Traffic Signal System Update

September 2, 2013
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This report provides an overview and update about the Town's traffic signal system.

Background

In partnership with the North Carolina Department of Transportation, the Town has completed the installation of a traffic signal system in Chapel Hill and Carrboro. This system is designed to improve the efficiency of traffic flow throughout the town by reducing congestion and bottlenecks during the busiest travel times throughout the day. The Town accepted the new signal system effective September 20, 2012. The upgrade project included the following key elements:

Signal Technician, Mike Rempson, in the Traffic Management Center

- Installation of fiber optic communication cable for the signal system
- Replacement of existing cabinets and controllers with new equipment
- Development of a *Traffic Management Center* located at the Town Operations Center
- Installation of closed-circuit television equipment for traffic monitoring at 16 locations
- Installation of new and revised signal phasing on major corridors
- Installation of pedestrian countdown displays at existing pedestrian signal locations
- Installation of bicycle-activated loops at 40 signalized intersections in Chapel Hill
- Installation of system detectors for the traffic-responsive system and revised traffic signal design plans

Performance Measures

In an effort to understand the level of improvement resulting from the new traffic signal system, the following metrics were selected for monitoring and modeling:

- Travel time runs through all major corridors (see list of corridors below)
- Total and stopped delay experienced by drivers throughout corridors and at individual intersections
- Fuel consumption*

*This metric was developed as a projection of possible benefits based on conditions modeled under the new traffic signal system.

The original intervals for measurement of before-and-after conditions were slated for the first, third, sixth and twelfth month following the date of installation. However, the Town was

unable to gather data for the one and six month intervals due to a combination of construction projects along major corridors as well as a lack of staffing resources during that time period. The next report will compare baseline data (pre-installation conditions) to new data collected at both the three-month and twelve-month intervals. This report provides a comparison of baseline and month three data for travel time runs, stopped and total delays during peak travel times. The study area for data collection includes traffic signals located along the following corridors:

- Fordham Blvd, from Estes Dr to I-40
- Martin Luther King Jr Blvd, from Whitfield Rd to Hillsborough St
- NC 54, from East Barbee Chapel Rd to Hamilton Rd
- US 15-501, from Fordham Blvd Ramps to Southern Village

Attachment 1 shows a map of the fiber optics communication network across the major corridors. Results for the downtown area were not captured as part of this initial comparison due to several ongoing construction projects and detours which resulted in frequent changes to the signal timing plans. The downtown corridor will be captured as part of future reports, starting this fall.

Results of Before-and-After Studies

Baseline ("before") data were gathered in the spring of 2012 to establish an understanding of pre-installation roadway conditions. The first interval of new data ("after") was gathered in the spring of 2013, three months after the installation of the new traffic signal system. The data and charts for this comparison are found in attachments 2-6. The main findings were as follows:

- Total travel time within major corridors was reduced during peak hours
- Travel delay to motorists was reduced on all corridors for peak hours
- Traffic signal synchronization was improved

In addition to the results captured by the before-and-after study, we have received positive feedback from both the Town's Police Department and Transit Department (specifically officers and bus drivers, respectively) regarding noticeable improvements to the traffic signal operations post installation.

The Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (MPO) plans to begin another cycle of travel time studies which may have some overlapping interest with the Town's current and continued efforts to capture traffic-related performance data in our major corridors. To the extent that we are able to share data with the MPO or vice versa, thus

minimizing or eliminating duplication of effort, the staffs of both organizations plan to coordinate where possible.

The traffic monitoring camera system is being used daily in conjunction with signal system elements to help implement temporary signal timing plans tailored for construction, major incidents and special events.

Next Steps

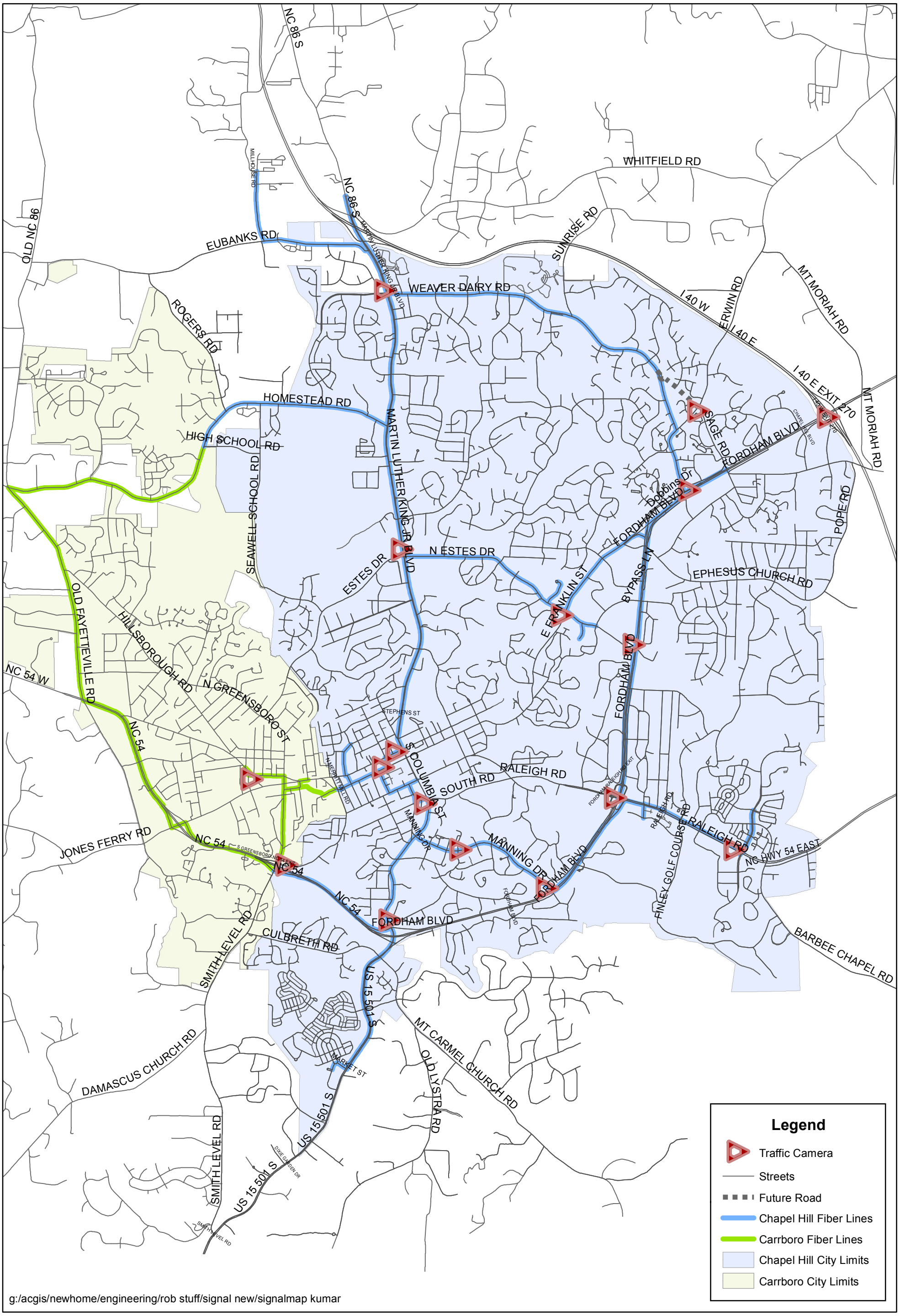
We will be providing this report to the public via the Town's website under the Traffic Signal Upgrade Project page. As part of this effort, we will continue to seek public input on the site and via the following email address: traffic@townofchapelhill.org. This fall, Town staff and the signal timing consultant will review the timing plans for all major corridors, including the downtown, in a continued attempt to optimize and improve traffic flows throughout the Town. Based on these additional changes, in November we will develop and provide another Council report which includes a before-and-after comparison for the one-year interval.

In addition to continued monitoring and reporting, the Town staff is currently evaluating a web-based traffic application that is capable of providing real-time travel data and congestion mapping. The staff is investigating ways of further developing a pilot project that may be of interest to both Town staff and the general public. Depending on the initial findings of the staff's review, more information about this tool may be shared as part of the one year report.

Attachments

1. Traffic Signal System - Map of Fiber Optic Cable Lines
2. Before-and-After Signal Timing Study - Fordham Blvd
3. Before-and-After Signal Timing Study - Martin Luther King Jr Blvd
4. Before-and-After Signal Timing Study - NC 54
5. Before-and-After Signal Timing Study - US 15-501
6. Projected Fuel Savings from Traffic Signal System Improvements

Attachment 1



Traffic Signal Fiber Map for Chapel Hill/Carrboro

Attachment 2

Fordham Blvd Before-and-After Signal Timing Study

Table 1. Before-and-After Comparisons of AM Peak Hour Travel Time, Stopped Delay and Total Delay

	Travel Time (seconds)	Stopped Delay (seconds)	Total Delay (seconds)
Before Retiming	393	90	146
After Retiming	312	17	64
Improvement (Before-After)	81	73	82
Percent Improvement	**21%**	**81%**	**56%**

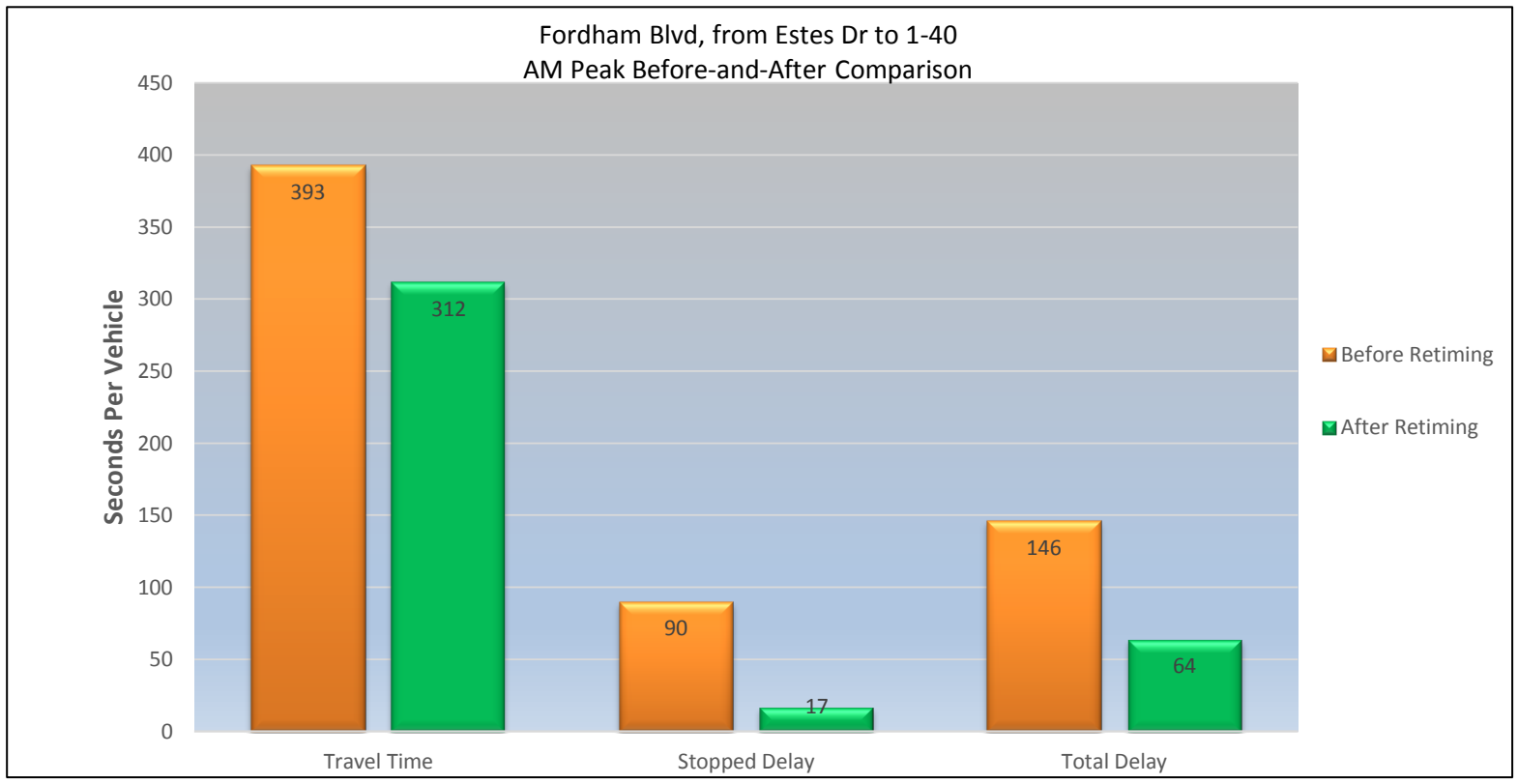
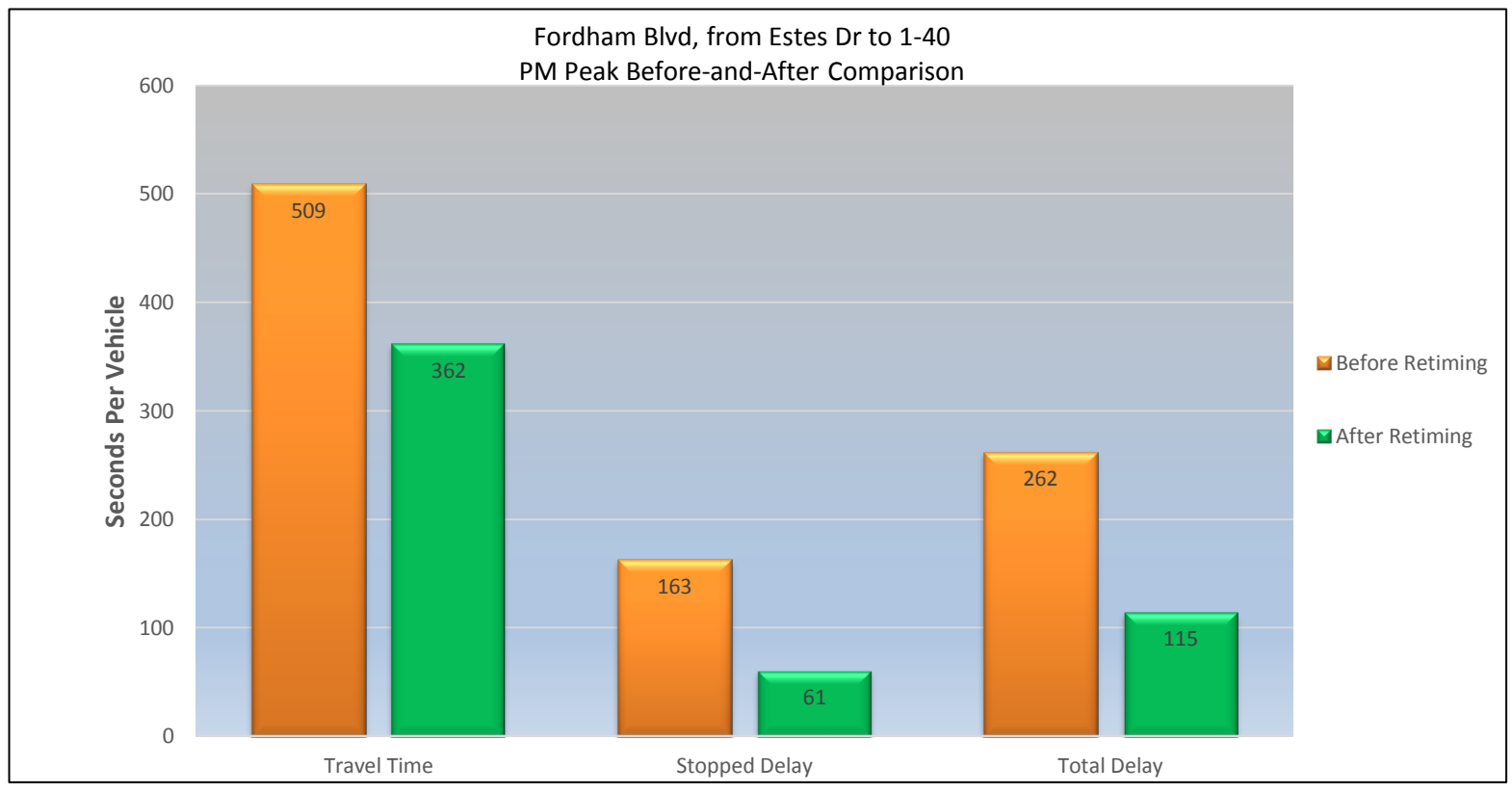


Table 2. Before-and-After Comparisons of PM Peak Hour Travel Time, Stopped Delay and Total Delay

	Travel Time (seconds)	Stopped Delay (seconds)	Total Delay (seconds)
BeforeRetiming	509	163	262
After Retiming	362	61	115
Improvement (Before-After)	147	102	147
Percent Improvement	**29%**	**63%**	**56%**



Total Delay = stopped-time delay plus additional delay factors forcing the vehicle to travel below the posted speed limit

Attachment 3

MLK Blvd/NC86 Before-and-After Signal Timing Study

Table 1. Before-and-After Comparisons of AM Peak Hour Travel Time, Stopped Delay and Total Delay

	Travel Time (seconds)	Stopped Delay (seconds)	Total Delay (seconds)
Before Retiming	409	57	87
After Retiming	370	40	48
Improvement (Before-After)	39	17	39
Percent Improvement	**10%**	**30%**	**45%**

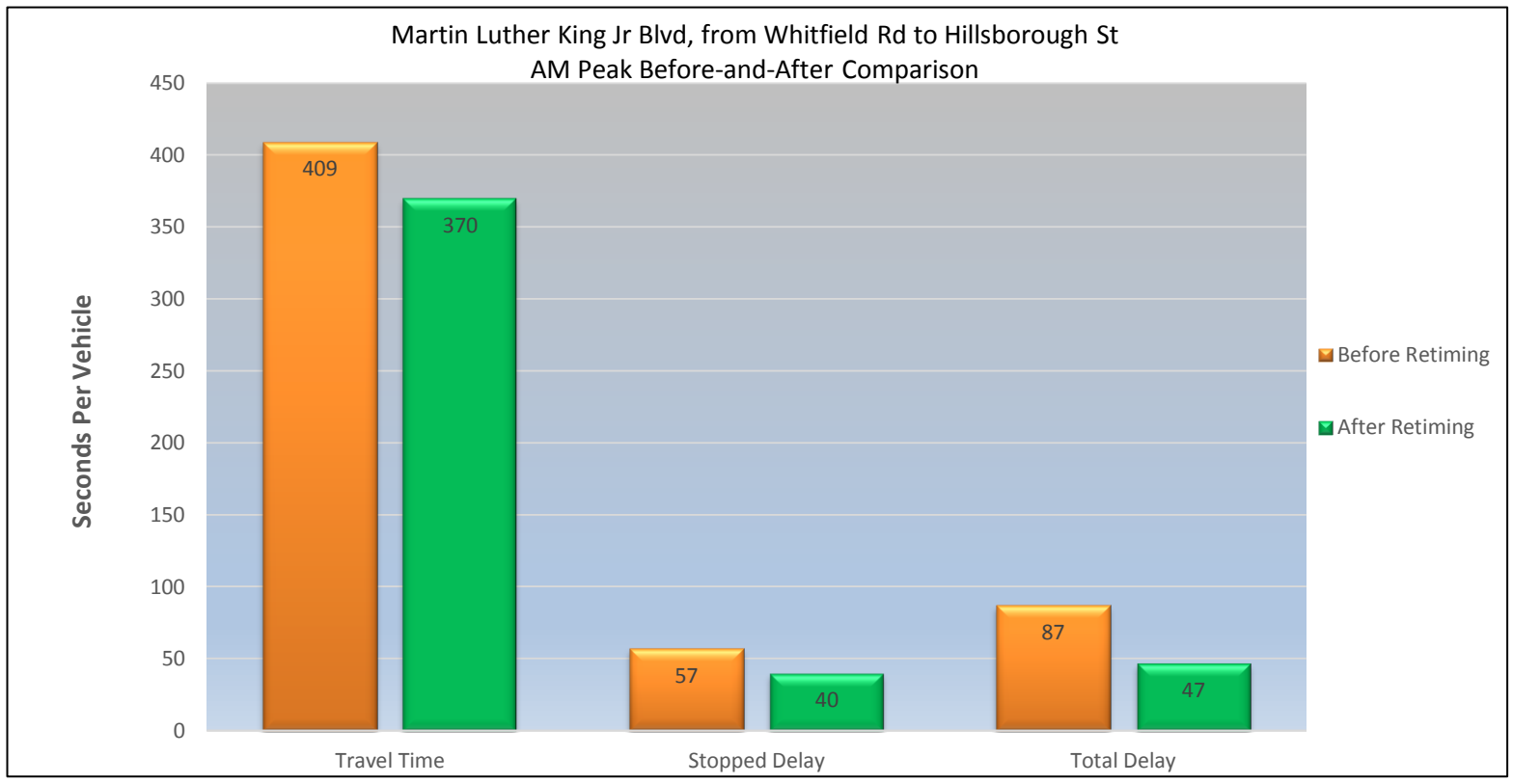
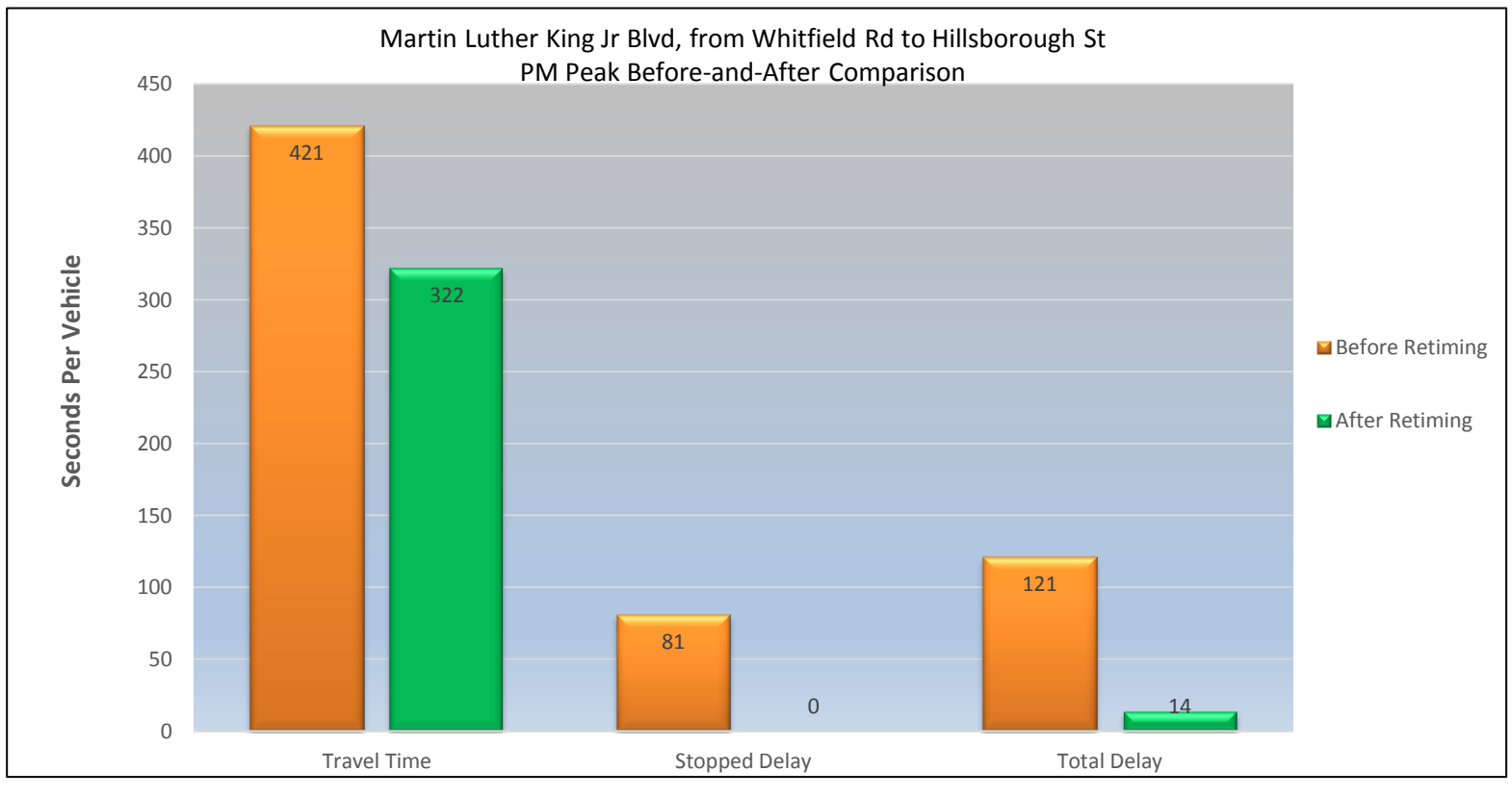


Table 2. Before-and-After Comparisons of PM Peak Hour Travel Time, Stopped Delay and Total Delay

	Travel Time (seconds)	Stopped Delay (seconds)	Total Delay (seconds)
Before Retiming	421	81	121
After Retiming	322	0	14
Improvement (Before-After)	99	81	107
Percent Improvement	**24%**	**100%**	**88%**



Total Delay = stopped-time delay plus additional delay factors forcing the vehicle to travel below the posted speed limit

Attachment 4

NC 54 Before-and-After Signal Timing Study

Table 1. Before-and-After Comparisons of AM Peak Hour Travel Time, Stopped Delay and Total Delay

	Travel Time (seconds)	Stopped Delay (seconds)	Total Delay (seconds)
Before Retiming	137	38	47
After Retiming	89	0	-1
Improvement (Before-After)	48	38	48
Percent Improvement	**35%**	**100%**	**102%**

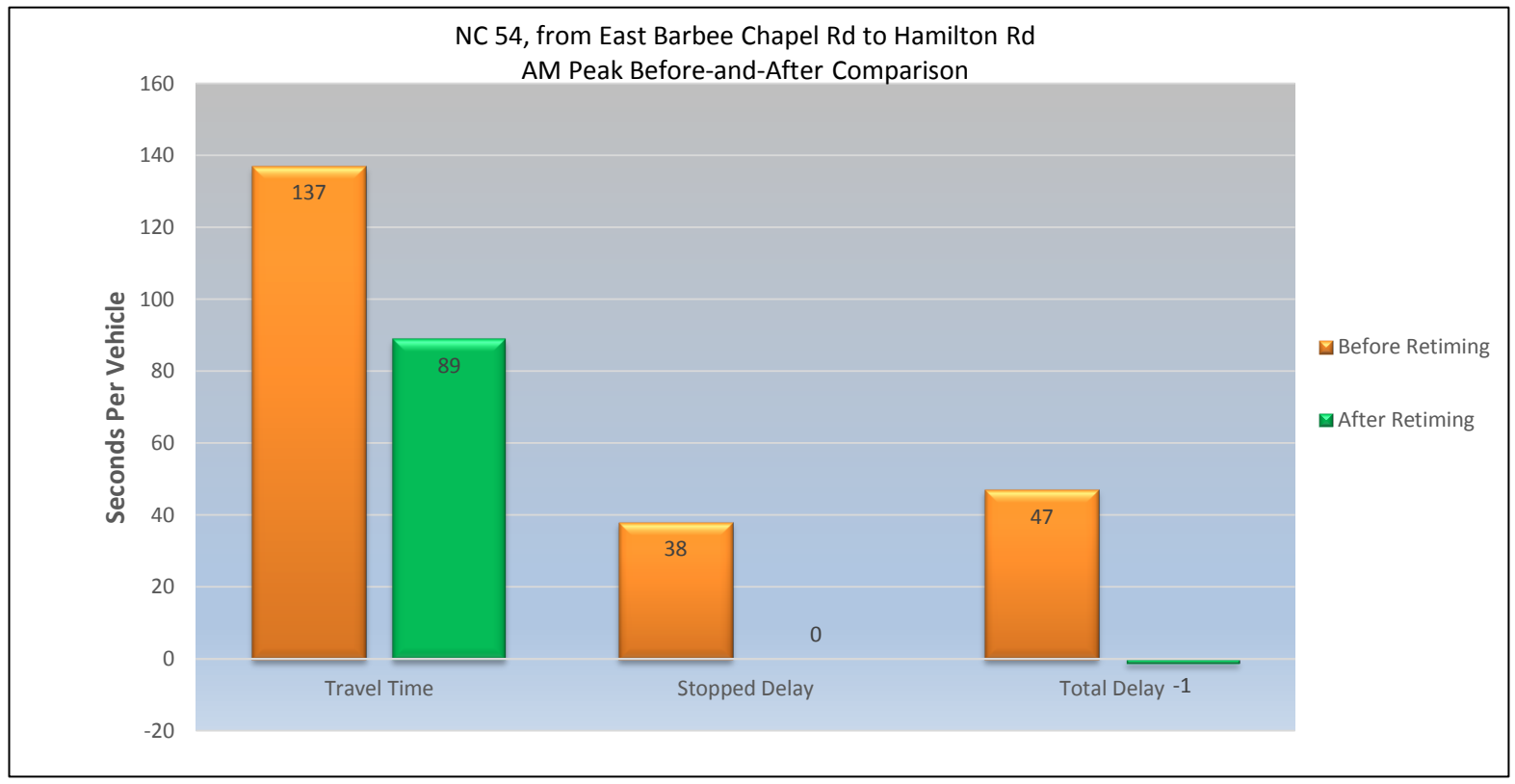
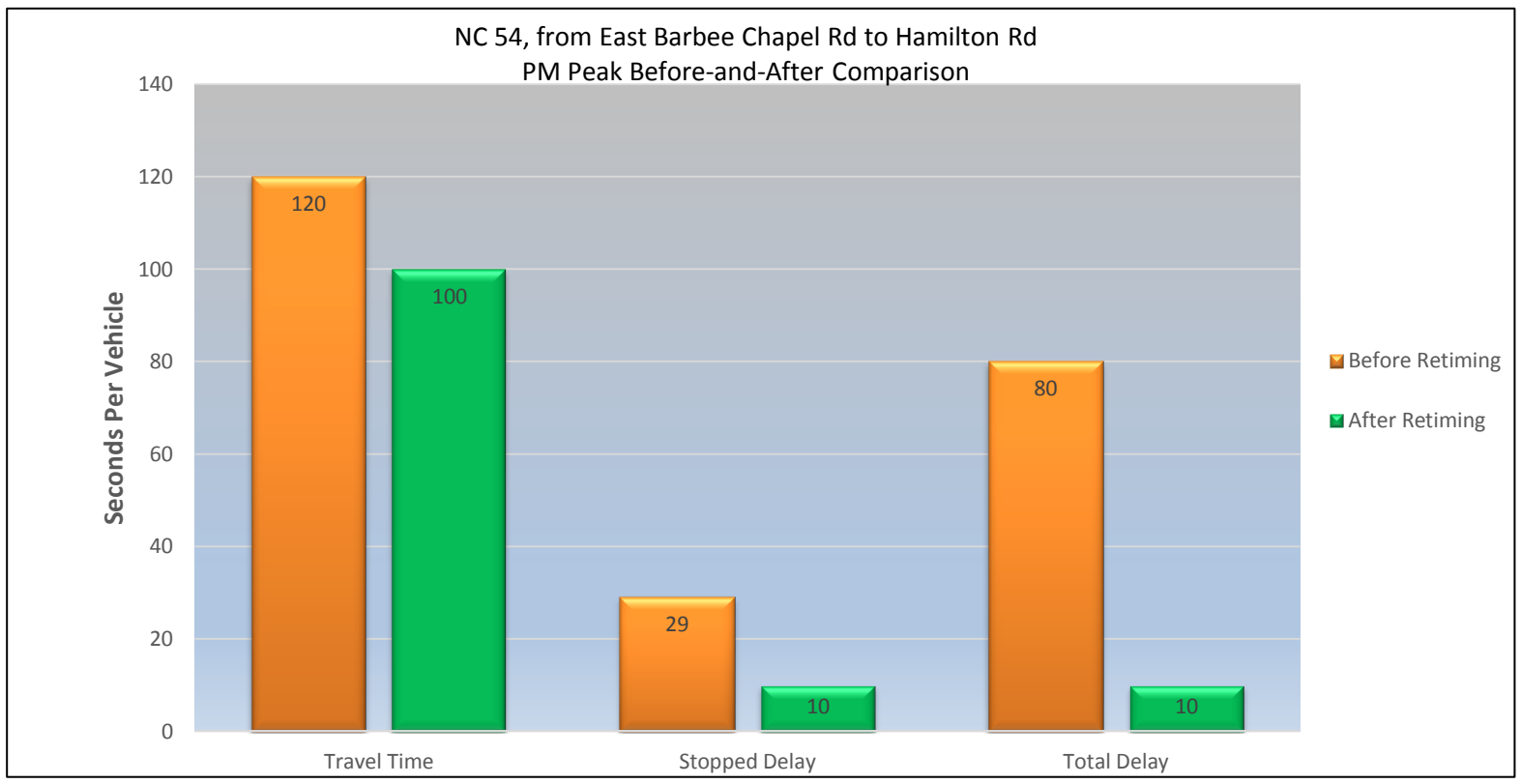


Table 2. Before-and-After Comparisons of PM Peak Hour Travel Time, Stopped Delay and Total Delay

	Travel Time (seconds)	Stopped Delay (seconds)	Total Delay (seconds)
Before Retiming	120	29	80
After Retiming	100	10	64
Improvement (Before-After)	20	19	16
Percent Improvement	**17%**	**66%**	**20%**



Total Delay = stopped-time delay plus additional delay factors forcing the vehicle to travel below the posted speed limit

Attachment 5

US 15-501 Before-and-After Signal Timing Study

Table 1. Before-and-After Comparisons of AM Peak Hour Travel Time, Stopped Delay and Total Delay

	Travel Time (seconds)	Stopped Delay (seconds)	Total Delay (seconds)
Before Retiming	181	55	75
After Retiming	143	21	37
Improvement (Before-After)	38	34	38
Percent Improvement	**21%**	**62%**	**51%**

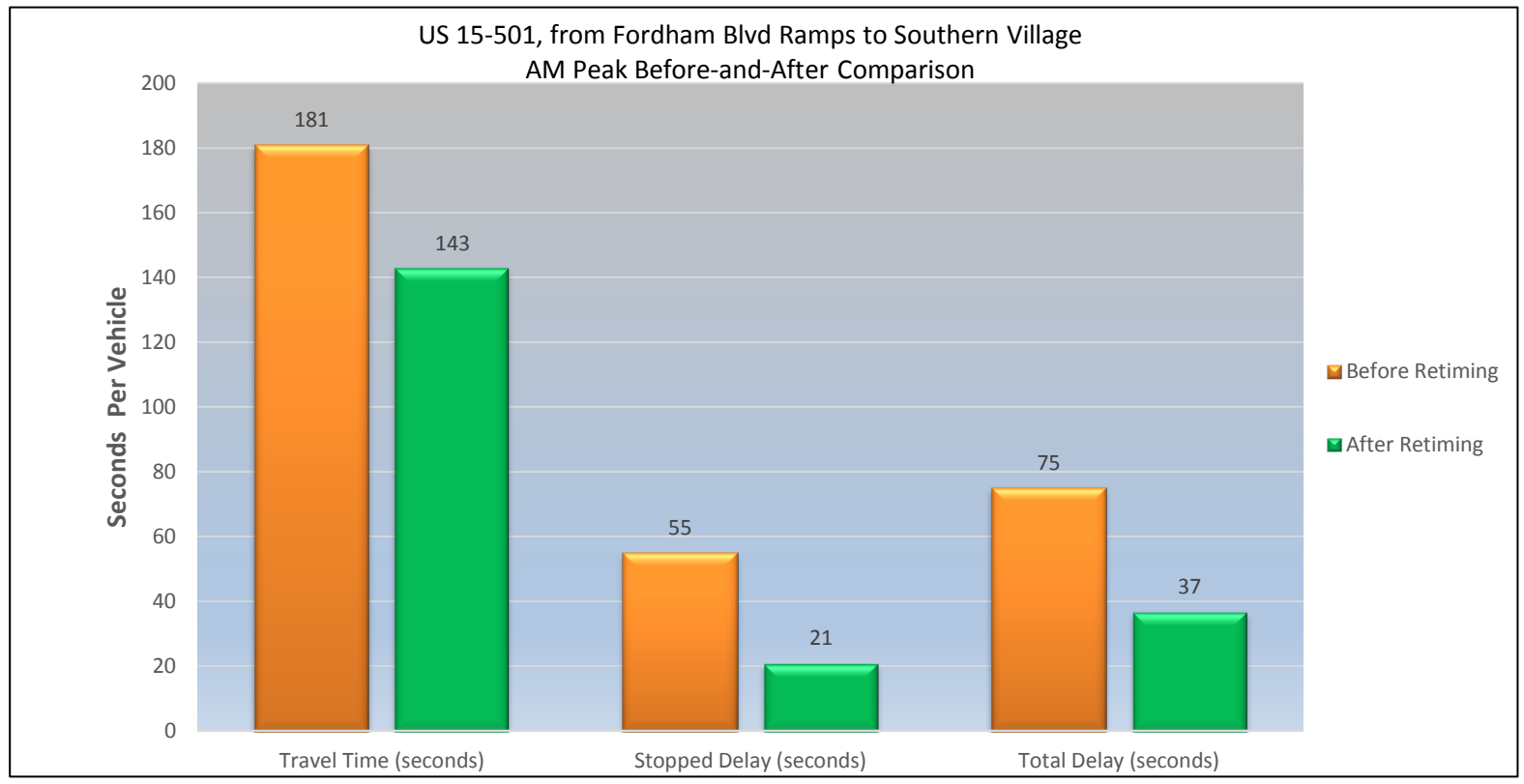
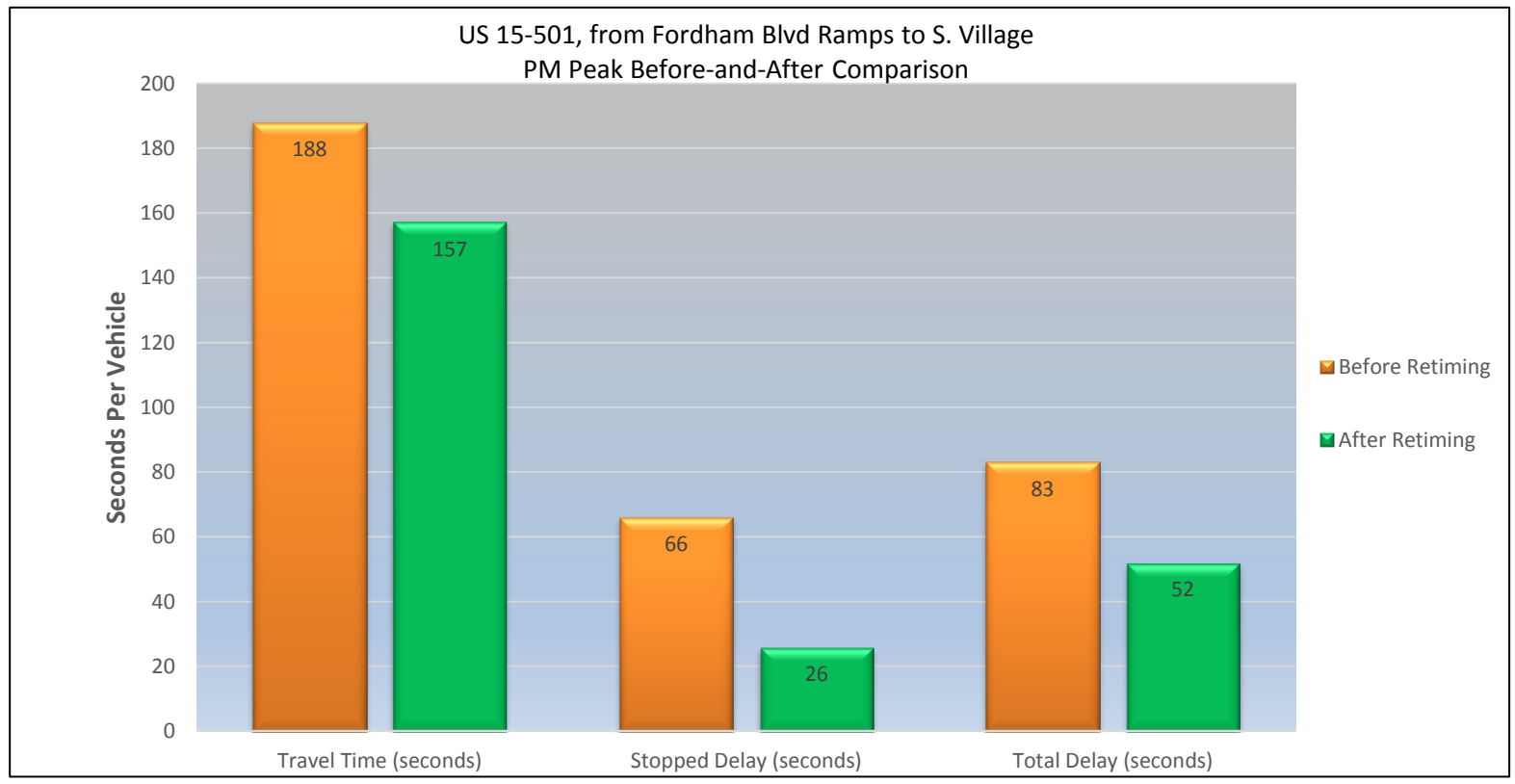


Table 2. Before-and-After Comparisons of PM Peak Hour Travel Time, Stopped Delay and Total Delay

	Travel Time (seconds)	Stopped Delay (seconds)	Total Delay (seconds)
BeforeRetiming	188	66	83
After Retiming	157	26	52
Improvement (Before-After)	31	40	31
Percent Improvement	**16%**	**61%**	**37%**



Total Delay = stopped-time delay plus additional delay factors forcing the vehicle to travel below the posted speed limit

Attachment 6

Projected Fuel Savings from Traffic Signal System Improvements

Table 1. Fordham Blvd, from Estes Dr to I-40

Fordham	Fuel Consumed (gal/hr)	Fuel Consumed (gal/hr)	Fuel Consumed (gal/hr)	Fuel Consumed
	Before	After	Savings	Savings ($)
AM Peak	1008	972	36	$ 48,060
MD Peak	1,189	1,107	82	$ 145,960
PM Peak	1,651	1,541	110	$ 244,750

Table 2. Martin Luther King Jr Blvd/NC 86, from Whitfield Rd to Hillsborough Rd

MLK	Fuel Consumed (gal/hr)	Fuel Consumed (gal/hr)	Fuel Consumed (gal/hr)	Fuel Consumed
	Before	After	Savings	Savings ($)
AM Peak	984	918	66	$ 88,110
MD Peak	499	475	24	$ 42,720
PM Peak	1,250	1,163	87	$ 193,575

Table 3. N.C. 54, from East Barbee Chapel Rd to Hamilton Rd

NC 54	Fuel Consumed (gal/hr)	Fuel Consumed (gal/hr)	Fuel Consumed (gal/hr)	Fuel Consumed
	Before	After	Savings	Savings ($)
AM Peak	507	408	99	$ 132,165
MD Peak	539	256	283	$ 503,740
PM Peak	498	523	(25)	$ (55,625)

Table 4. US 15-501 Southbound from Southern Village to Fordham Blvd Ramps

US 15-501	Fuel Consumed (gal/hr)	Fuel Consumed (gal/hr)	Fuel Consumed (gal/hr)	Fuel Consumed
	Before	After	Savings	Savings ($)
AM Peak	313	157	156	$ 208,260
MD Peak	289	167	122	$ 217,160
PM Peak	301	183	118	$ 262,550

Projections based on pre-installation models using the following assumptions:
AM Peak Hour: 1.5 Hours; MD (midday) Peak Hour: 2 Hours; PM Peak Hour: 2.5 Hours
Number of Peaks per Year: 250
Fuel Cost: $3.56/Gal