Adaptive Signal Control Gradually Emerging As a New Way to Decrease Costs Associated With Delays, Stops and Fuel Consumption

Prepared by Ken Winter, October 2007

KEY SEARCH TERMS:
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Adaptive Control Systems
Traffic Signal Control Systems
Real-Time Control

Research Synthesis Bibliography No. 14

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Florida, Minnesota and Wisconsin DOTs Experiment With Adaptive Signal Control

Since the 1960s time-of-day/day-of-week strategy has been used to select traffic control system timing plans. More recently, adaptive control systems (ACSs) have been developed. In these systems, signal timing parameters are generated in real-time based on detector measurements. ACS strategies can be applied at a single location, along arterial routes, or in grid networks. Decisions about timing plans are either made at a central location or at the local intersections, or both.

Florida, Minnesota and Wisconsin DOTs are experimenting with adaptive signal control to determine whether the benefits of ACS justify their cost (estimated at $10,000-$40,000 per intersection). In 2001 FHWA developed a low-cost adaptive traffic signal timing system (ACS-Lite) designed to take advantage of the closed loop architecture estimated to comprise 90% of the traffic signal systems in the U.S.

FHWA’s Arterial Management Program Web Site can provide practitioners with guidance, recommended practices, manuals and other technical resources to help improve their knowledge of traffic signal timing processes is also crucial in enhancing the state-of-the-practice. In addition to the specific citations listed in this RSB, the FHWA site may be the best starting place to learn more about how practitioners are using ACS in the United States. For more information, see: http://www.ops.fhwa.dot.gov/arterial_mgmt/pubs.htm

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ACSLite Algorithmic Architecture: Applying Adaptive Control System Technology To Closed-Loop Traffic Signal Control Systems


ABSTRACT: ACS-Lite is being developed by the Federal Highway Administration to be a cost-effective solution for applying adaptive control system (ACS) technology to current, state-of-the-practice closed-loop traffic signal control systems. This effort is intended to make ACS technology accessible to many jurisdictions without the upgrade and maintenance costs required to implement ACS systems that provide optimized signal timings on a second-by-second basis. The ACS-Lite system includes three major algorithmic components: a time-of-day (TOD) tuner, a run-time refiner, and a transition manager. The TOD tuner maintains plan parameters (cycle, splits, and offsets) as the long-term traffic conditions change. The run-time refiner modifies the cycle, splits, and offsets of the plan that is currently running based on observation of traffic conditions that are outside the normal bounds of conditions this plan is designed to handle. The run-time refiner also determines the best time to transition from the current plan to the next plan in the schedule, or, like a traffic-responsive system, it might transition to a plan that is not scheduled next in the sequence. The transition manager selects from the transition methods built in to the local controllers to balance the time spent out of coordination with the delay and congestion that is potentially caused by getting back into step as quickly as possible. These components of the ACS-Lite algorithm architecture are described and the similarities and differences of ACS-Lite with state-of-the-art and state-of-the-practice adaptive control algorithms are discussed. Closed-loop control system characteristics are summarized to give the context in which ACS-Lite is intended to operate.

ACCESS: Available at the VDOT Research Library, call number TA 1001.5 .T71 no.1856

Adaptive Control Strategy For Traffic Systems


ABSTRACT: As demand and congestion levels continue to rise, many traffic system providers are looking toward real-time, traffic-adaptive signal control systems as a powerful strategy for managing traffic. This paper explores some of the important issues related to adaptive signal control and its role in advanced traffic management systems (ATMS). The primary motivation for the development and deployment of adaptive control systems is the promise of improved performance with reduced requirements for signal timing plans. Adaptive control strategies continually adapt to traffic demand without the dependence on signal timing plans that were developed for assumed volume levels. The ability of adaptive control strategies to improve operational performance is based on the ability to respond to changes in traffic flow, especially unanticipated or short-term changes. Adaptive signal control strategies are particularly well suited to managing traffic in situations where traffic flow has a high degree of variability and traditional timing plans are difficult to develop and maintain. This paper concentrates on adaptive signal control, acknowledging that it is only one important component of ATMS. It examines some of the
important issues related to system performance, hardware and software requirements, and system configuration and management. Although the discussion attempts to be general in nature, where appropriate, it refers to the design, development, and integration of the real-time, hierarchical, optimized, distributed, effective, system for traffic control (RHODES).

ACCESS: Available through Interlibrary Loan.

Adaptive Signal Control IV : Evaluation Of The Adaptive Traffic Control System In Park City, Utah
ABSTRACT: The purpose of this project is to deploy and evaluate the effectiveness of the future Utah Department of Transportation (UDOT) Adaptive Traffic Control System (ATCS) on an arterial street network in Park City, Utah that experiences both everyday and unpredictable changes in traffic flow. Note: Note(s): Performed by Civil and Environmental Engineering, University of Utah ; Rept no. UTL-0505-83./ "December 2005"

Adaptive Signal Control System With On-Line Performance Measure For Single Intersection
ABSTRACT: In this paper, the authors present an adaptive signal control system utilizing an on-line signal performance measure. The proposed method unlike conventional signal control systems, uses real-time delay estimation and an on-line signal timing update algorithm. As a signal performance measure, intersection delay for each phase is measured in real-time using an advanced surveillance system that re-identifies individual vehicles at both upstream and downstream stations using vehicle waveforms that are obtained from advanced inductive loop detectors. In each cycle, the signal timing plan is optimized based on the delay estimated from the vehicle reidentification technology. The primary features of the algorithm is the on-line control capability using direct intersection delay measures. The paper describes the overall control system architecture and the optimization algorithm. In order to evaluate the performance of the proposed system, the Paramics high-performance microscopic traffic simulation program is used.

Adaptive Strategies For Managing Traffic Demand Along Signalized Oversaturated Arterials
ABSTRACT: This paper describes an adaptive dynamic procedure to design and evaluate signal coordination and queue management strategies along oversaturated arterials. The procedure can initiate queue management plans with different degrees of priority to mainline and cross-street traffic. It is based on a dynamic procedure that designs signal control parameters (offsets and green times) with explicit consideration of current and projected queue lengths. The main idea is to dynamically manage the formation and dissipation of queues on system links using a responsive signal control algorithm that can be customized to assign different priorities to arterial and cross street traffic to achieve a desired queue management strategy. The problem was formulated as a throughput maximization subject to state, control and queue management strategy choices. Solutions were obtained using Genetic Algorithms (GAs). Several queue management strategies with
varying degrees of priority to arterial and cross street traffic were tested. The results showed that the proposed procedure was able to initiate signal timing plans to respond to different traffic needs and priorities, and was able to discriminate between the merits and drawbacks of the different management plans. The procedure is adaptive and dynamic, therefore has very good potential for real-time implementation in ITS setting. ACCESS: Available at the VDOT Research Library, call number CD-ROM TE 228.3 .W69 2001

**Advanced Traffic Management Systems And Automated Highway Systems 2000**

*(NOTE: Entire issue devoted to this topic)*


ABSTRACT: Transportation Research Record contains the following papers: Impact of emergency vehicle preemption on signalized corridor operation : an evaluation (Nelson,EJ and Bullock,D); Development and evaluation of intelligent bus priority concept (Balke,KN, Dudek,CL and Urbanik,T); Control strategies for transit priority (Skabardonis,A); SCOOT real-time adaptive control in a CORSIM simulation environment (Hansen, BG, Martin,PT and Perrin,HJ); Enhanced genetic algorithm for signal-timing optimization of oversaturated intersections (Park, BB, Messer,CJ and Urbanik,T); Traffic signal coordination across jurisdictional boundaries : field evaluation of efficiency, energy, environmental, and safety impacts (Rakha,H, Medina,A, Sin,H and Dion,F); Comparison of VISSIM and CORSIM traffic simulation models on a congested network (Bloomberg,L and Dale,J); Genetic algorithms for traffic signal control and queue management of oversaturated two-way arterials (Abu-Lebdeh,G and Benekohal,RF); Signal coordination and arterial capacity in oversaturated conditions (Abu-Lebdeh,G and Benekohal,RF); Formulation of real-time control policy for oversaturated arterials (Lieberman,EB, Chang,J and Prassas,ES); Calibration of platoon dispersion parameters on the basis of link travel time statistics (Yu,L); Remote simulation to evaluate real-time traffic control strategies (Lucas,DE, Mirchandani,PB and Head,L); Integrated traffic-responsive urban corridor control strategy in Glasgow, Scotland : application and evaluation (Diakaki,C, Papageorgiou,M and McLean,T); Are minimization of delay and minimization of freeway congestion compatible ramp metering objectives? ((Banks,JH); Freeway traffic speed estimation with single-loop outputs (Wang,Y and Nihan,NL); New procedure for detector data screening in traffic management systems (Turochy,RD and Smith BL); Maximum possible weaving volume for effective operations of ramp-weave areas : online estimation (Kwon,E, Lau,R and Aswegan,J); Automatic vehicle identification technology-based freeway incident detection (Hellinga,B and Knapp,G); Progressive deployment steps leading toward an automated highway system (Shladover,SE).

ACCESS: Available at the VDOT Research Library, call number TA 1001.5 .T71 no.1727

**Advanced Traffic Management Systems And High-Occupancy-Vehicle Systems**

*(NOTE: Entire issue devoted to this topic)*


ABSTRACT: Transportation Research Record 1554 contains the following papers: Distributed approach to real-time control of complex signalized networks (Yagar,S and Dion,F); MULTIBAND-96 : a program for available-bandwidth progression optimization of multiarterial traffic networks (Stamatidis,C and Gartner,NH); Determination of timings in signal systems with traffic-actuated controllers (Skabardonis,A); Combined model for signal control and route choice in urban traffic networks (Gartner,NH and Al-Malik,M); Multivariate optimization strategies for real-time traffic control signals (Memon,GQ and
Analysis Of Corridor Delay Under Scats Control


ABSTRACT: The results of a study conducted to determine the change in travel time following the implementation of the Sydney Coordinated Adaptive Traffic System (SCATS) in Oakland County, Michigan, is presented in this paper. A before/after comparison was used to examine the change in travel time on a specific corridor. The results showed that the corridor travel-time improved for both directions for both the peak and the non-peak periods. Before/after intersection delay studies showed that the approach delay for the main street traffic decreased at the intersections as a result of SCATS implementation. A before/after offset study showed that the through bandwidth increased during all time periods for both directions, mainly as a result of extending the green time for the main street traffic.

Access: Available at the VDOT Research Library, call number CD-ROM TE 228.3 .W69 2001

ATCS : Adaptive Traffic Control System


Note: 7 leaves.; Title Subject: ATCS.; Note(s): At head of title (handwritten): Los Angeles./ "April 1995".; Other Titles: Adaptive traffic control system.; Los Angeles ATCS.; Responsibility: designed by: Sean Skehan.; Entry: 19960207; Update: 20060117.

ACCESS: Available through Interlibrary Loan.

Can We Scoot With Traditional Loops?


ABSTRACT: Signal Cycle Offset Optimization Technique, SCOOT, is a proven system of adaptive, real time traffic control. Developed in the mid 1970s by the British Transport Research Laboratory, SCOOT develops new system timing in response to actual traffic flow conditions. The traffic flow is measured each signal cycle with strategically placed vehicle detectors. These SCOOT detectors are typically placed at the "near side" of adjacent intersections, and the measured traffic demand is used to produce an optimum set of timing values for upstream intersections. The SCOOT philosophy is to provide continuous small changes in traffic signal green time allocation, with a current maximum change of 4 seconds per cycle for each split and offset.

ACCESS: Available through interlibrary loan.

Data-Driven Algorithms for Real-Time Adaptive Tuning of Offsets in Coordinated Traffic Signal Systems
ABSTRACT: This paper presents a real-time adaptive algorithm for tuning traffic signal offsets in a coordinated traffic signal system. The algorithm described here is used in the ACS-Lite adaptive control system. The algorithm uses a statistical average “flow profile” of traffic on the coordinated approaches to an intersection to assess when vehicles are arriving during the signal cycle. Alternative offset adjustments are evaluated by calculating how much of this flow profile is being “captured” by the green phase of each coordinated approach. The algorithm considers the impact of the offset adjustment on the traffic at the local intersection as well as adjacent intersections that are also under ACS-Lite control. Simulation tests have quantitatively shown that this tuning approach can improve arterial progression performance relative to the quality of the initial “baseline” fixed (non-optimal) offsets.
ACCESS: Available at the VDOT Research Library, call number CD-ROM TA 1005 .N38 2007

Development Of A Microcontroller-Based, Distributed, Adaptive Traffic Control System
Note: charts ; 30 cm; Vol. 3. (OCoLC)42376378; Note(s): Includes bibliographical references (p. 942).; Responsibility: K. Tavladakis ... [et al.] (Technical University of Crete).; Entry: 19991008; Update: 20050324.
ACCESS: Available through interlibrary loan.

Distributed Architecture and Algorithm for Robust Real-Time Progression Evaluation and Improvement
CITATION: Montasir Charara Abbas Hassan. , 2006, Pg. 62.
ABSTRACT: Closed-loop systems are widely implemented in Texas arterials to provide efficient operation of arterial intersections while still providing signal progression. Nevertheless, poor progression can be observed along most arterials due to outdated offsets, short-term variations in traffic patterns (early-return-to-green), or changes in arterial’s speed and changes in traffic volumes. The limited abilities of closed-loop systems to adapt to traffic variations have stimulated interest into incorporating the technologies of adaptive control software (ACS) into closed-loop systems in order to address such issues. These integrated-type systems require lower cost and minimal staff training, in comparison to fully adaptive systems, since traffic engineers and technicians managing the traffic signal operating systems are already familiar with the closed-loop logic. The objective of this research is to develop, implement, and test an algorithm that will address the limitations of previous efforts in the area of real-time offset-tuning. This final report describes a flexible experimental framework for theoretical development and experimentation of adaptive control algorithms, in the context of closed-loop systems operation. The developed system includes: 1) robust classification algorithm of progression quality and remedies, and 2) vendor-independent distributed implementation architecture for the proposed algorithm.
ACCESS: Available at the VDOT Research Library, call number TE 228 .D57 2006
Enhancing Signal Timing with Adaptive Control Software Lite
ABSTRACT: A program called Adaptive Control Software (ACS) has been used since the late 1990s to improve traffic signal control. However, the program requires high-end hardware and software and is designed primarily for large cities. This article describes how a new software tool called ACS Lite was developed by the Federal Highway Administration to be used in small and mid-sized cities, which often use a closed loop system to manage the flow of traffic. The ACS Lite software contains three major algorithmic components: a time-of-day tuner, a run-time refiner and a transition manager. The time-of-day tuner maintains the permanent plan parameters as the long-term conditions change and the run-time refiner modifies the temporary cycle, split and offset of the plan that is currently running, based on traffic conditions that are outside the normal conditions the plan is designed to handle. The transition manager selects the best signal timing plan transfer method to balance the time spent out of coordination during plan transition. The ACS Lite system has been deployed in several cities and overall results have been positive.
ACCESS: Available through the VDOT Research Library, periodicals section.

Evaluation and Practical Considerations For The S-Trac System-Wide Traffic Signal Control
ABSTRACT: The problem of system-wide traffic control is one of the most challenging in advanced traffic management. The S-TRAC (system-wide traffic-adaptive control) method was recently introduced as a means for producing optimal real-time signal timings on a system (network)-wide basis. S-TRAC has several desirable features that make it both practically feasible and theoretically sound in addressing the system-wide control problem. Among these features are: (1) no system-wide traffic flow model is required; (2) S-TRAC automatically adapts to long-term changes in the system (e.g., seasonal variations) while providing real-time responsive signal commands; and (3) S-TRAC is able to work with existing hardware and sensor configurations within the network of interest (although additional sensors may help the overall control capability). The Montgomery County (Maryland) Department of Transportation and JHU/APL have collaborated in moving towards a possible field demonstration of S-TRAC in a moderately congested network. This paper presents an innovative measure-of-effectiveness that evaluates the interruptions of the traffic flow caused by the traffic signal and also reflects the needs of traffic engineers in Montgomery County, Maryland. Also, this paper describes some of the practical implementation issues that have been addressed and presents the results of some realistic simulations built from Montgomery County traffic data.
ACCESS: Available at the VDOT Research Library, call number CD-ROM TA 1005 .N38

CITATION: James Elliott Moore, .
ABSTRACT: This report provides an overview of both the Anaheim Advanced Traffic Control System Field Operations Test (FOT) and of the technical issues associated with the evaluation of SCOOT performance during the test. The primary objective of the FOT was to implement and evaluate the performance of adaptive traffic signal control technologies and a video traffic detection system (VTDS). Results of the implementations are discussed, including the technical and institutional issues that limited performance. Note: Journal
Evolving To Real-Time Adaptive Traffic Signal Control


ABSTRACT: Network traffic signal control systems operate largely in a pre-planned or reactive mode. The direction of future traffic control systems is to be real time and adaptive. Experience in congested and closely spaced networks indicates that overly responsive systems can result in worse performance than more traditional control systems. Successful real-time adaptive systems must evolve in a manner that assures improved system performance. The Texas Transportation Institute is developing real-time adaptive control systems by integrating advanced computer and communication technology with traditional traffic control expertise to embark upon an advanced traffic control system. Efforts thus far have produced SMART DIAMOND Interchange Controller, which provides real-time multimodal, traffic adaptive control using advance traffic surveillance concepts. The SMART DIAMOND project is the first step in the evolutionary development of real-time adaptive network control. This new generation of control will integrate distributed, dynamic optimization algorithms with central oversight for global stability. The overall objective is to detect and prevent congestion in real-time by backward pressure propagation.

ACCESS: Available through interlibrary loan.

Experience Of Signal Control Agencies With Adaptive Control In North America


ABSTRACT: This paper summarizes the information obtained from telephone interviews that were performed with agencies that have implemented the SCOOT and SCATS adaptive traffic signal control systems in North America. The interviews included discussion of various issues associated with the deployments of adaptive signal control systems. The interviewed agencies were, in general, very satisfied with the performance of the implemented adaptive control systems.

ACCESS: Available through interlibrary loan.

Foundation For Self-Tuning Closed-Loop Progression System


ABSTRACT: Closed-loop systems are widely implemented in Texas arterials to provide efficient operation of arterial intersections while still providing signal progression. Nevertheless, poor progression can be observed along most arterials due to outdated offsets, short-term variations in traffic patterns (early-return-to-green), or changes in arterial's speed and changes in traffic volumes. The limited abilities of closed-loop systems to adapt to traffic variations have stimulated interest into incorporating the technologies of adaptive control systems into closed-loop systems in order to address such issues. These integrated-type systems require lower cost and minimal staff training, in comparison to fully adaptive systems, since traffic engineers and technicians managing the traffic signal operating systems are already familiar with the closed-loop logic. The objective of this research is to develop, implement, and test an algorithm that will address the limitations of previous efforts in this area of real-time offset-tuning. This first-year report lays the foundation for the development of this algorithm. The report also documents the proposed
Implementing Adaptive Signal Control In A Downtown Area: The Minneapolis AUSCI Project


ABSTRACT: The City of Minneapolis has successfully operated a 725-intersection computerized traffic signal control system for over 20 years. Construction of major commercial facilities in the Minneapolis central business district (CBD) has increased the need for more effective traffic control. Discussions with other cities and traffic specialists indicated that traffic congestion problems could be addressed by installing a system with adaptive control features. Minneapolis entered into a partnership with the Minnesota Guidestar office of the Minnesota Department of Transportation (Mn/DOT) to request funding for the Adaptive Urban Signal Control and Integration (AUSCI) test project. The project was approved in late 1994. This paper discusses the features that are being integrated into the existing T2000C centrally-based system, as presented at the 1998 ITS America Conference, and explains the status of the project, which began construction in July 1997 and is scheduled to begin operation in the fall of 1998. The AUSCI project consists of the installation and test of adaptive system operation in a 65-intersection portion of the CBD area of Minneapolis to enhance the existing T2000C computer system operation. Version 3.1 of the Split Cycle Offset Optimization Technique (SCOOT) adaptive control software will be implemented. Video detection, which includes 138 Autoscope Solo video sensors, is being installed to support the increased need for real-time traffic flow information. Control inputs and traffic flow evaluation data will be captured from the machine vision system and logged on a data file server located at the system master site. In addition, nine pan/tilt/zoom cameras will be installed for video surveillance. The city will manage and operate the SCOOT/T2000C modified control system. Operation will cover the SCOOT test area and the 660 other computer-controlled intersections. Note: Description: 12 p.; Document Source: UC Berkeley Transportation Library Source Data: PATH Record Number 14770; TRIS Files: PATH.

Implementation Of An Adaptive Signal Control System In Anaheim, California Resulted In Travel Time Changes Ranging From A 10 Percent Decrease To A 15 Percent Increase


ABSTRACT: Anaheim, California is an urban area with a population of 300,000. Within a 3 square mile area of the city there are 4 major event centers having a combined maximum attendance of 200,000 people. This study evaluated the implementation of the Split Cycle Offset Optimization Techniques (SCOOT) adaptive signal control system on a traffic signal network surrounding two of these event centers. The study used a before and after approach, with 10 observations before the implementation and 10 after. Travel times were determined using the floating-car technique on 5 routes before and after implementation. The study evaluated the ability of SCOOT to function using existing mid-block loop detectors rather than standard upstream intersection detection. The change in travel times for the routes in the study ranged from a decrease of 10 percent to an increase of 15 percent. More circuitous routes involving more of the SCOOT system saw travel time
changes ranging from a 2 percent reduction to a 6 percent increase. The relative performance against the baseline system was better when there were no events at the centers being studied.


**Integrated Corridor Traffic Management: The First Step To Freeway And Arterial Integration**


ABSTRACT: The Integrated Corridor Traffic Management (ICTM) project uses a unique approach to traffic management that combines technology and teamwork. ICTM involves an unprecedented partnership formed between city, county, state, and federal units of government. The cities of Bloomington, Richfield, and Edina, Hennepin County, the Minnesota Department of Transportation (Mn/DOT) and the Federal Highway Administration (FHWA) have joined together to improve the efficiency of travel within the Interstate 494 transportation corridor. The ICTM project spans five years and is broken up into four modules. Modules 1 & 2 are completed, with 27 ramp meters and 22 traffic signals running under adaptive control. In 1996, an additional 45 arterial traffic signals will come online. In 1997, motorist information signs, route guidance and surveillance equipment will be installed. The project will be fully operational by 1998. The Sydney Coordinated Adaptive Traffic System (SCATS) is being used to synchronize the timing of traffic signals and ramp meters within the corridor. The AWA Traffic Systems America/Roads and Traffic Authority (RTA) of New South Wales, Australia and Mn/DOT’s Traffic Management Center (TMC) staff collaborated on the system integration. This paper explains the system integration activities required to maintain a functional TMC while implementing a new system. It also explains the flow balance equation employed and the associated queue, ramp, and mainline factors that formulate the adaptive ramp metering algorithm. The Spring 1996 data collection efforts will measure the project’s benefits. The evaluation will assess both qualitative and quantitative measures. The qualitative measures are presented in this paper. Note: Description: n.p.; TRIS Files: HRIS.

ACCESS: Available through interlibrary loan.

**Lessons Learned : MN/DOT’s Integrated Corridor Traffic Management Experience**


ABSTRACT: Traffic engineers are looking for creative ways to better manage and use the existing roadway infrastructure. The Integrated Corridor Traffic Management (ICTM) project is attempting to accomplish this through a combination of teamwork and technology. The Federal Highway Administration, Minnesota DOT, Hennepin County, and the cities of Bloomington, Richfield, and Edina have joined forces to tackle these issues. The goal is to improve the efficiency of travel through a congested corridor. This goal will be accomplished by: Implementing an adaptive traffic control system; Developing corridor-wide traffic management strategies; Integrating freeway ramp meters and traffic signals; Enhancing the ramp metering system; Expanding the video surveillance system; Deploying an arterial motorist information system; and, Developing a comprehensive incident management plan. Note: Description: 20 p.; Document Source: UC Berkeley Transportation Library Source Data: PATH Record Number 14807; TRIS Files: PATH.

ACCESS: Available at the VDOT Research Library, call number CD-ROM TE 228.3 .W69 2001
Local Evaluation Report for ATLAS-ITS Phase II: Integration of Real-Time Traffic Information for Adaptive Signal Control, Traveler Information and Management of Transit and Emergency Services

CITATION: Pitu B. Mirchandani and David E. Lucas, the University of Arizona Department of Systems & Industrial Engineering, December 2005

ABSTRACT: Major roads and arterials in the City of Tucson and Pima County are already significantly detectorized with inductive loop detectors and, at places, with video-based detectors. These detectors are used for semi-actuated signal control and for limited traveler information. In addition, many intersections have systems that allow signal preemption by emergency services such as fire and ambulance. ATLAS II projects integrate real-time data from available detectors for (a) traffic adaptive signal control, (b) providing real-time traffic predictions to traveler information systems, (c) for adaptive signal priority for transit vehicles, and (d) for proactive coordination of signal phasing to provide preemptive pathways for emergency vehicles. The overall program consisted of six projects led by the University of Arizona, in cooperation with several public and private sector partners and/or collaborators. The goals and objectives of the ATLAS II program included:

- Assist in the development of an ITS Strategic Plan and Architecture that allows for the integration of real-time transportation information for planning purposes;
- Deploy and integrate a real-time traffic prediction method to provide data for an advanced traveler information system;
- Deploy and integrate a real-time traffic adaptive signal system for a grid of intersections to improve traffic flow;
- Deploy and integrate a transit signal priority system for arterial roadways for improved transit performance;
- Deploy and integrate a link travel time estimation system for arterial roadways to provide real-time data for use in traffic adaptive signal control; and
- Deploy a combined travel forecasting model, which is an alternative approach capable of evaluating future transportation and urban development plans while overcoming limitations inherent in existing approaches for large zone systems and networks.


Methodology For The Assessment Of Traffic Adaptive Control Systems


ABSTRACT: Most network delays are experienced at signalized intersections. Depending on the site conditions, implementation of traffic adaptive control has been demonstrated to result in a wide range of benefits. Municipal traffic engineers need methodology for the estimation of the effectiveness of investment in upgrading traffic control prior to actual implementation. Although it is useful to examine the results of adaptive control at other sites, reliance on these cannot be placed due to a wide variation in benefits experienced. This article reports on a methodology for the assessment of traffic adaptive signal control systems. The methodology is illustrated through a case study. Note: Description: p. 28-32; Figures(4); References(11); Tables(2); TRIS Files: HRIS.

ACCESS: Available through the VDOT Research Library, periodicals section.

Modeling For Real-Time Traffic Control In The Rhode Island Intelligent Road

Moving Targets.

ABSTRACT: This article describes SPOT, an adaptive traffic signal priority control system. It also discusses how a combined SPOT/UTOPIA system can coordinate traffic movements within a particular area and does not rely on fixed cycle times at each intersection.
ACCESS: Available through the VDOT Research Library, periodicals section.

Operating Multiple Signalized Intersections With One Controller

CITATION: D. R. Eyler., 1997, Institute of Transportation Engineers 67th annual Meeting.
ABSTRACT: From the earliest days of traffic signal control, the operation of multiple intersections with a single controller has been a technique used to reduce costs and ensure coordination. Recent developments in signal controllers provide the signal designer with the opportunity to use 12 or more phases, multiple timing plans and advanced detection schemes. The original motives for using one controller for multiple intersections were cost and the need to guarantee absolute coordination between adjacent intersections. Over the years the cost concerns have been reduced. Since the late 1960s, the cabinet with controller cost has remained around $10,000 despite the dollar falling to roughly 30% of its 1967 value. Today's controllers also have much greater capability. However, the addition of internal time base coordination, advanced control functions in coordinated operation and closed loop master controllers with the desire for standardized design and operation have led some traffic engineers to conclude that the provision of close coordination between adjacent intersections is also no longer a reason to consider multiple intersection controller operation. While "traditional" coordinated signal control has become more advanced it has also become more complex in its operation requirements. As a result, the concept of adaptive control systems such as SCOOT, SCATS and RT-TRACS has received interest. Adaptive control is claimed by its proponents to compare to conventional coordinated control in the same way that, for individual control, full traffic actuated operation compares to pre-timed control. This paper describes the comparisons and contrasts of adaptive control, and traces the development of single traffic control systems.
ACCESS: Available at the VDOT Research Library, call number CD-ROM TA 1005 .I52r


ABSTRACT: The real-time traffic adaptive control system (RT-TRACS) represents a new, state-of-the-art system in advanced traffic signal control. It was developed cooperatively by a team of U.S. academic, private, and public researchers under the guidance of the Federal Highway Administration. The system provides a framework to run multiple traffic control algorithms, existing ones as well as new adaptive algorithms, as they become available. The optimized policies for adaptive control (OPAC) strategy, which provides a dual capability of individual intersection control as well as coordinated control of
intersections in a network, was the first adaptive algorithm implemented within the RT-TRACS framework. The operational features of the OPAC prototype version that was developed for RT-TRACS are presented, and its implementation in the Reston Parkway field research test bed in Northern Virginia is described. The implementation provided valuable insights into the performance of coordinated OPAC under various traffic conditions and site geometry. Observations indicate that the strategy was instrumental in reducing delays and stops, compared with a well-tuned fixed time system that was in place, while maintaining progression along the arterial. Valuable lessons were learned that should lead to improvements in future implementations of adaptive algorithms.

**Performance Study Of SCOOT Traffic Control System With Non-Ideal Detectorization : Field Operational Test In The City Of Anaheim**


ABSTRACT: The Split Cycle Offset Optimization Technique (SCOOT) is a signalized urban network traffic control system developed in the United Kingdom which has been implemented in many cities around the world over the last three decades. It has however not found wide application in the United States. A primary reason for this is the nature of the pavement vehicle detectors prevalent in the US, and the expected cost associated with placing new detectors if SCOOT were to be implemented. SCOOT requires detectors that measure the traffic leaving each intersection in the network, and uses the measurement for controlling the signals at the intersections the traffic travels to. On the other hand, most US networks typically have had actuated signal control at many intersection based on stop line detectors that use traffic arrivals at each intersection approach. Some US networks however have detectors placed for the purpose of running the UTCS control systems which are sufficiently upstream from the intersection stop-lines which can be used for the purposes of SCOOT. In this paper, we report the performance of SCOOT implemented in the City of Anaheim using the UTCS detectors, as part of a FHWA Field Operational Test (FOT). The UTCS detectors are a few hundred feet ahead of the intersection approach stop line and could partially substitute for the "departure" detectors that SCOOT requires. Such detectorization is admittedly non-ideal for SCOOT, and thus the interest was in finding out whether there was a possibility for the traffic performance to still be reasonably acceptable under SCOOT.

ACCESS: Available at the VDOT Research Library, call number CD-ROM TA 1005 .N38 2001

**Pilot 05: Distributed Architecture for Robust Real-Time Progression Evaluation and Improvement**


ABSTRACT: Real-time offset tuning can provide an almost optimal operation while capitalizing on the existing knowledge and familiarity of traffic engineers and personnel with the current actuated control system. The real-time offset tuning concept was introduced several years ago by one of the authors of this paper. Advantages and disadvantages of the concept were discussed in subsequent papers. The concept was taken further for implementation by other researchers within the ACS Lite tactical-level architecture development. This paper describes a parallel effort that focuses more on (a) a robust classification algorithm of progression quality and remedies and (b) vendor-
independent distributed implementation architecture for the proposed algorithm. Rather than immediate implementation issues, this research establishes a flexible development framework for theoretical development and experimentation of adaptive control algorithms in the context of closed-loop systems operation.

ACCESS: Available at the VDOT Research Library, call number TA 1001.5 .T71 no.1978

**Real Time Traffic Adaptive Control Software : The First Implementation**


ABSTRACT: Federal Highway Administration's (FHWA) Office of Intelligent Systems and Technology Division has been researching the development of real time adaptive traffic control software. This effort is the logical next step after the development and implementation of the previous and highly successful software, the Urban Traffic Control Software (UTCS). It is also recognized that the one size fits all mold of UTCS is not applicable to the present traffic control systems. The modern systems must respond to varying network topology as well as levels of congestion. Further, with the varying level of system instrumentation the new software should be adaptable to a majority of applications. This is now possible with the advent of neural networks, artificial intelligence and other computing techniques. Therefore, the objective of the current research is to develop a suite of algorithms that could be tailored to a particular application.

ACCESS: Available through interlibrary loan.

**A Real-Time Offset Transitioning Algorithm For Coordinating Traffic Signals**


ABSTRACT: This report introduces an adaptive real-time offset transitioning algorithm that can be viewed as an integrated optimization approach designed to work with traditional coordinated-actuated systems. The Purdue Real-Time Offset Transitioning Algorithm for Coordinating Traffic Signals (PRO-TRACTS) adds to the controllers the ability to adaptively change their offsets in response to changes in traffic pattern, providing an intermediate solution between traditional coordinated-actuated control systems and adaptive control systems. To facilitate implementation, a new National Transportation Communication for ITS Protocol (NTCIP) object for capturing detector actuation at the controller's level is defined in this report. The unique cycle-based tabulation of volume and occupancy profiles at upstream detectors is used by a newly defined metric to examine the existence of shockwaves generated due to a poor offset downstream. The procedure is modeled after the analysis of variance testing. This procedure is performed on cycle-by-cycle basis to evaluate the offset performance and adjust it accordingly. Simulations of two case studies revealed 0-16% savings in total travel time and up to 44% saving in total number of stops for the coordinated movement when applied to systems with poor offsets. The algorithm is best suited for arterials with primarily through traffic. Heavy movements from the side streets onto the arterial make it difficult for the algorithm to determine which movement should be favored. PRO-TRACTS mitigates problems such as early-return-to-green, waiting queues, and improperly designed offsets using current setups of traffic signals/detectors in the U.S. The algorithm capitalizes on the existing knowledge and familiarity of traffic engineers and personnel with the current actuated control system to provide a cost-effective solution to improving signal coordination. Future research is needed to improve the stability of the algorithm with highly dispersed platoons and oscillatory traffic patterns caused by situations such as controllers skipping phases due to light traffic volume. It is also recommended that the algorithm should be extended to improve two-way signal...
progression instead of one-way progression. Note: Description: 400 p.; Appendices(4); Figures; References; Tables.
ACCESS: http://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1478&context=jtrp

**Real-Time Offset Tuning: Motivation, Findings, And Lessons Learned**


ABSTRACT: This paper discusses the advantages of real-time offset tuning that adds to the actuated controllers the ability of adaptively changing their offsets in response to changes in an arterial's traffic demand. In trying to bridge the gap between widely installed closed-loop systems and fully adaptive control systems, real-time offset tuning can provide a close-to-optimal operation while capitalizing on the existing knowledge and familiarity of traffic engineers and personnel with the current actuated control system. The paper reports the results of applying Purdue Real-time Offset Transitioning Algorithm (PRO-TRACTS) to two different case study networks in Indiana. Real-Time offset tuning resulted in up to 16% savings in the total travel time and up to 43% savings in the total number of stops for the coordinated movement. The paper also discusses some of the cycle transitioning issues and the pros and cons of using hardware-in-the-loop versus CORSIM's internal control algorithm.

ACCESS: Available at the VDOT Research Library call number CD-ROM TA 1005.N38 2002

**Real-Time Remedy: In The US The Deployment Of Adaptive Real-Time Traffic Control Systems Has Been Somewhat Limited**

Note: ill.; 30 cm; Responsibility: Vince Pearce.; Entry: 20010131; Update: 20010131.
ACCESS: Available through the VDOT Research Library, periodicals section.

**Recent Developments in Adaptive Control Systems in Germany**

CITATION: Juergen Mueck. , 2005, 12th World Congress on Intelligent Transport Systems, Pg. 11.

ABSTRACT: The dissemination of urban Adaptive Control Systems (ACS) in Germany and its neighbor country Austria has been starting during the last years, while traffic control in UK has experienced a wide range of SCOOT applications in the last decades. The paper will try to explain this divergent deployment of techniques by the German focus on developing sophisticated local control methods and will show the consequences German manufacturers had to face when starting to design and launch their adaptive control systems in the last decade. Based on a brief outline of the state of German ACS technology the paper attempts to demonstrate that the initial disadvantage of having sophisticated local control methods as precondition, which inevitably led to a hierarchical (microscopic / macroscopic) system architecture, brought along with it noteworthy benefits in practice.

ACCESS: Available at the VDOT Research Library, call number CD-ROM TE 228.3.W69 2005

**Remote Simulation To Evaluate Real-Time Traffic Control Strategies**

CITATION: Lucas, David E. Mirchandani, Pitu B. Head, K. Larry. , 2000, Transportation Research Record, No. 1727, Pg. 95-100.
Note: ill.; 28 cm; (OCoLC)1259379; Title Subject: RHODES (Computer file); Note(s):
A Review Of The Optimized Policies For Adaptive Control Strategy (OPAC)

ABSTRACT: This report gives an overview of Optimized Policies for Adaptive Control (OPAC), a real-time demand-responsive traffic signal timing optimization algorithm for individual intersections. The main difference between OPAC and traditional cycle-split signal control strategies is that OPAC does not use the concept of cycle. Rather, in OPAC, the signal control problem consists of a sequence of switching decisions made at fixed time intervals. It involves a dynamic optimization process which ensures that signal control is always up-to-date. The report discusses OPAC design philosophy, development history, implementation, and reported performance. Note: Journal Title: PATH working paper; UCB-ITS-PWP-98-9; Description: 10 p

RHODES-ITMS Corridor Control Project

ABSTRACT: The RHODES-ITMS Corridor Control project addresses real-time control of ramp meters of a freeway segment, with consideration of the traffic volumes entering and leaving the freeway from/to arterials, and the regulation of these volumes via real-time setting of ramp metering rates. Current approaches to traffic responsive control of ramp meters include (a) time-of-day control, (b) locally responsive strategies and (c) area-wide linear programming based approaches (currently implemented in parts of Europe). None of these approaches are both real-time responsive to traffic conditions and consider the multiple objectives of minimizing freeway travel times and decreasing congestion/queues at the interchanges. A control system, MILOS (Multi-objective Integrated Large-scale Optimized ramp metering System), was developed that determines ramp metering rates based on observed traffic on the freeway and its interchange arterials. MILOS temporally and spatially decomposes the ramp-metering control problem into three hierarchical subproblems: (1) monitoring and detection of traffic anomalies (to schedule optimizations at the lower levels of the control hierarchy), (2) optimization to obtain area-wide coordinated metering rates, and (3) real-time regulation of metering rates to adjust for local conditions. Simulation experiments were performed to evaluate the MILOS hierarchical system against (a) "no control" (i.e., when no ramp metering is in effect), (b) a locally traffic-responsive metering policy, and (c) an area-wide LP optimization problem re-solved in 5-minute intervals. Three test scenarios were simulated (1) a short "burst" of heavy-volume flows to all ramps, (2) a three-hour commuting peak, and (3) a three-hour commuting peak with a 30-minute incident occurring somewhere in the middle of the corridor. The performance results indicate that MILOS is able to reduce freeway travel time, increase freeway average speed, and improve recovery performance of the system when flow conditions become congested due to an incident.

RHODES-ITMS Tempe Field Test Project: Implementation And Field Testing Of RHODES, A Real-Time Traffic Adaptive Control System

ABSTRACT: RHODES is a traffic-adaptive signal control system that optimally controls the traffic that is observed in real time. The RHODES-ITMS Program is the application of the
RHODES strategy for the two intersections of a freeway-arterial diamond interchange. This report addresses the latest phase of the RHODES-ITMS Program that resulted in a field test in the City of Tempe, Arizona. In summary, this phase involved: (i) the integration of the RHODES logic within the signal controller; (ii) the validation of the RHODES logic using "hardware-in-the-loop" simulation; (iii) the integration of the RHODES algorithms within Tempe's traffic management system; (iv) the deployment of RHODES for the field test; and (v) the data gathering and evaluation of traffic performance "with" and "without" the RHODES logic. The objectives of this project were: (i) to see if a communication/computation infrastructure could be designed and implemented for second-by-second detector data collection and signal phase commands; (ii) to see if a traffic-adaptive signal control system could be implemented on an off-the-shelf Advanced Traffic Controller; (iii) to determine whether the RHODES strategy is viable in the field; and (iv) to evaluate the traffic performance of RHODES. The answers for the first three objectives were positive: that is, the communication/computation infrastructure was designed and implemented, and RHODES control strategy was integrated within the infrastructure and proved to be viable. With regard to the fourth objective, RHODES was able to match the performance of the current well-tuned semi-actuated control being used by the City of Tempe. The major contributions of the RHODES-ITMS Program can be categorized into the development and implementation (i) of new integrated hardware/software infrastructure that includes a new communication system, and (ii) of a traffic-adaptive signal control system. The infrastructure (i) integrates traffic-adaptive features within the 2070 Advanced Traffic Controllers, (ii) deploys, for the first time, a 2070 Controller within a TS2 cabinet, and (iii) implements a communication system for second-by-second decision making. The traffic-adaptive system has the following attributes and benefits: (i) it is second-by-second responsive; (ii) it has a hierarchical and distributed modular architecture that allows additional traffic control features; and (iii) it requires low maintenance of timing plans by traffic engineers. Last, but not least, the effort has extended the cutting edge in systems engineering methodology for the design of real-time decision-making systems and has expanded the workforce in traffic systems engineering by graduating several students through this research effort.


**RHODES-ITMS-MILOS: Ramp Metering System Test**


ABSTRACT: The RHODES-Integrated Traffic Management System Program addresses the design and development of a real-time traffic adaptive control system for an integrated system of freeways and arterial roads. The goals of this project were to test coordinated, adaptive ramp metering using the Multi-Objective, Integrated, Large-Scale, and Optimized System (MILOS) software on a major urban freeway. A 7-mile eastbound segment of I-10 in Phoenix, just west of the I-10/I-17 Interchange, was chosen as the study area because of the availability of data, and because of recurring congestion. The field test was to be accomplished in three phases: (i) testing the hierarchical MILOS control software via simulation, (ii) development of interfaces necessary to use MILOS in the field, and (iii) testing the effectiveness of MILOS in real time. The project accomplished the first of these objectives, developing a simulation model of the I-10 freeway and showing through experiments that coordinated adaptive ramp metering is more effective than no-control or traffic responsive metering. In developing the freeway model, the project further refined the processes needed to calibrate and test MILOS for a specific freeway. The second
objective was only partially met. The interfaces within MILOS have been refined, but only some of the interfaces with the real-time data have been established. The interface for data flowing from the freeway management system into MILOS has been established. An interface for delivering ramp-metering rates from MILOS to the field via the freeway management system has not been established. The development of this second interface via a subcontract was determined to be infeasible within the project budget. Because of this, the third objective has not yet been achieved. The effectiveness of MILOS and coordinated ramp metering in the field will not be proven until this third objective can be achieved.


**Robust Adaptive Control**

CITATION: P. A. Sun Ioannou Jing., 1996, description: xvii, 825 p. + 1 computer disk

ABSTRACT: This book presents a study of the existing techniques for designing and analyzing robust adaptive control systems. After an introductory chapter, the book is divided according to the following topics: 1) models for dynamic systems; 2) stability; 3) on-line parameter estimation; 4) parameter identifiers and adaptive observers; 5) model reference adaptive control; 6) adaptive pole placement control; 7) robust adaptive laws; and, 8) robust adaptive control systems.

ACCESS: Available through interlibrary loan.

**SCOOT Adaptive Signal Control: An Evaluation Of Its Effectiveness Over A Range Of Congestion Intensities**


ABSTRACT: This paper compares the performance of adaptive control using the Split, Cycle and Offset Optimization Technique (SCOOT) relative to a fixed-time plan based control. A four-intersection test corridor is modeled using the Corridor Simulation (CORSIM) program. Five sets of traffic flows were generated testing the corridor at increasing volumes from a volume to capacity (v/c) ratios of 0.7 through 1.1. The corridor was evaluated with pre-timed, actuated-coordinated actuated-uncoordinated, and fully actuated strategies to determine the most optimal one. This was used in comparing SCOOT performance relative to the optimal signal timing. The corridor is controlled by SCOOT through the SCOOT-CORSIM Interface which allows an actual SCOOT system to get detector information from CORSIM and provide signal timing to CORSIM. Results of the test corridor show that SCOOT reduces delay by 8% at the 0.7 v/c, which increases to 13% at a v/c of 0.9. Minimal improvements are observed as the corridor approaches saturation. This indicates that substantial savings are available with SCOOT during undersaturated flow conditions and SCOOT helps postpone the onset of congestion, but SCOOT operates much like a fixed time system once flows reaches saturation. Two real-world corridors were tested with SCOOT reducing overall corridor delays by 14% and 11%. Further, this paper shows the importance of validating the SCOOT system properly. The simple activation of SCOOT, without any validation, provides a 219% increase in corridor delays over the fixed time plan. After validation, the results show a delay reduction of 8% over fixed time control. The validation findings dispel the idea that adaptive control systems are "plug and play".
SCOOT, The World’s Foremost Adaptive Traffic Control System
ACCESS: Available from the VDOT Research Library, periodicals section.

SCOOT, Toronto’s Traffic Adaptive Control System : A Successful Its Deployment Initiative
ABSTRACT: SCOOT, is a uniquely advanced traffic adaptive signal control system. Its earlier demonstration and subsequent expansion in Toronto has had measurable positive effects on the efficiency of traffic flows, and through the increased efficiency, has led to reductions in fuel usage and associated emissions and quality of life benefits. The SCOOT Demonstration Project which was completed in 1995 signified the first major advanced traffic signal control system enhancement in Toronto in over a decade, and represents a significant advancement in traffic adaptive control by a major traffic system operator in North America. Applying the findings of the demonstration project, Toronto is selectively and incrementally expanding its SCOOT system to serve as a valuable complement to its existing signal operations. Since 1995 SCOOT operations have been expanded more than three-fold, broadening traffic adaptive control across Toronto This paper outlines the SCOOT system that has been initially installed and subsequently expanded the comprehensive evaluation of the system, and the resulting benefits that were identified and quantified. Note: Description: 25 p.; Document Source: UC Berkeley Transportation Library Source Data: PATH Record Number 18191; TRIS Files: PATH.
ACCESS: Available through interlibrary loan.

Synthesis of Practices for Work Zone Speed Management
ABSTRACT: Speeding in work zones is one of the most common traffic violations observed by road builders and road maintenance crews. It creates an unsafe environment for road workers and all types of road users. This synthesis is intended to help address this situation by reviewing work zone speed management efforts in Canada and the United States. The report provides an overview of technologies and methods for managing speed in work zones, with topics ranging from posted speed limit reductions and narrowing lanes to portable variable message signs and enforcement. In addition, the report discusses other methods for speed management, including merge control, driver and worker education, and real-time traffic information systems. The report also provides a number of conclusions and recommendations based on the synthesis, which identify some of the key problems and solutions.
ACCESS: Available through interlibrary loan

Timing Is Everything : Oakland County, Michigan, Has Built A Video- Based Adaptive Traffic Signal System That Has Brought Tremendous Improvements To Traffic On Suburban Streets
CITATION: Jenny King. ,1998, ITS World. Vol. 3, no. 4; Description: p. 24-28;
ABSTRACT: This article describes an adaptive traffic signal system in Oakland County, Michigan. The system uses machine vision technology to determine when vehicles are
present and software to adjust traffic signal timing that is based on real-time traffic conditions.

ACCESS: Available through interlibrary loan.

SELECTED WEB DOCUMENTS
Note: These documents were found online using general Internet search tools and may not represent peer-reviewed research or articles from vetted professional publications, however they may be of general or background interest.

FLORIDA
FDOT District Seven’s Approach to Adaptive Control Signals
For more info.: Florida Department of Transportation (FDOT) Traffic Engineering and Operations Office 605 Suwannee Street, M.S. 36 Tallahassee, Florida 32399-0450 (850) 410-5600 www.dot.state.fl.us.com

MINNESOTA
Concept Definition Report
Adaptive Urban Signal Control Integration (AUSCI) Project
http://www.dot.state.mn.us/guidestar/pdf/ausciint.pdf
For more info.: Integrated Corridor Traffic Management Final Evaluation Report
http://www.dot.state.mn.us/guidestar/pdf/ictmfinal.pdf
Designed to make travel safer, easier and more consistent throughout the I-494 transportation corridor, this project uses existing traffic signals, ramp meters, local streets and freeways. Discusses how an adaptive traffic control system has been installed at 27 ramp meters and 68 traffic signals along with 11 arterial closed circuit television cameras to monitor traffic.
Project Manager: Linda K. Taylor Mn/DOT - Metro Division, Waters Edge Phone: (651) 582-1461 Fax: (651) 582-1302 E-mail Address: linda.taylor@dot.state.mn.us

CALIFORNIA
Development of an Integrated Microscopic Traffic Simulation Model
For more info.: NEW JERSEY
Computer Modeling and Simulation of New Jersey Signalized Highways
For more info.:
FHWA
Arterial Management Program
http://www.ops.fhwa.dot.gov/arterial_mgmt/index.htm
Traffic signals and the design of arterial facilities affect us daily as we travel to and from work, school, shopping and recreational facilities. There are an estimated 272,000 traffic signals in the United States and each has a profound impact on how safety and efficiently we share the space of intersections as we travel to our destinations. In many major metropolitan areas, the freeway system is functioning at or beyond the capacity for which it was designed. Many drivers are choosing to use arterial streets as an alternative. The growing demand on arterial systems creates congestion on the thoroughfares that define our cities and suburbs. The Arterial Management program is dedicated to actively improving the operation of traffic signal systems and employing techniques to improve traffic flow and reduce congestion on arterial networks.

ENTRIES FOUND IN THE RESEARCH IN TRB’S PROGRESS (RiP) DATABASE
Note: these entries are for research that is ongoing or recently completed and may prove a helpful resource in locating experts in the field of adaptive traffic control.

Arizona Center for Traffic and Logistics Algorithms & Software (ATLAS)
Start date: 1998/8/30
End date: 2003/5/27
http://rip.trb.org/browse/dproject.asp?n=10935
Abstract: The Arizona Center for Traffic and Logistics Algorithms and Software (ATLAS) is a center of excellence specializing in research development of algorithms, software and systems which advance the state of the art and the state of the practice in traffic management and logistics management systems. In the advanced traffic management area, the University’s showpiece research is the development and deployment of RHODES (Real-Time Hierarchical Optimized Distributed Effective System), an innovative computer-based system for traffic-adaptive signal control. In laboratory testing, RHODES, which is the first system of its type developed in the United States, proved to be among the most effective traffic control systems dealing with congestion.

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Adaptive Signal Control Implementation and Evaluation
Start date: 2004/11/1
End date: 2005/12/31
http://rip.trb.org/browse/dproject.asp?n=10926
Abstract: Define traffic efficiency and safety criteria for Utah's first ASCS. Define Measures of Effectiveness (MOE's) to assess these criteria.

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Principle Investigator:
Martin, Peter

Development and Evaluation of a Multi-Agent Based Neuro-Fuzzy Arterial Traffic Signal Control System
Start date: 2006/9/1
End date: 2007/8/31
http://rip.trb.org/browse/dproject.asp?n=12249

ABSTRACT: Arterial traffic signal control is a very important aspect of traffic management system. Efficient arterial traffic signal control can reduce delay, stops, congestion, and pollution and save travel time. Commonly used pre-timed or traffic actuated signal controls does not have the capability to fully respond to real-time traffic demand and pattern changes. Although some of the well-known adaptive control systems have shown advantageous over the traditional per-timed and actuated control strategies, their centralized architecture makes the maintenance, expansion, and upgrade difficult and costly. Distributed artificial technologies such as multi-agent system is well suited for arterial signal control, and it has the ability to decompose complicated control problems and accomplish them by cooperatively simple agents such that flexibility, efficiency, robustness, and cost effectiveness can be achieved. The objective of this research is to conduct an in-depth investigation of applying multi-agent technology in arterial signal control. A multi-agent arterial signal control system will be developed and evaluated using simulation tools and real world traffic data. The goal of this project is to develop a new distributed adaptive control framework and control logic for arterial traffic signal control.

Project Manager:
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Real-time Adaptive Ramp Metering: Phase 1 - Simulation & Proof of Concept
Start date: 2004/12/29
End date: 2007/2/28
http://rip.trb.org/browse/dproject.asp?n=11414

ABSTRACT: The Arizona’s Department of transportation (ADOT) Freeway Management System is designed to apply “smart” ramp metering, taking into account the impacts on mainline freeway traffic flow. However, since its inception, smart real-time traffic-adaptive ramp metering has never been implemented. Planned FMS controller upgrades, and
existing communication infrastructure, would allow the full utilization of new ramp metering control strategies, such as the University of Arizona's traffic-adaptive MILOS program, on extended freeway corridors. Such “smart” corridors will make ramp-metered traffic flows smoother and improve the operation of system interchanges and connecting corridors in the region. This project’s corridor simulation modeling would validate the traffic-adaptive concept (this Phase 1), and will justify its early implementation when the FMS is upgraded (a Phase 2 effort, should it be shown beneficial in simulations).

Project Manager:
Owen, Stephen R.
Phone: (602) 712-6910

Real-time Adaptive Ramp Metering: Phase 2 - Implementation and Enhancement
Start date: 2005/10/1
http://rip.trb.org/browse/dproject.asp?n=11313
ABSTRACT: Arizona Department of Transportation’s (ADOT) Freeway Management System is designed for "smart" ramp metering, considering the impacts on mainline traffic flow, but real-time traffic-adaptive metering has never yet been deployed. New FMS upgrades will allow full utilization of control strategies, such as University of Arizona’s MILOS program, to smooth traffic flows and improve regional operations. This Phase 2 project will implement MILOS, evaluate its operation, and identify required operational enhancements. It will deploy MILOS as an operational prototype system that can be field tested by ADOT operations staff to more efficiently manage freeway corridor operations. Initially, MILOS will be operated in “shadow mode” to observe functionality, and to identify strengths and weaknesses as well as any needed enhancements. Solutions will be developed to address needs and deficiencies, tested using simulation, and implemented in the operational system. The program will then be run on-line to develop data to compare and evaluate both the “MILOS-ON” and “MILOS-OFF” performance.

Project Manager:
Owen, Stephen R.
Phone: (602) 712-6910

Real-Time Network Optimization System
Date Added: 07/10/2002
http://rip.trb.org/browse/dproject.asp?n=4568
ABSTRACT: The purpose of this project is to develop and test a real-time traffic network optimization system. This system will be capable of adapting to rapidly changing traffic patterns associated with incidents and special events in both urban grid and freeway networks. Integration of advanced techniques will be evaluated with data from an actual test area in Boston.

Sponsor Agency:
Department of Transportation
400 7th Street, SW
Washington, DC 20590
Principle Investigator:
Masaki, Ichiro

An Open-Systems Comm/Control Arch for Real-Time Traffic-Adapt Signal Controller
Start date: 2000/8/7
End date: 2004/3/31
http://rip.trb.org/browse/dproject.asp?n=6309
ABSTRACT: Not available.

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