Traffic Signal Systems Operations And Design An Activity Based Learning Approach Book 1 Isolated Intersections

This monograph is a synthesis of research carried out on traffic signal performance measures based on high-resolution controller event data, assembled into a methodology for performance evaluation of traffic signal systems. High-resolution data consist of a log of discrete events such as changes in detector and signal phase states. A discussion is provided on the collection and management of the signal event data and on the necessary infrastructure to collect these data. A portfolio of performance measures is then presented, focusing on several different topics under the umbrella of traffic signal systems operation. System maintenance and asset management is one focus. Another focus is signal operations, considered from the perspectives of vehicle capacity allocation and vehicle progression. Performance measures are also presented for nonvehicle modes, including pedestrians, and modes that require signal preemption and priority features. Finally, the use of travel time data is demonstrated for evaluating system operations and assessing the impact of signal retiming activities.

TRB’s second Strategic Highway Research Program (SHRP 2) Report S2-L06-RR-1: Institutional Architectures to Improve Systems Operations and Management examines a large number of topics concerning organizational and institutional approaches that might help transportation agencies enhance highway operations and travel time reliability.

This report provides a guideline to estimate the staffing and resource needs required to effectively operate and maintain traffic signal systems. The results of a survey performed under this project, as well as a review of the literature and other surveys indicated that agencies achieving a high level of signal system performance do so under a wide variety of conditions such as agency size, geography, system complexity and traffic conditions that do not adhere to the typical level of documented resource requirements. Accordingly, a set of performance-based criteria were developed to define requirements. The performance-based criteria are focused on establishing realistic and concise operations objectives and performance measures.

This issue explores 10 papers related to traffic signal systems, including: MESCOP: A Mesoscopic Traffic Simulation Model to Evaluate and Optimize Signal Control Plans Strategy for Multiobjective Transit Signal Priority with Prediction of Bus Dwell Time at Stops Empirical Evaluation of Transit Signal Priority: Fusion of Heterogeneous Transit and Traffic Signal Data and Novel Performance Measures Fine-Tuning Time-of-Day Transitions for Arterial Traffic Signals Use of Maximum Vehicle Delay to Characterize Signalized Intersection Performance Traffic Signal Battery Backup Systems: Use of Event-Based Traffic Controller Logs in Performance-Based Investment Programming Study of Truck Driver Behavior for Design of Traffic Signal Yellow and Clearance Timings Online Implementation and Evaluation of Weather-Responsive Coordinated Signal Timing Operations Resonant Cycles Under Various Intersection Spacing, Speeds, and Traffic Signal Operational Treatments Implementation of Real-Time Offset-Tuning Algorithm for Integrated Corridor Management

In this project, Florida Atlantic University researchers developed a methodology and software tools that allow objective, quantitative analysis of the performance of signal systems.

TRB's Transportation Research Record: Journal of the Transportation Research Board, No.

2080 includes 13 papers that explore the preempt trap of the highway-railway interface, fully actuated versus nonactuated coordinated phases, effectiveness of lead-lag phasing on progression bandwidth, high-resolution queue discharge and the effect on signal phasing, integration of real-time pedestrian performance measures into traffic signal systems, microsimulation of split-cycle offset optimization technique and coordinated actuated traffic control, and piecewise optimum delay estimation for improved signal control. This issue of the TRR also examines microsimulation of traffic operations at intersections in malfunction flash mode, variable maximum green time to improve rural traffic signal operations, stopping behavior at urban signalized intersections, traffic controller performance of coordinated actuated signal systems during time-of-day transition, unacceptable video detector performance for dilemma zone protection, and robust synchronization of arterial actuated signals.

TRB?s Transportation Research Record: Journal of the Transportation Research Board 1867 examines several algorithms that estimate speed from traffic surveillance cameras in a variety of traffic, weather, and lighting conditions; identify bottleneck locations, the active times, and the delays that are caused; and are applied to the archived loop detector data in the I-4 data warehouse.

Typical vehicle detection systems used in traffic signal operations are comprised of inductive loop detectors. Because of costs, installation challenges, and operation and maintenance issues, many alternative "non-intrusive" systems have been developed and are now commercially available. Field-testing was conducted to evaluate eight alternative vehicle detection systems (four video, one radar, one infrared, and two hybrid) at the stop bar zone of a signalized intersection under six conditions: (a) daytime, (b) nighttime, (c) favorable conditions, (d) windy conditions, (e) rain, and (f) snow. With several exceptions, performance generally degraded in nighttime when compared with day light conditions, and in adverse versus favorable weather conditions. In general, radar and hybrid systems performed with the greatest accuracy.

This handbook, which was developed in recognition of the need for the compilation and dissemination of information on advanced traffic control systems, presents the basic principles for the planning, design, and implementation of such systems for urban streets and freeways. The presentation concept and organization of this handbook is developed from the viewpoint of systems engineering. Traffic control studies are described, and traffic control and surveillance concepts are reviewed. Hardware components are outlined, and computer concepts, and communication concepts are stated. Local and central controllers are described, as well as display, television and driver information systems. Available systems technology and candidate system definition, evaluation and implementation are also covered. The management of traffic control systems is discussed.

Most current traffic signal systems are operated using a very archaic traffic-detection simple binary logic (vehicle presence/non presence information). The logic was originally developed to provide input for old electro-mechanical controllers that were developed in the early 1920s. It is currently in urgent need to improve the performance of traffic control devices. With the development of automatic controls, sensors, and

devices, it is now possible to design advanced intersection control systems that can fully utilize advanced technologies of detection and communication as well as the high quality data acquired by such technologies. One example of such systems is Vehicle Infrastructure Integration (VII). VII links vehicles, drivers, and surrounding infrastructure (which includes roadways, traffic controls, etc.) to improve the efficiency of traffic systems and promote transportation safety. It promises to "bridge the gap" between the infrastructure and individual drivers. The purpose of this research is to 1. Investigate the potential to utilize VII data to characterize system operation and estimate system-wide measure of performance, and 2. Develop advanced signal timing procedures that can capitalize on VII data and enhance the operations of traffic signal system operations. Three advanced traffic signal control systems are developed and tested in this research. The advantages of such systems were tested in terms of time savings, the environment, and system improvements.

TRB's Transportation Research Record: Journal of the Transportation Research Board, No. 2128 includes 23 papers that explore green time at congested traffic signals, traffic signal maintenance and operations needs, railroad-preempted intersections, three dimensional mapping of inductive loop detector sensitivity, cycle length performance measures, bus priority strategies on arterials controlled by SCOOT, tolerances for magnetometer orientation and field calibration procedure, and optimization of coordinated-actuated traffic signal system. This issue of the TRR also examines bicyclist intersection crossing times, left-turn signal control, optimizing traffic control to reduce fuel consumption and exhaust emissions, optimizing signal timings from the field, platoon-priority and advance warning flasher system at high-speed intersections, prediction of red light running, microscopic modeling of traffic signal operations, lost time and cycle length for an actuated traffic signal, specifying vehicle detection performance, local synchronization control scheme for congested interchange areas, distributed Ethernet network of advanced pedestrian signals, comparison of before-after versus off-on adaptive traffic control evaluations, generating traffic scenarios for large arterial networks, evaluating green-extension policies, and safety evaluation for intergreen intervals at signalized intersections.

Traffic Signal Systems Operations and DesignBook1: Isolated IntersectionsTraffic Control System OperationsInstallation, Management, and MaintenanceInst of Transportation EngrsTraffic Operation, Traffic Signal Systems, and Freeway Operations 1995 (R1494).Freeway Operations and Traffic Signal Systems, 2004

This document discusses the highway operations, capacity, and traffic control. It also describes the regional transportation systems management and operations and the traffic signal systems.

This project was conducted to investigate new concepts, new tools and emerging technologies directed at enhancing traffic operations and safety on signalized urban arterials that operate under saturated conditions. McFarland Boulevard, a six-lane urban arterial running north-south through Tuscaloosa, AL served as the research focus and test bed for the project. There are nine urban intersections along the study route, with a variety of configurations, turning movements and traffic volumes. In a unique approach, this project was conducted as three related and parallel efforts by the three participating UTCA universities. UAH investigated the feasibility of using video data for determining control delay on the approach to signalized intersections, and used the

results to investigate the accuracy of delay predictions by popular simulation models. UAB investigated use of VISTA as a simulation model for saturated arterial traffic flow analysis. UA investigated methods to optimize traffic flow at saturated intersections through enhanced simulation models.

This report provides a guideline to estimate the staffing and resource needs required to effectively operate and maintain traffic signal systems. In 2007, the NTOC Traffic Signal Report Card (TSRC) assigned a grade of D nationally to how agency programs support the efficient operation and maintenance of traffic signals (5). The D grade indicates that relative to what is considered "good practice", overwhelmingly an ad-hoc approach is taken, resulting in some positive outcomes, but generally agency programs are not as effective as they could be.