

Onondaga County Department of Transportation

**Traffic Signal Optimization Project
(Electronics Parkway/Henry Clay
Boulevard)
(Future Coordinated Corridor)**

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Onondaga County Department of Transportation

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CHAPTER I

INTRODUCTION

Outdated traffic signal timings account for a significant amount of traffic delay on urban and suburban roadways across the country. Periodically updating traffic signal equipment and timings based on new technology and current traffic volumes can provide significant benefits at a relatively low cost, alleviate the need for additional infrastructure, and reduce time spent in traffic, fuel consumption, and emissions. This report summarizes the results of a Traffic Signal Timing Optimization study conducted at various county-owned and controlled intersections along the Electronics Parkway/Henry Clay Boulevard corridor located in Onondaga County, New York.

A. Study Area

The study area intersections for this report include the following, as shown on Figure 1:

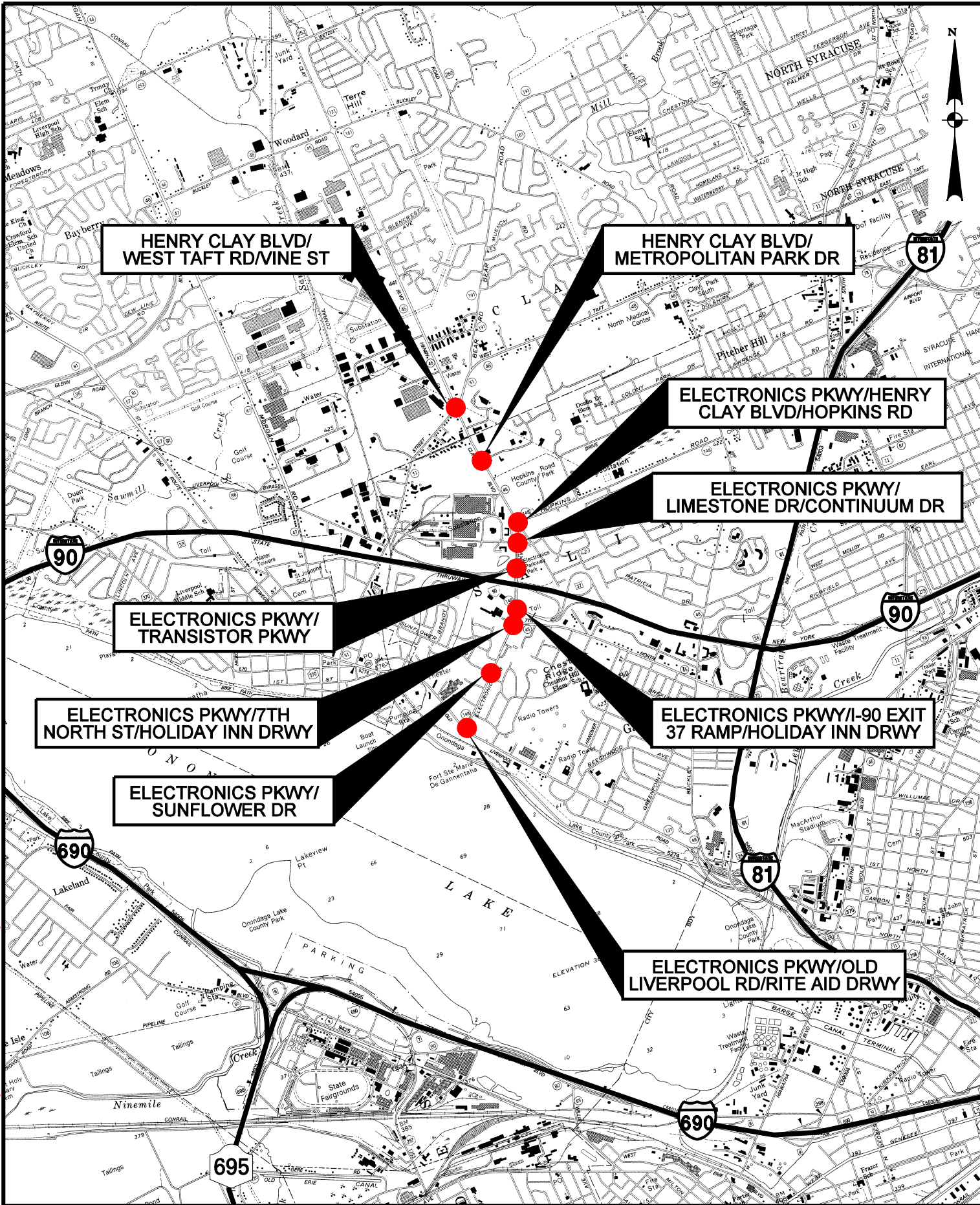
- Electronics Parkway/Old Liverpool Road/Rite Aid Driveway
- Electronics Parkway/Sunflower Drive
- Electronics Parkway/7th North Street/Holiday Inn Driveway
- Electronics Parkway/I-90 Exit 37 Ramp/Holiday Inn Driveway
- Electronics Parkway/Transistor Parkway
- Electronics Parkway/Limestone Drive/Continuum Drive
- Electronics Parkway/Henry Clay Boulevard/Hopkins Road
- Henry Clay Boulevard/Metropolitan Park Drive
- Henry Clay Boulevard/West Taft Road/Vine Street

B. Purpose and Methodology

The purpose of this study was to update intersection signal timings in order to maximize intersection capacity, reduce driver delays, reduce vehicle emissions, and improve the overall efficiency of traffic operations for the motoring public.

In order to accomplish this task, traffic count data, signal timing parameters, and intersection geometry was provided by the Syracuse Metropolitan Transportation Council (SMTC) and the Onondaga County Department of Transportation (OCDOT) to evaluate the current performance of the intersections. Adjustments in signal timings, off-sets, detection, and other parameters were made to improve intersection performance. Once adjustments were identified, changes to the field equipment could be made to implement improvements. Some adjustments, like converting from a leading protected left turn arrow to a lagging arrow will be easily noticed, while others, such as vehicle detection modifications, or minor changes in the green time allocation, may not be realized by drivers.

Traffic simulation models of each intersection were developed using the Synchro 7 program. Existing traffic operations were documented and summarized and then optimization of the signals was performed. The changes in the signal timing parameters and the resulting performance changes were then documented to identify the net benefits for the actions.



PROJECT LOCATION

TRAFFIC SIGNAL OPTIMIZATION
ONONDAGA COUNTY
SYRACUSE, NEW YORK



PROJECT: 09-094d

DATE: 7/10

FIGURE: 1

CHAPTER II

ANALYSIS

Traffic volume data, signal timings, intersection sketches, and photos of the study area intersections were gathered from data provided by the OCDOT and the SMTc. This information was used to create existing condition models of each intersection, which were then analyzed to determine their existing performance criteria. With the existing levels of service (LOS) established as the baseline condition, the signal was then optimized. The LOS definitions and a glossary of terms are included in Appendix A.

To maximize the efficiency and performance of each intersection, the traffic volumes for each peak hour were evaluated using a variety of cycle lengths and timing splits. In some cases, the optimized cycle lengths resulted in each signal phase operating at its maximum green time during each cycle of the peak hour. Given that traffic volumes will vary throughout the course of the peak hour, consideration was given to adjusting the cycle length to longer cycles, allowing the signal more flexibility to alter timings as traffic conditions warrant. For example, during low levels of traffic, the controller can reduce the cycle length and serve different approaches quicker. This is particularly useful during off-peak periods. During higher levels of traffic, most notably during peak hours, the cycle length can increase to provide longer green times on approaches that have higher volumes of traffic.

The nine study area intersections on Electronics Parkway/Henry Clay Boulevard were also evaluated to determine how the implementation of a traffic signal coordination plan would impact traffic progression through the corridor.

Changes to the existing timings, detection, or parameters such as minimums, maximums, recalls, clearance intervals, and vehicle extensions, are presented in this chapter along with the resulting intersection performance. Changes to these parameters are based on the Onondaga County Department of Transportation's *Traffic Signal Timing Standards* and the *Traffic Signal Timing Manual*, published by the Institute of Transportation Engineers (ITE), 2009. Appendix B includes detailed sketches, photos, controller settings, signal timings/splits, and level of service reports for each intersection.

A. Electronics Parkway/Old Liverpool Road/Rite Aid Driveway

This four-leg intersection operates under a four-phase traffic signal with a 140-second maximum cycle length. No recall is set, such that any phase can be skipped if no calls are placed on an approach. The southbound Electronics Parkway approach provides a shared left-turn/through lane and a separate right-turn lane while the northbound Rite Aid Driveway approach provides a single lane for shared travel movements. The westbound Old Liverpool Road approach provides a shared left-turn/through lane, a second through lane, and a separate slip right-turn lane controlled by a yield sign. The eastbound Old Liverpool Road approach provides two through lanes with shared left and right turns. Presence detection is provided on all lanes with the exception of the westbound slip right-turn lane. No sidewalks, crosswalks, or pedestrian controls are provided. The posted speed limit on Electronics Parkway and Old Liverpool Road is 40 mph. Table II.A.1 summarizes the detailed levels of service for existing and proposed conditions.

Table II.A.1 – Electronics Pkwy/Old Liverpool Rd/Rite Aid Drwy LOS Summary

| Intersection | Control | AM Peak Hour | | PM Peak Hour | |
|---|---------|--------------|-------------|--------------|-------------|
| | | Existing | Coordinated | Existing | Coordinated |
| Electronics Pkwy/Old Liverpool Rd/Rite Aid Drwy | S | | | | |
| Old Liverpool Road EB LT,TR | | C (35) | C (34) | D (44) | D (35) |
| Old Liverpool Road WB LT,T | | D (37) | C (32) | D (46) | D (38) |
| Rite Aid Drwy NB LTR | | D (45) | A (9) | E (56) | B (12) |
| Electronics Parkway SB LT | | C (28) | B (18) | D (53) | C (24) |
| | R | A (8) | A (9) | B (16) | A (5) |
| Overall | | C (31) | C (26) | D (42) | C (28) |

Key: NB, SB, EB, WB = Northbound, Southbound, Eastbound, Westbound intersection approaches
 L, T, R = Left-turn, through, and/or right-turn movements
 X (Y) = Level of Service (Delay, seconds per vehicle)

The intersection currently operates at LOS C/D during the AM and PM peak hours, respectively, with the northbound Rite Aid Driveway operating at LOS E. After optimization of the traffic signal, the intersection will operate at LOS C during both peak hours with all movements operating at LOS D or better.

To improve operations, the yellow/all-red clearance, the minimum greens, and vehicle extension were modified. In addition, the northbound and southbound split phasing was removed to allow for permitted travel movements. The signal was optimized using Synchro which resulted in an 80-second cycle length during the AM and PM peak hours. The AM and PM peak hour cycle lengths were adjusted to minimize vehicle delays, minimize the volume to capacity (v/c) ratio, and to coordinate the timings with adjacent signals located to the north. During the peak hours, the intersection will operate at the maximum cycle length during the higher percentiles of traffic, and shorter cycle lengths during lower percentiles of traffic. Table II.A.2 summarizes the suggested changes in the signal timing parameters. It is noted that there is also the potential to remove the eastbound and westbound split phasing for traffic traveling on Old Liverpool Road if it is not needed for other traffic related issues such as safety. The installation of a permitted eastbound and

westbound phase would allow this intersection to operate at better overall levels of service.

Table II.A.2 – Electronics Pkwy/Old Liverpool Rd/Rite Aid Drwy Parameter Summary

| Parameter | Existing | Proposed |
|-------------------|--------------------------|---|
| Detection | NB, SB, EB, WB | No change |
| Recall | None | Min SB |
| Minimum Green | 5-sec SB; 7-sec EB/WB/NB | 7-sec NB; 10-sec EB/WB/SB |
| Yellow/All Red: | 4/2-sec | 4/1.5-sec for 30-40-mph |
| Vehicle Extension | 3.5-sec | 1.5-sec SB/EB/WB ¹ , 1.8-sec NB ² |
| Cycle Length | 140-sec | 80-sec AM; 80-sec PM |

It may be necessary to modify the parameters in Table II.A.2 if Old Liverpool Road is or becomes a coordinated corridor.

B. Electronics Parkway/Sunflower Drive

This three-leg intersection operates under a two-phase traffic signal with a 59-second maximum cycle length. The northbound Electronics Parkway approach provides an exclusive left-turn lane and two through lanes with presence detection provided on the left-turn lane and a maximum recall. The southbound Electronics Parkway approach provides two through lanes with a shared right-turn lane with no detection and a maximum recall. The eastbound Sunflower Drive approach provides separate left and right turn lanes with presence detection and no recall. The eastbound phase is allowed to skip if no vehicles are detected since no recall has been set. No sidewalks, crosswalks, or pedestrian controls are provided. The posted speed limit on Electronics Parkway is 40 mph and 30 mph on Sunflower Drive. Table II.B.1 summarizes the detailed levels of service for existing and proposed conditions.

Table II.B.1 – Electronics Pkwy/Sunflower Dr LOS Summary

| Intersection | Control | AM Peak Hour | | PM Peak Hour | |
|-------------------------------|---------|--------------|-------------|--------------|-------------|
| | | Existing | Coordinated | Existing | Coordinated |
| Electronics Pkwy/Sunflower Dr | S | | | | |
| Sunflower Drive EB L | | B (20) | B (14) | C (21) | B (15) |
| R | | B (18) | B (13) | C (20) | B (14) |
| Electronics Parkway NB L | | A (4) | A (4) | A (4) | A (4) |
| T,T | | A (4) | A (5) | A (3) | A (3) |
| Electronics Parkway SB T,TR | | A (4) | A (5) | A (3) | A (4) |
| Overall | | A (6) | A (6) | A (4) | A (4) |

Key: NB, SB, EB, WB = Northbound, Southbound, Eastbound, Westbound intersection approaches
L, T, R = Left-turn, through, and/or right-turn movements
X (Y) = Level of Service (Delay, seconds per vehicle)

The intersection currently operates at good levels of service with low delays during the AM and PM peak hours. With the addition of point detection and minimum recall

¹ Max allowable headway = 3 sec, detection zone = 70 feet, approach speed = 40-45 mph.

² Max allowable headway = 3 sec, detection zone = 30 feet, approach speed = 30 mph.

on the northbound/southbound approaches, presence detection on the northbound left-turn lane, a half-cycle length, and traffic signal optimization, delay will be slightly reduced and drivers on the northbound and southbound Electronics Parkway approaches will be coordinated with the adjacent signals. This intersection will continue to operate at an overall LOS A with these improvements.

To improve operations as noted above, point detection was added to northbound and southbound Electronics Parkway through lanes, presence detection was added to the northbound left-turn lane, traffic signal coordination was provided, and the yellow/all-red clearance, minimum greens, and vehicle extension were modified. The signal was optimized using Synchro which resulted in a 40-second cycle length during the AM and PM peak hours. Review of the actuated green times indicated that each approach will generally operate below the maximum allowable split for all levels of traffic. Table II.B.2 summarizes the suggested changes in the signal timing parameters.

Table II.B.2 – Electronics Pkwy/Sunflower Dr Parameter Summary

| Parameter | Existing | Proposed |
|-------------------|---------------------------------|--|
| Detection | EB | Point detection added to NB/SB throughs; Presence detection added to NB left |
| Recall | Max NB/SB throughs | Min NB/SB throughs |
| Minimum Green | 8-sec EB; 10-sec NB/SB throughs | 7-sec EB; 10-sec NB/SB throughs |
| Yellow/All Red: | 3/3-sec | 4/2-sec for 30-40 mph speed |
| Vehicle Extension | 3-sec | 1.6-sec EB ³ ; 3.8-sec NB/SB throughs ⁴ |
| Cycle Length | 59-sec | 40-sec AM; 40-sec PM |

C. Electronics Parkway/7th North Street/Holiday Inn Driveway

This four-leg intersection operates under a three-phase traffic signal with a 103-second maximum cycle length. The southbound Electronics Parkway approach provides two left-turn lanes and two through lanes with shared right-turns while the northbound approach provides an exclusive left-turn lane, two through lanes, and a separate right-turn lane. Presence detection is provided on the northbound and southbound left-turn lanes while a maximum recall is only provided on the through movements. The westbound 7th North Street approach provides a shared left-turn/through lane and a separate yield controlled right-turn lane with presence detection and no recall. The eastbound Holiday Inn Driveway approach provides two through lanes with shared left and right turns with presence detection and no recall. The eastbound and westbound phases are allowed to skip if no vehicles are detected since no recall has been set. No sidewalks, crosswalks, or pedestrian controls are provided. The posted speed limit on Electronics Parkway and 7th North Street is 40 mph. Table II.C.1 summarizes the detailed levels of service for existing and proposed conditions.

³ Max allowable headway = 3 sec, detection zone = 30 feet, approach speed = 30 mph.

⁴ Max allowable headway = 3 sec, detection zone = 6 feet (placed 200 feet from the intersection), approach speed = 40-45 mph.

Table II.C.1 – Electronics Pkwy/7th North St/Holiday Inn Drwy LOS Summary

| Intersection | Control | AM Peak Hour | | | PM Peak Hour | | |
|--|---------|--------------|-----------------------|------------------------|--------------|-----------------------|------------------------|
| | | Existing | Standard Coordination | Clustered Coordination | Existing | Standard Coordination | Clustered Coordination |
| Electronics Pkwy/7 th North St/ Holiday Inn Drwy | S | | | | | | |
| Holiday Inn Drwy EB LT,TR | | C (25) | C (22) | C (24) | C (25) | C (21) | C (22) |
| 7 th North Street WB LT | | C (33) | C (28) | C (34) | D (41) | C (34) | D (43) |
| | | B (14) | B (13) | B (14) | B (12) | B (10) | A (9) |
| Electronics Parkway NB L | | D (42) | D (43) | D (37) | D (46) | C (32) | D (41) |
| | | C (21) | B (20) | B (11) | C (24) | C (24) | B (20) |
| | | B (19) | D (37) | A (10) | C (22) | D (46) | C (20) |
| Electronics Parkway SB LL | | C (32) | C (32) | D (37) | C (34) | C (25) | C (27) |
| | | A (10) | B (11) | A (10) | B (12) | A (6) | A (5) |
| Overall | | C (21) | C (21) | B (19) | C (23) | B (20) | B (18) |

Key: NB, SB, EB, WB = Northbound, Southbound, Eastbound, Westbound intersection approaches
L, T, R = Left-turn, through, and/or right-turn movements
X (Y) = Level of Service (Delay, seconds per vehicle)

During the AM and PM peak hours, the intersection operates at an overall LOS C with all movements operating at LOS D or better. It is noted that two separate signalized alternatives were analyzed for this intersection. The first alternative assumed that standard traffic signal coordination would be provided along Electronics Parkway with the adjacent signals. However, an alternative scenario was also analyzed which assumed that this intersection and the adjacent Electronics Parkway/I-90 Exit 37/Holiday Inn Driveway intersection would operate under the same traffic signal control since it is only located 300-feet to the north. This would ensure that northbound and southbound vehicles would be able to travel through both intersections during one traffic signal phase. With the addition of point detection on the northbound and southbound approaches, no recall on the eastbound/westbound approaches, minimum recall on the northbound/southbound approaches and traffic signal coordination, this intersection operate at an overall LOS C/B during the AM peak hour and an overall LOS B during the PM peak hour with all movements operating at LOS D or better depending on which alternative is progressed.

To improve operations, point detection was added to the northbound and southbound through lanes on Electronics Parkway and the yellow/all-red clearance, the minimum greens, and vehicle extension were modified. The signal was optimized using Synchro which resulted in two different improvement alternatives; standard coordination and clustered coordination. Both alternatives resulted in an 80-second cycle length during the AM and PM peak hours. The AM and PM peak hour cycle lengths were adjusted to minimize vehicle delays, minimize the v/c ratio, and to coordinate the timings with adjacent signals. During the peak hours, the intersection will operate at the maximum cycle length during the higher percentiles of traffic, and shorter cycle lengths during lower percentiles of traffic. Table II.C.2 summarizes the suggested changes in the signal timing parameters.

Table II.C.2 – Electronics Pkwy/7th North St/Holiday Inn Drwy Parameter Summary

| Parameter | Existing | Proposed |
|-------------------|--|--|
| Detection | NB/SB/WB lefts; EB | Point detection added to NB/SB throughs |
| Recall | Max NB/SB throughs | Min NB/SB throughs |
| Minimum Green | 8-sec EB/WB; 4.5-sec NB left; 5-sec SB left; 10-sec NB/SB throughs | 5-sec NB/SB lefts; 10-sec NB/SB/WB/EB throughs |
| Yellow/All Red: | 3/3-sec | 4.0/2.0-sec for 30-40 mph speed |
| Vehicle Extension | 3-sec | 1.5-sec NB/SB lefts and WB left\through ⁵ ; 2.2-sec WB right ⁶ ; 3.8-sec NB/SB throughs ⁷ |
| Cycle Length | 103-sec | 70-sec AM; 70-sec PM |

D. Electronics Parkway/I-90 Exit 37/Holiday Inn Driveway

This four-leg intersection operates under a three-phase traffic signal with a 90-second maximum cycle length. The southbound Electronics Parkway approach provides an exclusive left-turn lane and two through lanes with shared right-turns while the northbound approach provides an exclusive left-turn lane, two through lanes, and a slip right-turn lane not controlled by the signal. Presence detection is provided on the northbound and southbound left-turn lanes while a maximum recall is only provided on the through movements. The westbound I-90 Exit 37 Ramp approach provides a shared left-turn/through lane and a separate slip right-turn lane not controlled by the signal with presence detection on the shared lane and no recall. The eastbound Holiday Inn Driveway approach provides an exclusive left-turn lane and a shared through/right-turn lane with presence detection and no recall. The eastbound and westbound phases are allowed to skip if no vehicles are detected since no recall has been set. No sidewalks, crosswalks, or pedestrian controls are provided. The speed limit on Electronics Parkway is 40 mph and 30 mph on the I-90 Exit 37 approach. Table II.D.1 summarizes the detailed levels of service for existing and proposed conditions.

⁵ Max allowable headway = 3 sec, detection zone = 70 feet, approach speed = 40-45 mph.

⁶ Max allowable headway = 3 sec, detection zone = 30 feet, approach speed = 40 mph.

⁷ Max allowable headway = 3 sec, detection zone = 6 feet (placed 200 feet from the intersection), approach speed = 40-45 mph.

Table II.D.1 – Electronics Pkwy/I-90 Exit 37/Holiday Inn Drwy LOS Summary

| Intersection | Control | AM Peak Hour | | | PM Peak Hour | | |
|---|---------|--------------|-----------------------|------------------------|--------------|-----------------------|------------------------|
| | | Existing | Standard Coordination | Clustered Coordination | Existing | Standard Coordination | Clustered Coordination |
| Electronics Pkwy/I-90 Exit 37 Ramp/Holiday Inn Drwy | S | | | | | | |
| Holiday Inn Drwy EB L | | C (21) | C (24) | C (24) | C (27) | C (29) | C (23) |
| TR | | C (21) | C (24) | C (24) | C (26) | C (28) | C (23) |
| I-90 Exit 37 Ramp WB LT | | C (34) | D (45) | D (45) | D (36) | D (47) | C (27) |
| R | | A (1) | A (1) | A (1) | A (0) | A (0) | A (0) |
| Electronics Pkwy NB L | | C (35) | D (37) | D (36) | D (40) | C (33) | D (36) |
| T,TR | | C (35) | C (23) | C (24) | C (29) | C (22) | D (35) |
| Electronics Pkwy SB L | | C (31) | D (52) | D (54) | D (44) | C (29) | C (33) |
| T,TR | | B (13) | B (11) | A (4) | A (10) | B (11) | B (11) |
| Overall | | C (21) | B (20) | B (18) | C (22) | B (19) | C (22) |

Key: NB, SB, EB, WB = Northbound, Southbound, Eastbound, Westbound intersection approaches
L, T, R = Left-turn, through, and/or right-turn movements
X (Y.Y) = Level of Service (Delay, seconds per vehicle)

During the AM and PM peak hours, the intersection operates at an overall LOS C with all movements operating at LOS D or better. It is noted that two separate signalized alternatives were analyzed for this intersection. The first alternative assumed that standard traffic signal coordination would be provided along Electronics Parkway with the adjacent signals. However, an alternative scenario was also analyzed which assumed that this intersection and the adjacent Electronics Parkway/7th North Street/Holiday Inn Driveway intersection would operate under the same traffic signal control since it is only located 300-feet to the south. This would ensure that northbound and southbound vehicles would be able to travel through both intersections during one traffic signal phase. With the addition of point detection on the northbound and southbound approaches, no recall on the eastbound/westbound approaches, minimum recall on the northbound/southbound approaches and traffic signal coordination, this intersection operate at an overall LOS B during the AM peak hour and an overall LOS B/C during the PM peak hour with all movements operating at LOS D or better depending on which alternative is progressed.

To improve operations, point detection was added to the northbound and southbound through lanes on Electronics Parkway and the yellow/all-red clearance, the minimum greens, and vehicle extension were modified. The signal was optimized using Synchro which resulted in two different improvement alternatives; standard coordination and clustered coordination. Both alternatives resulted in an 80-second cycle length during the AM and PM peak hours. The AM and PM peak hour cycle lengths were adjusted to minimize vehicle delays, minimize the v/c ratio, and to coordinate the timings with adjacent signals. During the peak hours, the intersection will operate at the maximum cycle length during the higher percentiles of traffic, and shorter cycle lengths during lower percentiles of traffic. Table II.D.2 summarizes the suggested changes in the signal timing parameters.

Table II.D.2 – Electronics Pkwy/I-90 Exit 37/Holiday Inn Drwy Parameter Summary

| Parameter | Existing | Proposed |
|-------------------|---|--|
| Detection | NB/SB lefts, EB, and WB left/through | Point detection added to NB/SB throughs |
| Recall | Max NB/SB throughs | Min NB/SB throughs |
| Minimum Green | 4.5-sec NB/SB/WB lefts; 4-sec EB; 10-sec NB/SB throughs | 5-sec NB/SB lefts; 10-sec NB/SB/WB throughs; 7-sec EB |
| Yellow/All Red: | 4/2-sec | 4.0/2.5-sec for 30-45 mph speed |
| Vehicle Extension | 2.2-sec | 1.5-sec NB/SB lefts ⁸ ; 1.8-sec EB ⁹ ; 0.8-sec WB ¹⁰ ; 3.8-sec NB/SB throughs ¹¹ |
| Cycle Length | 90-sec | Standard Coordination: 80-sec AM; 80-sec PM Clustered Coordination: 80-sec AM; 80-sec PM |

E. Electronics Parkway/Transistor Parkway

This three-leg intersection operates under a two-phase traffic signal with an 87-second maximum cycle length. The northbound Electronics Parkway approach provides an exclusive left-turn lane and two through lanes with presence detection provided on the left-turn lane and a maximum recall. The southbound Electronics Parkway approach provides two through lanes with a shared right-turn lane with no detection and a maximum recall. The eastbound Transistor Parkway approach provides a single lane for shared left and right turns with presence detection and no recall. The eastbound phase is allowed to skip if no vehicles are detected since no recall has been set. No sidewalks, crosswalks, or pedestrian controls are provided. The speed limit is not posted on the Transistor Parkway while the posted speed limit on Electronics Parkway is 40 mph. Table II.E.1 summarizes the detailed levels of service for existing and proposed conditions.

Table II.E.1 – Electronics Pkwy/Transistor Pkwy LOS Summary

| Intersection | Control | AM Peak Hour | | PM Peak Hour | |
|--|---------|--------------|-------------|--------------|-------------|
| | | Existing | Coordinated | Existing | Coordinated |
| Electronics Parkway/Transistor Parkway | S | | | | |
| Transistor Parkway EB LR | | C (22) | D (36) | C (21) | D (36) |
| Electronics Parkway NB L | | C (22) | C (29) | C (22) | D (45) |
| T,T | | A (1) | A (1) | A (1) | A (1) |
| Electronics Parkway SB T,TR | | A (3) | A (5) | A (5) | A (6) |
| Overall | | A (2) | A (3) | A (4) | A (5) |

Key: NB, SB, EB, WB = Northbound, Southbound, Eastbound, Westbound intersection approaches
L, T, R = Left-turn, through, and/or right-turn movements
X (Y.Y) = Level of Service (Delay, seconds per vehicle)

⁸ Max allowable headway = 3 sec, detection zone = 70 feet, approach speed = 40-45 mph.

⁹ Max allowable headway = 3 sec, detection zone = 30 feet, approach speed = 30 mph.

¹⁰ Max allowable headway = 3 sec, detection zone = 70 feet, approach speed = 30 mph.

¹¹ Max allowable headway = 3 sec, detection zone = 6 feet (placed 200 feet from the intersection), approach speed = 40-45 mph.

The intersection currently operates at good levels of service with low delays during the AM and PM peak hours. With the addition of point detection and minimum recall on the northbound/southbound through lanes and traffic signal optimization, this intersection will continue to operate at good levels of service and drivers on the northbound and southbound Electronics Parkway approaches will be coordinated with the adjacent signals.

To improve operations as noted above, point detection was added to northbound and southbound Electronics Parkway through lanes, traffic signal coordination was provided, and the yellow/all-red clearance, minimum greens, and vehicle extension were modified. The signal was optimized using Synchro which resulted in an 80-second cycle length during the AM and PM peak hours. Review of the actuated green times indicated that each approach will generally operate below the maximum allowable split for all levels of traffic. Table II.E.2 summarizes the suggested changes in the signal timing parameters.

Table II.E.2 – Electronics Pkwy/Transistor Pkwy Parameter Summary

| Parameter | Existing | Proposed |
|-------------------|--|---|
| Detection | NB left, EB | Point detection added to NB/SB throughs |
| Recall | Max NB/SB throughs | Min NB/SB throughs |
| Minimum Green | 4.5-sec NB lefts and EB; 14-sec NB/SB throughs | 5-sec NB left; 10-sec NB/SB throughs; 7-sec EB |
| Yellow/All Red: | 4/1-sec NB/SB; 3/1 EB and NB left | 4.5/2-sec for 30-45 mph speed |
| Vehicle Extension | 2.2-sec | 3.0-sec NB left ¹² ; 1.8-sec EB ¹³ ; 3.8-sec NB/SB throughs ¹⁴ |
| Cycle Length | 87-sec | 80-sec AM; 80-sec PM |

F. Electronics Parkway/Continuum Drive/Limestone Drive

This four-leg intersection operates under a three-phase traffic signal with a 96-second maximum cycle length. The northbound and southbound Electronics Parkway approaches provide an exclusive left-turn lane and two through lanes with shared right-turns. Presence detection is provided on the northbound and southbound left-turn lanes while a maximum recall is only provided on the through movements. The eastbound Continuum Drive approach and the westbound Limestone Drive approach provide an exclusive left-turn lane and a shared through/right-turn lane with presence detection and no recall. The eastbound and westbound phases are allowed to skip if no vehicles are detected since no recall has been set. No sidewalks, crosswalks, or pedestrian controls are provided. The posted speed limit on Electronics Parkway is 45 mph and presumed to be 20 to 30 mph on Continuum Drive and Limestone Drive. Table II.F.1 summarizes the detailed levels of service for existing and proposed conditions.

¹² Max allowable headway = 3 sec, detection zone = 30 feet, approach speed = 45-50 mph.

¹³ Max allowable headway = 3 sec, detection zone = 30 feet, approach speed = 30 mph.

¹⁴ Max allowable headway = 3 sec, detection zone = 6 feet (placed 200 feet from the intersection), approach speed = 45-50 mph.

Table II.F.1 – Electronics Pkwy/Continuum Dr/Limestone Dr LOS Summary

| Intersection | Control | AM Peak Hour | | PM Peak Hour | |
|--|---------|--------------|-------------|--------------|-------------|
| | | Existing | Coordinated | Existing | Coordinated |
| Electronics Pkwy/Limestone Dr/Continuum Dr | S | | | | |
| Continuum Drive EB | L | C (32) | C (32) | C (28) | D (39) |
| | TR | C (32) | C (32) | B (19) | C (29) |
| Limestone Drive WB | L | C (34) | C (33) | C (20) | C (26) |
| | TR | C (33) | C (33) | B (18) | C (23) |
| Electronics Parkway NB | L | C (34) | D (39) | C (31) | D (49) |
| | T,TR | A (5) | A (5) | B (16) | A (9) |
| Electronics Parkway SB | L | D (38) | D (43) | C (30) | D (48) |
| | T,TR | C (31) | C (35) | B (13) | B (13) |
| Overall | | C (23) | C (26) | B (17) | B (17) |

Key: NB, SB, EB, WB = Northbound, Southbound, Eastbound, Westbound intersection approaches
L, T, R = Left-turn, through, and/or right-turn movements
X (Y.Y) = Level of Service (Delay, seconds per vehicle)

The intersection currently operates at an overall LOS C/B during the AM and PM peak hours. With the addition of point detection and minimum recall on the northbound/southbound through lanes and traffic signal optimization, this intersection will continue to operate at similar levels of service and drivers on the northbound and southbound Electronics Parkway approaches will be coordinated with the adjacent signals.

To improve operations as noted above, point detection was added to northbound and southbound Electronics Parkway through lanes, traffic signal coordination was provided, and the yellow/all-red clearance, minimum greens, and vehicle extension were modified. The signal was optimized using Synchro which resulted in an 80-second cycle length during the AM and PM peak hours. Review of the actuated green times indicated that each approach will operate at the maximum cycle length during the higher percentiles of traffic, and shorter cycle lengths during lower percentiles of traffic. A review of the simulation and the 95th percentile queue length indicates that the northbound Electronics Parkway left-turn lane should be lengthened to accommodate the heavy morning flow of traffic entering the Lockheed development so that vehicles do not extend into the northbound through travel lane. It is noted that the OCDOT typically does not allow a lagging left-turn arrow on four-leg intersections. However, it is noted that a leading southbound left-turn phase and a lagging northbound left-turn phase could improve progression through the corridor if this signal timing phasing is permitted. Table II.F.2 summarizes the suggested changes in the signal timing parameters.

Table II.F.2 – Electronics Pkwy/Continuum Dr/Limestone Dr Parameter Summary

| Parameter | Existing | Proposed |
|-------------------|---|--|
| Detection | NB/SB lefts, EB/WB | Point detection added to NB/SB throughs |
| Recall | Max NB/SB throughs | Min NB/SB throughs |
| Minimum Green | 4.5-sec NB/SB lefts; 12-sec NB/SB throughs; 6-sec EB/WB | 5-sec NB/SB left; 10-sec NB/SB throughs; 10-sec EB/WB |
| Yellow/All Red: | 4/2-sec NB/SB; 3/2 EB/WB and NB/SB lefts | 4.5/2-sec for 30-45 mph speed |
| Vehicle Extension | 2.0-sec | 1.5-sec NB/SB lefts ¹⁵ ; 1.8-sec EB/WB ¹⁶ ; 3.8-sec NB/SB throughs ¹⁷ |
| Cycle Length | 96-sec | 70-sec AM; 70-sec PM |

G. Electronics Parkway/Henry Clay Boulevard/Hopkins Road

This three-leg intersection operates under a three-phase traffic signal with a 93-second maximum cycle length. The southbound Henry Clay Boulevard approach provides an exclusive left-turn lane and two through lanes with presence detection provided on the left-turn lane and maximum recall on the through movement. The northbound Electronics Parkway approach provides two through lanes with a shared right-turn lane with no detection and maximum recall. The westbound Hopkins Road approach provides separate left and right turn lanes with presence detection and no recall. The westbound phase is allowed to skip if no vehicles are detected since no recall has been set. No sidewalks, crosswalks, or pedestrian controls are provided. The posted speed limit on the Electronics Parkway and Henry Clay Boulevard is 45 mph and 40 mph on Hopkins Road. Table II.G.1 summarizes the detailed levels of service for existing and proposed conditions.

Table II.G.1 – Electronics Pkwy/Henry Clay Blvd/Hopkins Rd LOS Summary

| Intersection | Control | AM Peak Hour | | PM Peak Hour | |
|---|---------|--------------|-------------|--------------|-------------|
| | | Existing | Coordinated | Existing | Coordinated |
| Electronics Pkwy/Henry Clay Blvd/Hopkins Rd | S | | | | |
| Hopkins Road WB L | | C (32) | C (35) | C (30) | C (32) |
| R | | C (28) | B (19) | C (28) | C (20) |
| Electronics Parkway NB T,TR | | A (9) | A (7) | B (12) | A (7) |
| Henry Clay Boulevard SB L | | C (32) | D (42) | C (31) | C (25) |
| T,T | | A (3) | A (2) | A (3) | A (6) |
| Overall | | A (9) | A (8) | B (11) | A (9) |

Key: NB, SB, EB, WB = Northbound, Southbound, Eastbound, Westbound intersection approaches
 L, T, R = Left-turn, through, and/or right-turn movements
 X (Y.Y) = Level of Service (Delay, seconds per vehicle)

The intersection currently operates at an overall LOS A/B during the AM and PM peak hours. With the addition of point detection and minimum recall on the northbound/southbound through lanes and traffic signal optimization, this

¹⁵ Max allowable headway = 3 sec, detection zone = 70 feet, approach speed = 45-50 mph.

¹⁶ Max allowable headway = 3 sec, detection zone = 30 feet, approach speed = 20 to 30 mph.

¹⁷ Max allowable headway = 3 sec, detection zone = 6 feet (placed 200 feet from the intersection), approach speed = 40-45 mph.

intersection will operate at an overall LOS A during both peak hours and drivers on the northbound and southbound Electronics Parkway approaches will be coordinated with the adjacent signals.

To improve operations as noted above, point detection was added to northbound and southbound Electronics Parkway through lanes, traffic signal coordination was provided, and the yellow/all-red clearance, minimum greens, and vehicle extension were modified. The signal was optimized using Synchro which resulted in an 80-second cycle length during the AM and PM peak hours. Review of the actuated green times indicated that each approach will generally operate below the maximum allowable split for all levels of traffic. Table II.G.2 summarizes the suggested changes in the signal timing parameters.

Table II.G.2 – Electronics Pkwy/Henry Clay Blvd/Hopkins Rd Parameter Summary

| Parameter | Existing | Proposed |
|-------------------|--|---|
| Detection | SB lefts, WB | Point detection added to NB/SB throughs |
| Recall | Max NB/SB throughs | Min NB/SB throughs |
| Minimum Green | 4.5-sec SB left; 12-sec NB/SB throughs; 6-sec WB | 5-sec SB left; 10-sec NB/SB throughs; 10-sec WB |
| Yellow/All Red: | 4/2-sec NB/SB; 3/2 WB and SB lefts | 4.5/2-sec for 40-45 mph speed |
| Vehicle Extension | 2.0-sec | 1.5-sec SB left ¹⁸ ; 1.4-sec WB ¹⁹ ; 3.8-sec NB/SB throughs ²⁰ |
| Cycle Length | 93-sec | 80-sec AM; 80-sec PM |

H. Henry Clay Boulevard/Metropolitan Park Drive

This three-leg intersection operates under a two-phase traffic signal with a 68-second maximum cycle length. The southbound Henry Clay Boulevard approach provides two through lanes with a shared left-turn lane while the northbound Henry Clay Boulevard approach provides two through lanes with a shared right-turn lane. Presence detection and maximum recall is provided on the northbound and southbound movements. The westbound Metropolitan Park Drive approach provides a single lane for shared left and right turns with presence detection and no recall. The westbound phase is allowed to skip if no vehicles are detected since no recall has been set. No sidewalks, crosswalks, or pedestrian controls are provided. The posted speed limit on Henry Clay Boulevard is 45 mph and 30 mph on Metropolitan Park Drive. Table II.H.1 summarizes the detailed levels of service for existing and proposed conditions.

¹⁸ Max allowable headway = 3 sec, detection zone = 70 feet, approach speed = 45-50 mph.

¹⁹ Max allowable headway = 3 sec, detection zone = 30 feet, approach speed = 40 mph.

²⁰ Max allowable headway = 3 sec, detection zone = 6 feet (placed 200 feet from the intersection), approach speed = 45-50 mph.

Table II.H.1 – Henry Clay Blvd/Metropolitan Park Dr LOS Summary

| Intersection | Control | AM Peak Hour | | PM Peak Hour | |
|--------------------------------------|---------|--------------|-------------|--------------|-------------|
| | | Existing | Coordinated | Existing | Coordinated |
| Henry Clay Blvd/Metropolitan Park Dr | S | | | | |
| Metropolitan Park Drive WB LR | | C (22) | C (33) | C (25.) | C (30) |
| Henry Clay Boulevard NB T,TR | | A (5) | A (5) | B (10) | A (3) |
| Henry Clay Boulevard SB LT,T | | A (7) | A (4) | A (9) | A (4) |
| Overall | | A (7) | A (6) | B (12) | A (7) |

Key: NB, SB, EB, WB = Northbound, Southbound, Eastbound, Westbound intersection approaches
L, T, R = Left-turn, through, and/or right-turn movements
X (Y.Y) = Level of Service (Delay, seconds per vehicle)

The intersection currently operates at an overall LOS A/B during the AM and PM peak hours. With the addition of point detection and minimum recall on the northbound/southbound through lanes and traffic signal optimization, this intersection will operate at an overall LOS A during both peak hours and drivers on the northbound and southbound Electronics Parkway approaches will be coordinated with the adjacent signals.

To improve operations as noted above, point detection was added to northbound and southbound Electronics Parkway through lanes, traffic signal coordination was provided, and the yellow/all-red clearance, minimum greens, and vehicle extension were modified. The signal was optimized using Synchro which resulted in an 80-second cycle length during the AM and PM peak hours. Review of the actuated green times indicated that each approach will generally operate below the maximum allowable split for all levels of traffic. Table II.H.2 summarizes the suggested changes in the signal timing parameters.

Table II.H.2 – Henry Clay Blvd/Metropolitan Park Dr Parameter Summary

| Parameter | Existing | Proposed |
|-------------------|---------------------------------|---|
| Detection | WB | Point detection added to NB/SB throughs |
| Recall | Max NB/SB throughs | Min NB/SB throughs |
| Minimum Green | 10-sec NB/SB throughs; 8-sec WB | 10-sec NB/SB throughs; 7-sec WB |
| Yellow/All Red: | 4/3-sec | 4.5/2-sec for 30-45 mph speed |
| Vehicle Extension | 4.0-sec | 1.8-sec WB ²¹ ; 3.8-sec NB/SB throughs ²² |
| Cycle Length | 68-sec | 80-sec AM; 80-sec PM |

I. Henry Clay Boulevard/West Taft Road/Vine Street

This four-leg intersection operates under a four-phase traffic signal with a 113-second maximum cycle length. The southbound Henry Clay Boulevard approach provides an exclusive left-turn lane and two through lanes with shared right-turns while the northbound approach provides an exclusive left-turn lane, two through

²¹ Max allowable headway = 3 sec, detection zone = 30 feet, approach speed = 30 mph.

²² Max allowable headway = 3 sec, detection zone = 6 feet (placed 200 feet from the intersection), approach speed = 45-50 mph.

lanes, and a right-turn lane. Presence detection is provided on all northbound and southbound movements while maximum recall is provided on the through movements. The westbound West Taft Road approach provides two exclusive left-turn lanes and two through lanes with shared right-turns that flare at the intersection and are controlled by a yield sign. The eastbound Vine Street approach provides an exclusive left-turn lane, a through lane, and a separate slip right-turn lane that is controlled by a yield sign. Presence detection is provided on all of the eastbound and westbound movements with the exception of the right-turn movements. The eastbound and westbound phases are allowed to skip if no vehicles are detected since no recall has been set. No sidewalks, crosswalks, or pedestrian controls are provided. The posted speed limit on the Henry Clay Boulevard, West Taft Road, and Vine Street is 40 mph. Table II.I.1 summarizes the detailed levels of service for existing and proposed conditions.

Table II.I.1 – Henry Clay Blvd/West Taft Rd/Vine St LOS Summary

| Intersection | Control | AM Peak Hour | | PM Peak Hour | |
|--------------------------------------|---------|--------------|-------------|--------------|-------------|
| | | Existing | Coordinated | Existing | Coordinated |
| Henry Clay Blvd/West Taft Rd/Vine St | S | | | | |
| Vine Street EB | L | D (49) | D (36) | D (52) | D (42) |
| | T | D (39) | C (35) | D (46) | D (54) |
| | R | A (0) | A (0) | A (0) | A (0) |
| West Taft Road WB | L,L | D (47) | D (40) | D (52) | D (55) |
| | T,TR | C (31) | C (25) | D (40) | C (31) |
| Henry Clay Boulevard NB | L | D (45) | D (47) | D (54) | D (49) |
| | T,T | D (37) | D (39) | E (62) | D (46) |
| | R | C (21) | D (54) | C (32) | C (28) |
| Henry Clay Boulevard SB | L | D (48) | D (47) | E (58) | D (52) |
| | T,TR | D (37) | C (29) | D (41) | C (28) |
| Overall | | D (36) | C (34) | D (47) | D (39) |

Key: NB, SB, EB, WB = Northbound, Southbound, Eastbound, Westbound intersection approaches

L, T, R = Left-turn, through, and/or right-turn movements

X (Y.Y) = Level of Service (Delay, seconds per vehicle)

During the AM and PM peak hours, the intersection operates at an overall LOS D with all movements operating at LOS D or better, with the exception of the northbound through movement and the southbound left-turn movement which operates at LOS E during the PM peak hour. With no recall provided on the eastbound/westbound approaches and minimum recall on the northbound/southbound approaches, drivers on Henry Clay Boulevard will be served more frequently when gaps appear in Vine Street/West Taft Road traffic and overall delay will be reduced.

To improve operations, the yellow/all-red clearance, the minimum greens, and vehicle extension were modified. The signal was optimized using Synchro which resulted in two different improvement scenarios. The signal was optimized using Synchro which resulted in an 80-second cycle length during the AM and PM peak hours. Review of the actuated green times indicated that each approach will operate at the maximum cycle length during the higher percentiles of traffic, and shorter cycle lengths during lower percentiles of traffic. Table II.I.2 summarizes the suggested changes in the signal timing parameters.

Table II.I.2 – Henry Clay Blvd/West Taft Rd/Vine St Parameter Summary

| Parameter | Existing | Proposed |
|-------------------|---|---|
| Detection | NB/SB; EB/WB lefts and throughs | No change |
| Recall | Min EB/WB throughs | Min NB/SB throughs |
| Minimum Green | 5-sec NB/SB/EB/WB lefts; 10-sec NB/SB/EB/WB throughs | No change |
| Yellow/All Red: | 3.5/1.5-sec NB/SB/EB/WB lefts; 3.5/2 NB/SB/EB/WB throughs | 4.5/1.5-sec for 40-45 mph speed |
| Vehicle Extension | 3.5-sec NB/SB/EB/WB lefts; 5.0-sec EB/WB throughs; 6.0-sec SB through; 4-sec NB through | 1.5-sec SB/EB/WB ²³ ; 1.7-sec NB ²⁴ |
| Cycle Length | 113-sec | 80-sec AM; 80-sec PM |

J. Corridor Evaluation Summary

Measures of effectiveness (MOEs) serve as performance measures for evaluating the Electronics Parkway/Henry Clay Boulevard corridor. The MOEs can include delays, fuel consumption, average speed, emissions, travel time, and the “performance index” (PI) from the traffic simulation model. The PI represents a combination of the delays, stops, and queuing penalty. A lower PI indicates better overall operations. The corridor was optimized and evaluated with coordination. Table II.J.1 summarizes the MOEs for Electronics Parkway/Henry Clay Boulevard for the standard coordinated alternative and the clustered coordinated alternative.

Table II.J.1 – Measures of Effectiveness on Electronics Pkwy/Henry Clay Blvd

| Measure of Effectiveness | AM Peak Hour | | | PM Peak Hour | | |
|--------------------------|--------------|-----------------------|------------------------|--------------|-----------------------|------------------------|
| | Existing | Standard Coordination | Clustered Coordination | Existing | Standard Coordination | Clustered Coordination |
| Total Delay (Hours) | 75 | 63 | 63 | 87 | 62 | 65 |
| Performance Index | 95.6 | 83.0 | 81.8 | 111.2 | 84.2 | 89.3 |
| Fuel Consumed (gal) | 267 | 254 | 247 | 311 | 280 | 293 |
| Overall Speed (mph) | | | | | | |
| NB | 23 | 25 | 25 | 22 | 26 | 25 |
| SB | 22 | 24 | 24 | 23 | 26 | 26 |
| Travel Time (seconds) | | | | | | |
| NB | 323 | 288 | 281 | 359 | 302 | 314 |
| SB | 357 | 316 | 310 | 365 | 304 | 297 |

Overall, Table II.J.1 shows that the MOEs along Electronics Parkway/Henry Clay Boulevard will improve under both coordinated systems. Total delay through the corridor will be reduced and speeds will improve from 2 to 4-mph based on peak hour and approach.

²³ Max allowable headway = 3 sec, detection zone = 70 feet, approach speed = 40-45 mph.

²⁴ Max allowable headway = 3 sec, detection zone = 55 feet, approach speed = 40-45 mph.

K. Optimization Summary

The recommendations discussed in the preceding sections are intended to develop consistency in the operations of each signal, improve responsiveness, and increase efficiency. The addition of detection on all approaches enables a signal to respond to changing traffic conditions, which increases the capacity of the intersection. Once vehicle detection is installed, recall settings in the signal controller can be used to create a minimum operating condition that the signal must serve. Beyond that, the controller can respond to the current demand.

Another key component of the recommendations is updating the vehicle extension times to accurately reflect the existing or proposed detection. The vehicle extension adds time to an approach that has already served the initial platoon of traffic with the minimum green, but continues to see additional vehicles arriving on the approach. The traffic signal will not start to “gap out” (i.e. end the current phase) until the vehicle has left the detection zone.

Many of the intersections included in this analysis currently have presence detection (long vehicle detection loops, typically 60 to 70 feet) and a 3 or 4 second vehicle extension time. Depending on the speed of approaching vehicles, this combination of presence detection and a 3 to 4 second vehicle extension will result in the continued extension of the green phase for a dwindling amount of vehicles, which increases the delay for drivers on conflicting approaches waiting for straggling vehicles to pass through the intersection. Therefore, this report generally recommends that the vehicle extension time be reduced to 0.8 to 3.0 seconds for presence detection to allow the signal to serve all approaches more efficiently and reduce overall delay at the intersection.

In contrast, point detection uses a small detection zone; typically a 6-foot detector loop placed 100 to 200 feet from the intersection, and has a much shorter period of detection as a vehicle passes over it. Point detection requires longer vehicle extensions, since the detector has less time to detect a vehicle approaching the intersection. Therefore, for point detection, this report generally recommends using a 3.8-second vehicle extension time to allow the signal to serve all approaches more efficiently and reduce overall delay at the intersection.

Tables II.K.1-2 and Tables II.K.3-4 provide the traffic signal coordination plans for the AM and PM peak hours for the standard coordinated alternative and the clustered coordinated alternative.

Table II.K.1 – Standard Coordination Data Table (AM Peak Hour)

| AM Peak Hour – 80 Second Cycle Length (7:00 to 9:00 AM) | | | | | | | | | |
|---|--------|----|----|----|----|----|----|----|--------|
| Intersection | Splits | | | | | | | | Offset |
| | Ø1 | Ø2 | Ø3 | Ø4 | Ø5 | Ø6 | Ø7 | Ø8 | |
| Old Liverpool Rd | 19 | 17 | 44 | | | | 44 | | 64 |
| Sunflower Dr | 25 | 15 | | | | | | | 8 |
| 7 th North St/Holiday Inn Drwy | 24 | 26 | 30 | | 11 | 39 | | | 10 |
| I-90 Exit 37/Holiday inn Drwy | 22 | 33 | 25 | | 12 | 43 | 25 | | 0 |
| Transistor Pkwy | 12 | 54 | 14 | | | | | | 76 |
| Continuum Dr/Limestone Dr | 12 | 51 | 17 | | 29 | 34 | | | 56 |
| Hopkins Rd | 19 | 41 | 20 | | | 60 | | | 48 |
| Metropolitan Park Dr | 63 | 17 | | | | | | | 4 |
| West Taft Rd/Vine St | 14 | 23 | 13 | 30 | 15 | 22 | 22 | 21 | 76 |

Table II.K.2 – Standard Coordination Data Table (PM Peak Hour)

| PM Peak Hour – 80 Second Cycle Length (4:00 to 6:00 PM) | | | | | | | | | |
|---|--------|----|----|----|----|----|----|----|--------|
| Intersection | Splits | | | | | | | | Offset |
| | Ø1 | Ø2 | Ø3 | Ø4 | Ø5 | Ø6 | Ø7 | Ø8 | |
| Old Liverpool Rd | 19 | 21 | 40 | | | | 40 | | 23 |
| Sunflower Dr | 27 | 13 | | | | | | | 16 |
| 7 th North St/Holiday Inn Drwy | 24 | 24 | 32 | | 11 | 37 | | | 6 |
| I-90 Exit 37/Holiday inn Drwy | 30 | 30 | 20 | | 12 | 48 | 20 | | 0 |
| Transistor Pkwy | 12 | 54 | 14 | | | | | | 20 |
| Continuum Dr/Limestone Dr | 12 | 39 | 29 | | 12 | 39 | | | 28 |
| Hopkins Rd | 16 | 47 | 17 | | | 63 | | | 28 |
| Metropolitan Park Dr | 49 | 31 | | | | | | | 52 |
| West Taft Rd/Vine St | 16 | 19 | 16 | 29 | 12 | 23 | 20 | 25 | 24 |

Table II.K.3 – Clustered Coordination Data Table (AM Peak Hour)

| AM Peak Hour – 80 Second Cycle Length (7:00 to 9:00 AM) | | | | | | | | | |
|---|--------|----|----|----|----|----|----|----|--------|
| Intersection | Splits | | | | | | | | Offset |
| | Ø1 | Ø2 | Ø3 | Ø4 | Ø5 | Ø6 | Ø7 | Ø8 | |
| Old Liverpool Rd | 19 | 17 | 44 | | | | 44 | | 58 |
| Sunflower Dr | 25 | 15 | | | | | | | 18 |
| 7 th North St/Holiday Inn Drwy | 24 | 31 | 25 | | 12 | 43 | 25 | | 0 |
| I-90 Exit 37/Holiday inn Drwy | 24 | 31 | 25 | | 12 | 43 | 25 | | 0 |
| Transistor Pkwy | 25 | 41 | 14 | | | | | | 64 |
| Continuum Dr/Limestone Dr | 12 | 51 | 17 | | 30 | 33 | | | 52 |
| Hopkins Rd | 19 | 41 | 20 | | | 60 | | | 58 |
| Metropolitan Park Dr | 63 | 17 | | | | | | | 10 |
| West Taft Rd/Vine St | 14 | 23 | 13 | 30 | 15 | 22 | 21 | 22 | 4 |

Table II.K.4 – Clustered Coordination Data Table (PM Peak Hour)

| PM Peak Hour – 80 Second Cycle Length (4:00 to 6:00 PM) | | | | | | | | | |
|---|--------|----|----|----|----|----|----|----|--------|
| Intersection | Splits | | | | | | | | Offset |
| | Ø1 | Ø2 | Ø3 | Ø4 | Ø5 | Ø6 | Ø7 | Ø8 | |
| Old Liverpool Rd | 19 | 21 | 40 | | | | 40 | | 38 |
| Sunflower Dr | 27 | 13 | | | | | | | 18 |
| 7 th North St/Holiday Inn Drwy | 27 | 25 | 28 | | 12 | 40 | 28 | | 0 |
| I-90 Exit 37/Holiday inn Drwy | 27 | 25 | 28 | | 12 | 40 | 28 | | 0 |
| Transistor Pkwy | 16 | 50 | 14 | | | | | | 26 |
| Continuum Dr/Limestone Dr | 12 | 39 | 29 | | 12 | 39 | | | 30 |
| Hopkins Rd | 16 | 47 | 17 | | | 63 | | | 50 |
| Metropolitan Park Dr | 49 | 31 | | | | | | | 78 |
| West Taft Rd/Vine St | 15 | 20 | 16 | 29 | 12 | 23 | 20 | 25 | 40 |

The tables above illustrate the differences in the standard and cluster coordination tables. It is noted that the splits for the standard coordination plan at the 7th North Street/Holiday Inn Driveway and I-90 Exit 37/Holiday Inn Driveway on Electronics Boulevard are similar and the offsets are very close to each other for the AM and PM peak hours (ten seconds for the AM peak hour and six seconds for the PM peak hour). This indicates that the northbound and southbound coordinated approaches will have slightly staggered green phases which will allow vehicles to travel through the adjacent intersection without stopping. The clustered coordination plan shows that these two traffic signals would have the same exact splits which would turn green at the same exact time for the northbound and southbound movements as evidence by the zero offset. For example, a motorist stopped at the 7th North Street/Holiday Inn Driveway intersection traveling northbound on Electronics Boulevard would receive a green light at the same time as the traffic signal at the I-90 Exit 37/Holiday Inn Driveway intersection.

CHAPTER IV CONCLUSIONS

Based on the results of this Traffic Signal Timing Optimization study, the following recommendations are offered for the study area intersections:

- Electronics Parkway/Old Liverpool Road/Rite Aid Driveway: This intersection currently operates at LOS C/D during the AM and PM peak hours, respectively, with the northbound Rite Aid Driveway operating at LOS E. It is recommended that the northbound and southbound split phasing be removed to allow for permitted travel movements and that the timing parameters be adjusted as shown in Table II.A.2 to minimize vehicle delays, minimize the v/c ratio, and coordinate the timings with adjacent signals for the coordinated condition. These changes will result in continued acceptable overall operating conditions with all movements operating at LOS D or better during both peak hours. It is noted that there is also the potential to remove the eastbound and westbound split phasing for traffic traveling on Old Liverpool Road if it is not needed for other traffic related issues such as safety. The installation of a permitted eastbound and westbound phase would allow this intersection to operate at better overall levels of service.
- Electronics Parkway/Sunflower Drive: This intersection currently operates at acceptable levels of service during the AM and PM peak hours. However it is recommended that the timing parameters be adjusted as shown in Table II.B.2 to minimize vehicle delays, minimize the v/c ratio, and coordinate the timings with adjacent signals. These changes will result in continued acceptable operating conditions.
- Electronics Parkway/7th North Street/Holiday Inn Driveway: During the AM and PM peak hours, this intersection operates at an overall LOS C with all movements operating at LOS D or better. It is noted that two separate signalized alternatives were analyzed for this intersection. The first alternative assumed that standard traffic signal coordination would be provided along Electronics Parkway with the adjacent signals while a second alternative scenario was analyzed which assumed that this intersection and the adjacent Electronics Parkway/7th North Street/Holiday Inn Driveway intersection would operate under the same traffic signal control since it is only located 300-feet to the north. This would ensure that northbound and southbound vehicles would be able to travel through both intersections during one traffic signal phase. It is recommended that the timing parameters be adjusted as shown in Table II.C.2 to minimize vehicle delays, minimize the v/c ratio, and coordinate the timings with adjacent signals. These changes will result in continued acceptable operating conditions for either the standard coordination or clustered coordination scenarios.
- Electronics Parkway/I-90 Exit 37/Holiday Inn Driveway: During the AM and PM peak hours, this intersection operates at an overall LOS C with all movements operating at LOS D or better. It is noted that two separate signalized alternatives were

analyzed for this intersection. The first alternative assumed that standard traffic signal coordination would be provided along Electronics Parkway with the adjacent signals, while a second alternative scenario was analyzed which assumed that this intersection and the adjacent Electronics Parkway/7th North Street/Holiday Inn Driveway intersection would operate under the same traffic signal control. This would ensure that northbound and southbound vehicles would be able to travel through both intersections during one traffic signal phase. It is recommended that the timing parameters be adjusted as shown in Table II.D.2 to minimize vehicle delays, minimize the v/c ratio, and coordinate the timings with adjacent signals. These changes will result in continued acceptable operating conditions for either the standard coordination or clustered coordination scenarios.

- Electronics Parkway/Transistor Parkway: This intersection currently operates at acceptable levels of service during the AM and PM peak hours. However it is recommended that the timing parameters be adjusted as shown in Table II.E.2 to minimize vehicle delays, minimize the v/c ratio, and coordinate the timings with adjacent signals. These changes will result in continued acceptable operating conditions.
- Electronics Parkway/Limestone Drive/Continuum Drive: This intersection currently operates at an overall LOS C/B during the AM and PM peak hours. However it is recommended that the timing parameters be adjusted as shown in Table II.F.2 to minimize vehicle delays, minimize the v/c ratio, and coordinate the timings with adjacent signals. A review of the traffic simulation and the 95th percentile queue length indicates that the northbound Electronics Parkway left-turn lane should be lengthened to accommodate the heavy morning flow of traffic entering the Lockheed development so that vehicles do not extend into the northbound through travel lane. It is noted that the OCDOT typically does not allow a lagging left-turn arrow on four-leg intersections. However, it is noted that a leading southbound left-turn phase and a lagging northbound left-turn phase could improve progression through the corridor if this signal timing phasing is permitted.
- Electronics Parkway/Henry Clay Boulevard/Hopkins Road: This intersection currently operates at acceptable levels of service during the AM and PM peak hours. However it is recommended that the timing parameters be adjusted as shown in Table II.G.2 to minimize vehicle delays, minimize the v/c ratio, and coordinate the timings with adjacent signals. These changes will result in continued acceptable operating conditions.
- Henry Clay Boulevard/Metropolitan Park Drive: This intersection currently operates at acceptable levels of service during the AM and PM peak hours. However it is recommended that the timing parameters be adjusted as shown in Table II.H.2 to minimize vehicle delays, minimize the v/c ratio, and coordinate the timings with adjacent signals for the coordinated condition. These changes will result in continued acceptable operating conditions.

- Henry Clay Boulevard/Vine Street/West Taft Road: During the AM and PM peak hours, the intersection operates at an overall LOS D with all movements operating at LOS D or better, with the exception of the northbound through movement and the southbound left-turn movement which operates at LOS E during the PM peak hour. It is recommended that the timing parameters be adjusted as shown in Table II.I.2 to minimize vehicle delays, minimize the v/c ratio, and coordinate the timings with adjacent signals for the coordinated condition. These changes will result in continued acceptable overall operating conditions with all movements operating at LOS D or better during both peak hours.

Overall, most intersections can achieve better levels of service and reduced delays with the addition of vehicle detection, updated signal timings, modified controller parameters, and implementing a traffic signal coordination plan. In some instances, these improvements will reduce delays on most movements. Additional physical improvements may be necessary to further reduce delays and congestion.

These recommendations are made solely on the basis of the information provided. Other engineering factors, such as sight distances, accident history, presumed detector locations, and previous experiences at these intersections need to be considered in the implementation or modification of these recommendations.