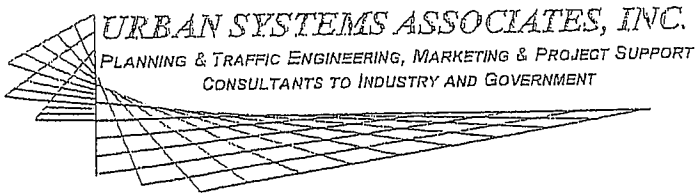# APPENDIX P

ADAPTIVE TRAFFIC CONTROL

- MEMO TO CITY STAFF

ATTN:	Victoria Huffman & Ann Gonsalves– City of San Diego	E-Mail: ▼ vhuffman@sandiego.gov agonsalves@sandiego.gov

FROM:	Andrew P. Schlaefli	TOTAL PAGES (Including Cover): 5
DATE:	August 30, 2011	TIME: 3:04:38 PM JOB NUMBER: 002407

SUBJECT: *Adaptive Traffic Control*

Recently you asked that we provide some basic information regarding Adaptive Traffic Control. Traffic signal systems for controlling vehicles at intersections has become increasingly more efficient due to new technology improvements. Most recently a significant improvement in control technology due to communications, information feedback and software has occurred. These most recent improvements are generally referred to as "ADAPTIVE TRAFFIC CONTROL SYSTEMS" (ATCS).

The process which is common to all ATCS typically include:

- Data collection from sensors to describe traffic signal conditions and changes,

- The evaluation of alternative signal timing strategies.

- Implementation of the best strategy.

- Continuous recycling through the steps described above to optimize flow.

The hardware and software used for ATCS uses existing traffic cabinet hardware so implementation is typically rather simple, cost effective and efficient. Costs vary for different systems but typically they may range from $25,000.00 to $50,000.00 per intersection. Therefore a high volume corridor of eight to ten intersections such as Del Mar Heights Road could cost from $250,000.00 to $500,000.00 depending on communications requirements. This cost does NOT include the cost of any transportation control center or other communications to the control center. Monitoring or other elements may also affect costs.

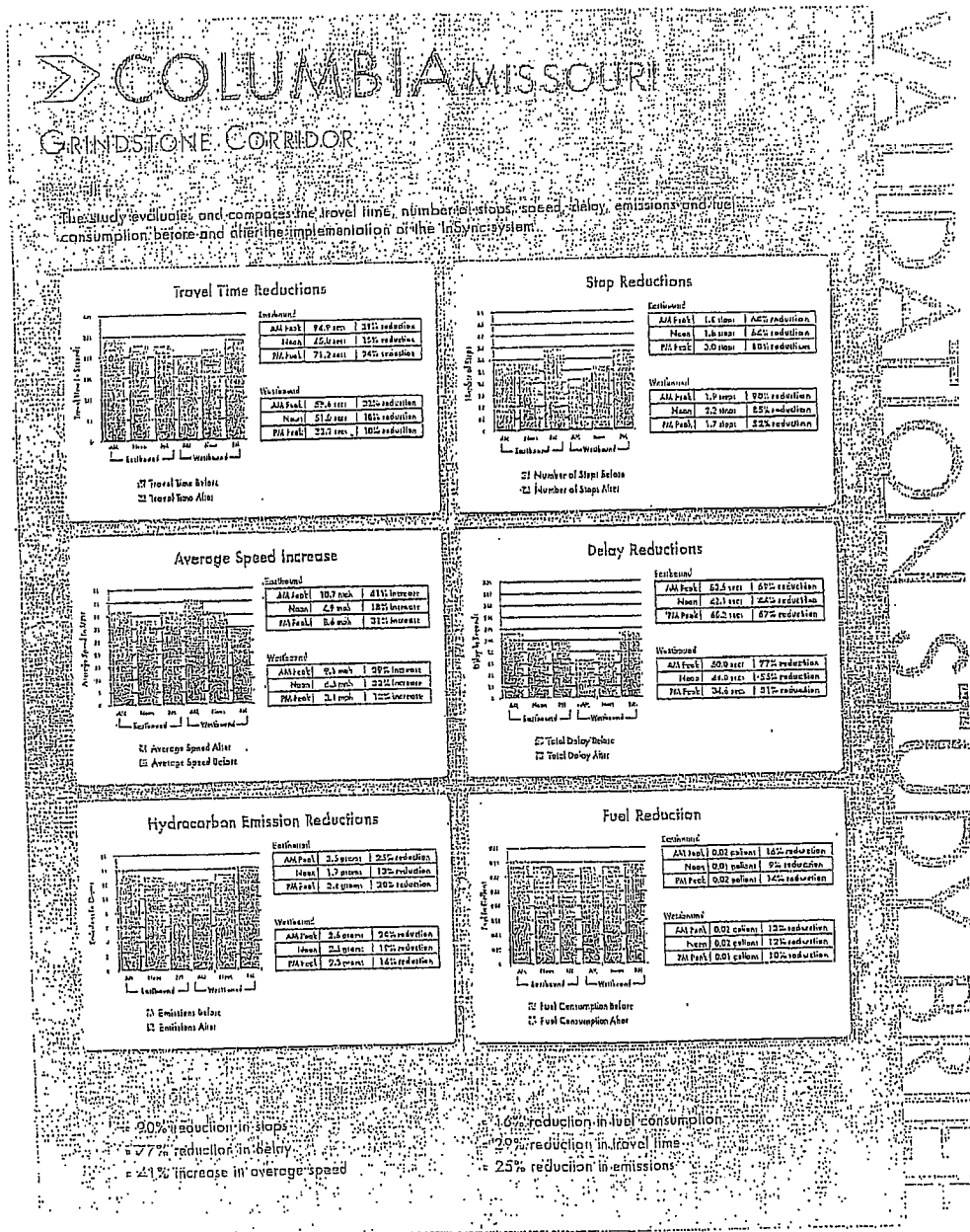Implementation and monitoring of ATCS throughout the country have shown that:

- Travel time along a corridor may be reduced by 30%.

- Emissions are typically reduced by 30%.

- Stops are reduced by up to 90%.

- Fuel consumption is reduced by 20%.

Attachments 1, 2 and 3 summarize these expected benefits for three actual road corridors in Georgia and Missouri for a second generation type of adaptive traffic control system. Although not evaluated for these systems it is clear that the safety, efficiency, and travel time savings also result in improved traffic flow and thru put along a corridor. This equates to a 10-15% improvement in capacity. Therefore a ATCS corridor improvement can be counted on to mitigate additional traffic from a proposed project or improve an existing deficiency along a corridor.
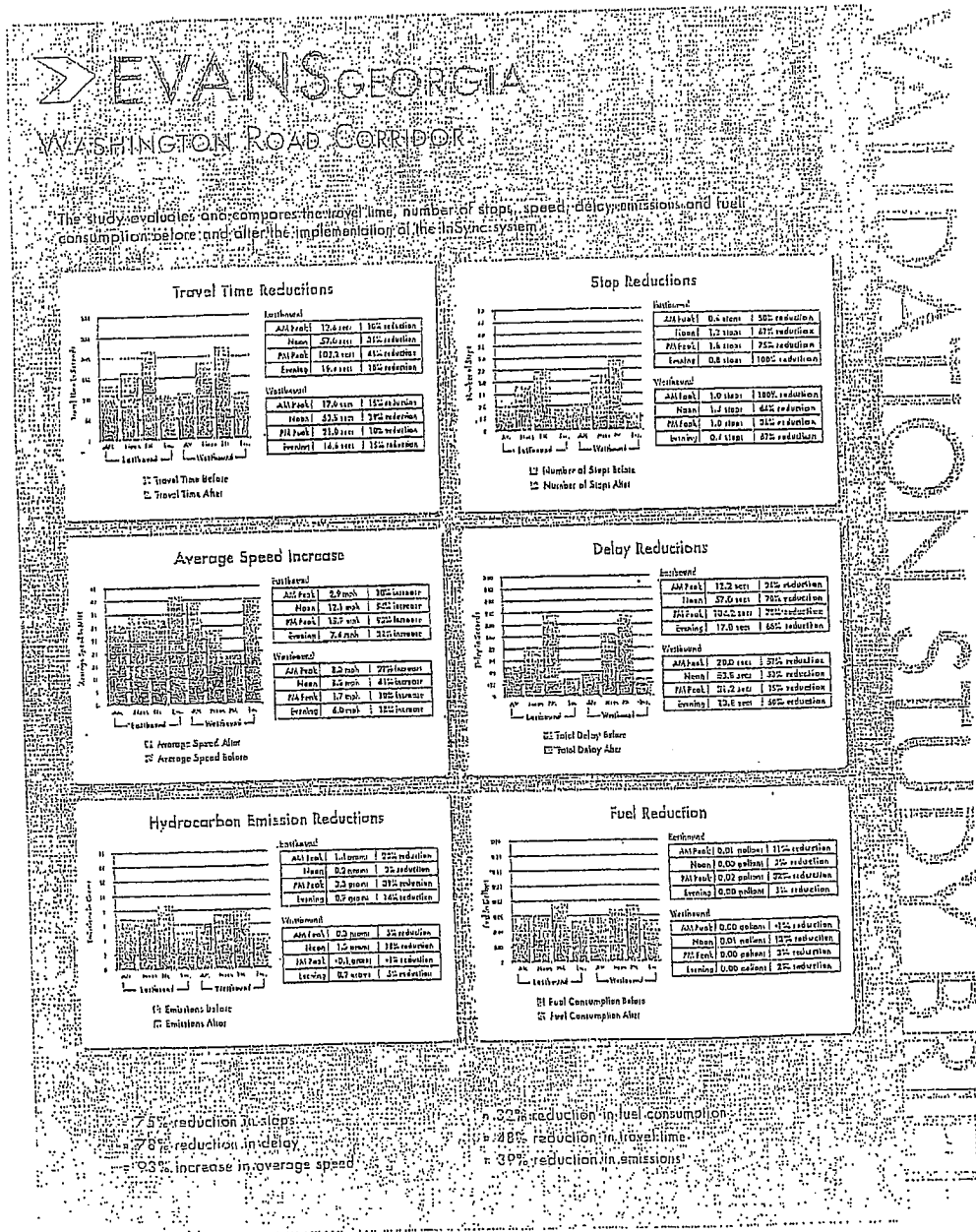
Cc: Bob Little

Attachment 1

ATCS Performance

Attachment 2

ATCS Performance

Attachment 3

ATCS Performance
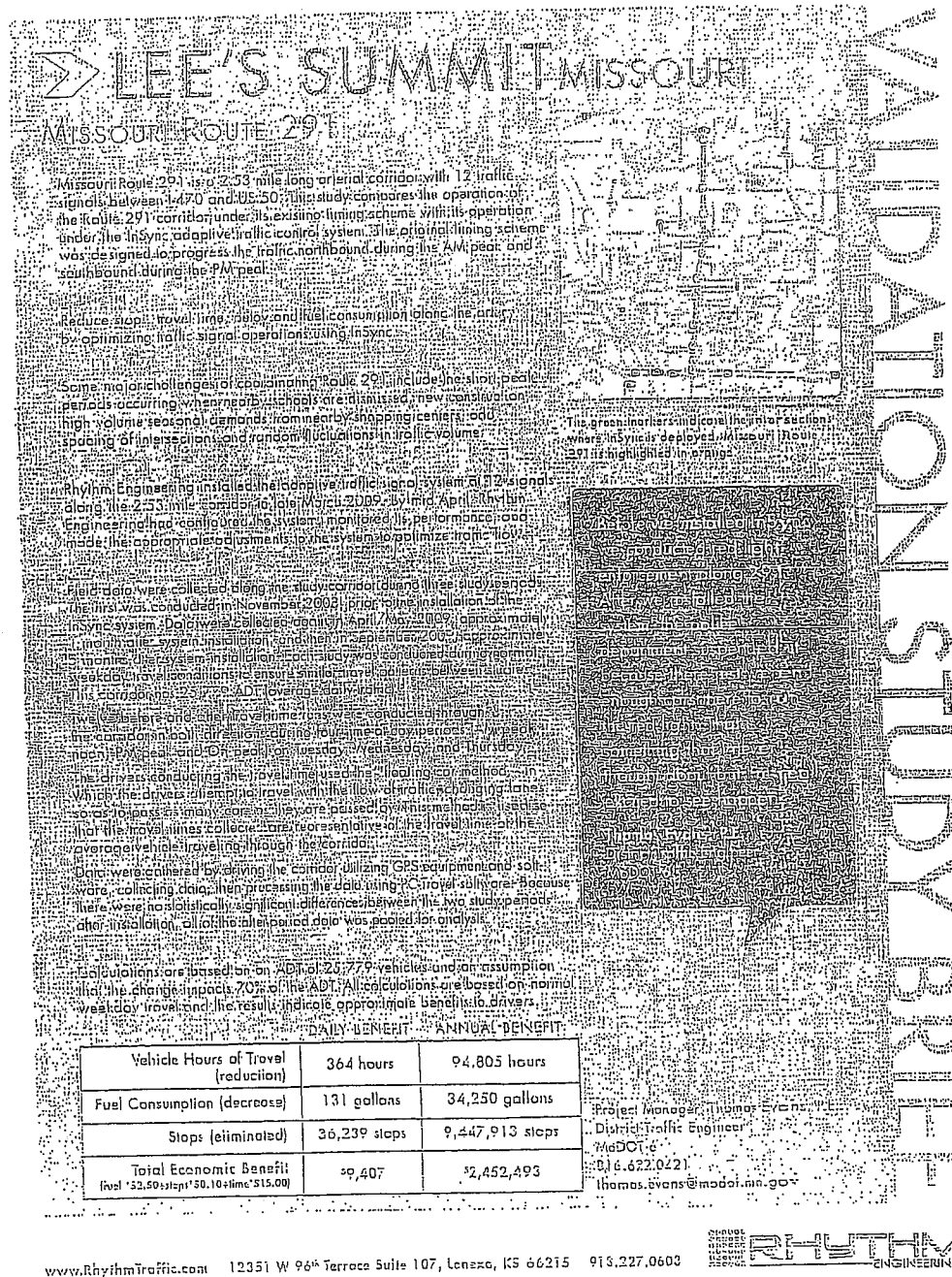
➤ LEE'S SUMMIT MISSOURI
MISSOURI ROUTE 291

	DAILY BENEFIT	ANNUAL BENEFIT
Vehicle Hours of Travel (reduction)	364 hours	94,805 hours
Fuel Consumption (decrease)	131 gallons	34,250 gallons
Stops (eliminated)	36,239 stops	9,447,913 stops
Total Economic Benefit (fuel *$2.50 stops*$0.10+time*$15.00)	$9,407	$2,452,493

Project Manager: Thomas Evans
District Traffic Engineer
MoDOT-6
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QuicTrac™

Adaptive Signal Control Software
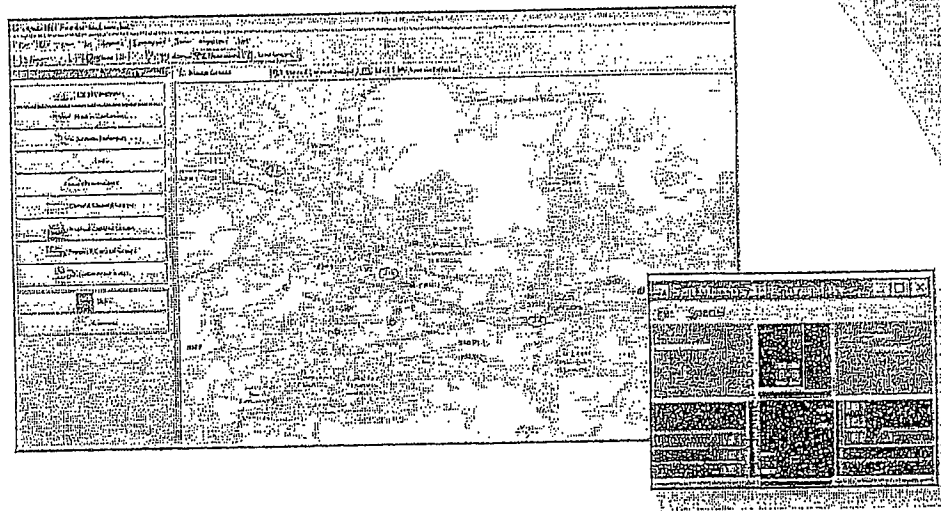
Overview

McCain's *QuicTrac*™ adaptive control, a component of *QuicNet Pro*™ central software, coordinates traffic signals along a corridor based on prevailing conditions, smoothing traffic flow and enhancing arterial performance. By reducing the number of stops and delays, this innovative, cost-effective solution expedites travel times, minimizes congestion, and reduces fuel consumption and emissions. Best of all, in today's eco-conscious political climate, *QuicTrac* software provides a vehicle for securing federal funds under an increasing number of legislative and funding initiatives that require a positive environmental impact.

Benefits

- Improves arterial performance by adjusting to real-time traffic demand
- Field-proven system for reducing delays up to 46%
- Boosts intersection efficiency and mobility
- Minimizes congestion and emissions
- Positively impacts the environment helping to secure federal funds under green legislation
- Compatible with 170 and 2070 controllers
- Easy-to-use Windows based software

Product Description

McCain's *QuicTrac* adaptive control software is a field-proven solution for real-time actuated signal control along a corridor. Resulting in fewer accidents, less congestion, smoother traffic flow, decreased pollution, and happier drivers!

QuicTrac software collects data from a modest number of field detectors - loop or video - requiring only enough detectors to obtain a reasonable sampling of speed along the corridor. Acquired data is then analyzed using McCain's proprietary algorithms, calculating optimum cycle lengths, splits and offsets based on prevailing traffic conditions.

Compatible with Model 170 or 2070 controllers, QuicTrac adaptive control requires no special hardware. Best of all, as an integral part of *QuicNet Pro* central software, training is minimal and *QuicNet Pro* software users can be brought up to speed in a matter of hours.

McCain®

www.mccain-inc.com

QuicTrac Adaptive Control
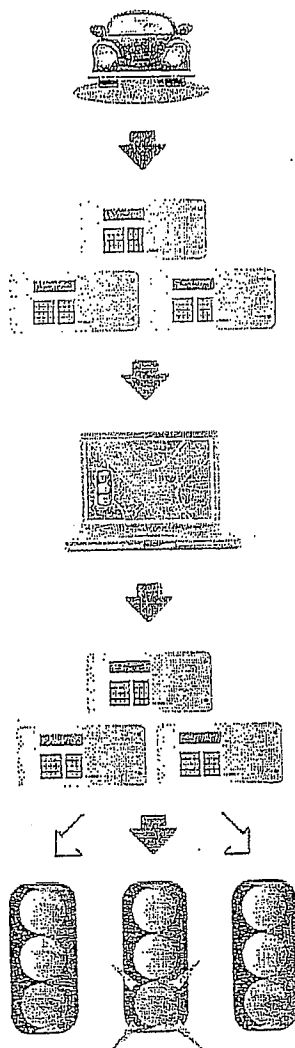
Traffic Conditions Established

Field detectors, loop or video, collect data on prevailing traffic conditions.

Modest system detector requirements demand only enough detectors to reasonably sample speed along the corridor.

Local Controllers Collect Volume Data

Local controllers collect data from field detectors which are then sent to the *QuicTrac* software module of *QuicNet* central control software.

Optimal Signal Timing Calculated for Corridor

QuicTrac adaptive control software utilizes McCain's proprietary algorithms to analyze data from the controller network to calculate optimum signal timing along the entire corridor to expedite traffic flow in the desired direction.

QuicTrac software then distributes cycle lengths back to the individual local controllers.

New Split Patterns Calculated

Local controllers utilize cycle length data received from *QuicTrac* software to determine new split patterns.

Signal Timing Optimized

Signal timing is adjusted to expedite traffic flow along the corridor creating fewer stops, yielding less congestion and accidents, and reducing harmful emissions.

System Specifications

Compatibility

- Multiple communication channels
- Model 170 or 2070 controllers

System Requirements

- *QuicNet Pro* central software (see separate data sheet)
- Field detectors, existing or new installation, video or loop technology. Exact number required based on corridor length and number of signals.

Installation

- As a component of *QuicNet Pro* central software, the installation process for *QuicTrac* adaptive control is quick and seamless.

To learn more about McCain's Integrated Traffic Solutions, please contact info@mccain-inc.com or call (760) 727-8100

QuicTrac™ Adaptive Control Delivers Delay Reductions up to 44% on San Marcos Boulevard.

EXECUTIVE SUMMARY:
San Marcos Achieves "Smart Corridor" through Optimized, Real-Time Traffic Signal Control

The City of San Marcos transformed San Marcos Boulevard, it's most congested arterial, into a "smart corridor" through the successful implementation of QuicTrac adaptive signal control, resulting in maximum benefits for the motoring public at a minimal cost to the City.

Data was collected across the Boulevard's four peak travel times, yielding dramatic results up to:

- 46.0% less delay
- 39.1% fewer stops
- 7.8% less fuel consumption
- $645,000 in first year benefits

THE SITUATION:
High Volume Arterial with Increasing Congestion and Delays Impacted by Schools & Businesses

San Marcos Boulevard is the second busiest surface arterial in San Diego County, with an average daily traffic volume of 22,000 - 46,000. Comprised of both major and minor intersections, the corridor intersects a major highway, and is lined with businesses and schools.

Even with a previously coordinated traffic signal plan in place, the City still experienced significant congestion during four peak travel periods:

- Morning Peak (AM)
- Midday Peak (MD)
- Evening Peak (PM)
- School Hours / Off Peak (OFF)

Project at a Glance

CORRIDOR
San Marcos Boulevard faced several challenges
- 22,000 - 46,000 average daily traffic
- Four peak periods
- Significant congestion levels
- Major & minor intersections

SOLUTION
McCain's QuicTrac adaptive control software optimized traffic flow by making real-time adjustments to signal coordination based on demand.

TOP BENEFITS / RESULTS
- ✓ Delay reductions as high as 46%
- ✓ Lifetime benefit-cost ratio of 8:1
- ✓ Minimal displacement to traffic going opposite the optimized direction of traffic
- ✓ $645,000 in benefits to the public during the first year of operation
- ✓ Delivered maximum public benefit at minimal cost

THE SOLUTION:
Optimize Signal Coordination Based on Prevailing Conditions with QuicTrac Adaptive Control

An adaptive control system was identified as the optimum solution to improve traffic flow on the corridor. FHWA studies show that adaptive systems have an average of 10% or more improvements in performance metrics including travel time, delay, stops, emissions and fuel consumption.

System Selection: After researching available technologies, the City of San Marcos selected McCain's QuicTrac adaptive control for reasons that include:

- Compatible with City's existing controllers
- Cost-effective and easy to setup & maintain
- Provides real-time signal adjustments

System Deployment: The corridor was configured into three adaptive groups for optimum performance.

The overall system deployment utilized existing infrastructure, loop and video detectors, and controllers, where available. Communications and infrastructure upgrades were completed, as needed, along the corridor.

THE RESULTS:
Significantly Reduced Vehicle Delays, Stops, and Fuel Consumption Earns San Marcos Top Honors

Results showed significant improvements in travel time, delay, and corridor speed, far exceeding expectations. With a benefit-cost ratio of 8:1, the system has succeeded in offering a maximum benefit to the public at a minimal cost to the City.

Traveling eastbound, the most congested direction, during the Boulevard's four peak periods produced an average:

- 29.7% less delay

Results showed significant improvements in travel time, delay and corridor speed, far exceeding expectations.
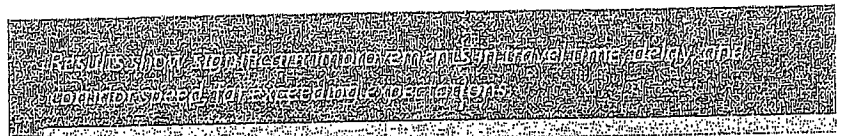
- 19.6% fewer stops
- 10.4% reduced travel times
- 11.8% speed increase

The City of San Marcos has been recognized for their "Smart Corridor" project locally and nationally as a showcase for the benefits of ITS solutions. As a technology leader in Southern California, the City is well positioned for future ITS deployments including Connected Vehicle Research.

Results at a Glance

AVERAGE REDUCTION IN DELAY: 29.7%

Peak Period	Delay	Stops	Travel Time	Fuel Consumption
AM (7:00 a.m. - 9:00 a.m.)	19.1%	12.5%	2.7%	4.5%
MD (11:30 a.m. - 2:00 p.m.)	31.5%	16.7%	13.6%	18.3%
PM (3:00 p.m. - 6:00 p.m.)	46.0%	39.1%	13.2%	15.7%
OFF (9:00 a.m. - 11:30 a.m.)	22.3%	10%	12.2%	13.1%

QuicTrac™ Adaptive Software Reduces Arterial Congestion and Residual Queuing on Freeways, Promoting Mobility for City Residents.

EXECUTIVE SUMMARY:
Temecula Significantly Improves Traffic Flow to Enhance Quality of Life for Residents

The City of Temecula deployed *QuicTrac* adaptive control software on seven major arterials, including 83 signalized intersections spanning 18 miles, to reduce congestion and improve traffic flow.

Significant improvements in mobility were achieved through three main initiatives. First, new signal timing plans were engineered to reflect current demand. Next, communication was established with Caltrans' signals to integrate corridors with the freeway. Lastly, adaptive control technology was implemented to ensure perpetual optimization of arterials, allowing signals to optimize signal timing on-the-fly to meet demand. Citywide results included:

- 29% fewer stops during peak periods
- 17% improvement in speed
- 14% reduction in travel time

THE SITUATION:
Hefty Commute Times and Congestion Plagued the City's Primary Arterials and Freeway Interchanges

Temecula's major corridors connect the City's residential communities to commercial districts, institutions and the region's primary interstate, the I-15 freeway.

Existing signal coordination did not respond to prevailing traffic conditions causing unnecessary congestion. In addition, the lack of communication with I-15 signal interchanges caused traffic to backup on the off-ramps, causing residual queuing during the morning and evening rush hours:

- Morning Peak (7:00 AM - 9:00 AM)
- Evening Peak (4:00 PM - 6:00 PM)

Project at a Glance

PROJECT SCOPE
Seven major arterials spanning 18 miles of roadway, connecting residential communities, commercial districts, and the freeway.
- Two peak periods
- Significant congestion levels
- Traffic backup on off-ramps
- Major intersections that include freeway access

SOLUTION
McCain's *QuicTrac* adaptive control software optimized traffic signal coordination for 83 signalized intersections, including 7 Caltrans signals, smoothing traffic flow and enhancing freeway access.

TOP BENEFITS / RESULTS
- ✓ Achieved communication with Caltrans signals and minimized queuing at freeway ramps
- ✓ Lifetime benefit-to-cost ratio of 30:1
- ✓ 81.3% of intersections showed reduction in delays during peak periods
- ✓ Minimal displacement to traffic traveling opposite to the optimized direction of traffic
- ✓ Delivered maximum public benefit at minimal cost

THE SOLUTION:
Establish Communications with Caltrans' Signals & Optimize Coordination with *QuicTrac* Adaptive

McCain's *QuicTrac* adaptive control software was implemented to lower congestion and maximize thoroughfare with a system that is easy to understand, and simple to set up and maintain. It was selected for its proven local success and ability to maximize use of Temecula's existing infrastructure - detectors, controllers, and central control software.
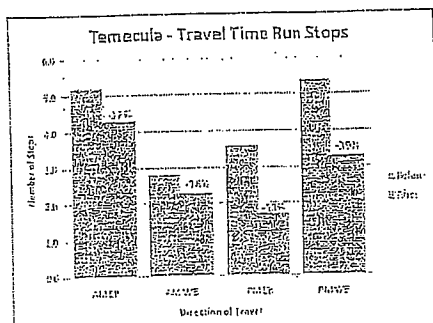
Traffic flow was improved by optimizing signal timing, establishing communication with Caltrans' signals...

System Deployment: Each arterial was evaluated for current conditions highlighting necessary infrastructure improvements (i.e. separating loop detectors to provide lane-by-lane vehicular data) and signal timing plan updates. New traffic volume counts were collected and analyzed to engineer new coordination plans that served as the base parameters for adaptive operations.

At the major freeway access points, yellow yield or one-way communication with Caltrans' signals was established. Coordination plans were then implemented to clear traffic from the ramp signals onto the main corridors to minimize queuing down the ramps, whereas normal coordination emphasizes only movement along the corridor.

THE RESULTS:
Temecula Residents Experience Reduced Commute Times and Improved Quality of Life

Temecula successfully achieved their goal of improving the quality of life for residents by reducing commute times and smog producing vehicle emissions.

Results varied on an arterial by arterial basis, yielding significant citywide improvements in travel time (14%) and corridor speeds (17%), as well as reductions in stops (29%) that far exceeded expectations.

Results also showed enhancements in the level of service (LOS), measured in delay per vehicle (sec/veh), for each intersection during AM and PM peaks.
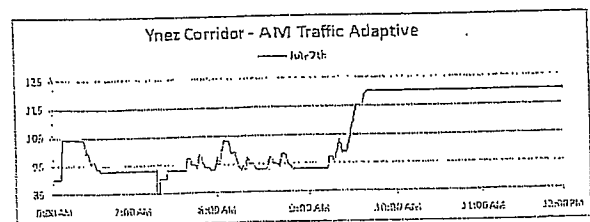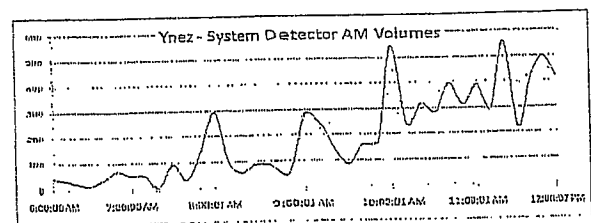
- 81.3% showed improvements in delay
- 30.6% improved by a full grade or more (LOS)

In addition, the optimization of traffic flow made a positive impact on commuter's wallets and the environment.

- $2.6 million in annual travel time savings
- $437,000 in annual fuel costs saved

With a benefit-to-cost ratio of 30:1, the system has succeeded in offering a maximum benefit to the public at a minimal cost to the City.

The City of Temecula has joined the ranks of cities recognized nationwide for their advanced traffic solutions.

Results at a Glance

Project Performance Measure	Improvements
Average Speed Increase	17%
Average Decrease in Travel Time	14%
Benefit-to-Cost Ratio	30:1
First Year Fuel Savings	120,000 gal
First Year Emissions Reduction	14,000 lbs.

Temecula Citywide Travel Time Run Stops

Ynez Corridor – Real Time Cycle Length and Volume Comparison