

INTRODUCTION

PURPOSE

This synthesis summarizes the systems engineering processes and methodologies, including those that have been developed and used by transportation agencies. It reports on the traffic engineering community's experience with various systems engineering approaches. The major aspects of the synthesis study are as follows:

- Definition of systems engineering and identification of the general processes, steps, and methodologies commonly used in industry.
- Relation of these processes to traffic signal systems.
- Potential requirements for traffic signal systems processes.
- Existing traffic signal systems processes and deficiencies.

- Results of a survey of transportation agencies to identify the practices currently used, the extent to which they are used, and user satisfaction with the results.
- Additional information that the survey respondents feel is required.
- Relative importance of various issues in traffic signal systems engineering.
- Recommendations for the development of additional methodologies and documentation.

BACKGROUND

Transportation agencies are developing, redesigning, or upgrading traffic signal systems using a number of different processes with varying degrees of success. Figure 1 highlights the city and county of Denver, Colorado's



FIGURE 1 The city and county of Denver (Colorado) Public Works Department maintains a website describing traffic signal upgrades using advanced technologies. (Courtesy: City and County of Denver Public Works Department.)

program for upgrading its signal system. Systems engineering processes have been successfully applied to the design of similar complex systems in other industries. Systems engineering logically identifies requirements and ensures that the resulting systems satisfy those requirements throughout their life cycle. Such processes can aid transportation agencies in the planning, design, operations, and maintenance of their systems in a manner that supports interoperability and growth.

Chapter two presents systems engineering approaches, definitions, and key resources. Chapter three provides an overview of various systems engineering approaches based on a review of the relevant literature and current methodologies used by state and local organizations. Chapter four reviews the current state of the practice considering the

extent to which operational agencies use systems engineering. Chapter five summarizes the results of current, formal engineering practices in planning and evaluating traffic signal systems by the surveyed organizations. Chapter six presents a summary of the findings. Suggestions are offered to resolve current shortcomings and to prepare a user-friendly document for practitioners. Abbreviations used in the report are provided after the references. The appendixes provide a copy of the survey questionnaire (Appendix A) and a list of survey respondents (Appendix B), as well as examples of the Structured Analysis Process (Appendix C) and the Quality Functional Deployment Methodology (Appendix D), Interface Alternatives for Communicating with Controllers (Appendix E), and Methodology for Communication System Selection (Appendix F).