SUMMARY

The purpose of the manual is to improve the quality of transportation research. It was written in response to a perceived need for a single, comprehensive source of information on the conduct of research. Emphasis has been placed on applied research because this constitutes the dominant research activity of most transportation agencies. The manual includes state-of-the-art techniques for problem statement development; literature searching; development of the research work plan; execution of the experiment; data collection, management, quality control, reporting of results; and evaluation of the effectiveness of the research, as well as the requirements for the systematic, professional, and ethical conduct of transportation research. The recommended practices are based largely on the procedures of the Transportation Research Board. The contents of Volume I have been organized into five chapters and five appendices.

The manual has been written for transportation agency personnel who perform or supervise research, though it will also be useful to people conducting transportation research in other work environments such as universities and consulting. The contents are directed primarily to individuals with a college or university education, but with no formal training in research. The presentation presumes that the reader has completed a basic course in statistics, and is comfortable working with a personal computer.

Research involves careful study and investigations to discover new facts or information. Basic research is undertaken to extend knowledge and understanding without concern for the utility of the findings, whereas applied research is undertaken in pursuit of specific objectives with quantifiable benefits. All scientific research is built on a foundation of trust, which demands that reports and papers are honest attempts by the authors to describe the results of their work accurately, and without bias. Chapter One introduces the principles of scientific research, and explains the protocols that have evolved for the professional and ethical conduct of research.

Problems in science are usually solved by a rigorous, systematic approach. This is sometimes called “the scientific method”, although there are three types of investigation that can be recognized: the observational method, the experimental method, and the survey method. Experimental work begins with a hypothesis. The experiment is then designed to either prove or disprove the validity of the hypothesis. Chapter Two explains terminology and the principles of scientific investigation. It also discusses barriers to good science, including reasoning that is illogical, lack of proper controls, insufficient repetitions, bias, and sustaining unsuccessful projects.

Chapter Three describes the research process at the project level and includes sections on problem statement development, project selection, requests for qualifications or proposals, reviewing proposals, development and execution of the work plan, the dissemination and implementation of the findings, and evaluation of the research project. Where the conduct of research includes activities that overlap with management issues, such as measuring progress, these activities are included at appropriate places in the chapter. However, purely management issues, such as program development, funding, staffing and administration, are not included.

Issues involved in the collection and management of data are contained in Chapter Four. Answers are provided to issues that arise during the chronological life of a project, i.e. before, during, and after data collection, after data analysis, and after the study is complete. The chapter includes an explanation of the organization of data, records and files, and a discussion of how to determine the integrity and validity of data. Actual data should be compared with anticipated data and, if

necessary, modifications made to the research plan before large quantities of data have been collected. Checks applied to the data prior to the main analysis can be very effective in saving resources and in enhancing the validity of the study.

A research study is not complete until a written report has been completed. Chapter Five provides an overview of the organization and content of reports and technical papers. Detailed instructions are given on the content of each chapter in a report, as well as a discussion of the researcher's obligations under the Copyright Act. Guidance is given on the use and misuse of graphs. A final section provides a brief summary of the requirements for making visual aids and giving a successful oral presentation.

Useful references that were cited in the development of chapters one through five are listed after Chapter Five.

The five appendices to the manual supplement the text. They include guidance on conducting literature searches and gives details on sources of information (Appendix A). Appendix B complements Chapter Three and provides background information, additional detail, and examples of documents used in the life a research project. Appendix C provides additional information on the writing and format of reports. Appendix D describes the process of peer review of technical and scientific papers. A checklist of the items that comprise the key steps in the research process is contained in Appendix E.

Volume II, Design, Analysis, and Interpretation, delves into more detail on statistical methods and applications. It is intended to provide support for the statistical details and applications encountered in research, whereas Volume I is more focused on research management issues.