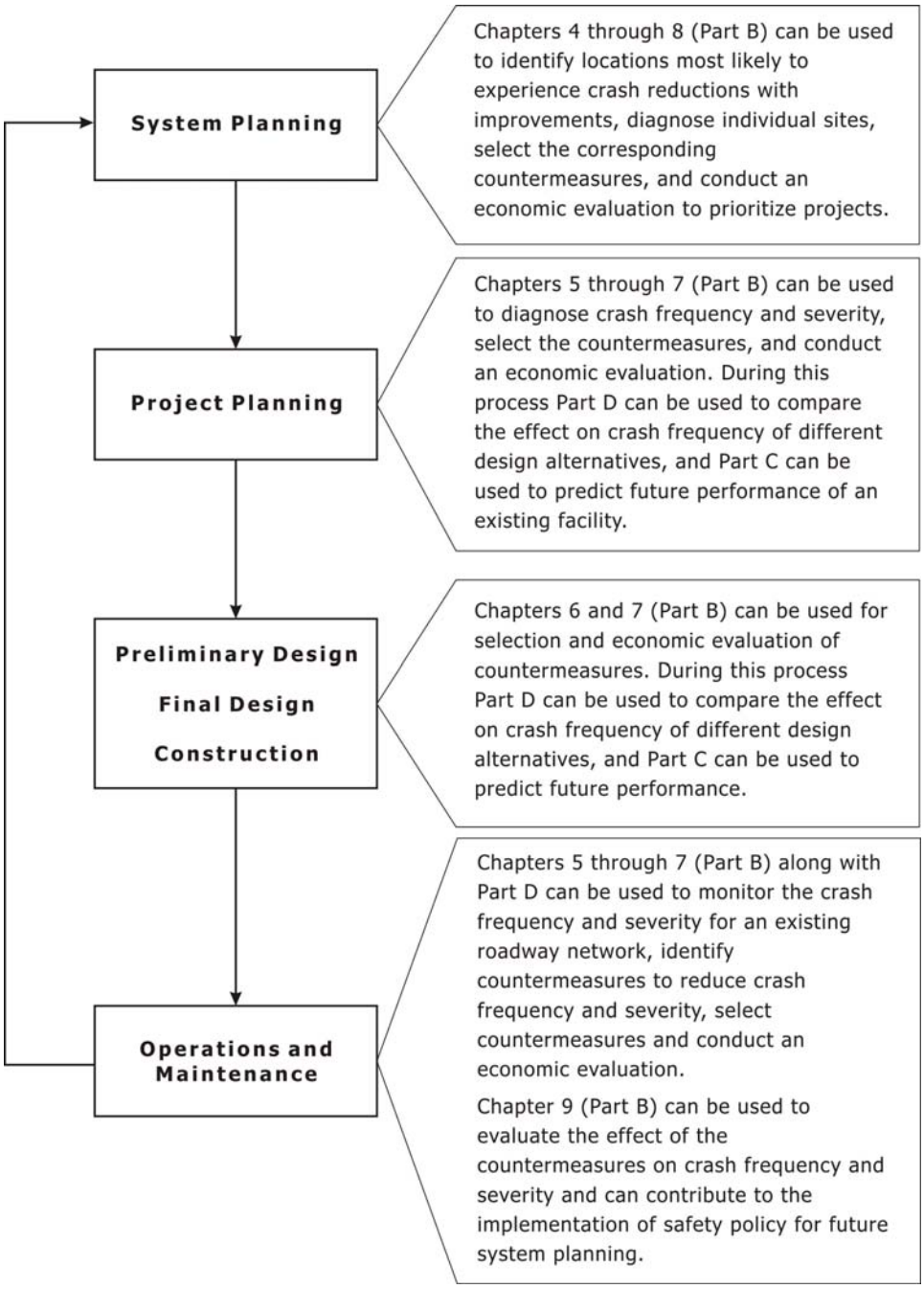
- System Planning: *Chapters 4, 7,* and *8* present methods to identify locations within a network with potential for a change in crash frequency. Projects can then be programmed based on economic benefits of crash reduction. These improvements can be integrated into long-range transportation plans and roadway capital improvement programs.

- Project Planning: As jurisdictions are considering alternative improvements and specifying project solutions, the diagnosis (*Chapter 5*), countermeasure selection (*Chapter 6*), and economic appraisal (*Chapter 7*) methods presented in *Part B* provide performance measures to support integrating crash analysis into a project alternatives analysis.

- Preliminary Design, Final Design and Construction: Countermeasure selection (*Chapter 6*) and Economic Appraisal (*Chapter 7*) procedures can also support the design process. These chapters provide information that could be used to compare various aspects of a design to identify the alternative with the lowest expected crash frequency and cost.

- Operations and Maintenance: Safety Effectiveness Evaluation (*Chapter 9*) procedures can be integrated into a community's operations and maintenance procedures to continually evaluate the effectiveness of investments. In addition, Diagnosis (*Chapter 5*), Selecting Countermeasures (*Chapter 6*), and Economic Appraisal (*Chapter 7*) procedures can be evaluated as part of ongoing overall highway safety system management.

Exhibit B-1: The Project Development Process



B.3. APPLYING PART B

Chapter 4 presents a variety of crash performance measures and screening methods for assessing historic crash data on a roadway system and identifying sites which may respond to a countermeasure. As described in *Chapter 4*, there are strengths and weaknesses to each of the performance measures and screening methods that may influence which sites are identified. Therefore, in practice it may be useful to use multiple performance measures and/or multiple screening methods to identify possible sites for further evaluation.

Chapters 5 and *6* present information to assist with reviewing crash history and site conditions to identify a crash pattern at a particular site and identify potential countermeasures. While the HSM presents these as distinct activities, in practice they may be iterative. For example, evaluating and identifying possible crash contributing factors (*Chapter 6*) may reveal the need for additional site investigation in order to confirm an original assessment (*Chapter 5*).

The final activity in *Chapter 6* is selecting a countermeasure. *Part D* of the HSM presents countermeasures and, when available, their corresponding Accident Modification Factors (AMF). The AMFs presented in *Part D* have satisfied the screening criteria developed for the HSM, which is described in the *Part D Introduction and Applications Guidance*. There are three types of information related to the effects of treatments:

1) a quantitative value representing the change in expected crashes (i.e., an AMF);

2) an explanation of a trend (i.e., change in crash frequency or severity) due to the treatment, but no quantitative information; and,

3) an explanation that information is not currently available.

Chapters 7 and *8* present information necessary for economically evaluating and prioritizing potential countermeasures at any one site or at multiple sites. In *Chapter 7*, the expected reduction in average crash frequency is calculated and converted to a monetary value or cost-effectiveness ratio. *Chapter 8* presents prioritization methods to select financially optimal sets of projects. Because of the complexity of the methods, most projects require application of software to optimize a series of potential treatments.

Chapter 9 presents information on how to evaluate the effectiveness of treatments. This chapter will provide procedures for:

- Evaluating a single project to document the change in crash frequency resulting from that project;
- Evaluating a group of similar projects to document the change in crash frequency resulting from those projects;
- Evaluating a group of similar projects for the specific purpose of quantifying a countermeasure AMF; and,
- Assessing the overall change in crash frequency resulting from specific types of projects or countermeasures in comparison to their costs.

Knowing the effectiveness of the program or project will provide information suitable to evaluate success of a program or project, and subsequently support policy and programming decisions related to improving roadway safety.

B.4. RELATIONSHIP TO PARTS A, C, AND D OF THE HIGHWAY SAFETY MANUAL

Part A: Introduction, Human Factors and Fundamentals

Part A provides introductory and fundamental knowledge for application of the HSM. An overview of Human Factors (*Chapter 2*) is presented to support engineering assessments in *Parts B* and *C*. *Chapter 3* presents fundamentals for the methods and procedures in the HSM. Concepts from *Chapter 3* that are applied in *Part B* include: expected average crashes, safety estimation, regression to the mean and regression-to-the-mean bias, and empirical Bayes methods.

Part C of the HSM introduces techniques for estimating crash frequency of facilities being modified through an alternatives analysis or design process. Specifically, *Chapters 10-12* present a predictive method for two-lane rural highways, multilane rural highways, and urban and suburban arterials, respectively. The predictive method in *Part C* is a proactive tool for estimating the expected change in crash frequency on a facility due to different design concepts. The material in *Part C* can be applied to the *Part B* methods as part of the procedures to estimate the crash reduction expected with implementation of potential countermeasures.

Part C: Predictive Methods

Finally, as described above, *Part D* consists of accident modification factors that can be applied in *Chapters 4, 6, 7, and 8*. The accident modification factors are used to estimate the potential crash reduction as the result of implementing a countermeasure(s). The crash reduction estimate can be converted into a monetary value and compared to the cost of the improvement and the cost associated with operational or geometric performance measures (e.g., delay, right-of-way).

Part D: Accident Modification Factors

B.5. SUMMARY

The roadway safety management process provides information for system planning, project planning, and near-term design, operations, and maintenance of a transportation system. The activities within the roadway safety management process provide:

- Awareness of sites that could benefit from treatments to reduce crash frequency or severity (*Chapter 4 Network Screening*);
- Understanding crash patterns and countermeasure(s) most likely to reduce crash frequency (*Chapter 5 Diagnosis*, *Chapter 6 Select Countermeasures*) at a site;
- Estimating the economic benefit associated with a particular treatment (*Chapter 7 Economic Appraisal*);
- Developing an optimized list of projects to improve (*Chapter 8 Prioritize Projects*); and,
- Assessing the effectiveness of a countermeasure to reduce crash frequency (*Chapter 9 Safety Effectiveness Evaluation*).

The activities within the roadway safety management process can be conducted independently or they can be integrated into a cyclical process for monitoring a transportation network.

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