STAFF REPORT

ITEM NO. 11

CITY OF OCEANSIDE

DATE: July 9, 2008

TO: Honorable Mayor and City Councilmembers

FROM: Development Services Department

SUBJECT: **APPROVAL OF THE USE OF ADAPTIVE TRAFFIC SIGNAL CONTROL FOR COLLEGE BOULEVARD**

SYNOPSIS

Staff and the Transportation Commission recommend that the City Council approve the use of adaptive traffic signal control on College Boulevard between Lake Boulevard and Silver Bluff Drive/Town Center Drive.

BACKGROUND

On November 15, 2006, staff updated the City Council on the progress of a report reviewing the need for adaptive traffic signal control for College Boulevard. Since that time the City's consultant, IBI Group, has finalized the report and made recommendations for adaptive traffic signals on College Boulevard.

ANALYSIS

Adaptive traffic signal control is a method of traffic signal coordination that changes the timing of the traffic signals based upon the current traffic demand. Traditional traffic signal coordination uses fixed timing parameters that change during the peak periods of the day.

The final report for the adaptive traffic signal control for College Boulevard was divided into six tasks to properly evaluate the value of adaptive traffic signal control on College Boulevard. Following is a summary of the tasks:

IBI Group reviewed 17 signalized intersections on the College Boulevard corridor from Lake Boulevard to Silver Bluff Drive/Town Center Drive. The review considered the spacing of intersections, the AM and PM peak periods, the effect of emergency vehicle preemption (average of nine per day), Caltrans ramp at State Route 78, and the Sprinter rail line.

Analysis of Existing Signal Infrastructure and Traffic Patterns

IBI Group estimated the theoretical potential benefits of deploying traffic adaptive signal control in the project area. The estimated reduction in PM peak period average intersection delay (all directions at an intersection) through the implementation of adaptive controls ranged from 30 percent at Oceanside and College Boulevards to an increase in average intersection delay of eight percent at College Boulevard and Mesa Drive. Overall there is potential for a net improvement at 12 of the 17 intersections (during the PM peak).

Summary of Adaptive Signal Control Concepts and Options

IBI Group provided an overview of the various adaptive signal control implementation options and their compatibility with Oceanside's existing traffic signal communication system. They reviewed three traffic adaptive systems that provide adaptive technology. The systems included two versions of SCOOT (Split Cycle and Offset Optimization Technique, developed in the United Kingdom), SCATS (Sydney Coordinated Adaptive Traffic System developed in Sydney, Australia) and ACS – Lite (Adaptive Control System developed by the Federal Highway Administration). The advantages and the disadvantages were reviewed to make recommendations. SCOOT and SCATS have systems world-wide but they require extensive calibration and staff training (some agencies have not been able to commit the time to the systems and have since abandoned them). ACS-Lite is not recommended due to the minimal benefits for a traffic actuated system.

The preferred adaptive control system is SCATS (theoretically as an operating system) with a QuicTRAC (Traffic Adaptive Control) system recommended as a low-cost alternative (City staff recommended QuicTRAC as an alternative due to compatibility with the existing QuicNET signal management system and the reduced maintenance and operating costs). The QuicTRAC system is also a software program provided by a local manufacturer which will benefit system start-up and operation.

Preliminary Assessment of Adaptive Control

A budgetary estimate was prepared with SCATS as a model for the estimate. The estimated cost of the system is approximately $1 million. The software cost is approximately $400,000 and another $500,000 in system modifications (hardware, testing, detection, and miscellaneous). In addition, the annual SCATS maintenance cost is estimated to be approximately $20,000 to $50,000 depending on the level of involvement from the vendor. Also additional staff resources (half-time Traffic Engineer and full-time Signal Technician) are required to operate and maintain the SCATS system. The total estimated annual operational cost for a SCATS system is $90,000. The analysis identified the SCATS system as the preferred adaptive traffic signal control system at a total cost of $1.1 million. At this time, staff does not believe it is practical to implement the SCATS system when other systems and operational improvements will provide some of the benefits of a SCATS system.

The final report recommends that City staff consider using the QuicTRAC system that is compatible with the City's existing computerized communication system. The cost of the QuicTRAC software as a part of the existing system is estimated at $20,000. Other improvements to the system to implement QuicTRAC are estimated at less than $75,000.

Staff recommends employing the QuicTRAC system on several intersections on College Boulevard (recommendations by the vendor) in the next several months and then expanding the system as staff gains expertise and confidence in the system.

FISCAL IMPACT

The QuicTRAC system software, including potential upgrades is estimated to cost $95,000. A carry forward of all funds in the College Boulevard Adaptive Signal project (503.765218) is projected to be $258,500. Therefore, sufficient funds are available.

COMMISSION OR COMMITTEE REPORT

At their June 17, 2008, meeting, the Transportation Commission reviewed and approved the use of adaptive traffic signal control for College Boulevard.

CITY ATTORNEY'S ANALYSIS

Does not apply.

RECOMMENDATION

Staff and the Transportation Commission recommend that the City Council approve the use of adaptive traffic signal control on College Boulevard between Lake Boulevard and Silver Bluff Drive/Town Center Drive.

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Attachments:

Presentation Material
Final Report Summary

City of Oceanside
Adaptive Signal Control Assessment for College Boulevard

July 9, 2008

Objectives

- Summarize findings of final report
- Seek approval to implement adaptive signal control on College Boulevard

Agenda

- Project Purpose
- Analysis
- Conclusions
- Recommendations

Purpose

- Assess traffic adaptive control options
  - Estimate benefit
  - Estimate costs
- Recommend options for deployment that would enhance efficiency and operations on College Boulevard

Analysis Efforts

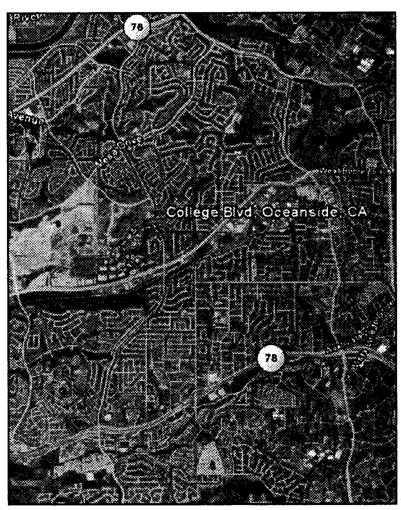
Tasks undertaken as part of the analysis:

1. Project meetings
2. Data collection and field reviews
3. Analysis of existing traffic patterns
4. Summary of adaptive signal control options
5. Preliminary assessment of adaptive control
6. Summary of findings

Data Collection and Field Reviews

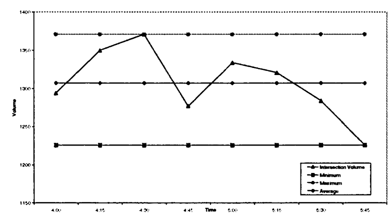
College Boulevard Corridor:

- 17 signalized intersections
- Adaptive Control:
  - Variability in AM (26%)
  - Variability in PM (12%)
  - Frequent emergency vehicle pre-emption
  - Sprinter rail line
  - Highway 78 interchange



Analysis of Existing Traffic Patterns

- Estimate benefits of adaptive
- Synchro traffic analysis
- PM peak focus of analysis:
  - Improved operations at 12 intersections
  - 30% reduction in average intersection delay at Oceanside Boulevard
  - 8% increase in average intersection delay at Mesa Drive



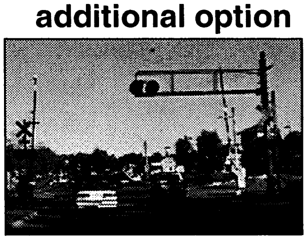
Delay analyzed was for all directions on average, not just College Blvd.

Summary of Adaptive Control Options

Evaluated three systems:

- SCOOT (Peek & Siemens)
- SCATS
- ACS Lite

QuicTRAC/McCain as additional option

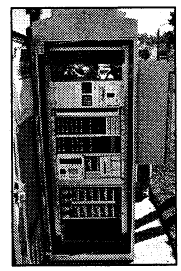


Criteria:

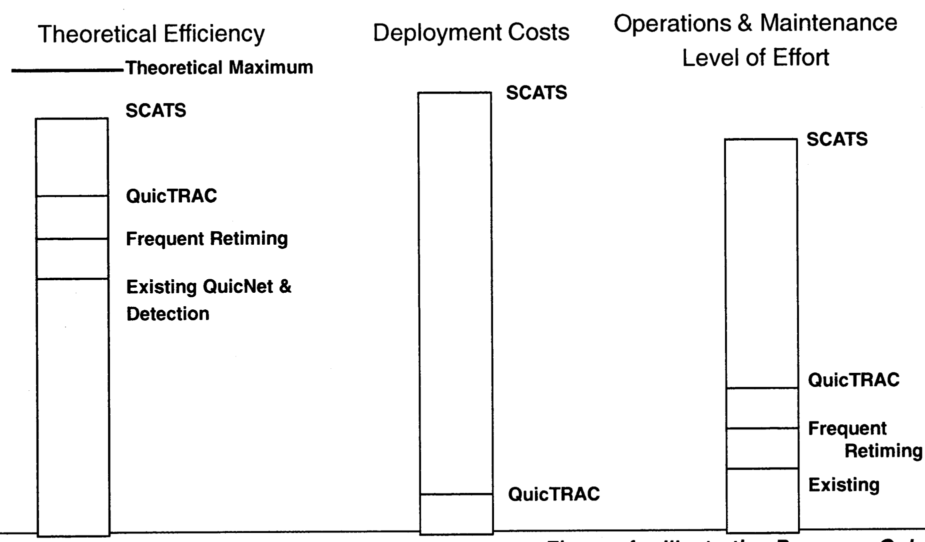
- On-street operations
- System features
- System standards
- Controller standards
- Communication
- Detection
- Pre-emption
- Costs
- Vendor support

Preliminary Assessment of Adaptive Control

- Experience of other agencies – SCATS preferred from pure technical/efficiency benefits perspective.
- SCATS costs:
  - Budgetary capital/installation costs - $1 million
  - Annual maintenance costs - $20-$50,000
  - System operations costs - $90,000
- SCATS far more costly than QuicTRACS adaptive option.



Considering the Options



Figures for Illustrative Purposes Only

Summary of Findings

- Question: Best option of potential improvement versus cost?
- McCain QuicTRAC:
  - Incorporates easily into existing system
  - Compatible with existing communications system
  - Capital cost - $20,000
  - Installation cost - $75,000
- McCain option offers better balance of potential operational benefits versus costs and implementation risks.

Recommendation

- Council support the deployment and application of QuicTRAC on College Boulevard.
- If QuicTRAC demonstrates effective gains on College Boulevard then other corridors in the City should be considered for implementation.

City of Oceanside

ADAPTIVE SIGNAL CONTROL REVIEW FOR COLLEGE BOULEVARD

TASK 6 FINAL REPORT

MAY 2008

IBI GROUP

DOCUMENT CONTROL

Client:	City of Oceanside
Project Name:	Adaptive Signal Control Review for College Boulevard
Report Title:	Adaptive Signal Control Review for College Boulevard
IBI Reference:	TO-13910
Version:	2.0
Digital Master:	[J:\13910\10.0 Reports\Task 6\STR Task 6_Final_Report_2008-05-07.doc\2008-05-08\MJC]
Originator:	[Mike Corby]
Reviewer:	[Don Murphy]
Authorization:	[Don Murphy]
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LIST OF EXHIBITS

1. INTRODUCTION

The purpose of the Adaptive Signal Control Review for College Boulevard is to assess traffic adaptive signal control options and determine if the application of adaptive control offers particular benefits along the College Boulevard corridor in the City of Oceanside. The IBI Group work program included six project tasks for this assignment, namely:

- Task 1: Project Meetings;
- Task 2: Data Collection and Field Reviews;
- Task 3: Analysis of Existing Signal Infrastructure and Traffic Patterns;
- Task 4: Summary of Adaptive Signal Control Options;
- Task 5: Preliminary Assessment of Adaptive Control;
- Task 6: Draft and Final Report.

This project task, Task 6 Draft and Final Report documents the finding from this project. Based on the project findings, and in consideration of the needs of the project corridor and the City of Oceanside staff may want to consider using the QuicTRAC system for adaptive control as a low cost option. Alternatively, the City of Oceanside may elect to improve the corridor operations through improved monitoring and analysis of the project corridor operations.

Section 2 through 5 of this report summarizes the findings from project Task 2, 3, 4 and 5, respectively. A summary of the project findings is presented in Section 6, along with the report recommendations.

2. TASK 2 DATA COLLECTION AND FIELD REVIEWS

Task 2 Data Collection and Field Review documented the existing traffic signal control system equipment on the project corridor, and identified unique traffic characteristics that must be considered in the deployment of a traffic adaptive signal control system. The major findings from this work, which require further analysis are:

- Due to the short signal spacing between the signalized intersection at College Boulevard at Vista Way and College Boulevard at SR 78 Eastbound Off Ramp, the off ramp should be included in the traffic adaptive signal control system to ensure coordination. This signalized intersection is owned by CalTrans;
- Additional signalized intersections may need to be included in the adaptive system due to their proximity to College Boulevard, including: Vista Way at SR 78 Westbound Ramp, adjacent signals on Oceanside Boulevard;
- The train frequency and the impact of railroad pre-emption on the ability of the traffic adaptive signal control system to improve traffic operations;
- The ability to double-cycle a signalized intersection within a co-ordinated zone to mimic existing operations at College Boulevard at Chroma Drive;

- The ability to operate signals in isolation to improve on-street operations (e.g. College Boulevard at Oceanside Boulevard);
- The ability to automatically adjust control areas depending on current operations. For example, remove College Boulevard at Oceanside Boulevard from the College Boulevard control area during the AM peak to operate in isolation;
- The ability to operate actuated phases (i.e. full actuated control) with a sophisticated local detection strategy;
- The potential use of video detection for traffic adaptive detection.

3. TASK 3 ANALYSIS OF EXISTING SIGNAL INFRASTRUCTURE AND TRAFFIC PATTERNS

Task 3 Analysis of Existing Signal Infrastructure and Traffic Patterns estimated the potential benefit of deploying traffic adaptive control in the project area, and introduced three traffic adaptive systems that could be deployed. From the Task 3 analysis, the estimated reduction in PM Peak period control delay through the implementation of adaptive control ranges from 30% at Oceanside & College to an increase in intersection control delay of 8% at Mesa Drive. Overall there is a net improvement in control delay at the most project signalized intersections (12 of 17 coordinated during the PM peak), with a minor increase at the remaining signalized intersections.

4. TASK 4 SUMMARY OF ADAPTIVE SIGNAL CONTROL CONCEPTS AND OPTIONS

Task 4 Summary of Adaptive Signal Control Concepts and Options provided an overview of the various adaptive signal control implementation options, highlighting advantages and disadvantages of each system. The following system options were evaluated for Oceanside's consideration:

1. SCOOT Peek using Novax 6905 controllers;
2. SCOOT Siemens using only Eagle M40, M50 or 2070 controllers, with either Siemens UTC or ACTRA;
3. SCATS using a 170E controller; and
4. ACS Lite using BiTrans Quic/Net and 170E controllers.

Based on the Task 4 evaluation results, the preferred traffic adaptive signal control system is a standards-based system that makes use of the existing Oceanside traffic signal control system infrastructure. Furthermore, the system should be relatively simple to implement, and maintain. Based on these key attributes, the preferred system is SCATS. It is worth noting that QuicTRAC could provide a low-cost alternative to SCATS.

5. TASK 5: PRELIMINARY ASSESSMENT OF ADAPTIVE CONTROL

As part of Task 5 agency interviews were conducted to document lessons-learned from traffic adaptive control system users (Section 5.1). Based on these lessons-learned combined with the Task 4 project findings, SCATS is the preferred traffic adaptive systems. Task 2 identified several operational concerns in the Project Corridor. These operational concerns are summarized in

Section 5.2, and contrasted with the experience gathered through discussion with SCATS Users. Section 5.3 presents a budgetary estimate to implement SCATS.

5.1 Experience of Other Agencies

Interviews with traffic adaptive signal control system users were conducted to validate the findings from Task 4. The following summarizes the results of the stakeholder interviews.

5.1.1 SCOOT

City of San Diego, Duncan Hughes, 619.533.3761

The City of San Diego implemented a Peek SCOOT traffic adaptive signal control system that used BiTrans firmware operating on 170 controllers. The SCOOT-BiTrans interface was never properly completed. It is suspected that the challenge with the interface was translating the SCOOT single ring stage logic into the North American NEMA style phase logic. Although the SCOOT-BiTrans system was not working properly the system was operational for a period of time, but required a long cycle length for optimisation. In the end the system was deactivated, without completing the SCOOT-BiTrans interface. The City of San Diego staff did not pursue SCOOT because they believed that the actuated control was mostly likely as good as SCOOT.

5.1.2 ACS LITE

City of El-Cajon, CA, Trev Homan, 619.441.1665

The City of El-Cajon deployed the ACS Lite traffic adaptive system, through a Federal grant program. ACS Lite was deployed on the existing BiTrans Quic/Net system and 170 controllers operating with Program 233. This work followed the deployment of ACS Lite by Peek, Econolite and Eagle. The following summarize the discussion with Trev regarding the ACS Lite system:

- The system was operating for approximately 1 month;
- There were problems with the system that have not been resolved. As an example, ACS Lite only accepts whole second values (i.e. amber cannot be 3.2 seconds, but must be 4 seconds);
- ACS Lite does not optimize the cycle length, and is suppose to work on a fixed cycle length that is changeable by time of day;
- When ACS Lite was operational, it would only operate on one cycle length throughout the day;
- The operating cycle length had to be the largest cycle length that could accommodate all movements, plus additional time for optimization. This produced a 160 second cycle length, which was less then optimal. The negative impact of the long cycle length was reduced by double-cycling signalized intersections;
- ACS Lite did not improve on-street operations;
- ACS Lite requires software updates (bug fixes such as whole second issue), and improvement (such as cycle length optimization), before deployment is warranted.

McCain – Steve Brown, 760.734.5093

Steve Brown reiterated the issues working with ACS Lite. His comments agreed with Trev Holman, and confirmed that ACS Lite requires more development.

5.1.3 QUICTRAC

McCain, Steve Brown, 760.734.5093

Steve Brown from McCain recommended that Oceanside consider the use of the QuicTRAC traffic adaptive signal control system. This system is an enhancement of QuicNet and can operate using either a 170 or 2070 controller. The system uses two levels, a tactical level implemented in the local intersection controller, and a strategic level implemented in the central system computer.

The Strategic Level uses system detectors to measure traffic flow, and determine control area cycle length and offsets. At the Tactical Level, the local intersection controller determines its optimum cycle length and transmits this information to the Strategic Level for control area cycle length determination. The Tactical Level is responsible for determining split times by measuring traffic flow either at the intersection or upstream of the intersection. This system has been deployed in Sunnyvale.

City of Sunnyvale, Dennis Ng, 408.730.7412

The City of Sunnyvale has implemented three traffic adaptive signal control systems, namely Rhodes, QuicTRAC, and SCATS.

The QuicTRAC system showed minimal benefits, and was not the preferred adaptive system when compared with SCATS.

5.1.4 SCATS

City of Gresham, OR, Tony Sepich, 503.970.8231

The City of Gresham has been operating SCATS for several months. The following summarizes the discussion with Tony:

- The vendor provided excellent support throughout the installation, and continues to provide on-going support during operations;
- Install the system recommended by the vendor, and in particular install new detectors as per the SCATS design;
- It is not an easy system to understand SCATS. It is not as easy to operate as Quic/Net;
- Ambitious staff eager to learn the system are required to make SCATS successful;
- Additional staff time need to be allocated for system implementation;
- Additional staff time is required for ongoing operations and maintenance. For example, implementing an advanced left turn phase takes double the time in comparison to the Quic/Net system;

- SCATS provides a wealth of data that is beneficial for system trouble shooting. For example, the system provides feedback on the status of system detectors;

- The cost of SCATS cost was approximately $1.6 million to implement at 11 signalized intersections. A significant portion of the project cost is onetime costs, such as central hardware and software, training, etc.

The City of Gresham published an article in the Westernite, September-October 2007 on "*Evaluating an Adaptive Control System in Gresham*". The following summarizes the findings from this article:

- The City of Gresham and Multnomah County share the TransSuite central signal system with the City of Portland;

- The project corridor, Burnside Drive, is a 5 lane major arterial that carries approximately 38,000 ADT, is 1.88 mile in length, and includes 11 signalized intersections. The project corridor has retail development in the south end, and forms a triangle with Avenue/Division. This triangle requires careful coordination due to the close signal spacing (1,000 foot) and heavy volumes;

- In 2005 the signal timings on the project corridor were optimized and a significant travel time reduction achieved in comparison to the previous "free mode" operation;

- SCATS was implemented in March 2007 and fined tuned between early March and April 2007;

- To capture the benefits of SCATS multiple traffic surveys were conducted over multiple days and at several locations along the project corridor, while the signalized intersections were either operating time of day coordinated, or SCATS traffic adaptive;

- Measures of performance include: travel time, traffic volume, delay and queuing, number of stops, average travel speed, and agency staff perception;

- Significant peak period travel time reductions were achieved after the implementation of adaptive control. During the PM peak period, travel times were achieved lower then the travel times recorded in 1998.

- The most significant travel time improvements occurred during the PM peak period, where the average travel time was reduced by 1 minute in both directions from 6 minutes to 5 minutes.

City of Sunnyvale, Dennis Ng, 408.730.7412

The City of Sunnyvale has implemented three traffic adaptive signal control systems, namely Rhodes, QuicTRAC, and SCATS.

The Rhodes traffic adaptive logic was implemented with the Next Phase intersection controller logic. This system requires very specific detectors both at the stop bar and upstream from the signalized intersection. The system is expensive, and not very intuitive to use. This system is not recommended for future deployment.

Sunnyvale initially implemented SCATS at 24 signalized intersections, but is currently expanding SCATS to include 11 more signalized intersections in two distinct control areas.

Sunnyvale staff were extremely please with the customer support and expertise provided by Transcore during system implementation, and operation. This project was a turnkey project, and now City staff are completing system training. Dennis recommended having staff involved at project inception to ensure that the system can be operated and maintained by City staff.

Although not published, an evaluation of SCATS was completed. SCATS improved speeds while reducing delay. The results of the evaluation should be available soon.

City of Chula Vista, Cecil Chau, 619.397.6165

Chula Vista implemented SCATS at eleven signalized intersections on two intersecting six lane arterial roadways. These roadways are East H Street and Otay Lakes Road, which service 33,000 ADT and 29,000 ADT, respectively.

SCATS was selected as the preferred traffic adaptive signal control system because:

- It had a much smaller system structure size;
- The system could be customized to fit in the existing 170/NEMA dual-ring configuration;
- Either the existing 170E or the newer 16 bit 2070 controller could be used;
- Existing telecommunication circuits consisting of both hardwire interconnect and 'point-to-point' circuits could b utilized.

The City of Chula Vista published a SCAT evaluation report, May 2003. Travel time studies were used to evaluate SCATS in comparison the previous free operation. The study indicates that SCATS demonstrated the ability to respond to traffic demand dynamically by changing the split and cycle times dynamically while maintaining reasonable coordination in the direction of heavier traffic flow. Double cycles were used to minimize excessive delays to both side street vehicle traffic and pedestrians crossing the major arterials.

The conclusion of the study was that SCATS showed an improvement over fixed cycle coordination traffic control by reducing average delay time by up to 43% and average travel time by up to 15%.

Cecil also reaffirmed that the Transcore staff are very knowledgeable on SCATS, and provide excellent customer support.

Transcore, Travis White, Neil Gross, 713.939.5410

Travis and Neil responded to technical questions regarding the use of SCATS. The following summarizes their response to questions:

- In Cobb County SCATS controls signalized intersections that have a rail crossing. Trains require anywhere from 15 seconds to 5 minutes to cross the roadway depending on the length of the train and it's operating speed. The SCATS control logic varies depending on the duration of the pre-empt. If the pre-empt is short (less then one minute), then the local controller responds to the pre-empt. If the pre-empt is longer then one minute then SCATS intervenes, adjusting the operation at adjacent intersections to limit the vehicles arriving at the railroad crossing.
- Following the railroad pre-empt SCATS recovery logic is designed to quickly and efficiently recover. Macros are written that help SCAT recovery from pre-empt. In fact

macros can be written to help during the pre-empt routine as well, depending on the specific agency needs.

- In Sunnyvale SCATS controls CalTrans signalized intersections.

5.2 Application to Oceanside

Task 2 identified several operational concerns in the Project Corridor. Exhibit 5-1 reiterates these operational concerns, and summarizes the discussion with the SCATS Users as they relate to these operational concerns.

Exhibit 5-1: SCATS Operational Assessment for College Boulevard

Task 2 Operational Concern	User Discussion
Due to the short signal spacing between the signalized intersection at College Boulevard at Vista Way and College Boulevard at SR 78 Eastbound Off Ramp, the off ramp should be included in the traffic adaptive signal control system to ensure coordination. This signalized intersection is owned by CalTrans.	The City of Sunnyvale operates signalized intersections controlled by CalTrans. The budgetary estimate will include these signalized. A memorandum of understanding is required with CalTrans to convert these signals to traffic adaptive control. Furthermore, CalTrans may require system access, system training, etc, before these signals can be added to the traffic adaptive system.
Additional signalized intersections may need to be included in the adaptive system due to their proximity to College Boulevard, including: Vista Way at SR 78 Westbound Ramp, adjacent signals on Oceanside Boulevard.	A more detailed analysis of the project limits is required to determine if these signalized intersections should be included in the adaptive control system.
The train frequency and the impact of railroad pre-emption on the ability of the traffic adaptive signal control system to improve traffic operations.	Transcore confirmed that they have processes that can be used to implement logic suitable for frequent rail pre-emption, and length rail-pre-emption.
The ability to double-cycle a signalized intersection within a co-ordinated zone to mimic existing operations at College Boulevard at Chroma Drive.	Chula Vista uses double cycling in SCATS operation.
The ability to operate signals in isolation to improve on-street operations (e.g. College Boulevard at Oceanside Boulevard).	SCATS inherently optimizes signalized intersections in isolation, adjusting splits and control area cycle length.
The ability to automatically adjust control areas depending on current operations. For example, remove College Boulevard at Oceanside Boulevard from the College Boulevard control area during the AM peak to operate in isolation.	As SCATS optimizes, it determines whether signalized intersections should be coordinated or operate in isolation ("married versus divorced"). Alternatively, signalized intersections can be forced into coordination by time of day through the time of day scheduler. Offsets are selected from a suite of predetermined offsets to suite the on-street conditions.
The ability to operate actuated phases (i.e. full actuated control) with a sophisticated local detection strategy.	SCATS is operating in Sunnyvale and Chula Vista using operational strategies similar to Oceanside. Local detectors will need to be installed that meet SCATS requirements.
The potential use of video detection for traffic adaptive detection.	In Chula Vista video detection was used at five signalized intersections.

5.3 Budgetary Estimate

Exhibit 5-2 presents the budgetary estimate required to procure, install, optimize and evaluate the SCATS system at the 17 signalized intersections in the project area. This budgetary estimate was developed assuming a project schedule of approximately 6 months. This budgetary estimate is based on the SCATS system estimate provided by Transcore in November 2005, the SCATS project budgetary estimate provided by the City of Chula Vista, and through consultation with the various SCATS users contacted during this assignment.

Exhibit 5-2: SCATS Budgetary Estimate

	Component	Quantity	Unit Cost		Total	
			Oceanside	Transcore	Oceanside	Transcore
	Central System					
S.1	SCATS central software, hardware, supply and install[1]	1		$365,000		$365,000
	Communication System					
C.1	Modifications to isolate SCATS from existing Quic/Net	1	$30,000		$30,000	
	Field Equipment					
F.1	2070 controller with 2070-6A modem	17	$5,000		$85,000	
F.2	SCATS controller firmware (17 intersections)	1		included		
	Installation					
I.1	2070 controller	17	$2,500		$42,500	
I.2	Detection (17 intersections *12 loops per intersection)	204	$1,000		$204,000	
I.3	SCATS Calibration	17	$1,000	included	$17,000	
	Ancillary					
A.1	Project Management (6 month project at $120,000/year Traffic Engineer and $90,000/year Signal Tech, plus one vehicle at $12,000/yr)	1	$111,000	included	$111,000	
A.2	Training - 8 days (assume 8 people at $250/day)	1	$16,000	included	$16,000	
A.3	Documentation	1		included		
A.4	Warranty (basic hardware and 12 month software)	1		included		
A.5	Testing	1		included		
	Procurement					
P.1	Transcore contract negotiations/system procurement - assumed 2 months at $120,000/year Traffic Engineer	1	$20,000	included	$20,000	
P.2	Independent Consultant for Testing/Acceptance	1	$50,000		$50,000	$0
						$0
				Subtotal	**$575,500**	**$365,000**
				Contingency (20%)	$115,100	$73,000
				Subtotal	**$690,600**	**$438,000**
				TOTAL		**$1,128,600**

[1] Inflated the 2005 Transcore bid of $325,000 by 4% per year over three years

In addition, the annual SCATS maintenance cost is estimated to be approximately $20,000 to $50,000 depending on the level of involvement of Transcore. Additional City staff resources are required to operate and maintain the SCATS system. As the SCATS system is expanded to additional signalized intersections, the City resources required to operate and maintain SCATS will increase. As an initial estimate, the project area will required approximately 25% full time equivalent of a Traffic Engineer ($120,000 per year), Signal Technician ($90,000 per year), and one vehicle ($12,000 per year). This translates to an annual cost of $55,500 plus the annual maintenance cost of approximately $20,000 to $50,000 for a total annual cost of approximately $75,500 to $105,500.

6. SUMMARY OF FINDINGS AND RECOMMENDATIONS

Based on the above analysis, SCATS is the preferred traffic adaptive signal control system. However, given the initial capital costs $1,128,600, combined with the total annual cost of system operation and maintenance, $75,500 to $105,500, it is not practical to implement traffic adaptive control on the project corridor.

Instead, City staff will use the existing Quic/Net signal system, and develop optimized signal timing plans for the project corridor. Under this scenario City staff will continually monitor corridor performance and continue to develop new signal timing plans on a regular basis (i.e. annual), especially when the new Sprinter service is implemented. It is difficult to compare adaptive control versus optimized signal timing plans in terms of operational benefits. In most cases optimized timing plans will perform nearly as well as an adaptive signal control system for day-to-day operations, when signal timing plans are carefully developed. In some cases additional signal timing plans are required to carefully follow the build-up and dissipation of traffic volume through the peak periods (e.g. pre-AM peak plan, AM peak plan and post AM peak plan). However, as time goes on and subtle changes in traffic patterns start to accumulate, the performance of the optimized timing plans start to degrade in comparison to adaptive control. Furthermore, during time periods when traffic volumes vary significantly from typical (i.e. freeway incident), traffic adaptive control generally performs better then optimized signal timing plans.

City of Oceanside Staff may want to consider using QuicTRAC for adaptive control as a low cost option to SCATS. QuicTRAC is compatible with the City's existing QuicNet system, and is also supplied and supported by a local Company (McCain Traffic in Vista) that could facilitate staff to develop and monitor an adaptive system. QuicTRAC would allow City staff to transition into an adaptive system and expand as necessary.

In contrast to adaptive control, the cost to continually monitor and develop optimized signal timing plans for the project area will required approximately 8% (one month) full time equivalent of a Traffic Engineer ($120,000 per year), Signal Technician ($90,000 per year), and one vehicle ($12,000 per year). This translates to an annual cost of $18,500, which is significantly lower then the cost of traffic adaptive control.