SCATS Signal System Feasibility Study

U.S. Highway 31
Vestavia Hills, Alabama

Project Background

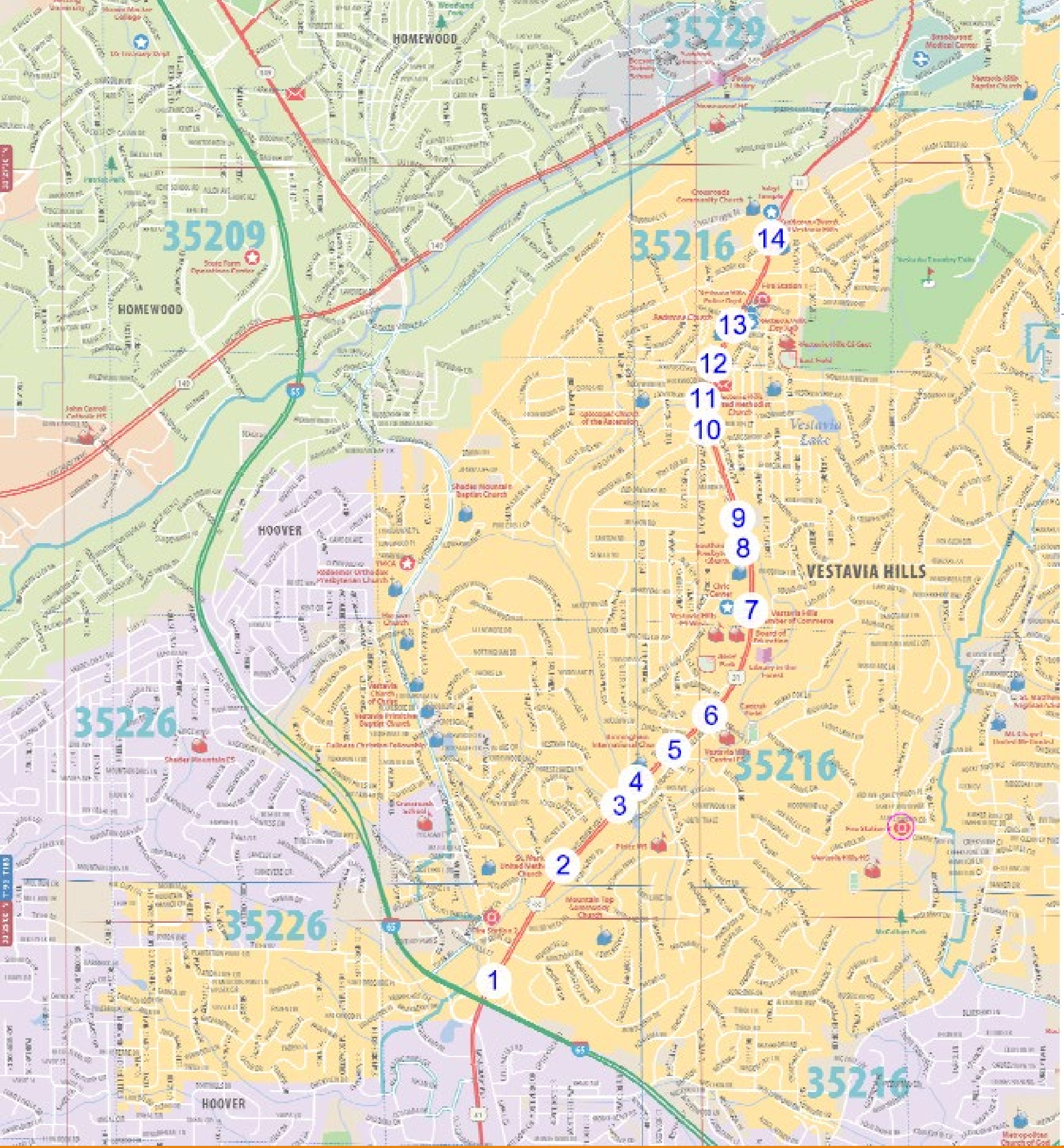
SCATS installed on three corridors in Alabama in 2012

- U.S. Highway 280 Birmingham
- Eastern and Southern Boulevard Montgomery
- Governors Drive Huntsville

SCATS system was subsequently removed on Governors Drive

16 SCATS intersection licenses available for use by ALDOT

ALDOT requested a study to determine the feasibility for use of SCATS on U.S. Highway 31 in Vestavia Hills



1. I-65 Northbound Ramps/Columbiana Road
2. Vestavia Parkway
3. Massey Road
4. Pizitz Drive
5. Vestridge Drive
6. Elementary School/Wal-Mart
7. Merryvale Road
8. Vesthaven Way
9. City Hall
10. Old Creek Trail
11. Canyon Road
12. Kentucky Avenue
13. Laurel Road
14. Shades Crest Road

PRESENTATION OUTLINE

1. General Benefits of Adaptive Signal Control
2. Specific Benefits of SCATS
3. Specific Benefits for US-31
4. Cost Estimate
5. Evaluation Matrix

General Benefits of Adaptive Signal Control

VDOT Experience

Benefits of Adaptive Signal Control Technology From the Pilot Project	
Travel times improved	At 11 of 13 roadways
Speed increase at roadways where travel time improved	3-5 mph
Average decrease in 95th percentile travel times	4.5 percent
Improvement in p.m. peak travel-time reliability	23 percent
Average reduction in number of stops	37 percent
Reduction in total intersection crashes	17 percent
Benefits accrued in one year outweighed cost of installation	At 10 of 13 roadways
Benefit-Cost ratio (average annual)	8.2-to-1

NCHRP Survey

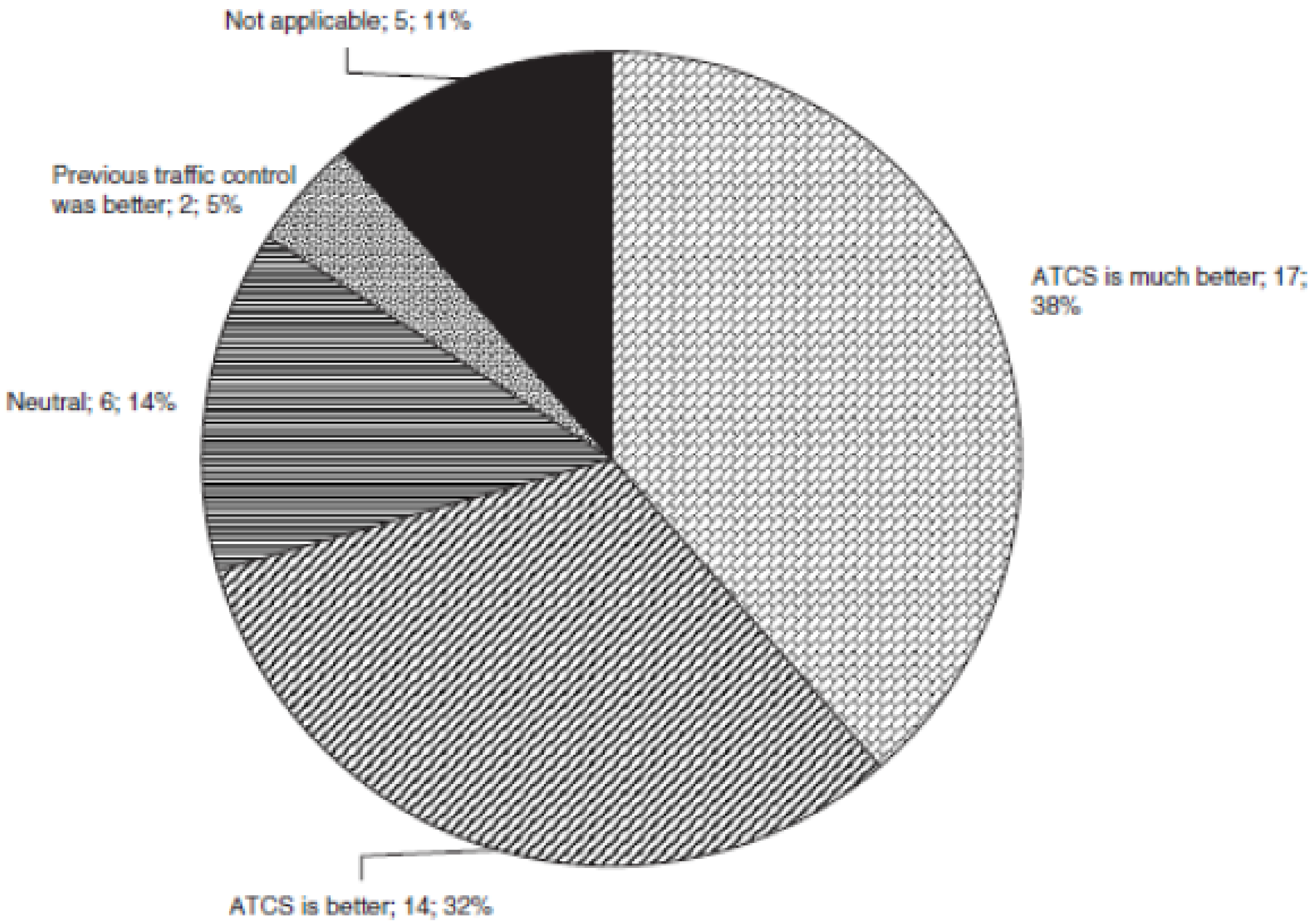


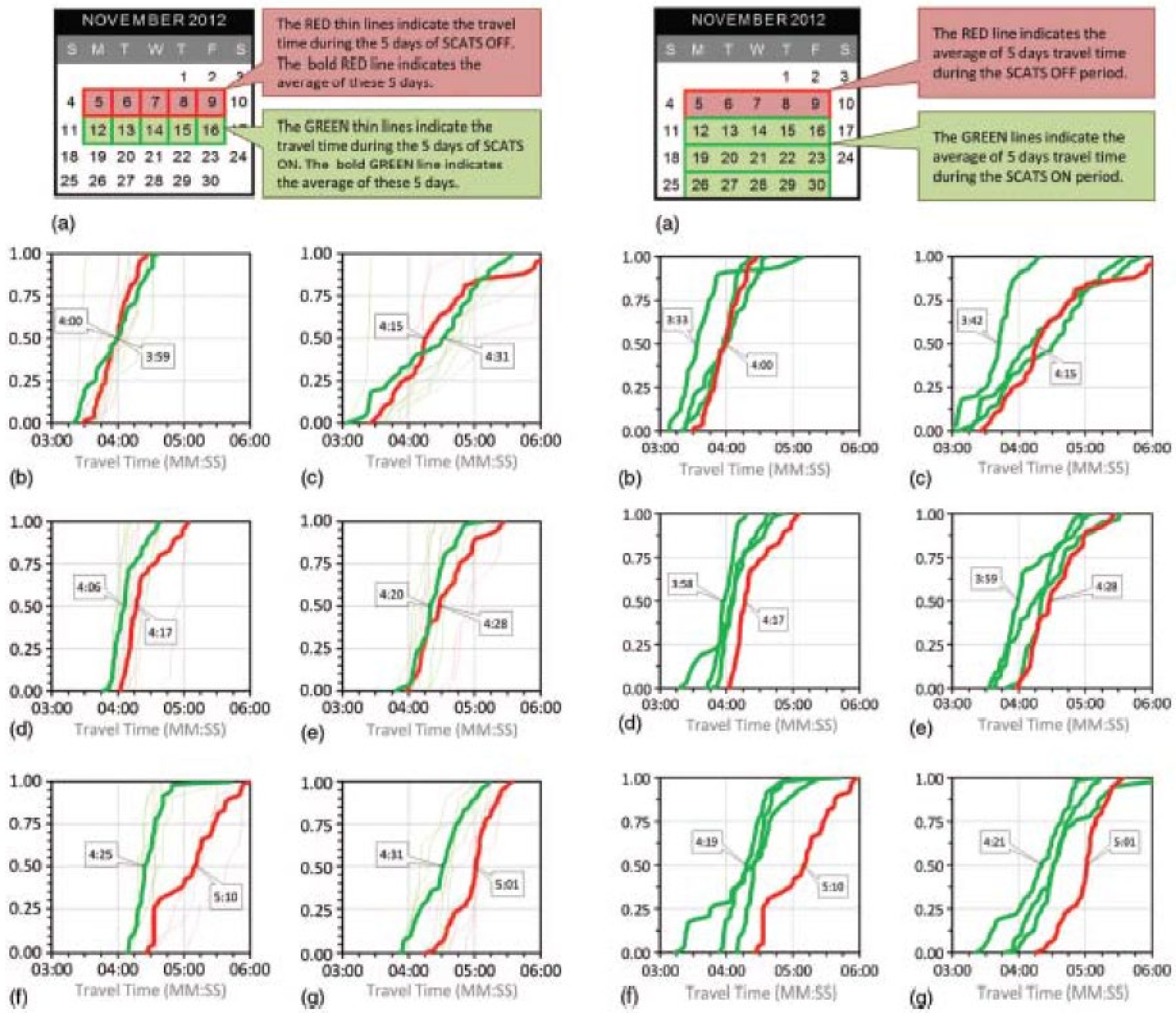
FIGURE 15 Comparison of performances: ATCS vs. other traffic control.

Specific Benefits of SCATS

UTCA SCATS Study

Eastern Boulevard

Montgomery, Alabama



AM

PM

Northbound Southbound Northbound Southbound

ALDOT Bluetooth Data

U.S. Highway 280

Birmingham, Alabama

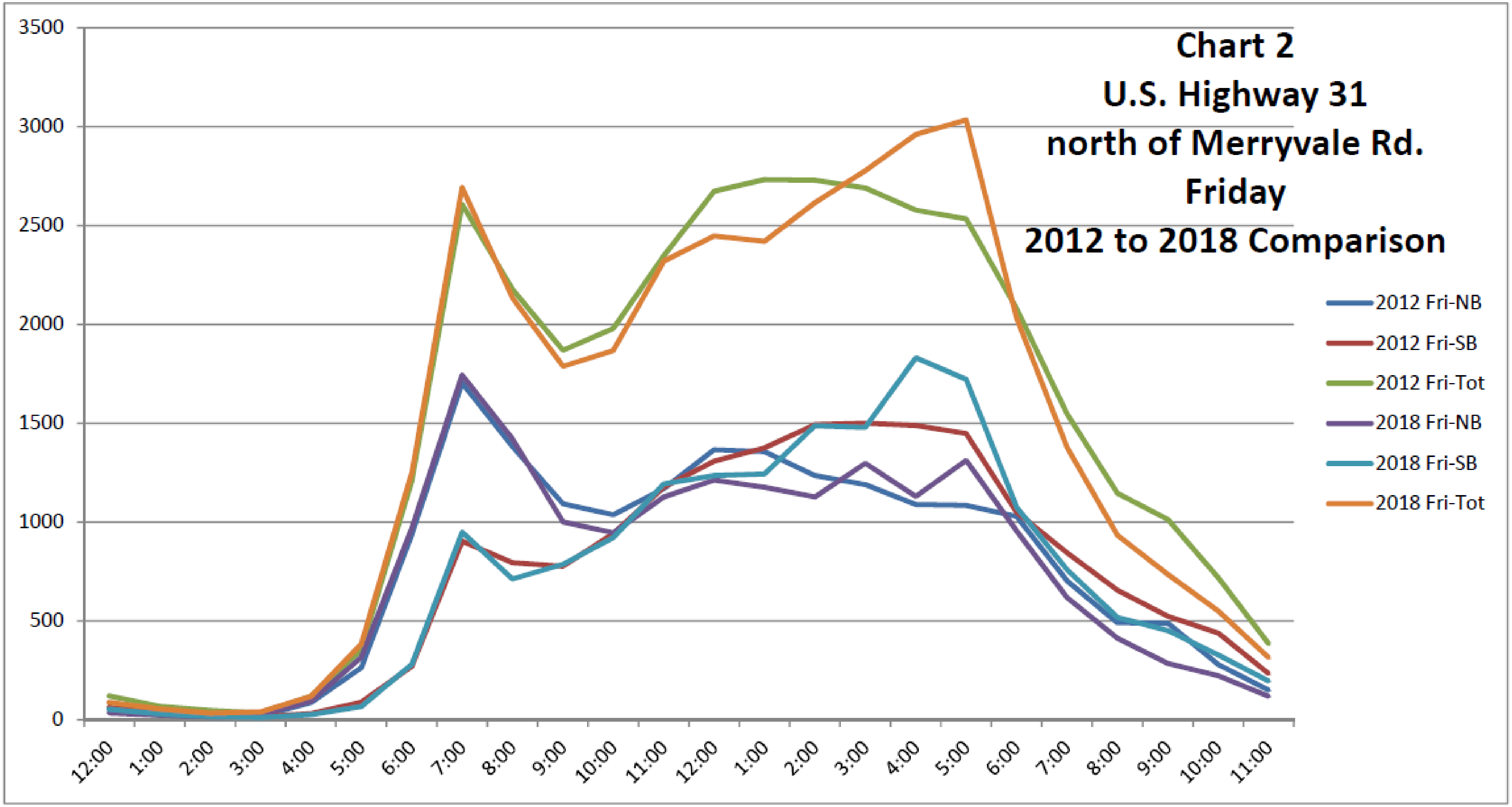
Table 1: Percent Travel Time Improvements along US 280

Peak Period	Outside 459	Inside 459
AM Inbound	7%	14%
AM Outbound	8%	10%
PM Inbound	13%	6%
PM Outbound	11%	24%

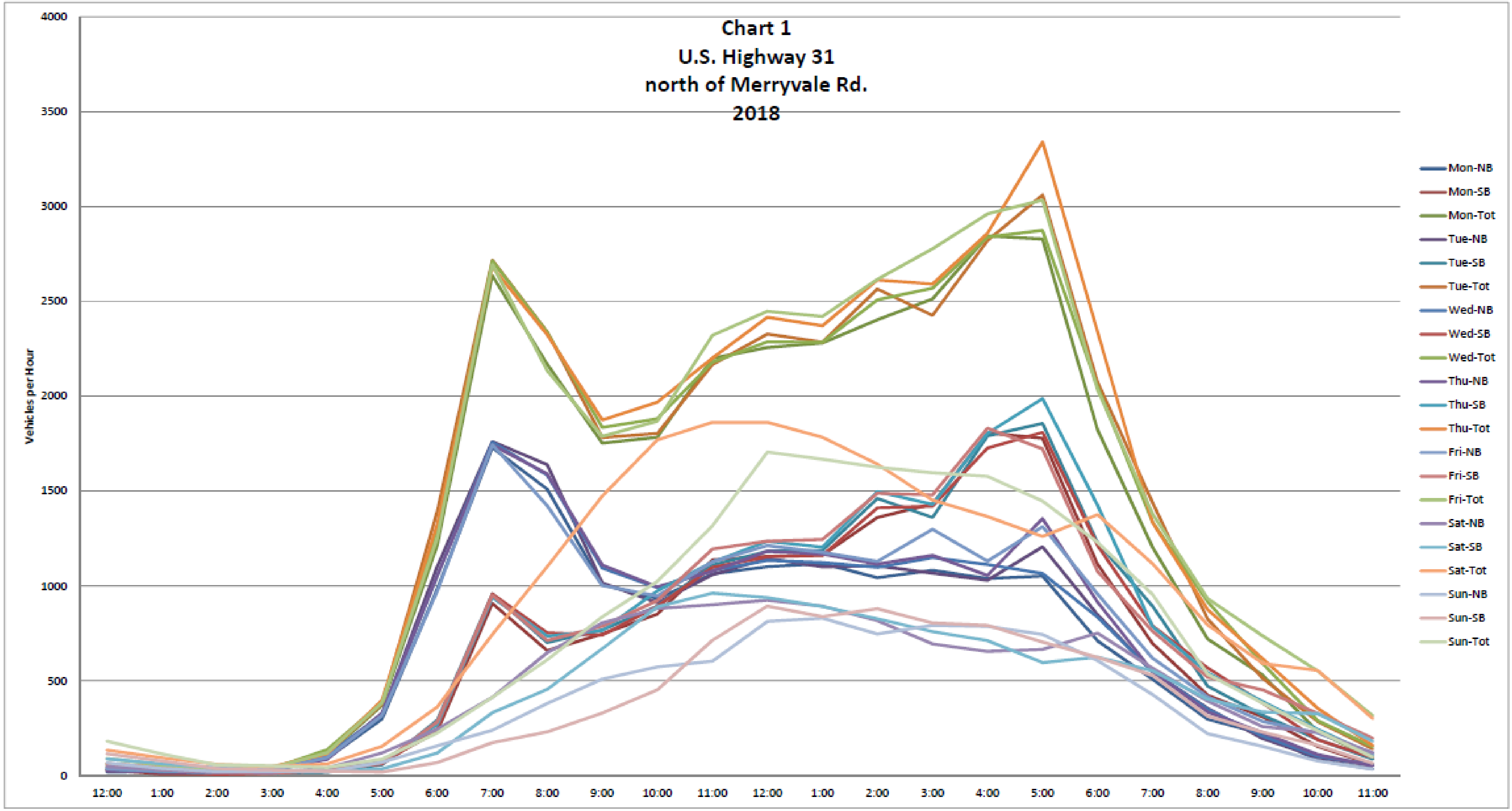
Source: ALDOT, 2013

Specific Benefits for U.S. Highway 31

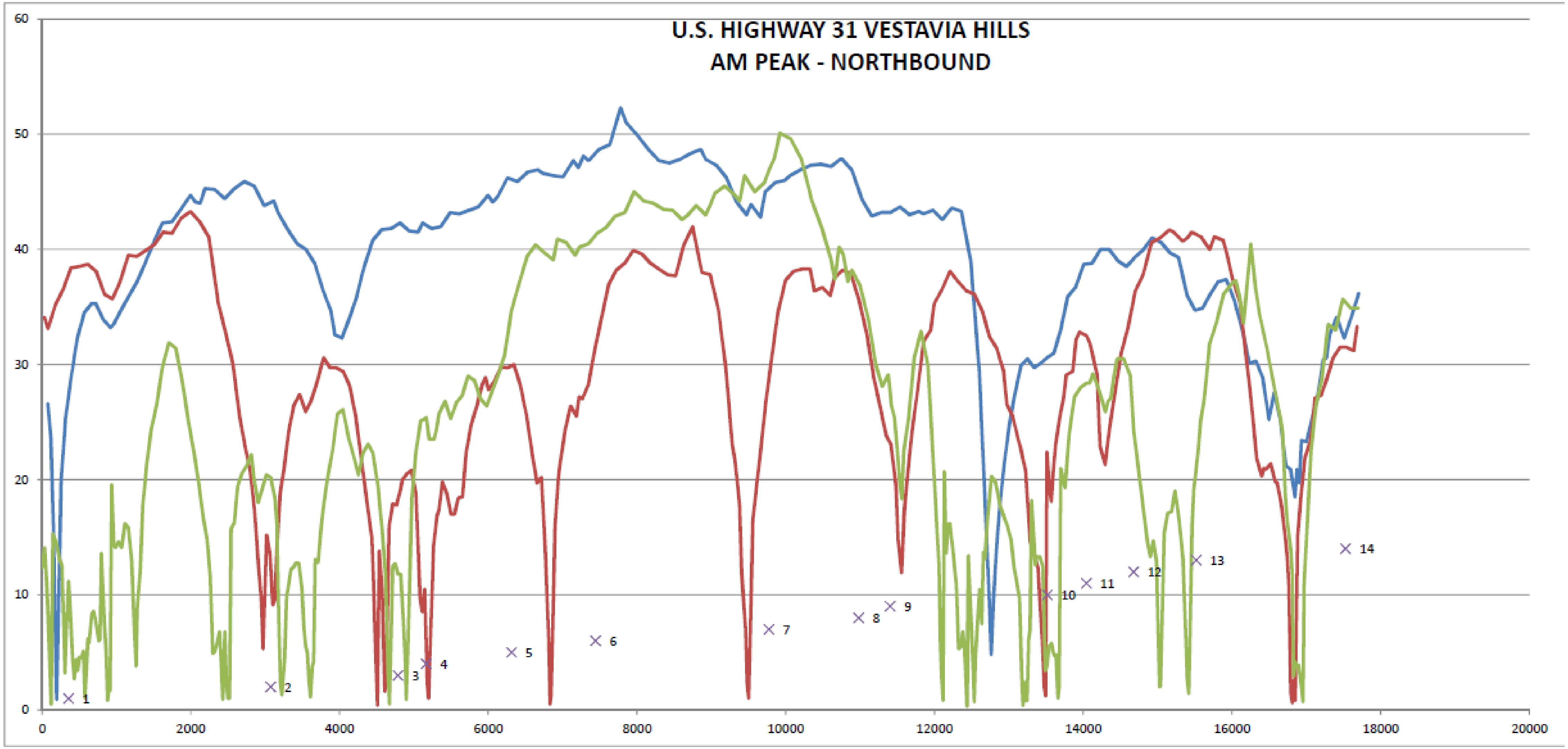
Yearly Variation in Traffic Flow



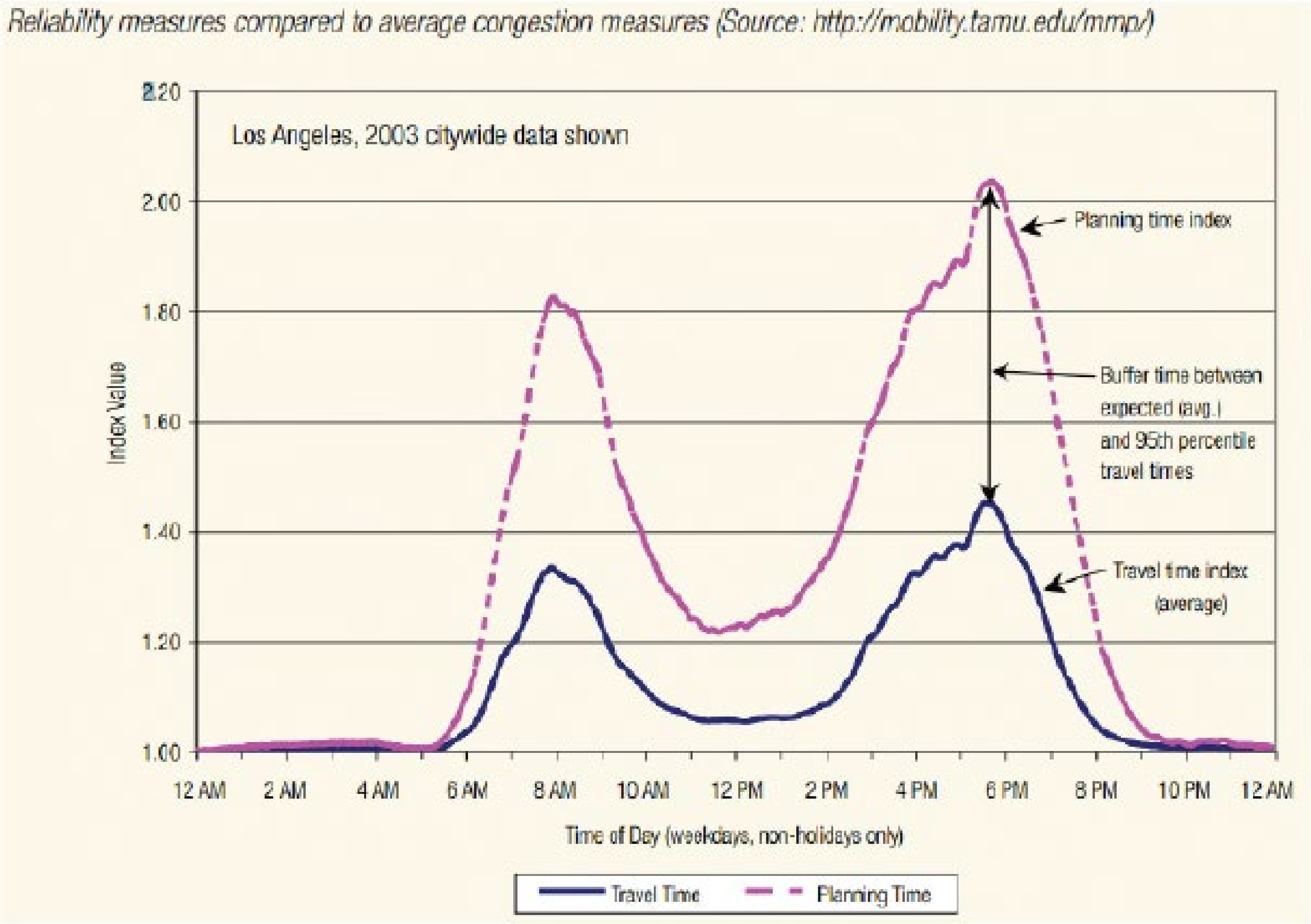
Daily Variation in Traffic Flow



Peak Hour Variation in Traffic Flow



Travel Time Indices



Travel Time Indices

U.S. Highway 31

Vestavia Hills, Alabama

TABLE 6
TRAVEL TIME INDEX CALCULATIONS

	AM Peak Hour		***PM Peak Hour***	
	Northbound	***Southbound***	***Northbound***	***Southbound***
Free Flow Travel Time	304.4 secs	304.4 secs	304.4 secs	304.4 secs
Average Travel Time	570.6 secs	461.4 secs	406.6 secs	530.0 secs
Travel Time Index (TTI)	1.87	1.52	1.34	1.74
Planning Time (95th Percentile)	679.7 secs	680.8 secs	642.0 secs	771.6 secs
Planning Time Index (PTI)	2.23	2.33	2.11	2.53
Buffer Time	109.1 secs	219.3 secs	235.4 secs	241.6 secs
Buffer Index (BI)	19.1%	47.5%	57.9%	45.6%

Based on HERE data April 2018

Cost Estimate

Cost Estimate

TABLE 7
COST ESTIMATE

Work Item	Unit Cost	Quantity	Extended Cost
Adaptive System (Transcore)	$228,500	1	$228,500
Detection (radar)	$32,000	14	$448,000
Controller (Siemers M60)	$4,400	14	$61,600
Ethernet Switch	$1,800	14	$25,200
Fiber Optic Connection to Server	$50,000	1	$50,000
Update Coordination Timing	$40,000	1	$40,000
		Construction Subtotal	*$853,300*
Mobilization		10%	$85,330
Traffic Control		7.5%	$64,000
Erosion Control		2%	$17,070
Engineering Controls		1.5%	$12,800
Construction Fuel		1%	$8,530
		Construction Total	*$1,041,030*
Engineering		10%	$104,100
Construction Engineering and Inspection		15%	$156,150
		Project Total	*$1,301,280*

Notes:

Existing SCATS licenses are only good for older controllers (M50)

Differential in cost to obtain new licenses is $20,500

Evaluation Matrix

TABLE 8
EVALUATION MATRIX

Measure	*Rating*	*Discussion*
Initial Cost	◑ (Negative)	Up-front cost of SCATS system is high compared to some other adaptive systems, and considerably higher than typical signal systems. However, the project is less expensive than roadway improvements.
Ongoing Cost	△ (Neutral)	Ongoing costs for the SCATS system are limited to replacement of failed equipment and occasional tech support for complex issues. New equipment will come with standard warranties and the initial cost includes one year of tech support.
Initial Time Investment	◑ (Negative)	Initial time investment of City staff during the deployment of the system could be around 140 hours, including system set-up and training.
Learning Curve	○ (Slightly Negative)	Around 4-6 months will be required for the City to become functionally familiar with the SCATS system.
Ongoing Time Investment	● (Very Negative)	The City currently invests little staff time in maintaining signal coordination. SCATS will require around 8 hours per week for typical operations.
Skill Level Required for Engineers/Technicians	○ (Slightly Negative)	SCATS requires development of a skill set which is not currently commonly available in the immediate work force.
Equipment Maintenance	◑ (Negative)	In order to the SCATS system to work, detection must be maintained and communication must be maintained. Failure in either system will disable the SCATS system.
Maximize Use of Existing Equipment	◑ (Positive)	The proposed system re-uses the largest investment in the existing signal system – the fiber optic interconnect. Of all the other existing signal equipment, only the controllers and fiber optic modems must be replaced. The proposal also makes maximum reuse of equipment available from ALDOT from the City of Huntsville.
Upgrade Antiquated Equipment	● (Very Positive)	Most of the existing controllers (12 of 14) are outdated and need to be replaced.
Potential Down-Time	△ (Neutral)	It can be anticipated that the SCATS system will not be operational for approximately 18 days per year due largely to detection and communication failure. The system will revert to time-of-day coordination.
Real-Time Signal Monitoring	● (Very Positive)	The SCATS system will allow the City to have real-time monitoring of signal status from remote locations.
Availability of Current Measures of Effectiveness	○ (Slightly Positive)	The SCATS system will allow the City to be able to analyze up-to-date measures of effectiveness of traffic flow.
Expandable for Other Traffic Control Measures	◑ (Positive)	The transition to an Ethernet-based communications protocol would allow the City to implement other ITS equipment, such as cameras, speed monitoring, and variable message signs.
Travel Time Improvement	◑ (Positive)	The SCATS system is likely to produce a 4-5% reduction in travel times on U.S. Highway 31.
Reduction in Side Street Delay	△ (Neutral)	In most cases, the SCATS system will give less time to side street traffic. However, during the "shoulders" of the peak times, cycle lengths will likely be lower than current time-of-day patterns, and thus the side streets will be served more frequently.
Reduction in Stops	● (Very Positive)	The SCATS system is likely to produce a 30-40% reduction in the number of stops of traffic on U.S. Highway 31.
Reduction in Fuel Consumption	◑ (Positive)	The SCATS system is likely to improve fuel efficiency in the corridor by 4%.
Reduction in Emissions	◑ (Positive)	The SCATS system is likely to reduce emissions by 4-10%, with the largest decrease being in NOx.
Improved Response to Congestion	◑ (Positive)	The SCATS system, because of its ability to adapt cycle lengths and offsets, will be able to respond to congestion caused by the decrease in travel speed on U.S. Highway 31, particularly the pattern of stops seen during the northbound a.m. peak period of traffic flow.
Improved Response to Traffic Variability	● (Very Positive)	The SCATS system will be able to respond to variations in traffic flow, producing customized coordination plans for the various days of the week. This is not provided in the current coordination timings, and would be expensive to implement with time-of-day control with the existing equipment. This is also true for seasonal variations in traffic flow (such as summer and holidays).
Improved Response to Weather Events	○ (Slightly Positive)	The SCATS system will be able to respond to variations in traffic flow, particularly speeds, caused by weather events.
Improved Response to Crashes	○ (Slightly Positive)	The SCATS system will be able to respond to variations in traffic flow caused by crashes. This could include decreased speeds caused by lane blockages or increased traffic caused by diversion traffic.
Improved Response to Special Events	○ (Slightly Positive)	The SCATS system will be able to respond to variations in traffic flow, particularly to side street traffic volumes, caused by special events.
Improved Safety	◑ (Positive)	The SCATS system is likely to reduce intersection-related crashes by 17%.
Travel Time Reliability Improvement	● (Very Positive)	The SCATS system is likely to dramatically improve travel time reliability on U.S. Highway 31. The current Buffer Indexes for peak hour traffic flow show that drivers have to budget an extra 2-4 minutes beyond average travel times to traverse US-31 through Vestavia Hills with a 95% confidence in not being late.
Improved Response to Traffic Growth	◑ (Positive)	The SCATS system will be able to respond to variations in traffic flow, particularly traffic volumes, related to traffic growth, thereby reducing the frequency of corridor signal retiming projects.
Pedestrian Impacts	○ (Slightly Positive)	The SCATS system should have a favorable impact on pedestrian traffic by having lower cycle lengths on the "shoulders" of the peak periods.
Potential Public Perception	○ (Slightly Negative)	"Lessons Learned" from other studies showed that there is a negative trend to public perception of adaptive signal systems. This is due to the fact that side street wait times may be longer, side street green times may be shorter, and often implementation of adaptive signal systems is accompanied by changes in signal phasing such as "lead-lag" left turns
Impact to Through Commuter Traffic	◑ (Positive)	The "through" commuter traffic should benefit from implementation of the SCATS system.
Impact to Local Turning Traffic	◑ (Negative)	The "local" traffic, that is the traffic which does not make a long trip on U.S. Highway 31, is likely to experience increased delay in making turns onto and off of U.S. Highway 31.

● Very Positive   △ Neutral   ● Very Negative
◑ Positive   ◑ Negative
○ Slightly Positive   ○ Slightly Negative

Questions/Comments