Sandy City Signal Management Report

Avenue Consultants

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EXECUTIVE SUMMARY

In coordination with Sandy City (Sandy), Salt Lake County (SLCo), the Utah Department of Transportation (UDOT), and Avenue Consultants (Avenue), the project team developed and implemented new signal timing plans throughout Sandy with a goal to reduce travel times, delays, and emissions. Figure 1 depicts the project corridors (in light blue) throughout Sandy where signal timing was revised.

UDOT was included as part of the project team to incorporate state-owned signals into the new signal timing plans to maintain a seamless network of coordination throughout the city.

Before the signal timings were modified, on-site observations were performed and UDOT's Automated Traffic Signal Performance Metrics (ATSPMs – traffic signal-related data that is collected at specific signalized intersections) were analyzed to understand current issues. Using this information, the project team brainstormed new signal timing strategies and modeled them in Synchro, a traffic microsimulation modeling software to determine what signal timing implementation strategy would perform the best. The strategy focused on identifying appropriate cycle lengths, including reviewing harmonic signal cycle lengths (periodic cycle length corresponding to a fractional multiple of the other signals on the corridor, e.g. a 100-second harmonic cycle coordinates with a 150-second corridor 1/3 of the time) to improve the progression of vehicles along the corridor and reduce travel times and congestion. These new timings were implemented and fine-tuned between September 2019 and February 2020.

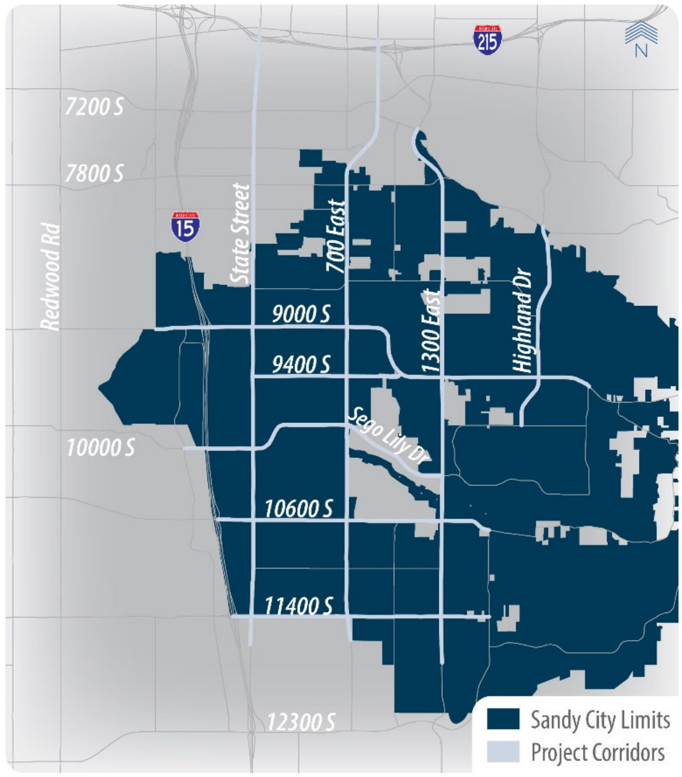


Figure 1. Project Corridor Map

To identify the benefit of the new timings, the project team evaluated before-after travel times and HERE data (GPS data) provided by UDOT. The **average daily travel time was reduced by 128 hours in the AM peak period, 581 hours in the midday period, and 299 hours in the PM peak period with a total of 1,008 hours daily**. This also decreased total daily fuel consumption, CO_2 emissions, and other critical air pollutants ($PM_{2.5}$, CO, NO_X, VOC, and PM_{10}) as shown in the Table 1.

Table 1. Corridor Total Average Daily Emission Reduction Summary

Measure	AM	MD	PM	Saturday
Fuel (gal)	36	164	84	125
CO_2 (lbs.)	685	3,094	1,593	2,361
Total Critical Air Pollutants (lbs.)	10	51	26	39

The total weekday emissions saving accounts for 284 gallons of fuel, 5,372 pounds of CO_2 and 87 pounds of other critical air pollutants. Based on 250 workdays per year the results of this effort will **reduce fuel consumption by 71,000 gallons per year and remove over 670 tons of CO_2 and 11 tons of other critical air pollutants over a year** without accounting for the benefits over the weekends and holidays.

Another method to measure the effectiveness of signal timing improvements is to compare the benefit of the travel time reduction (i.e., user cost savings of the improvement) to the project cost. This benefit-to-cost ratio is derived by calculating the total financial value of the travel time savings as a result of the improvements. For this project, the total travel time savings were determined using a vehicle occupancy constant, the time cost of a standard passenger vehicle, and the time cost to operate a truck. This total travel time savings value was then compared to the project cost to determine the ratio of the benefit provided to the cost, which was 53:1 for this project. That means that **the total user cost savings of the improvement is 53 times greater than the total cost of the project**.

1 INTRODUCTION

Sandy City is a regional destination for employment, commercial, and entertainment as well as home to a significant number of residents. Its traffic signal network is vital to the mobility of those traveling around the city in passenger vehicles, larger trucks, on bikes, using transit, or by walking. Sandy requested that Avenue Consultants optimize traffic signal timing and coordination throughout the city. The results of this effort reduced vehicle delays at traffic signals, which in turn reduced vehicle emissions providing for better air quality. This memo outlines the process and results of the effort including a calculation of the benefit-to-cost ratio for the project.

2 PROJECT OVERVIEW

The scope of this retiming project included all traffic signals located within the borders of Sandy, Utah. This included signals owned wholly or in part by Sandy and UDOT, along with a few owned by other jurisdictions bordering Sandy, as shown in Figure 2. For ease of reporting, and to facilitate the discussion of corridor progression, these signals are organized into the following corridors:

- State St/US-89 (6100 S to 12300 S)
- 700 E/SR-71(6600 S to 12300 S)
- 1300 E (6600 S to 12300 S)
- Highland Dr (Bengal Blvd to 9600 S)
- 9000 S/SR-209 (Redwood Rd to 2300 E)
- 9400 S (State St to SR-209)
- 10000 S / Sego Lily Dr (500 W to 700 E)
- 10600 S (I-15 to 1700 E)
- 11400 S (I-15 to 1300 E)

Additionally, four individual signals which were not part of a corridor were reviewed:

- 7800 S and 1000 E
- Monroe Street and Civic Center Dr
- 11000 S and Automall Dr
- Wasatch Blvd and 1700 Ea

Retiming was performed for the weekday AM, midday (MD), PM, off-peak, and overnight timing plans as well as event traffic plans (around REAL Stadium and Hale Center Theater) and Saturday and Sunday timing plans.

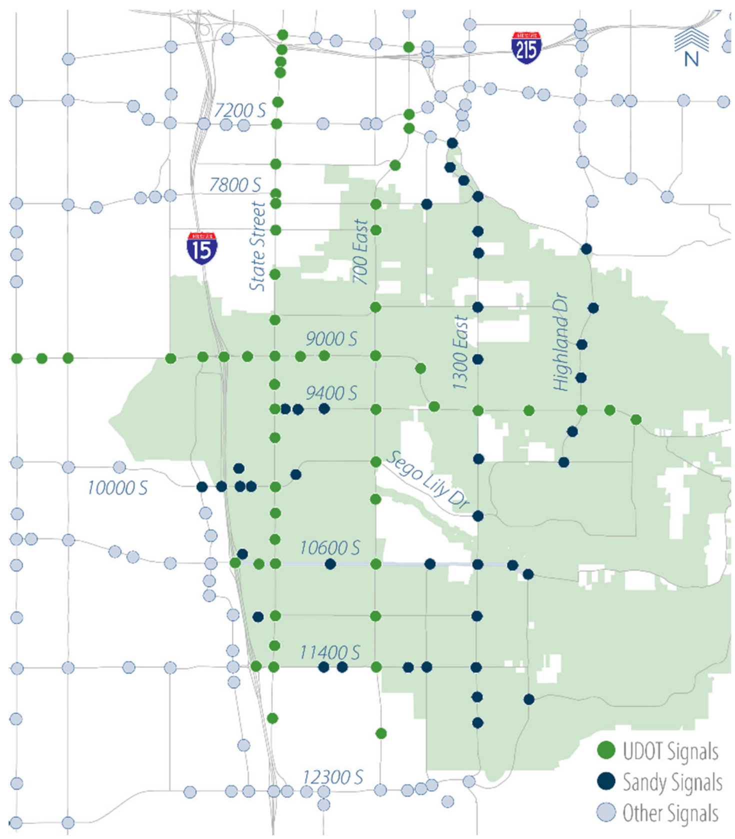


Figure 2. Project Signals Map

3 GOALS/STRATEGIES

The goals of this project are to reduce travel time, delay, and vehicle emissions. During the initial discussion with Sandy, Salt Lake County, and UDOT (the Stakeholders), several strategies were developed to help accomplish these goals, which were then used to help guide decisions when considering different signal timing alternatives:

- Take a comprehensive approach to the signal operations in Sandy by coordinating both Sandy and UDOT signals at the same time to provide the best opportunity to improve travel times and avoid unnecessary stops. This strategy will also reduce daily emissions, as the amount of time a vehicle is running is directly associated with the amount of pollution coming from the vehicle.
- Fine-tune existing signal timing that is working well on Sandy and UDOT signals.
- Identify alternative solutions for capacity-constrained intersections (e.g., coordinate heavy left turn movements, strategically change signal phasing to be more efficient, recommend design elements to improve system functionality).
- Consider transition time adjustments between plans (e.g., the time when the AM plan ends, and the MD plan starts). This strategy will better address the daily demand fluctuations by providing the correct signal timing plans for the variations in traffic patterns and demand for each time of day.
- Prioritize UTA TRAX crossings to help ensure minimal impact to transit travel times.

4 SIGNAL TIMING TERMS

- **Arrival-on-Green (AoG):** counts of total vehicle volume arriving during green signal time, this metric gives an indication of progression quality for the given movement.
- **Automatic Traffic Signal Performance Metrics (ATSPMs):** an online tool managed by UDOT using data collected at specific signalized intersections that provides a set of measurements and visualizations to help traffic teams design, tune, and troubleshoot traffic intersection operations.
- **Coordinated signal phase:** signal phase(s) associated with the prioritized intersection movement (typically the traffic movement with the highest traffic volume).
- **HERE data:** online tool using probe data to report existing travel times, origin destinations, and other traffic-related operations on roadways. This data is collected using personal and vehicle-installed GPS devices and was acquired by UDOT.
- **Level of service (LOS):** Letter grade ranking based on the average delay for vehicles at an intersection. This rating is from A to F with the A letter grade representing a minimum amount of delay for each vehicle.
- **Oversized pedestrian phase:** a signal phase that is programmed to be less than the amount of time it takes to serve the correlating pedestrian crossing phase. When this occurs and a pedestrian actuates the pedestrian signal phase, the signal controller steps out of coordination to serve the full pedestrian signal phase. The signal controller then uses excess green time from minor movements to step back into coordination. This may require multiple signal cycles to get back into coordination. This strategy is typically used at locations with a lower volume of pedestrian crossings.
- **Probe vehicle (aka, probe data):** a single vehicle collecting GPS data while traveling within a platoon of vehicles.
- **Purdue Coordination Diagram:** a graphical representation of individual vehicles arriving at the intersection relative to cycle time (red, yellow and green), highlighting vehicle platoon arrival characteristics, and platoon progression quality.
- **Signal coordination:** a method of timing traffic signals along an arterial roadway to yield smoother traffic with grouped vehicle platoons and minimal stops.

- **Signal cycle:** the total time to complete one sequence of signalization for all movements at an intersection.
- **Signal phase:** the green, yellow, and red (clearance) intervals in a signal cycle assigned to specified movements of traffic (e.g., left, through, or right).
- **Signal phase force-off:** a point within a cycle where a phase must end regardless of continued demand.
- **Signal split:** the portion of a signal phase that the signal is green.
- **Split failure:** when the green signal time fails to meet the vehicle volume demand.

5 DATA COLLECTION

To help with the process of optimizing the signals timing in Sandy, data was collected from on-site observations, UDOT's ATSPMs, travel time runs, and using HERE data provided by UDOT.

5.1 Automated Traffic Signal Performance Metrics (ATSPM)

ATSPMs are a summary of data gathered by the traffic signal controller during signal operations. The data is summarized in a variety of methods to show how the signal is performing. Some of the operation data includes signal phase time served, pedestrian activations, phase split failures, and vehicle arrival data. The metrics available at each signal varies based on the level of detection and number of detector channels. For this project ATSPMs were used to evaluate existing conditions, including the time of day (TOD) schedule, and to provide data for the Synchro models.

One of the many metrics used to help with the evaluation of existing conditions was the Split Monitor, which shows the average split, 85th percentile, and percentage force-offs for each phase. This metric was used to determine the usage of the existing splits and help to determine if changes were needed. For example, if a phase had a high frequency of signal cycles with force-offs, additional time could be allocated to avoid failing to clear the vehicle queue for that phase. This was used in conjunction with the Split Failure metric which was used to determine if a phase consistently didn't serve the queue, if there are vehicles left in the queue after a phase has been served this is identified as a split failure.

ATSPM also includes turning movement counts and approach volume which were used to help determine the appropriate transition times for the TOD schedule and in creating Synchro models. These volumes were used to evaluate the existing TOD schedule by making it possible to identify traffic pattern shifts and where changes were needed in the signal timing to address these shifts.

When it was available, the Purdue Coordination Diagram was also used to review vehicle arrivals on green. This metric uses advanced detection to determine if vehicles approaching the intersection are going to arrive on the green phase or if they will get stopped on the red phase.

5.2 Travel Times

To better understand the improvements associated with the retiming efforts, vehicle travel times were collected on each of the corridors. The before and after travel times were collected using GPS in a probe vehicle. To increase the accuracy of the data, multiple travel time runs are performed during each period and in each direction.

Travel times were also measured using HERE data provided by UDOT. HERE data is also GPS data from probe vehicles collected over a longer period (in this case a minimum of a week). These probe vehicles include fleet vehicles and personal GPS devices (including smartphones using specific applications) that collect the data.

5.3 Observations

To better determine the needs of each corridor, the project team observed the current signal timings and traffic patterns. The primary focus was to identify improvements to progression and how to reduce the delay at each signal. These observations included driving each corridor to understand the experience drivers have, to observe queues and split failures.

6 CORRIDOR ALTERNATIVE DEVELOPMENT AND SELECTION

Observations of the existing conditions were conducted for each of the corridors to identify where improvements can be made. The project team met to discuss and review observations, cycle lengths, splits, and offsets of the existing conditions to identify potential improvements for the corridors.

6.1 Proposed Cycle Lengths

As a project team we met and discussed our observations of the existing conditions to identify appropriate cycle lengths for each corridor and for the whole network. Consistent cycle lengths provide good progression between intersections, particularly for the largest traffic volumes which typically correspond with the coordinated signal movements. However, a cycle length that is longer than necessary can increase delay at intersections, particularly for the traffic movements corresponding with uncoordinated signal phases at the intersection (typically the intersection approaches with minor traffic volumes). We identified alternative cycle lengths with potential to improve signal timing for the AM, MD, PM and Saturday signal timing plans. The summary below outlines some general notes about the cycle lengths as well as some of the benefits and challenges for each alternative. These various signal timing plans for different peak traffic patterns are combined to create a Time of Day (TOD) schedule for each intersection.

6.1.1 General Notes

- We used the lowest cycle lengths possible that maintain good coordination and serve as much of the traffic demand as possible. This was done to serve the traffic volumes on the minor streets as quickly as possible to reduce the delay on these minor approaches.
- We used half cycle or harmonic cycle lengths (e.g., a 100-second cycle length next to a 150-second cycle length) to reduce the cycle lengths at intersections with less volume while still maintaining a measure of coordination with adjacent signals. The shorter cycle lengths are also beneficial at locations with frequent progression interruptions (e.g. UTA TRAX crossings) so the signal can get back into corridor coordination quicker.
- Avenue updated the base signal controller setting including the pedestrian crossing times and the yellow and red intersection clearance intervals to adopt the most current Institute of Traffic Engineers (ITE) and UDOT Signal Timing Guidelines.
- Two of the individual signals, the signal at 11000 S and Automall Dr as well as at Wasatch Blvd and 1700 E, were left running free since there are no other signals in close proximity where coordination would be necessary and they are not located on a main corridor. The benefit of coordination at these signals would not have outweighed the increased delay to vehicles waiting on the uncoordinated phases.

6.1.2 AM Cycle Lengths

Figure 3 shows the proposed cycle lengths for the AM peak period, generally from 6 AM to 9 AM. The corridors have slightly different timeframes for the AM peak period. The day plans with the various corridor cycle lengths are shown in Appendix B. The following describes the logic behind these cycle lengths.

- Between Redwood Rd (not shown on the map) and State St, the 7200 S, 9000 S, 10600 S, and 11400 S corridors were programmed to run 150-second cycle lengths during the AM peak period independently of this project. Using the 150-second cycle length on State St at these four intersections allows for good continuous east-west progression, which starts and ends at State Street.
- On State St north of 9000 S, the traffic demand would allow for a 120-second cycle length. However, this would have led to a break in north-south progression due to the 150-second cycle lengths at 9000 S and 7200 S (see previous bullet). Using smaller 100-second cycle length (which would have provided better progression) would not have accommodated the traffic volume demand. Thus, a 150 second cycle length was maintained between 7200 S and 9000 S.
- The current 120-second cycle length on the corridors east of State St (including 700 E, 1300 E, Highland Drive, 9000 S, 10600 S, and 11400 South) serves the traffic volume demand with minimal split failures. A longer cycle length would not have provided much benefit along these corridors and could have increased delay on the minor street approaches.
- The 120-second cycle length east of State St causes a cycle length break between State St and 700 E because State St uses a 150-second cycle to provide consistent coordination on east/west corridors between Redwood Road and State Street. Due the progression between these signals is often already broken due to the unpredictable train arrivals at the TRAX crossings and was selected as an appropriate place for a cycle length break.
- On Sego Lily Dr (10000 South) and 9400 S, a 100-second cycle length was used to harmonically coordinate these signals with the other traffic signals on State Street. The 100-second cycle serves the traffic volume demand while keeping the cycle length and consequent delay relatively low.
- A 60-second cycle mitigates delay for pedestrian crossings while tying into corridor progression of adjacent intersections with 120-second cycle lengths. We implemented this strategy at locations where minor street traffic volume demand was low.
- With the 150-cycle length at the 9000 S, 10600 S and 11400 S signals, a shorter 100-second cycle length on State St south of 9000 S in between these signals works with the lighter traffic volumes while still allowing for a harmonic relationship.
- On State St at 8720 S and at Princeton Dr a 75-second cycle length was used to provide progression but also reduce delay for vehicles crossing or turning onto State St.
- The individual signal at 7800 S and 1000 E was coordinated at a 60 second cycle length to tie into the signals at 700 E and 1300 E. This provided balance by prioritizing the vehicles along 7800 S and minimizing delay for vehicles crossing or turning onto 7800 S.
- The individual signal at Civic Center Dr and Monroe Street was coordinated with the signal on 1000 E due to the close proximity, within 1000 ft, of the signals.

6.1.3 Midday (MD) Cycle Lengths

Figure 4 shows the proposed cycle lengths for the MD/off-peak period, generally from 9 AM to 3 PM. The corridors have slightly different timeframes for the MD period. The day plans with the various corridor cycle lengths are shown in Appendix B. The following describes the logic behind these cycle lengths.

- This period has the most consistent cycle length plan with 108-seconds used through most of Sandy City.
- Where possible a 54-second cycle length (aka, half-cycle) was used to further reduce delay for vehicles crossing or turning onto major corridors.
- Using a 108-second cycle length on Sego Lily Dr (10000 South) provides better coordination with State Street. Alternatively, a 100-second cycle length on Sego Lily Dr all day long would have provided more consistency with AM, PM, and off-peak signal timing. Ultimately, it was determined that using the 108-second cycle during the MD peak, coordinates signal progression better with State St, and the minor street traffic volumes are relatively low at signals along 10000 S.
- The individual signal at 7800 S and 1000 E was coordinated at a 54 second cycle length to tie into the signals at 700 E and 1300 E. This provided balance by prioritizing the vehicles along 7800 S and minimizing delay for vehicles crossing or turning onto 7800 S.
- The individual signal at Civic Center Dr and Monroe Street was coordinated with the signals on 1000 E with a 108 second cycle length due to the close proximity, within 1000 ft, of the signals.

6.1.4 PM Cycle Lengths

Figure 5 shows the proposed cycle lengths for the PM peak period, generally from 3 PM to 6 PM. The corridors have slightly different timeframes for the PM peak period. The day plans with the various corridor cycle lengths are shown in Appendix B. The following describes the logic behind these cycle lengths.

- The signals on the north end of 1300 E have an orange ring around a red circle. This indicates that these signals have a shoulder timing plan. A shoulder timing plan runs on the fringe of the peak period to accommodate ramping up of the PM peak volume. The 150-second cycle length isn't needed at the beginning/end of the PM peak period, but the 108-second cycle length doesn't accommodate the traffic during this timeframe. This shoulder pattern continues north of Sandy City and was maintained to keep signals along this section of 1300 E coordinated with signals to the north.
- Between Redwood Rd (not shown on the map) and State St, the 7200 S, 9000 S, 10600 S, and 11400 S corridors were programmed to run 150-second cycle lengths during the PM peak period independently of this project. Using the 150-second cycle length on State St between these signals maintained the cycle length along the corridor and provided improve progression. The vehicle volume demand warranted this higher cycle length.
- On 700 E, it took multiple signal cycles at Fort Union Blvd and at 9000 S to go southbound through the intersection. A higher cycle length reduced this congestion by allocating additional time to each cycle for the southbound through traffic.
- The 9000 S corridor acted as a barrier for vehicles heading southbound. North of Sandy City, many of the major corridors use a 150-second cycle length. Continuing this cycle length south through 9000 S progresses vehicles traveling past this barrier. This higher cycle length also reduces delay for the major southbound movement during the PM peak.

- With the increase in cycle lengths during the PM peak, it was critical to review the time period that this plan would run to ensure shorter cycle lengths begin after the peak volume is served.
- The traffic volumes south of 9000 S could have been served with a 120-second cycle length. However, different cycle lengths across 9000 S would create breaks in vehicle progression creating more congestion and stops for vehicles. Using a 150-second cycle length reduced vehicle delay.
- Using the 150-second cycle length south of 9000 S increased the delay for vehicles on the minor approaches but reduced delay for vehicle on the major corridors. However, the overall delay decreased with the 150 second cycle length due to the disproportionate number of vehicles using the main corridors. Often there are 3 to 5 times more vehicles traveling along the main corridor.
- Using a 75 or 100-second harmonic cycle length on 1300 E and 700 E doesn't provide enough time for many of the intersections on these corridors to serve the pedestrian crossing intervals and all the signal phases. However, the 150-second length accommodates all the signal phases and pedestrian crossing intervals and provides better coordination for the major approaches with higher traffic volumes.
- A 100-second cycle length harmonically coordinates the interactions between the 10000 S and 9400 S corridors with State St without increasing the cycle length beyond what was needed.
- On Highland Dr the harmonic 100-second cycle length allows for a shorter cycle length to better serve the minor approaches while maintaining a measure of coordination along Highland Dr.
- The individual signal at 7800 S and 1000 E was coordinated at a 75 second cycle length to tie into the signals at 700 E and 1300 E. This provided balance by prioritizing the vehicles along 7800 S and minimizing delay for vehicles crossing or turning onto 7800 S.
- The individual signal at Civic Center Dr and Monroe Street was coordinated with the signals on 1000 E at a 100 second cycle length due to the close proximity, within 1000 ft, of the signals.

6.1.5 Weekend/Off-peak/Event Plan Cycle Lengths

The weekend plan cycle lengths generally utilize the MD plan with a few exceptions.

- Separate Saturday patterns on 700 E at Fort Union Blvd and S Union Ave coordinate with the other signals on Fort Union Blvd. These use a 120-second cycle length plan during the busiest part of Saturday due to the heavier shopping traffic at these signals. These plans also help to reduce southbound left turn split failures at Fort Union.
- In addition, some of the signals on State Street use a 120 second cycle length pattern to account for shopping traffic during the busiest part of Saturday. These signals include those from 10600 S to 11400 S and the signals west of State Street.
- Most of the inbound and outbound traffic for event traffic use 9000 S to connect to I-15 with the event plans for the Rio Tinto Stadium using a 150 second cycle length plan to account for the volume of traffic. This plan also extends on State St down to 10600 S.
- For events at the Mountain America Exposition Center and Hale Center Theater, the normal traffic patterns were observed to be able to handle the traffic as well as an event plan and so no event plan was needed.

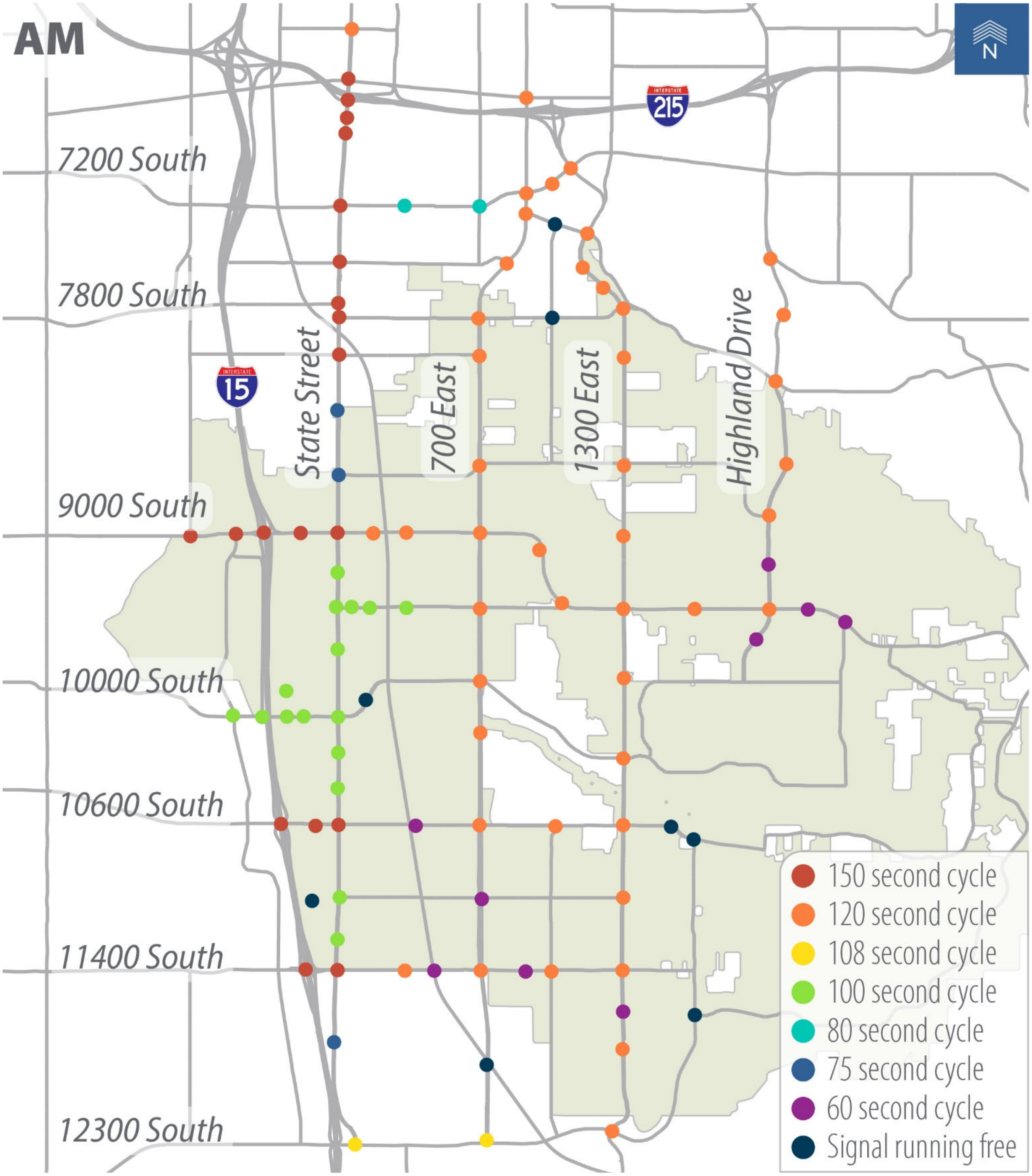


Figure 3. AM Proposed Cycle Lengths

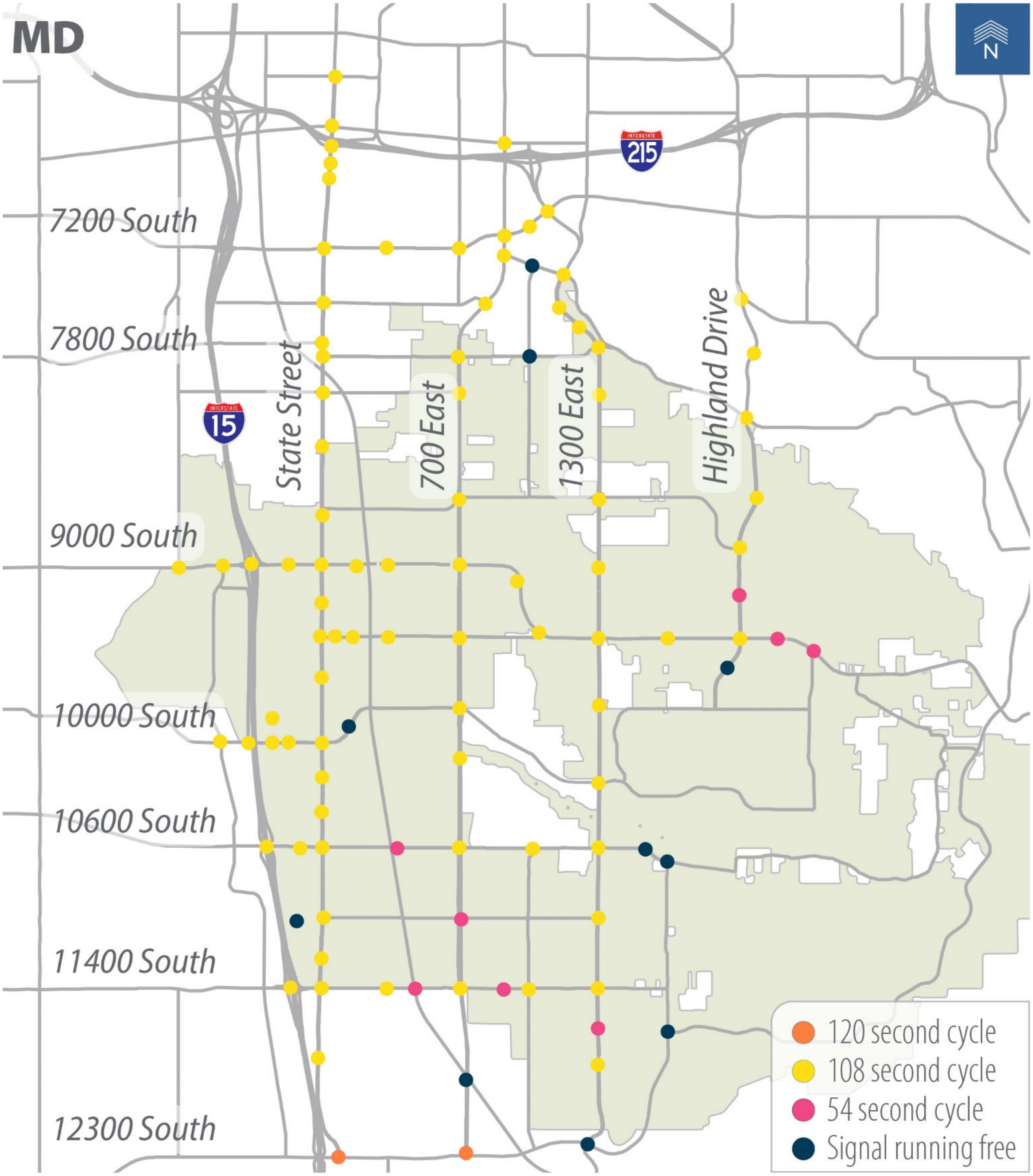


Figure 4. Midday/Off-peak Proposed Cycle Lengths

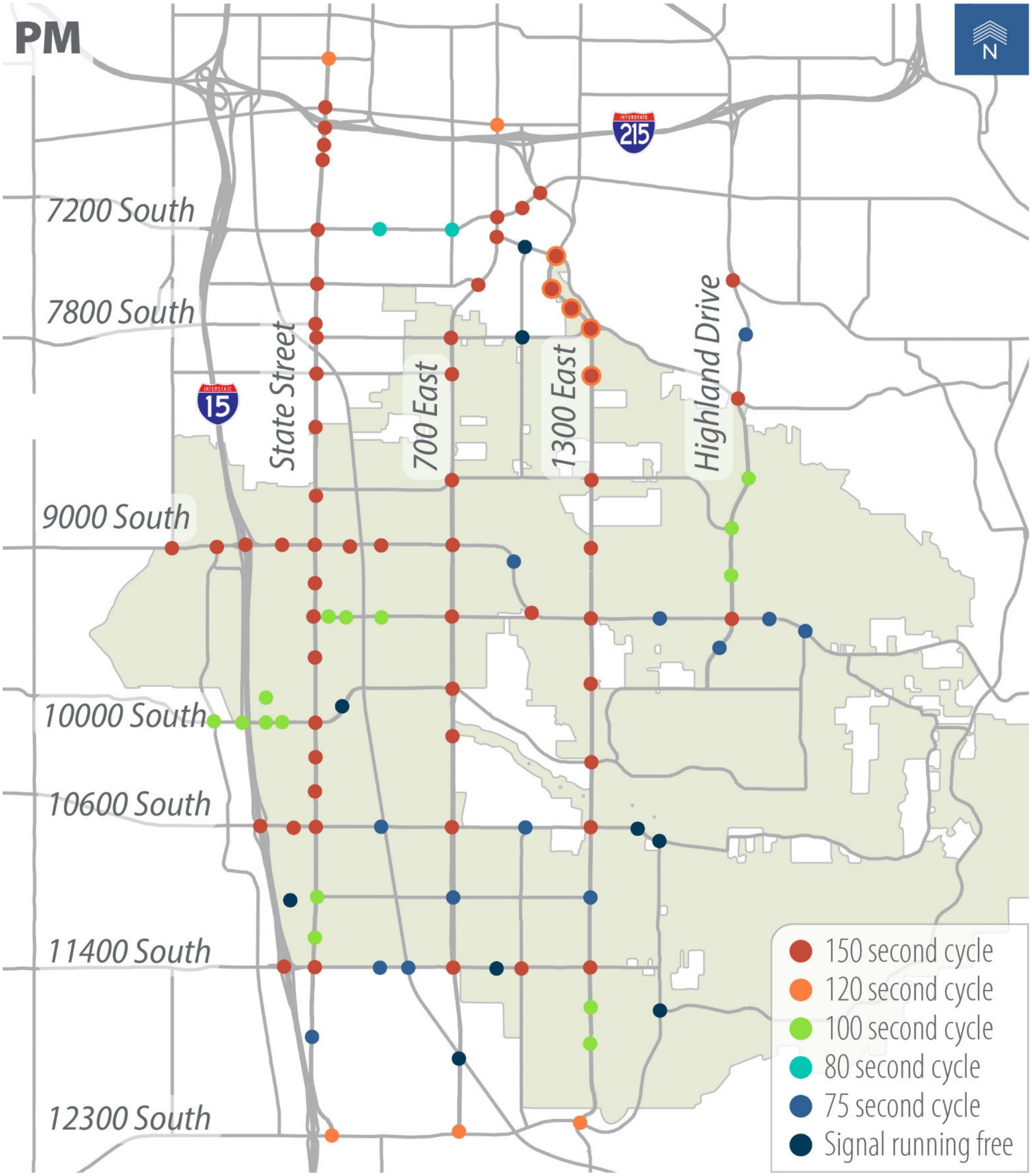


Figure 5. PM Proposed Cycle Lengths

7 IMPLEMENTATION PROCESS AND OBSERVATIONS

Each of the corridor weekday (AM, MD/off-peak, PM) and weekend (Saturday, Sunday) signal timings were installed in the late evening prior to the weekday fine tuning. The initial timing plans for the weekend were based off the weekday off-peak signal timing plans, and then fine-tuned to address weekend-specific conditions. Fine tuning often takes multiple weekdays and weekends to ensure revisions address traffic conditions throughout the various times of day. Reviewing ATSPM data is also vital to identify areas of concern and adjustments necessary to best address traffic congestion. Some of the implementation observations and resulting signal timing revisions are included in Appendix A.

We also observed traffic patterns before and after a REAL Salt Lake game at the Rio Tinto Stadium to determine if event plans are needed at any of the surrounding Sandy City signals. UDOT signals are using event plans on 9000 S and State St to facilitate traffic arrivals and departures for these events. Some of the key observations and recommendations are also included in Appendix A, but specific plans to accommodate REAL events were not needed at Sandy City signals. Events at the Hale Center Theater and Mountain America Exposition Center were also reviewed to determine if event plans were need or if the traffic demand from these events were adequately served by the regular signal timing plans. For the Halle Center Theater most of the traffic travelled up to 9000 S on Monroe St to access the I-15 interchange. During observations the northbound left turn at 9000 S and Monroe St cleared each cycle. At the Mountain America Exposition Center inbound and outbound traffic for events are generally spread throughout the day due to the types of events held here. Due to this, the regular signal timings typically can serve the event traffic.

8 TIME OF DAY SCHEDULE

Part of the retiming effort included reviewing TOD schedules for the weekdays and weekend. Changes were made when necessary due to observations of traffic patterns or to standardize the plans along a corridor to start and end signal timing plans at the same time. The TOD schedules were set based on the ATSPM data and observations of traffic patterns. Changes for the weekday TOD plans at each corridor took into account the impact that these changes would have to vehicles traveling along the corridor and also to other considerations such as keeping the entire corridor on the same schedule, start and end times for schools located on the corridor, and delay for vehicles on the minor approaches. More details, including the transition times and the weekend TOD plans, can be found in Appendix B.

9 IMPLEMENTATION RESULTS

9.1 Corridor Measures of Effectiveness

The travel times and HERE data provided by UDOT were used to evaluate the improvements made to the signal timings. The travel time savings was also used to calculate the fuel savings, reduction in CO_2 emissions, and other Critical Air Pollutants ($PM_{2.5}$, CO, NO_X, VOC and PM_{10}). The calculations for these pollutants were based on the 2018 MOVES model.

9.1.1 Probe-vehicle Travel Times

A summary of the before-after probe vehicle travel time differences can be found in Table 2.

Table 2. Probe Vehicle Travel Time Difference (seconds per vehicle)

Time of Day	1300 E	Highland Dr	9400 S	Sego Lily Dr	10600 S	11400 S	Total
AM	-45	-9	-28	-36	11	-59	**-166**
MD	-10	-3	-34	-11	-72	-29	**-159**
PM	-15	-14	-44	31	-3	-54	**-98**
Saturday	-15	-9	22	-35	-64	-46	**-146**

Note: Negative values in table represent reduction in travel time.

Out of the 24 corridor timing plans, 21 experienced a decrease in travel time. The travel time reduction on these corridors accounts for a **combined daily travel time savings for all vehicles each weekday of 612 hours** or a **yearly savings of over 150,000 hours** (assuming 250 workdays a year and approximately 80% of AADT occurs in coordinated periods). On 10600 S in the AM period the eastbound travel time increased. This increase was created by adjustments to the 700 E and 1300 E signals, stopping more of the eastbound vehicles on 700 E, which was necessary to provide better progression on both 700 E and 1300 E. Similarly, at Sego Lily Dr in the PM peak, the increase in delay is caused by an increase in the cycle length at State St, creating longer stops for vehicle crossing State St. These travel times do not include any of the benefit found at the four individual signals, which may increase the travel time savings.

9.1.2 HERE Data Travel Times

A summary of the before-after travel times differences in the HERE data can be found in Table 3. These travel times differ from those collected by probe vehicle due to variations in the data collection methods which allowed for a larger sample size with the HERE then was possible using the probe vehicle.

Table 3. HERE Data Travel Time Difference (seconds per vehicle)

Time of Day	1300 E	Highland Dr	9400 S	Sego Lily Dr	10600 S	11400 S	700 E	State St	9000 S	Total
AM	-7	-3	-5	-1	9	-2	-8	5	-6	**-19**
MD	-7	0	-14	-6	-9	-7	-24	-40	-36	**-142**
PM	-3	6	-7	-8	5	3	-20	-24	-4	**-53**
Saturday	0	0	-6	-4	-15	-15	5	7	-57	**-89**

Note: Negative values in table represent reduction in travel time.

Based on the collected travel time HERE data the average travel times were reduced on 29 of the 36 corridors for all time periods. The largest improvement is seen during the mid-day/off-peak period where the travel time reduction on all corridors is more than 2 minutes. For the other 7 corridor timing plans the increases in travel times are within 10 seconds and may represent limited data points or changes in traffic patterns between the before and after signal timing implementation. The largest increase in travel time occurred on 10600 S were the travel time increased by 9 seconds during the AM peak period. On average across Sandy City travel times reduced by 19 seconds in the AM peak, 142 seconds in the MD, by 53 seconds in the PM peak, and by 89 seconds on Saturday. The travel time reduction along all corridors in Sandy City equates to a **combined daily reduction for all vehicles of 128 hours in the AM peak, 581 hours in the midday, and 299 hours in the PM peak with a total of 1,008 hours daily** for all vehicles combined. This total daily reduction in travel time accounts for a 10% reduction in total delay for all vehicles travel on the signalized corridors throughout Sandy City. A summary of the collection travel times can be found in Appendix C.

Table 4 summarizes the daily decrease in emissions for each of the corridors based on this travel time reduction. The daily emission calculations use the probe data as the primary data source and is supplemented with the HERE data.

Table 4. Daily Reductions in Fuel Consumption and Emissions

Time of Day	1300 E	Highland Dr	9400 S	Sego Lily Dr	10600 S	11400 S	700 E	State St	9000 S	Total
Fuel (gal)										
3	-13	-2	-4	-4	3	-12	-3	1	-2	**-36**
MD	-6	-1	-13	-4	-50	-16	-15	-30	-28	**-164**
PM	-10	-5	-16	9	-2	-27	-14	-16	-4	**-84**
Weekday Total	**-29**	**-8**	**-33**	**1**	**-49**	**-55**	**-32**	**-45**	**-34**	**-284**
Saturday	-9	-3	9	-12	-44	-25	3	5	-46	**-123**
CO2 (lbs.)										
AM	-254	-29	-76	-84	51	-225	-48	27	-47	**-685**
MD	-117	-19	-251	-71	-939	-306	-293	-562	-537	**-3,094**
PM	-183	-101	-298	179	-30	-509	-269	-310	-72	**-1,593**
Weekday Total	**-554**	**-149**	**-625**	**24**	**-918**	**-1040**	**-610**	**-845**	**-656**	**-5,372**
Saturday	-172	-59	161	-222	-833	-479	57	95	-865	**-2,316**
Total Critical Air Pollutants (lbs.)										
AM	-4	0	-1	0	1	-4	-1	0	-1	**-10**
MD	-2	0	-4	-1	-16	-5	-5	-9	-9	**-51**
PM	-3	-2	-5	3	-1	-8	-4	-5	-1	**-26**
Weekday Total	**-9**	**-2**	**-10**	**2**	**-16**	**-17**	**-10**	**-14**	**-11**	**-87**
Saturday	-3	-1	3	-4	-14	-8	1	2	-7	**-31**

Note: Negative values in table represent reduction in Fuel, CO2 or Critical Air Pollutants.

The reduction in travel times along the nine corridors correlates to a total daily (weekday) **reduction of 5,372 pounds of CO_2 and 87 pounds of other critical air pollutants**. Over the course of a year, assuming 250 workdays, this **reduction will be over 670 tons of CO_2, 11 tons of other critical air pollutants, and 71,000 gallons of fuel**. However, this doesn't include the benefits in reduced emission from a reduction in travel times experienced over the weekends and holidays.

9.2 Arrivals on Green (AoG)

The percent arrivals on green is a measure of individual phase progression performance which estimates the proportion of vehicles that arrive to a green light versus the proportion that arrive to a red light. This provides an estimate of total stops and identifies the quality of the offsets between two coordinated intersections. This metric is available on the UDOT States Routes in Sandy due to the detection available at these signals. Figure 6, 7, 8, and 9 show the percent-change in the number of vehicles arriving on green during the AM, MD, PM and Saturday plans, respectively, for all the Utah State Routes in Sandy.

AM AOG

- On 700 E, the number of vehicles arriving on green increased most significantly in the northbound direction with about 890 more vehicles arriving on green during the AM peak period.
- On 9000 S, the number of vehicles arriving on green increased in both directions for the AM period with about 700 more vehicles in each direction (totaling about 2,270) arriving on green.
- On State St, the total number of vehicles arriving on green remaining about the same before and after the new signal timings. However, north of 9000 S there were 980 more vehicles arriving on green.
- Several signals experienced minor decreases in AoGs. These changes of 3% or less are often caused by vehicles arriving slightly early, for example, on 700 E the northbound platoon arrives slightly early at South Union but shifting the offset sooner would cause the southbound platoon to arrive on red, or can even be simply due to the limited sample size in the analysis.
- On State St there were also several signals that experienced more significant decreases in arrivals on green. The majority of these were caused by changes to the cycle lengths on State St, primarily the shift to using a combination of 150 and 100 second cycle lengths. While this combination of cycle length reduces the delay for vehicles waiting to cross or turn onto State St, the harmonic cycle lengths between intersections only aligns the corridor progression 2 out of every 3 cycles.

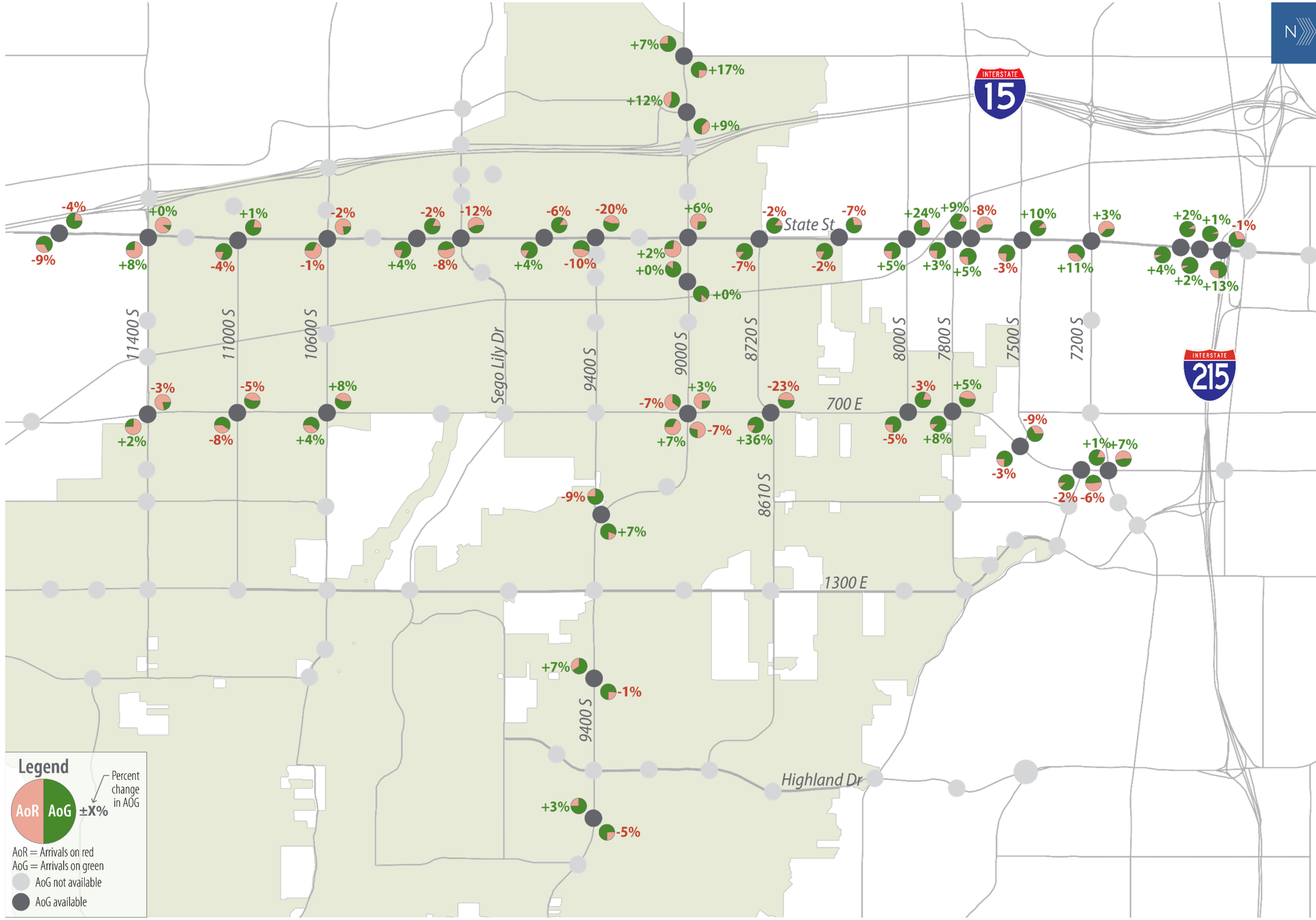


Figure 6. AM AOG Figure

MD AOG

- On 700 E, the total number of vehicles arriving on green didn't change drastically in either direction for the MD period. The net difference has about 100 less vehicles arriving on green. However, in the northbound direction there are about 1,020 more vehicles arriving on green at 8000 S. Also, southbound at 8600 S there are about 1,000 more vehicles arriving on green.
- Many of the decreases in arrivals on green that occurred on 700 E were offset by increases at nearby signals, or improvements in arrivals at signals where arrivals on green are not available. For example, at 9000 S the northbound arrival decreased to improve the southbound arrival at 9400 S and Sego Lily Dr.
- On 9000 S, the number of vehicles arriving on green increased in the westbound direction during the MD period by 770 more vehicles.
- On State St, the number of vehicles arriving on green increased in both directions for the MD period with about 160 more vehicles arriving on green in the northbound direction and about 1,050 more vehicles arriving on green in the southbound direction.

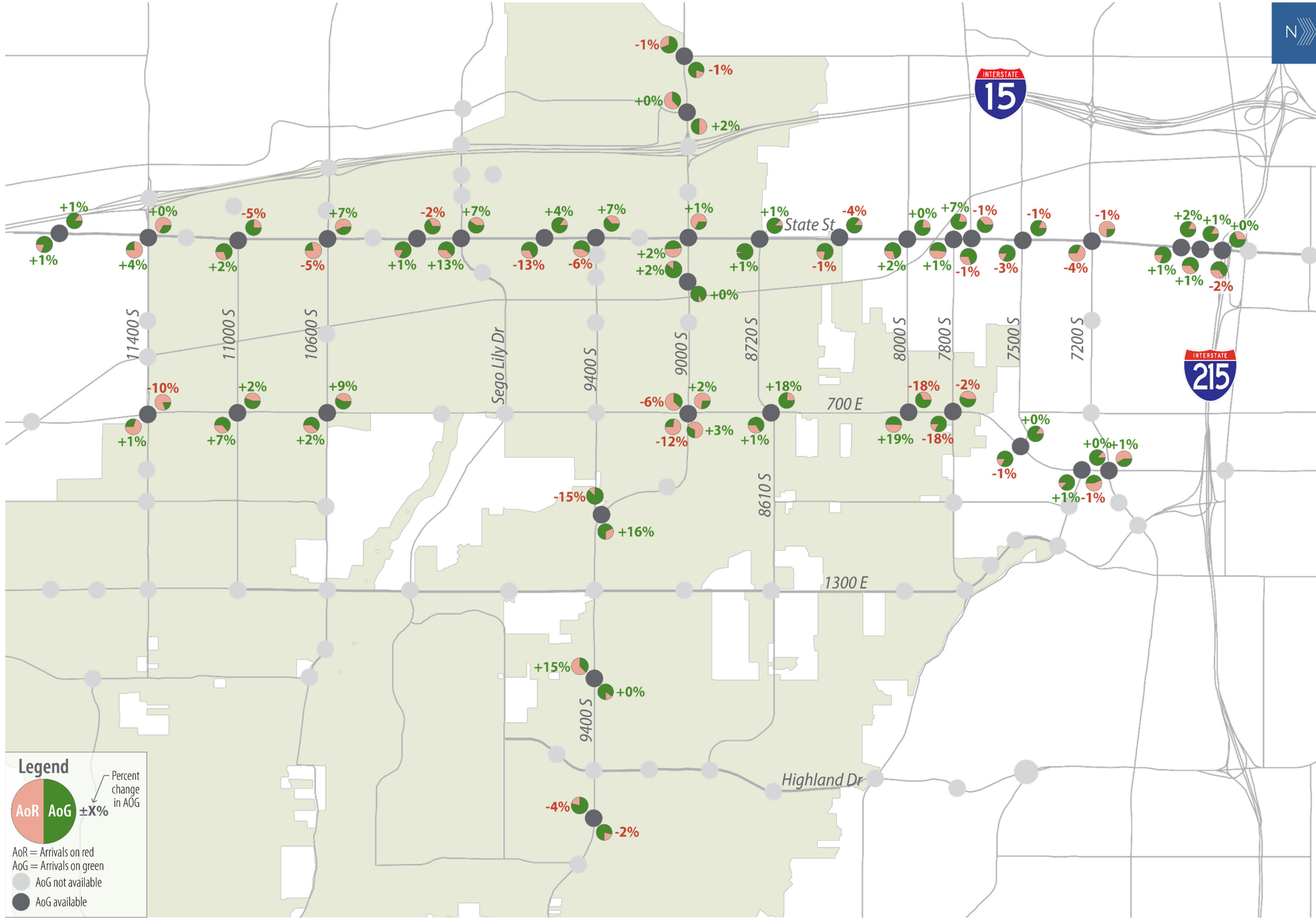


Figure 7. MD AOG Figure

PM AOG

- On 700 E, the number of vehicles arriving on green increased in both directions for the PM period with about 3,350 more vehicles arriving on green in the northbound direction and about 1,850 more vehicles arriving on green in the southbound direction.
- On 9000 S, the number of vehicles arriving on green increased in the westbound directions during the PM period with about 940 more vehicles arriving on green.
- On 9000 S the arrivals on green at 1700 E decreased in both the eastbound and westbound decreased. This change is due to using a 75 second cycle length, which is half of the cycle used at 1300 E and Highland Dr. At this signal vehicles arrival before the start of green but reducing the offset would stop vehicles at the end of the platoon. The change in arrivals on green at this signal accounts for about 800 less vehicles arriving on green.
- On State St, the number of vehicles arriving on green increased most significantly in the southbound direction with about 2,710 more vehicles arriving on green during the PM peak period.

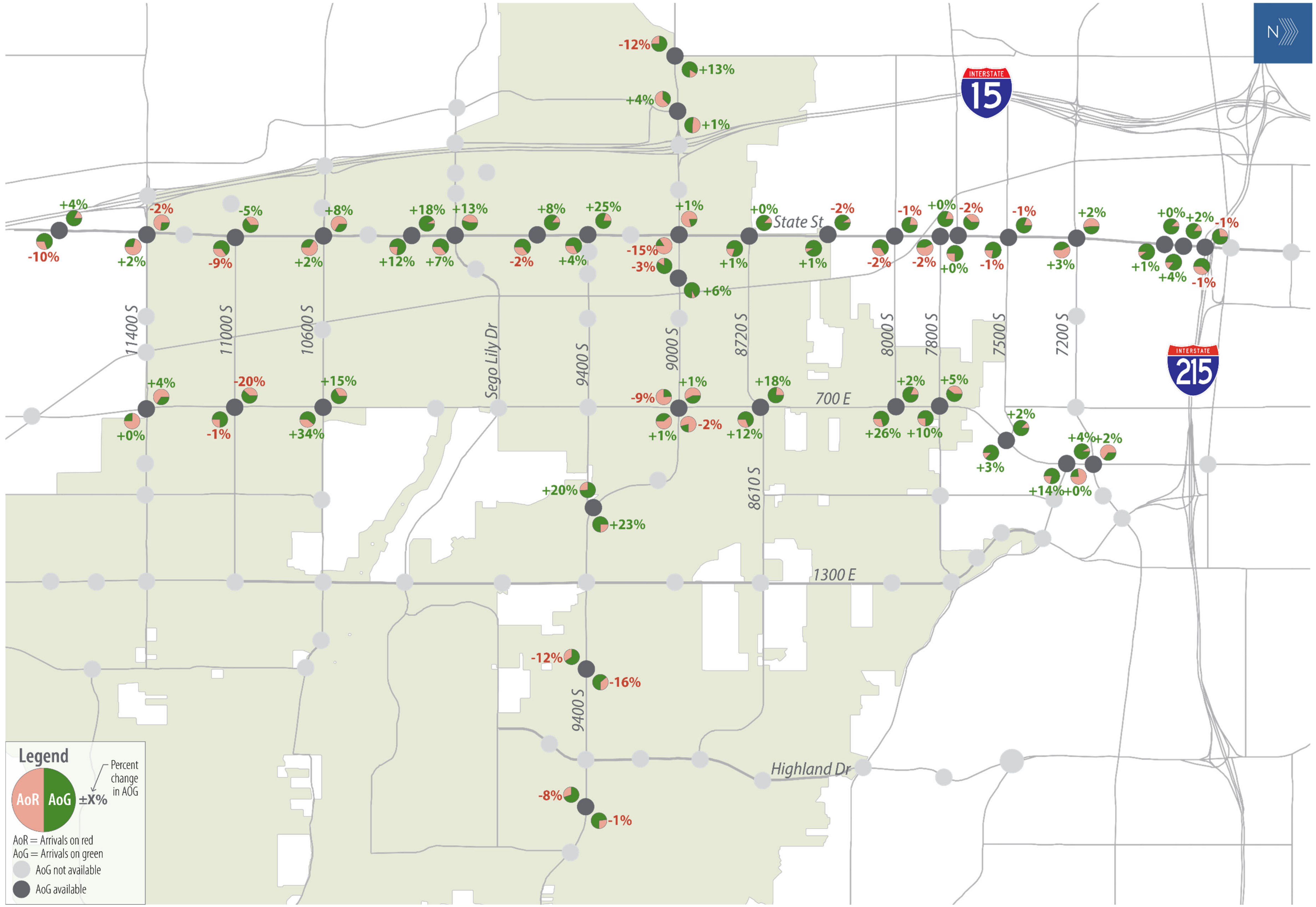


Figure 8. PM AOG Figure

Saturday AOG

- On 700 E, the number of vehicles arriving on green increased most significantly in the northbound direction with about 760 more vehicles arriving on green during the Saturday period.
- On 700 E a few signals toward the north end of the corridor experience decreases in arrivals on green, such as at Hillcrest. One of the main causes of this a break in the cycle length during the busiest part of Saturday where the signals at South Union and Fort Union use a longer cycle length due to the heavier traffic around the Fort Union shopping areas.
- On Saturday about 380 more westbound vehicles on 9000 S arrived on green while the total number of vehicles arriving on green remained about the same.
- On State St, the total number of vehicles arriving on green dropped on Saturday. One of the main causes was several cycle length breaks which interrupts progression along the length of the corridor but are needed due to the popular shopping areas located along the corridor.
- On State Street, there were a few signals which on Saturday experienced a substantial improvement in arrivals on green including the northbound direction. There are about 470 more vehicles arriving on green at 10200 S and 10600 S. Also, southbound at 9400 S there are about 580 more vehicles arriving on green.

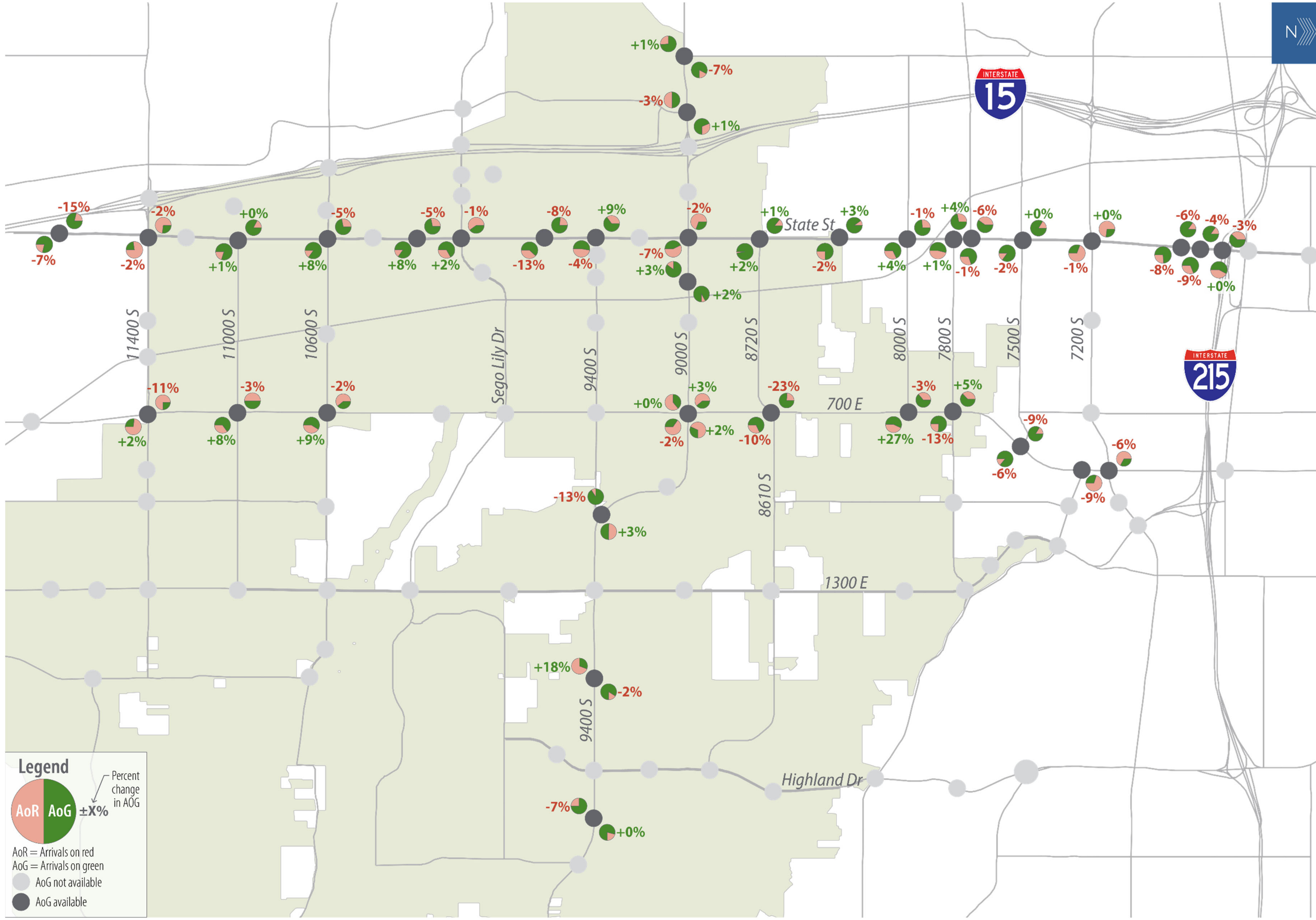


Figure 9. Saturday AOG Figure

9.3 Synchro Model Delay and LOS for Key Intersections

At intersections where counts were performed the delay and LOS provided by Synchro were reviewed. The LOS and average delay per vehicles at some of the key intersection are shown in Table 5 with additional information, including the Synchro reports, in Appendix D.

Table 5. Synchro LOS and Delay (seconds)

Intersection	Before Retiming			After Retiming		
	AM	Offpeak	PM	AM	Offpeak	PM
1300 E & 9400 S	C / 34	C / 30	E / 56	C / 29	D / 35	D / 49
1300 E & Sego Lily Dr	D / 47	C / 25	D / 39	D / 46	C / 21	D / 43
1300 E & 10600 S	C / 33	C / 27	D / 45	D / 39	C / 26	D / 43
1300 E & 11400 S	C / 34	C / 24	D/ 42	D / 40	C / 22	D / 45
State St & 11400 S	C / 34	C / 25	D / 40	D / 38	C / 30	D / 44
10600 S & Automall Dr	C / 25	E / 55	D / 40	C / 21	E / 56	D / 46
9000 S & 450 W	D / 35	C / 31	E / 64	C / 32	C / 28	E / 58
Highland Dr & 9400 S	C / 31	D / 36	C / 33	C / 34	C / 29	D / 41
1000 S & Monroe St	C / 28	C / 23	C / 29	C / 28	C / 28	C / 31

Many of the intersections experienced a decrease in the average delay per vehicle. While the changes in cumulative delay through multiple signals along a corridor can be significant, signal timing improvements alone typically do not change LOS at a single intersection, since the capacity of the intersection generally has not changed. Some intersections also experienced a slight increase in average delay per vehicles. This increase is likely due to the changes to the yellow and red times based on the new clearance interval timing standards. With these changes the yellow and red times at most intersection increased, reducing available green time.

9.4 Benefit/Cost Analysis

A comparison of the *project cost* versus the *user cost travel time savings* was completed using HERE travel time data supplemented with probe-vehicle travel time data. To obtain the financial value of the user travel time savings per year, the combined travel time savings for all vehicles using the route when the signal timing is active is multiplied by three values:

1. Average vehicle occupancy (1.5 people per vehicle)
2. Average user cost ($18.12 per person-hour for passenger vehicles and $52.14 per person-hour for large trucks)
3. Number of workdays per year (250 workdays per year)

The average vehicle occupancy and average user cost values were derived by the Texas Transportation Institute. The percentage of truck traffic was assumed to be 2% of the vehicle composition. The calculated user cost travel time savings along with the project cost and the calculated benefit-cost ratio are summarized in Table 5.

Table 6. Project Benefit and Cost Totals

User Cost Travel Time Savings	Project Cost	Benefit / Cost Ratio
$7,105,000	$134,000	53 : 1

That means that the total user cost savings of the improvement is 53 times greater than the total cost of the project. This value was determined using following formula:

$$B/C = 53$$

Where

$$Annual\ Benefit\ (B) = Travel\ Time\ Saving * Vehicle\ Occupancy *$$

$$User\ Cost * Workdays\ in\ a\ year = \$7{,}105{,}000$$

$$Total\ Project\ Cost\ (C) = \$134{,}000$$

10 OTHER SIGNAL TIMING CONSIDERATIONS

In addition to review and updating the splits, cycle length and offset at each signal located within Sandy City other settings such as pedestrian crossing times, yellow and red times, and other setting within the signal controllers were also reviewed. Below are some notes about key observations and changes that were made:

- While most pedestrian crossing times were calculated using a walking speed of 4 ft per second (as is described in the Guidelines for Signal Timing in Utah), school crossing used 3.5 ft per seconds to allow additional crossing time.
- Where possible the splits for phases with associated pedestrian crossings were long enough to cover the needed crossing time without having to extend the phase longer than the given split.
- At Highland Drive and Alta Canyon Drive special logic is in place to omit the permissive part of the protected/permissive left turn phasing for northbound and southbound left turn vehicles if there is a vehicle in the opposing left turn lane. The purpose of this logic is to enable vehicles to make a left turn at this signal safely, with the geometry of the intersection vehicle in the left turn lanes block the sight distance of vehicle in the opposing left turn.

11 POTENTIAL TRANSPORTATION SYSTEM SOLUTIONS

While driving Sandy's roadway network during observations, travel time runs, and implementation, Avenue identified potential improvement recommendations for areas within Sandy City. These solutions are included in Appendix E. Generally, the main observed choke points are locations with capacity issues and are listed below:

- 700 E and 9000 S. this signal is at the crossing of two major corridors and while intersection performance improved with the signal retiming this signal still operates at capacity during the PM peak period.
- 1300 E and 9400 S, during the PM peak this signal still experiences split failures for the eastbound and southbound thru movements. While performance improved with the signal timing optimization, based on the Synchro analysis the average delay per vehicle dropped by 7 seconds (from 56 to 49 seconds), this signal still operates at capacity.

- Sego Lily Dr and 1300 East (Particularly at the start of school in the AM peak). At the start of school there is a heavy movement heading westbound thru this intersection which requires a larger split than during the rest of the period. During this time the northbound thru queue also experiences longer queues and split failures. Overall, this intersection performs at a LOS D based on the Synchro analysis but retiming was not able to significantly reduce the delay during peak 20 to 30 minutes from the school inbound traffic.
- Fort Union Shopping Area (Particularly on 1300 E during PM peak). On this section of 1300 E traffic from Union Park Ave combines with traffic from 1300 E which creates a heavy southbound movement which operates at or above capacity.
- State St and 11400 S (Due to westbound lane utilization as vehicle approach interchange). With the new signal timing the delay for westbound vehicles reduced by 10 seconds but vehicles in the left thru lane and right thru lane still often must wait two cycles in the AM and PM peak hours.

12 PROJECT GOAL CONCLUSIONS

New traffic signal timings were implemented in Sandy to help meet the city's goal to, **reduce travel times**, delays, and emissions for all modes, and provide better coordination between traffic signals operated by Sandy and UDOT. The **combined daily travel time of all vehicles was reduced by 128 hours in the AM peak, 581 hours in the midday, and 299 hours in the PM peak with a total of 1,008 hours daily**. Table 6 shows a summary of the total travel time reductions.

Table 7. Summary Daily Travel Time Reduction (hours)

AM	MD	PM	Saturday
-128	-581	-128	-442

Note: Negative values in table represent reduction in travel time.

This reduction in travel times also equates to a corresponding **reduction in fuel usage, CO_2 and other critical air pollutants** as shown in Table 7.

Table 8. Summary Daily Emission Reduction

Measure	AM	MD	PM	Saturday
Fuel (gallons)	-36	-164	-84	-125
CO2 (pounds)	-685	-3,094	-1,593	-2,361
Total Critical Air Pollutants (pounds)	-10	-51	-26	-39

The total daily emissions saving accounts for 284 gallons of fuel, 5,372 pounds of CO_2 and 87 pounds of other critical air pollutants. Based on 250 workdays per year the results of this effort will **reduce fuel consumption by 71,000 gallons per year and remove over 670 tons of CO_2 and 11 tons of other critical air pollutants over a year** without accounting for the benefits over the weekends and holidays or at the four individual signals that were also reviewed.

Where possible the **existing coordination that was working well was maintained with only minor adjustment**s. As part of our signal timing efforts several strategies were discussed and implemented. Some of the key strategies included reducing cycle lengths, coordinating Sandy and UDOT signals together, and reevaluating the transition times to address **daily traffic demand fluctuations.** The transition times were evaluated to ensure coordination patterns are only operating when needed to reduce the delay. During the periods of coordination, travel times are reduced for heavier volumes traveling along the corridor. However, coordination also reduces the frequency that the minor approaches can be served. When the volumes are light along the corridor, coordination unnecessarily increases the delay for vehicles on the minor approach. Timing the transition times to match the traffic patterns reduces unnecessary delay. Coordination transitions were done through a combination of observing traffic and reviewing ATSPM data.

Cycle lengths were carefully considered throughout this project. The main objective was to provide cycle lengths that would serve the traffic volumes at the signals and decrease delay by servicing vehicles, pedestrians, and bikes more frequently. To accomplish this task with minimal impact to traffic on the major corridors, half cycle lengths (e.g. a 60-second cycle length with a 120-second cycle length) were used when needed. Optimal coordination throughout Sandy required collaboration with all stakeholders including Sandy, Salt Lake County, UDOT, and UTA. The **UTA TRAX crossings have priority,** and half-cycles were deployed at adjacent intersections to return corridors with TRAX crossings back into coordination more quickly. Using harmonic cycle lengths allowed the cycle length to be scaled to the needs of each individual signal without losing the benefits of coordination between signals. In addition, short half cycle lengths at High-Intensity Activated crossWalK beacons (HAWK) can allow for more frequent service of the pedestrian phase while still maintaining coordination.

APPENDIX A - IMPLEMENTATION OPTIMIZATION OBSERVATIONS

Observations during AM, Off-peak, PM and Saturday Implementation

- For State St, the shorter (100-second) cycle length worked well between the major signals in the AM and PM peak periods. This cycle length serves the traffic at the minor intersection signals with good corridor progression.
- During the PM peak period southbound vehicles on 700 E at 9000 S and on 1300 E at 9400 S wait two cycles to travel through these intersections. This typically only occurs during the busiest part of the PM peak period, typically for less than an hour. While we didn't observe this every cycle, we reviewed and adjusted the splits and offsets at both intersections to improve this condition and ensure the majority of vehicle get thru the signal on the first cycle. However, on occasion a few vehicles are left after the green phase and must wait until the next cycle.
- The traffic volumes on 1300 E fit best with the 150-second cycle lengths during the PM peak, with the northbound and southbound vehicles using all the available green time for the northbound and southbound through phases. Using a consistent cycle length along all of 700 E and 1300 E also better corridor progression for vehicles traveling the length of the corridor. Where possible we used a half or harmonic cycle length to reduce delay for the minor approaches.
- At 1300 E and Hidden Valley we considered a harmonic signal cycle for all periods (AM, off-peak, and PM) but this would require oversizing the pedestrian phases. This proved problematic with the heavily used Indian Hills Middle School crosswalk on the north leg of the intersection. The traffic volumes on 1300 E are lower than traffic farther north on the corridor but are still significant (between 800 to 1000 vehicles per hour in the peak periods) and are benefitted by signal coordination. We observed 2 to 3 vehicles waiting on the minor approaches to cross or turn left onto 1300 E each cycle, but never observed any split failures on the minor approaches.
- During the AM peak, changes to splits reduced northbound split failures at 9400 S and 1300 E reduced by 7% (from 48% to 41%). During the PM peak, split changes at this location reduced southbound split failures by 7% (from 57% to 50%).
- Reducing cycle lengths at some of the intersection on Highland Dr reduces delay for vehicles crossing or turning onto Highland Dr while maintaining good progression on Highland Drive. Falcon Way and Highland Dr is using a half cycle in both the AM (60-second cycle length) and off-peak plans (54 second cycle length). On Highland Dr during the PM peak the intersections of Falcon Way, Newcastle Drive, and Alta Canyon Road use a harmonic 100-seconds cycle (reduced from the previous 120-second cycle length).
- At 9600 S and Highland Dr a half cycle (60-seconds in the AM and 75-seconds in the PM peak) helped to progress traffic on Highland Dr while minimizing the wait time for vehicles coming out of the Home Depot Shopping Center. This signal was set to run "Free" (without coordination) during the off-peak periods as the traffic volumes on this section of Highland Dr are much lower during the off-peak times than during the AM and PM peak periods.
- During the AM peak, we adjusted the offset at Alta Canyon Dr and Highland Dr (by 10 seconds) to help address a citizen complaint and observed that this change improved southbound progression, making it

so drivers can travel to 9400 S without stopping. This change also didn't hurt the northbound progression on Highland Drive.

- On 9000 S between 700 W and State St the AM and off-peak cycle lengths remained unchanged (120s in the AM/108s in the Off-peak), in the PM peak the cycle length was increased to 150-seconds. A consistent cycle length along 9000 S in the PM peak provided good progression from I-15 through Highland Drive. The increased cycle length also helped to reduce some of the southbound queuing issues at 700 E and 1300 East.
- At 9000 S and 450 W we increased the westbound left turn split to 50 seconds (33% of the cycle length) to reduce queuing from 450 W to I-15. We also increased the extension time for this phase from 0.6 seconds to 1.6 seconds to allow more time for left turning vehicles (in the queue or blocked by thru vehicles) to get to the signal.
- At 9400 S and 300 E we observed the northbound and southbound signal phases used all their split time without serving all vehicles, particularly around the start and end times of Mount Jordan Middle School. Taking time away for the eastbound and westbound movements to increase these splits didn't cause any queuing or issues for the eastbound or westbound traffic while allow the northbound and southbound phases to serve all vehicles in the queue.
- We evaluated a concern that the northbound left turn phase would often run before all the left turning vehicles were able to get to the intersection in the morning at 9400 S and 1300 East. Checking the ATSPM data showed us split failures occur 7% of the time for this movement, with this phase frequently serving all the vehicle demand. We considered revisions to the sequence that would change when this phase would run. This revision would have created a southbound stop at 9400 S and at Sego Lily Dr for southbound traffic or have caused a northbound stop with the vehicles on 1300 E arriving too early. We ended up not making this revision for the northbound left turn as it seemed to be hurting more vehicles than it helped.
- At 9000 S and State St we evaluated a complaint that the northbound left turn in the off-peak period was taking vehicles multiple cycles to get through the intersection. We added a few seconds to this movement and this change helped to reduce the queue for this left turn. Unfortunately, we have concerns that this change won't completely resolve the issue as the ATSPM data shows split failures for this movement occur 70% of the time. However, with the current cycle length more time was not available to be moved to this phase. A increase in the MD cycle length could help alleviation some of these issues but should only be considered if the cycle length for adjacent signals on 9000 S are also increased.
- We observed northbound left turning vehicles at 10600 S and 1700 E vehicles waiting for the coordinated (eastbound and westbound) phases to run while there were no vehicles traveling eastbound or westbound through the intersection. The coordinated eastbound and westbound volumes are so low during the off-peak period that they are only using about 15 to 20 seconds of the coordinated phase phases. Even during the busier times of day, the northbound left turn vehicles were often waiting while there were no eastbound or westbound vehicles. A half cycle didn't lessen this inefficiency as the coordinated phases only had vehicles every other cycle coming from 1300 East. Based on these observations the signal was set to run free all day, which should decrease the delay for northbound vehicles turning onto 10600 S and improve the performance of the intersection.

- We implemented a 100-second and a 75-second cycle length for the PM peak plan at 11400 S and 300 East. The 75-second cycle length provided better progression on 11400 S. With the 100-second cycle, the adjacent signals on 11400 S had poor vehicles arrivals every other cycle. At this intersection we also received a complaint that the pedestrian crossing time was too short. This time had been adjusted using with the yellow and all red time for the phase being subtracted from the crossing time. However, shortening this time can be difficult for a school crossing guard which must cross to the middle of the street before the students can start crossing. Because of this we increased this time back to what they were previously to make sure that there is enough time for the students to cross.
- Separate Saturday patterns on 700 E at Fort Union Boulevard and S Union Avenue were implemented to coordinate with the other signals on Fort Union Boulevard which use a 120-second cycle length plan during the busiest part of Saturday. This change allows a longer split time for the southbound left turn which was experiencing split failures 56% of the time, with this change the split failure rate was reduced by 9% down to 45%

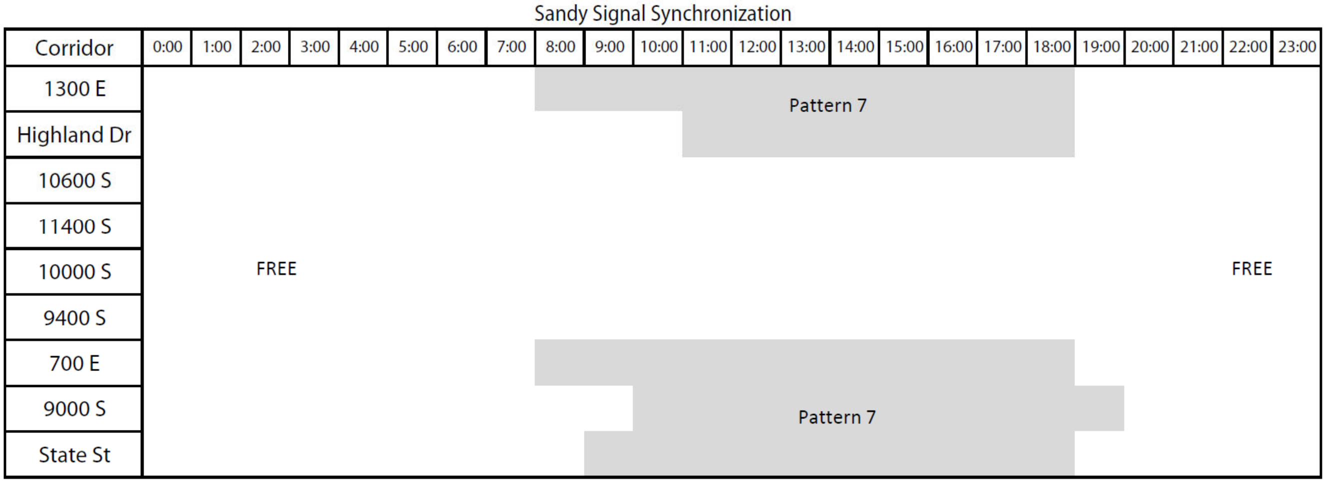
Observations during Event Plan Implementation

- Most of the inbound and outbound traffic for Salt Lake REAL games use the 9000 S and State St corridors. Most of the outbound traffic on State St continues south to 10600 S and I-15.
- The inbound eastbound left turn traffic at Monroe St and Sego Lily Dr have queues between 18 and 25 vehicles which didn't clear every cycle, though at most it took vehicles two cycles to clear. The northbound through movement is also busy but the vehicles clear the intersection each cycle. The peak inbound traffic lasted for about 20 to 30 minutes before the game.
- After the game, most of vehicles using Sego Lily Dr come from the southbound right turning vehicles at Monroe Street. This isn't causing any significant queues or delay as Sego Lily Dr doesn't have a lot of background traffic and most of the traffic as is coming from the event.
- For the Hale Center Theater no issues were observed for inbound or outbound traffic on 10000 S. Similar to the Salt Lake REAL games most of the traffic used the interchange on 9000 S. After shows at the Hale Center Theater the northbound left turn at 9000 S and Monroe St experience and increase in traffic volume but this volume is served by the normal signal operations.
- Traffic for events at the Mountain America Exposition Center is often spread throughout the day due to the type of events held there. Where there are sharp peaks in traffic due to events it typically occurs during the AM and PM peak periods. In these periods, the main movements on State Street and 9000 S that experience this increase in traffic are already prioritized in the signal timings.

APPENDIX B – TIME OF DAY PLANS

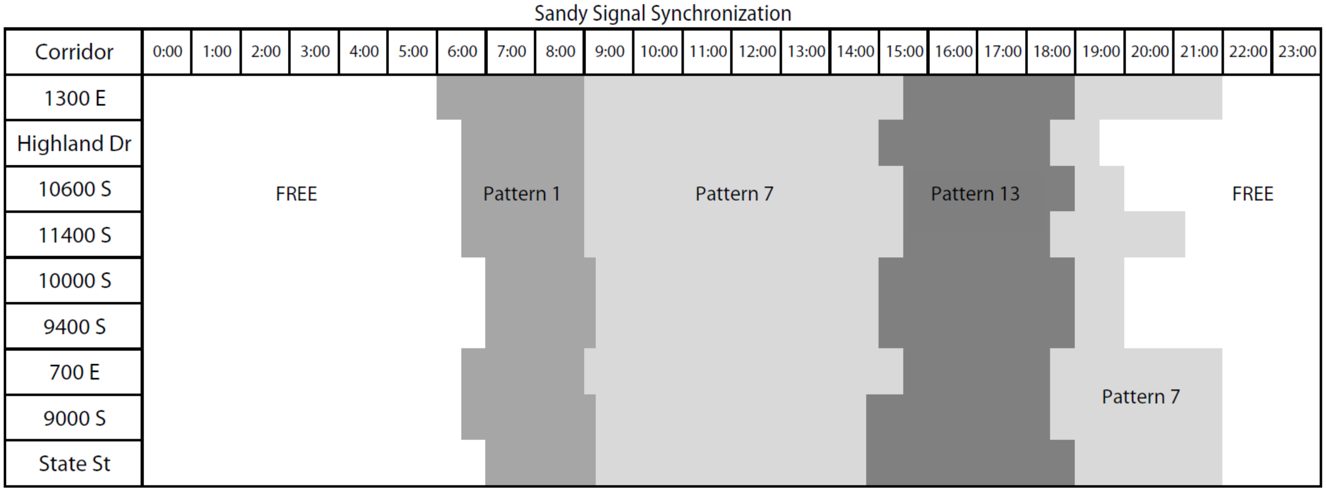
Day Plan 1 (Sunday) Corridor Schedule

Sandy Signal Synchronization



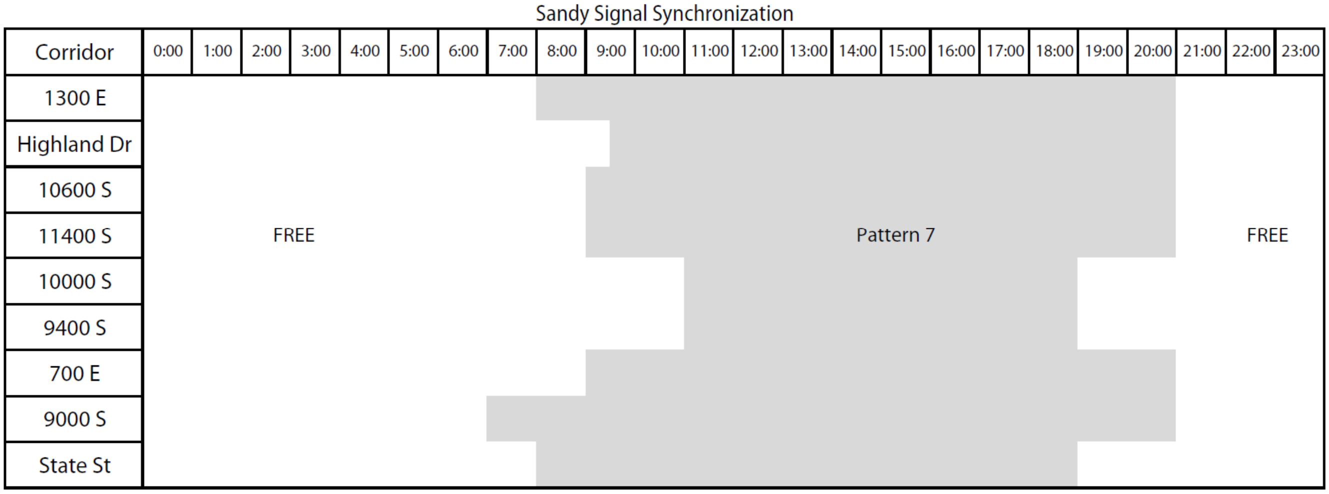
Day Plan 2 (Weekday) Corridor Schedule

Sandy Signal Synchronization



Day Plan 7 (Saturday) Corridor Schedule

Sandy Signal Synchronization



APPENDIX C – REPORTED TRAVEL TIMES

TABLE C1: Corridor Weekday Travel Times Before Signal Retiming

Corridor	Collection Period	NB/EB			SB/WB		
		Probe Travel Time (min)	Avenue Sample Size	HERE Data Travel Time (min)	Probe Travel Time (min)	Avenue Sample Size	HERE Data Travel Time (min)
Weekday - AM Peak Period							
1300 E	7:00 - 9:10 AM	11.9	5	10.3	12.2	5	10.7
Highland Dr	7:10 - 9:00 AM	3.9	10	4.4	4.1	11	4.1
9400 S	7:40 - 9:00 AM	4	4	3.5	4.4	4	3.8
10000 S	7:00 - 7:45 AM	2.8	4	3.8	3.3	4	3
10600 S	6:45 - 8:40 AM	5.1	5	5.3	7.3	4	6.6
11400 S	7:10 - 8:50 AM	3.7	7	4.5	4.9	6	4.7
700 E	7:00 - 9:00 AM			12.6			12.6
State St	7:00 - 9:00 AM			13.7			14.2
9000 S	7:00 - 9:00 AM			11.6			11.1
Weekday - MD Peak Period							
1300 E	12:00 - 2:00 PM	10	5	10.5	11.9	5	10.6
Highland Dr	12:00 - 2:00 PM	3.8	11	4.6	3.7	11	3.9
9400 S	11:30 - 12:50 PM	3.2	4	3.5	4	4	4
10000 S	12:50 - 1:30 PM	2.6	5	4.3	3.4	6	3.3
10600 S	12:00 - 1:00 PM	6.2	4	6	8.7	4	6.9
11400 S	1:00 - 2:00 PM	4.1	7	4	4.7	7	4.5
700 E	12:00 - 2:00 PM			13.2			13.1
State St	12:00 - 2:00 PM			16.0			14.6
9000 S	12:00 - 2:00 PM			11.6			11.6
Weekday - PM Peak Period							
1300 E	4:30 - 6:30 PM	11.8	4	11.3	12.6	4	11.8
Highland Dr	4:00 - 6:00 PM	4.9	9	4.7	3.8	9	3.9
9400 S	4:40 - 6:15 PM	4	4	3.6	5.3	4	4.0
10000 S	4:00 - 4:40 PM	2.9	4	4.3	3	4	3.5
10600 S	4:30 - 6:00 PM	6.7	6	5.8	8.1	7	7.1
11400 S	5:30 - 6:30 PM	4.9	4	4.3	4.8	4	4.7
700 E	4:30 - 6:30 PM			14.3			14.1
State St	4:30 - 6:30 PM			15.9			15.3
9000 S	4:30 - 6:30 PM			12.4			12.2

TABLE C2: Corridor Saturday Travel Times Before Signal Retiming

Corridor	Collection Period	NB/EB			SB/WB		
		Probe Travel Time (min)	Avenue Sample Size	HERE Data Travel Time (min)	Probe Travel Time (min)	Avenue Sample Size	HERE Data Travel Time (min)
Saturday Peak Period							
1300 E	2:00 - 4:00 PM	10.6	6	10.3	11.2	5	10.1
Highland Dr	12:40 - 1:40 PM	3.8	12	4.6	3.9	12	3.8
9400 S	2:45 - 3:10 PM	3.1	4	3.5	3.4	4	4
10000 S	1:00 - 1:40 PM	3.6	4	3.7	2.7	4	3.3
10600 S	11:45 - 12:45 PM	7	3	5.8	9.2	3	7
11400 S	12:45 - 1:45 PM	4.4	4	3.9	4.9	4	4.9
700 E	2:00 - 4:00 PM			12.9			12.7
State St	2:00 - 4:00 PM			16.3			15.6
9000 S	2:00 - 4:00 PM			11.9			4.9

TABLE C3: Corridor Weekday Travel Times After Signal Retiming

Corridor	Collection Period	NB/EB			SB/WB		
		Probe Travel Time (min)	Avenue Sample Size	HERE Data Travel Time (min)	Probe Travel Time (min)	Avenue Sample Size	HERE Data Travel Time (min)
Weekday - AM Peak Period							
1300 E	7:00 - 9:10 AM	11.3	4	10.2	11.1	4	10.4
Highland Dr	7:15 - 8:30 AM	4	6	4.4	3.4	5	4.0
9400 S	7:40 - 9:10 AM	3.8	4	3.4	3.8	6	3.7
10000 S	7:05 - 7:45 AM	2.4	5	3.7	2.6	6	3.0
10600 S	6:45 - 8:00 AM	6	4	5.6	7.1	4	6.6
11400 S	8:00 - 8:45 AM	3.9	4	4.3	3.3	5	4.7
700 E	7:00 - 9:00 AM			12.6			12.3
State St	7:00 - 9:00 AM			14.1			14.1
9000 S	7:00 - 9:00 AM			11.5			11.0
Weekday - MD Peak Period							
1300 E	12:00 - 2:00 PM	11.1	5	10.5	10.4	4	10.3
Highland Dr	12:00 - 2:00 PM	3.9	10	4.6	3.5	10	3.9
9400 S	11:40 - 1:05 PM	2.9	4	3.4	3.2	5	3.7
10000 S	1:05 - 1:50 PM	3.4	5	4.1	2.3	5	3.3
10600 S	12:00 - 1:00 PM	6.3	4	5.8	6.3	3	6.9
11400 S	1:00 - 2:00 PM	3.3	4	3.7	4.5	4	4.5
700 E	12:00 - 2:00 PM			12.9			12.6
State St	12:00 - 2:00 PM			14.9			14.3
9000 S	12:00 - 2:00 PM			11.0			11.0
Weekday - PM Peak Period							
1300 E	4:30 - 6:30 PM	12	4	11.2	12.1	4	11.7
Highland Dr	4:00 - 5:50 PM	4.8	9	4.6	3.5	9	4.2
9400 S	4:40 - 6:00 PM	3.8	4	3.5	3.9	4	3.9
10000 S	4:00 - 4:40 PM	3.5	5	4.1	3.4	5	3.4
10600 S	4:30 - 5:30 PM	7.1	4	6.0	7.5	5	7.1
11400 S	5:30 - 6:45 PM	4.8	6	4.5	2.9	4	4.6
700 E	4:30 - 6:30 PM			13.7			13.9
State St	4:30 - 6:30 PM			15.4			14.9
9000 S	4:30 - 6:30 PM			11.9			12.4

TABLE C4: Corridor Saturday Travel Times After Signal Retiming

Corridor	Collection Period	NB/EB			SB/WB		
		Probe Travel Time (min)	Avenue Sample Size	HERE Data Travel Time (min)	Probe Travel Time (min)	Avenue Sample Size	HERE Data Travel Time (min)
Saturday Peak Period							
1300 E	2:00 - 4:00 PM	10.4	5	10.3	10.9	5	10.1
Highland Dr	12:40 - 1:40 PM	3.9	6	4.4	3.5	6	4.0
9400 S	2:45 - 3:10 PM	3.2	4	3.5	4	4	3.8
10000 S	1:00 - 1:40 PM	2.3	5	3.9	2.8	5	3.0
10600 S	11:45 - 12:45 PM	6.2	4	5.8	7.9	4	6.5
11400 S	12:45 - 1:45 PM	4.1	4	3.9	3.7	4	4.4
700 E	2:00 - 4:00 PM			13.2			12.5
State St	2:00 - 4:00 PM			17.7			14.5
9000 S	2:00 - 4:00 PM			10.4			4.4

APPENDIX D – SYNCHRO LOS AND DELAY REPORTS

4143: 1300 E & Union Ave/Creek Rd

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	All
Future Volume (vph)	216	88	48	13	119	274	122	1628	110	883	3501
Control Delay / Veh (s/v)	39	35	0	27	52	45	10	23	34	16	25
Total Delay (hr)	2	1	0	0	2	3	0	10	1	4	24
Stops / Veh	0.77	0.75	0.00	0.85	0.88	0.52	0.37	0.86	0.49	0.49	0.69
Stops (#)	166	66	0	11	105	142	45	1393	54	437	2419

4149: Automall Dr & 10600 S

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	148	1263	75	1400	220	78	55	50	105	97	3491
Control Delay / Veh (s/v)	73	13	82	12	78	76	2	60	76	11	25
Total Delay (hr)	3	5	2	5	5	2	0	1	2	0	24
Stops / Veh	0.97	0.44	0.96	0.38	0.95	0.95	0.00	0.90	0.73	0.08	0.49
Stops (#)	143	558	72	525	210	74	0	45	77	8	1712

4150: 1300 E & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	All
Future Volume (vph)	268	314	40	44	368	120	176	864	10	64	720	2988
Control Delay / Veh (s/v)	48	46	0	25	48	6	20	29	0	14	17	30
Total Delay (hr)	4	4	0	0	5	0	1	7	0	0	3	25
Stops / Veh	0.72	0.88	0.00	0.70	0.89	0.09	0.50	0.75	0.00	0.31	0.60	0.68
Stops (#)	193	275	0	31	327	11	88	650	0	20	435	2030

4364: Monroe St & 10000 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR	All
Future Volume (vph)	250	354	32	56	332	84	100	404	64	76	80	1832
Control Delay / Veh (s/v)	26	27	0	16	29	1	42	41	18	27	1	28
Total Delay (hr)	2	3	0	0	3	0	1	5	0	1	0	14
Stops / Veh	0.69	0.80	0.00	0.59	0.82	0.00	0.77	0.77	0.64	0.78	0.00	0.68
Stops (#)	173	283	0	33	271	0	77	313	41	59	0	1250

4403: 1300 E & 10230 S (Sego LIly Dr)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	194	132	124	400	324	40	100	1212	124	100	808	128
Control Delay / Veh (s/v)	168	44	8	96	58	0	17	30	4	36	36	10
Total Delay (hr)	9	2	0	11	5	0	0	10	0	1	8	0
Stops / Veh	0.80	0.83	0.13	0.89	0.93	0.00	0.35	0.73	0.15	0.77	0.95	0.60
Stops (#)	155	110	16	354	300	0	35	879	18	77	765	77

4403: 1300 E & 10230 S (Sego LIly Dr)

Lane Group	All
Future Volume (vph)	3686
Control Delay / Veh (s/v)	46
Total Delay (hr)	47
Stops / Veh	0.76
Stops (#)	2786

4404: 1300 E & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	388	172	116	36	392	152	184	1060	64	80	748	336
Control Delay / Veh (s/v)	71	31	7	55	54	5	48	24	1	55	25	11
Total Delay (hr)	8	1	0	1	6	0	2	7	0	1	5	1
Stops / Veh	0.98	0.62	0.25	0.94	0.92	0.05	0.90	0.62	0.03	0.99	0.78	0.37
Stops (#)	380	107	29	34	361	8	166	654	2	79	581	125

4404: 1300 E & 10600 S

Lane Group	All
Future Volume (vph)	3728
Control Delay / Veh (s/v)	32
Total Delay (hr)	33
Stops / Veh	0.68
Stops (#)	2526

4406: 1300 E & 7755 S/Forbush Ln

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR	All
Future Volume (vph)	173	133	19	86	117	153	69	1248	17	615	104	2734
Control Delay / Veh (s/v)	61	45	0	32	60	11	7	16	10	11	2	20
Total Delay (hr)	3	2	0	1	2	0	0	5	0	2	0	15
Stops / Veh	0.92	0.84	0.00	0.77	0.92	0.12	0.41	0.75	0.29	0.31	0.07	0.60
Stops (#)	160	112	0	66	108	18	28	941	5	189	7	1634

4804: 1300 E & 8020 S

Lane Group	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	44	31	115	128	1260	40	40	641	15	2314
Control Delay / Veh (s/v)	62	1	52	1	2	0	4	10	2	8
Total Delay (hr)	1	0	2	0	1	0	0	2	0	5
Stops / Veh	0.91	0.00	0.76	0.04	0.05	0.00	0.33	0.43	0.13	0.21
Stops (#)	40	0	87	5	62	0	13	278	2	487

4807: 1300 E & 7500 S

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT	All
Future Volume (vph)	160	100	60	50	100	1576	20	620	2686
Control Delay / Veh (s/v)	64	14	46	4	94	3	44	23	16
Total Delay (hr)	3	0	1	0	3	1	0	4	12
Stops / Veh	0.93	0.26	0.83	0.08	0.95	0.16	1.05	0.67	0.38
Stops (#)	148	26	50	4	95	249	21	417	1010

4854: 1000 E & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	93	557	73	33	700	76	181	106	42	23	65	84
Control Delay / Veh (s/v)	11	17	2	9	21	2	25	28	0	20	34	6
Total Delay (hr)	0	3	0	0	4	0	1	1	0	0	1	0
Stops / Veh	0.45	0.64	0.05	0.52	0.74	0.07	0.72	0.76	0.00	0.78	0.86	0.11
Stops (#)	42	356	4	17	519	5	131	81	0	18	56	9

4854: 1000 E & 11400 S

Lane Group	All
Future Volume (vph)	2033
Control Delay / Veh (s/v)	18
Total Delay (hr)	10
Stops / Veh	0.61
Stops (#)	1238

7014: 450 W & 9000 S

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	83	1994	695	1086	492	76	124	370	164	153	26	5263
Control Delay / Veh (s/v)	59	42	51	19	7	43	66	16	63	64	0	35
Total Delay (hr)	1	23	10	6	1	1	2	2	3	3	0	52
Stops / Veh	0.98	0.92	0.90	0.64	0.28	0.82	0.94	0.11	0.90	0.91	0.00	0.74
Stops (#)	81	1825	627	690	139	62	117	41	148	139	0	3869

7018: 1300 E & 9400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	100	520	200	400	700	250	300	760	320	150	450	200
Control Delay / Veh (s/v)	71	27	4	74	31	4	72	21	4	57	53	25
Total Delay (hr)	2	4	0	8	6	0	6	4	0	2	7	1
Stops / Veh	0.97	0.80	0.15	0.89	0.86	0.22	0.87	0.74	0.19	0.97	0.81	1.00
Stops (#)	97	418	29	354	602	55	262	562	62	146	366	199

7018: 1300 E & 9400 S

Lane Group	All
Future Volume (vph)	4350
Control Delay / Veh (s/v)	35
Total Delay (hr)	42
Stops / Veh	0.72
Stops (#)	3152

7019: Highland Dr & 9400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	380	500	60	67	710	181	150	350	50	108	250	486
Control Delay / Veh (s/v)	55	22	8	57	28	8	35	50	1	21	26	28
Total Delay (hr)	6	3	0	1	6	0	1	5	0	1	2	4
Stops / Veh	0.95	0.75	0.42	0.93	0.72	0.43	0.73	0.89	0.00	0.47	0.73	0.77
Stops (#)	362	377	25	62	511	77	110	312	0	51	183	374

7019: Highland Dr & 9400 S

Lane Group	All
Future Volume (vph)	3292
Control Delay / Veh (s/v)	31
Total Delay (hr)	29
Stops / Veh	0.74
Stops (#)	2444

7176: State St & 10000 S

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	250	154	146	282	294	183	702	144	148	767	125	3195
Control Delay / Veh (s/v)	60	49	10	75	44	79	9	1	65	21	3	33
Total Delay (hr)	4	2	0	6	4	4	2	0	3	4	0	29
Stops / Veh	0.94	0.88	0.13	0.99	1.37	1.00	0.25	0.06	0.86	0.66	0.22	0.66
Stops (#)	235	135	19	279	403	183	179	8	128	510	28	2107

7178: State St & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	278	606	247	94	1045	189	644	66	51	416	284	3920
Control Delay / Veh (s/v)	58	5	1	78	25	79	64	1	76	69	23	38
Total Delay (hr)	4	1	0	2	7	4	11	0	1	8	2	41
Stops / Veh	0.98	0.29	0.05	0.96	0.63	0.96	0.93	0.00	0.94	0.94	0.49	0.65
Stops (#)	273	176	12	90	655	181	599	0	48	392	139	2565

7200: 700 E & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	88	407	54	46	726	120	191	857	52	77	541	169
Control Delay / Veh (s/v)	71	35	1	54	50	15	77	24	1	56	47	25
Total Delay (hr)	2	4	0	1	10	0	4	6	0	1	7	1
Stops / Veh	0.95	0.77	0.02	0.96	0.93	0.81	0.88	0.53	0.08	1.00	0.96	0.87
Stops (#)	84	313	1	44	677	97	168	455	4	77	519	147

7200: 700 E & 10600 S

Lane Group	All
Future Volume (vph)	3328
Control Delay / Veh (s/v)	39
Total Delay (hr)	36
Stops / Veh	0.78
Stops (#)	2586

7351: State St & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	450	662	200	78	954	75	149	480	50	64	238	300
Control Delay / Veh (s/v)	39	23	10	50	30	0	58	57	1	57	60	9
Total Delay (hr)	5	4	1	1	8	0	2	8	0	1	4	1
Stops / Veh	0.78	0.62	0.22	0.87	0.76	0.00	0.97	0.99	0.04	0.95	0.98	0.26
Stops (#)	353	413	44	68	721	0	145	475	2	61	233	78

7351: State St & 11400 S

Lane Group	All
Future Volume (vph)	3700
Control Delay / Veh (s/v)	34
Total Delay (hr)	35
Stops / Veh	0.70
Stops (#)	2593

4143: 1300 E & Union Ave/Creek Rd

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	All
Future Volume (vph)	216	88	48	13	119	274	122	1628	110	883	3501
Control Delay / Veh (s/v)	39	35	0	27	52	45	8	15	33	16	21
Total Delay (hr)	2	1	0	0	2	3	0	7	1	4	20
Stops / Veh	0.77	0.75	0.00	0.85	0.88	0.52	0.20	0.75	0.48	0.49	0.64
Stops (#)	166	66	0	11	105	142	25	1221	53	437	2226

4149: Automall Dr & 10600 S

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	148	1263	75	1400	220	78	55	50	105	97	3491
Control Delay / Veh (s/v)	79	19	84	13	78	75	2	59	76	5	27
Total Delay (hr)	3	7	2	5	5	2	0	1	2	0	26
Stops / Veh	0.97	0.50	0.96	0.43	0.95	0.95	0.00	0.90	0.73	0.02	0.53
Stops (#)	143	635	72	596	210	74	0	45	77	2	1854

4150: 1300 E & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	All
Future Volume (vph)	268	314	40	44	368	120	176	864	10	64	720	2988
Control Delay / Veh (s/v)	55	55	6	26	48	2	33	37	0	20	35	39
Total Delay (hr)	4	5	0	0	5	0	2	9	0	0	7	32
Stops / Veh	0.97	0.99	0.30	0.70	0.89	0.01	0.72	0.77	0.00	0.72	0.69	0.76
Stops (#)	261	310	12	31	326	1	126	662	0	46	499	2274

4364: Monroe St & 10000 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR	All
Future Volume (vph)	250	354	32	56	332	84	100	404	64	76	80	1832
Control Delay / Veh (s/v)	16	20	0	17	30	7	59	49	17	26	5	28
Total Delay (hr)	1	2	0	0	3	0	2	6	0	1	0	14
Stops / Veh	0.65	0.77	0.00	0.68	0.80	0.42	0.80	0.84	0.45	0.87	0.33	0.72
Stops (#)	163	273	0	38	265	35	80	341	29	66	26	1316

4403: 1300 E & 10230 S (Sego LIly Dr)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	194	132	124	400	324	40	100	1212	124	100	808	128
Control Delay / Veh (s/v)	182	61	3	54	69	0	13	38	2	40	33	4
Total Delay (hr)	10	2	0	6	6	0	0	13	0	1	7	0
Stops / Veh	0.79	0.88	0.02	0.92	0.91	0.00	0.36	0.94	0.15	0.77	0.96	0.25
Stops (#)	154	116	2	368	295	0	36	1145	19	77	774	32

4403: 1300 E & 10230 S (Sego LIly Dr)

Lane Group	All
Future Volume (vph)	3686
Control Delay / Veh (s/v)	45
Total Delay (hr)	46
Stops / Veh	0.82
Stops (#)	3018

4404: 1300 E & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	388	172	116	36	392	152	184	1060	64	80	748	336
Control Delay / Veh (s/v)	66	44	8	44	101	3	64	33	0	53	17	5
Total Delay (hr)	7	2	0	0	11	0	3	10	0	1	3	0
Stops / Veh	0.96	0.91	0.27	0.86	0.88	0.00	0.99	0.95	0.02	0.86	0.72	0.38
Stops (#)	372	156	31	31	344	0	182	1012	1	69	540	129

4404: 1300 E & 10600 S

Lane Group	All
Future Volume (vph)	3728
Control Delay / Veh (s/v)	38
Total Delay (hr)	39
Stops / Veh	0.77
Stops (#)	2867

4406: 1300 E & 7755 S/Forbush Ln

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR	All
Future Volume (vph)	173	133	19	86	117	153	69	1248	17	615	104	2734
Control Delay / Veh (s/v)	72	64	1	33	60	8	4	6	6	10	1	17
Total Delay (hr)	3	2	0	1	2	0	0	2	0	2	0	13
Stops / Veh	0.99	0.93	0.05	0.77	0.92	0.08	0.14	0.34	0.24	0.53	0.03	0.46
Stops (#)	171	124	1	66	108	13	10	424	4	324	3	1248

4804: 1300 E & 8020 S

Lane Group	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	44	31	115	128	1260	40	40	641	15	2314
Control Delay / Veh (s/v)	62	1	52	2	2	0	9	17	5	10
Total Delay (hr)	1	0	2	0	1	0	0	3	0	6
Stops / Veh	0.91	0.00	0.76	0.07	0.08	0.00	0.58	0.53	0.27	0.26
Stops (#)	40	0	87	9	103	0	23	340	4	606

4807: 1300 E & 7500 S

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT	All
Future Volume (vph)	160	100	60	50	100	1576	20	620	2686
Control Delay / Veh (s/v)	64	14	46	3	96	4	48	7	13
Total Delay (hr)	3	0	1	0	3	2	0	1	10
Stops / Veh	0.93	0.26	0.83	0.06	0.88	0.23	1.10	0.26	0.32
Stops (#)	148	26	50	3	88	367	22	162	866

4854: 1000 E & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	93	557	73	33	700	76	181	106	42	23	65	84
Control Delay / Veh (s/v)	4	11	4	8	18	0	57	51	1	35	53	2
Total Delay (hr)	0	2	0	0	3	0	3	1	0	0	1	0
Stops / Veh	0.24	0.59	0.26	0.39	0.49	0.00	0.98	0.89	0.00	0.83	0.89	0.00
Stops (#)	22	331	19	13	341	0	177	94	0	19	58	0

4854: 1000 E & 11400 S

Lane Group	All
Future Volume (vph)	2033
Control Delay / Veh (s/v)	19
Total Delay (hr)	11
Stops / Veh	0.53
Stops (#)	1074

7014: 450 W & 9000 S

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	83	1994	695	1086	492	76	124	370	164	153	26	5263
Control Delay / Veh (s/v)	107	26	70	14	4	52	78	15	69	77	0	32
Total Delay (hr)	2	14	14	4	0	1	3	2	3	3	0	47
Stops / Veh	0.99	0.81	0.97	0.42	0.09	0.82	0.94	0.10	0.88	0.94	0.00	0.64
Stops (#)	82	1623	671	454	43	62	117	38	144	144	0	3378

7018: 1300 E & 9400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	100	520	200	400	700	250	300	760	320	150	450	200
Control Delay / Veh (s/v)	64	28	5	74	32	5	60	26	4	31	21	5
Total Delay (hr)	2	4	0	8	6	0	5	5	0	1	3	0
Stops / Veh	0.99	0.53	0.20	0.89	0.85	0.24	0.87	0.74	0.17	0.62	0.43	0.17
Stops (#)	99	277	39	356	595	59	261	559	54	93	194	34

7018: 1300 E & 9400 S

Lane Group	All
Future Volume (vph)	4350
Control Delay / Veh (s/v)	30
Total Delay (hr)	36
Stops / Veh	0.60
Stops (#)	2620

7019: Highland Dr & 9400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	380	500	60	67	710	181	150	350	50	108	250	486
Control Delay / Veh (s/v)	54	31	11	54	26	6	37	54	2	23	33	32
Total Delay (hr)	6	4	0	1	5	0	2	5	0	1	2	4
Stops / Veh	0.97	0.82	0.43	0.90	0.67	0.23	0.79	0.93	0.08	0.68	0.90	0.68
Stops (#)	367	412	26	60	475	41	118	326	4	73	224	331

7019: Highland Dr & 9400 S

Lane Group	All
Future Volume (vph)	3292
Control Delay / Veh (s/v)	34
Total Delay (hr)	31
Stops / Veh	0.75
Stops (#)	2457

7176: State St & 10000 S

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	250	154	146	282	294	183	702	144	148	767	125	3195
Control Delay / Veh (s/v)	52	29	18	50	31	46	22	8	47	19	3	28
Total Delay (hr)	4	1	1	4	3	2	4	0	2	4	0	25
Stops / Veh	0.99	0.96	0.74	0.85	0.55	0.78	0.87	0.57	0.77	0.63	0.22	0.74
Stops (#)	247	148	108	239	162	143	608	82	114	483	28	2362

7178: State St & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	278	606	247	94	1045	189	644	66	51	416	284	3920
Control Delay / Veh (s/v)	61	5	1	78	25	79	64	1	76	69	23	38
Total Delay (hr)	5	1	0	2	7	4	11	0	1	8	2	41
Stops / Veh	0.99	0.16	0.01	0.96	0.63	0.96	0.93	0.00	0.94	0.94	0.49	0.63
Stops (#)	275	96	3	90	655	181	599	0	48	392	139	2478

7200: 700 E & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	88	407	54	46	726	120	191	857	52	77	541	169
Control Delay / Veh (s/v)	75	33	4	81	39	4	54	28	4	57	46	22
Total Delay (hr)	2	4	0	1	8	0	3	7	0	1	7	1
Stops / Veh	0.97	0.77	0.09	0.89	0.78	0.21	0.68	0.80	0.21	1.00	0.93	0.91
Stops (#)	85	314	5	41	568	25	130	686	11	77	501	153

7200: 700 E & 10600 S

Lane Group	All
Future Volume (vph)	3328
Control Delay / Veh (s/v)	36
Total Delay (hr)	33
Stops / Veh	0.78
Stops (#)	2596

7351: State St & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	450	662	200	78	954	75	149	480	50	64	238	300
Control Delay / Veh (s/v)	65	19	8	72	31	0	59	63	5	72	69	10
Total Delay (hr)	8	3	0	2	8	0	2	8	0	1	5	1
Stops / Veh	0.94	0.51	0.21	0.94	0.69	0.00	0.90	0.93	0.16	0.92	0.93	0.30
Stops (#)	423	338	41	73	658	0	134	447	8	59	222	90

7351: State St & 11400 S

Lane Group	All
Future Volume (vph)	3700
Control Delay / Veh (s/v)	38
Total Delay (hr)	39
Stops / Veh	0.67
Stops (#)	2493

4143: 1300 E & Union Ave/Creek Rd

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	All
Future Volume (vph)	179	91	82	28	88	186	75	961	239	1150	3079
Control Delay / Veh (s/v)	62	47	3	34	54	14	6	8	12	11	15
Total Delay (hr)	3	1	0	0	1	1	0	2	1	4	13
Stops / Veh	0.94	0.90	0.02	0.82	0.92	0.16	0.28	0.33	0.35	0.47	0.44
Stops (#)	168	82	2	23	81	29	21	315	83	545	1349

4149: Automall Dr & 10600 S

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	400	1166	94	886	400	100	126	57	342	310	3881
Control Delay / Veh (s/v)	54	17	52	15	67	37	8	53	324	25	55
Total Delay (hr)	6	6	1	4	7	1	0	1	31	2	59
Stops / Veh	0.95	0.60	0.97	0.39	0.92	0.81	0.15	0.93	0.67	0.23	0.60
Stops (#)	379	694	91	348	367	81	19	53	230	72	2334

4150: 1300 E & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	All
Future Volume (vph)	220	220	84	20	304	56	86	412	58	136	612	2208
Control Delay / Veh (s/v)	61	40	4	24	42	1	11	20	0	5	11	24
Total Delay (hr)	4	2	0	0	4	0	0	2	0	0	2	15
Stops / Veh	0.84	0.85	0.06	0.75	0.87	0.00	0.47	0.62	0.00	0.15	0.66	0.62
Stops (#)	184	187	5	15	263	0	40	255	0	21	401	1371

4364: Monroe St & 10000 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR	All
Future Volume (vph)	192	360	56	64	440	140	106	264	108	120	136	1986
Control Delay / Veh (s/v)	22	26	1	16	29	5	64	20	20	30	5	23
Total Delay (hr)	1	3	0	0	4	0	2	1	1	1	0	13
Stops / Veh	0.65	0.78	0.00	0.58	0.82	0.10	0.76	0.53	0.64	0.81	0.07	0.61
Stops (#)	125	281	0	37	361	14	81	140	69	97	10	1215

4403: 1300 E & 10230 S (Sego LIly Dr)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	40	76	28	296	48	44	24	856	144	156	816	28
Control Delay / Veh (s/v)	54	52	1	56	37	1	11	17	3	24	25	1
Total Delay (hr)	1	1	0	5	0	0	0	4	0	1	6	0
Stops / Veh	0.93	0.91	0.00	0.94	0.79	0.00	0.29	0.59	0.15	0.97	0.82	0.07
Stops (#)	37	69	0	278	38	0	7	505	22	151	671	2

4403: 1300 E & 10230 S (Sego LIly Dr)

Lane Group	All
Future Volume (vph)	2556
Control Delay / Veh (s/v)	25
Total Delay (hr)	18
Stops / Veh	0.70
Stops (#)	1780

4404: 1300 E & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	260	284	28	40	204	136	104	648	16	236	728	208
Control Delay / Veh (s/v)	51	39	0	48	50	5	51	18	0	36	21	9
Total Delay (hr)	4	3	0	1	3	0	1	3	0	2	4	1
Stops / Veh	0.92	0.84	0.00	0.93	0.92	0.04	0.96	0.53	0.00	0.89	0.67	0.39
Stops (#)	240	239	0	37	187	5	100	341	0	209	490	81

4404: 1300 E & 10600 S

Lane Group	All
Future Volume (vph)	2892
Control Delay / Veh (s/v)	27
Total Delay (hr)	22
Stops / Veh	0.67
Stops (#)	1929

4406: 1300 E & 7755 S/Forbush Ln

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR	All
Future Volume (vph)	147	135	42	89	111	31	59	847	44	821	162	2488
Control Delay / Veh (s/v)	53	44	1	29	53	0	10	24	4	7	0	19
Total Delay (hr)	2	2	0	1	2	0	0	6	0	1	0	13
Stops / Veh	0.91	0.87	0.00	0.75	0.90	0.00	0.44	0.66	0.11	0.19	0.00	0.47
Stops (#)	134	117	0	67	100	0	26	562	5	157	0	1168

4804: 1300 E & 8020 S

Lane Group	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	30	24	49	76	868	20	58	871	15	2011
Control Delay / Veh (s/v)	51	1	37	1	1	0	1	1	0	3
Total Delay (hr)	0	0	1	0	0	0	0	0	0	2
Stops / Veh	0.97	0.00	0.63	0.04	0.05	0.00	0.00	0.11	0.00	0.10
Stops (#)	29	0	31	3	45	0	0	97	0	205

4807: 1300 E & 7500 S

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT	All
Future Volume (vph)	20	10	28	20	10	1006	50	1019	2163
Control Delay / Veh (s/v)	50	0	52	1	48	1	48	8	6
Total Delay (hr)	0	0	0	0	0	0	1	2	4
Stops / Veh	1.00	0.00	1.00	0.00	1.20	0.05	0.88	0.44	0.28
Stops (#)	20	0	28	0	12	49	44	452	605

4854: 1000 E & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	74	550	118	30	558	23	113	64	30	30	85	71
Control Delay / Veh (s/v)	11	16	4	10	20	0	18	24	0	17	30	4
Total Delay (hr)	0	2	0	0	3	0	1	0	0	0	1	0
Stops / Veh	0.50	0.61	0.14	0.57	0.70	0.00	0.64	0.77	0.00	0.70	0.84	0.07
Stops (#)	37	333	17	17	392	0	72	49	0	21	71	5

4854: 1000 E & 11400 S

Lane Group	All
Future Volume (vph)	1746
Control Delay / Veh (s/v)	16
Total Delay (hr)	8
Stops / Veh	0.58
Stops (#)	1014

7014: 450 W & 9000 S

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	100	1350	480	1200	300	100	200	250	250	200	100	4530
Control Delay / Veh (s/v)	67	26	38	33	11	28	53	11	52	44	1	31
Total Delay (hr)	2	10	5	11	1	1	3	1	4	2	0	39
Stops / Veh	0.97	0.47	0.86	0.90	0.65	0.72	0.91	0.15	0.75	0.88	0.00	0.68
Stops (#)	97	641	411	1081	194	72	182	38	187	175	0	3078

7018: 1300 E & 9400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	223	550	250	350	550	162	300	514	250	164	553	212
Control Delay / Veh (s/v)	57	31	6	53	26	7	48	25	7	57	31	7
Total Delay (hr)	4	5	0	5	4	0	4	4	0	3	5	0
Stops / Veh	0.93	0.81	0.27	0.95	0.70	0.22	0.88	0.85	0.39	0.79	0.94	0.48
Stops (#)	207	444	67	332	385	36	265	437	97	129	520	101

7018: 1300 E & 9400 S

Lane Group	All
Future Volume (vph)	4078
Control Delay / Veh (s/v)	30
Total Delay (hr)	34
Stops / Veh	0.74
Stops (#)	3020

7019: Highland Dr & 9400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	453	405	100	118	400	77	150	200	69	167	250	400
Control Delay / Veh (s/v)	46	25	12	59	28	7	36	47	2	48	59	29
Total Delay (hr)	6	3	0	2	3	0	2	3	0	2	4	3
Stops / Veh	0.98	0.72	0.39	0.96	0.74	0.32	0.77	0.90	0.01	1.01	0.97	0.70
Stops (#)	443	292	39	113	297	25	116	179	1	169	243	281

7019: Highland Dr & 9400 S

Lane Group	All
Future Volume (vph)	2789
Control Delay / Veh (s/v)	36
Total Delay (hr)	28
Stops / Veh	0.79
Stops (#)	2198

7176: State St & 10000 S

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	250	212	180	240	187	300	670	208	200	907	150	3504
Control Delay / Veh (s/v)	56	44	7	79	31	45	9	1	59	21	3	29
Total Delay (hr)	4	3	0	5	2	4	2	0	3	5	0	28
Stops / Veh	0.88	0.87	0.09	0.90	0.55	0.97	0.30	0.01	0.86	0.68	0.17	0.58
Stops (#)	219	184	17	215	103	292	199	2	171	621	25	2048

7178: State St & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	332	490	277	127	779	245	700	114	240	668	161	4133
Control Delay / Veh (s/v)	33	12	2	55	29	53	51	7	81	49	10	36
Total Delay (hr)	3	2	0	2	6	4	10	0	5	9	0	42
Stops / Veh	0.85	0.40	0.10	0.94	0.73	0.98	0.94	0.31	0.92	0.79	0.60	0.72
Stops (#)	281	197	28	119	567	240	661	35	220	531	97	2976

7200: 700 E & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	143	498	73	47	493	102	114	433	50	94	435	214
Control Delay / Veh (s/v)	101	42	3	58	51	7	50	17	4	35	30	19
Total Delay (hr)	4	6	0	1	7	0	2	2	0	1	4	1
Stops / Veh	0.85	0.88	0.05	0.96	0.92	0.14	0.58	0.88	0.38	0.87	0.91	0.87
Stops (#)	121	440	4	45	456	14	66	383	19	82	396	187

7200: 700 E & 10600 S

Lane Group	All
Future Volume (vph)	2696
Control Delay / Veh (s/v)	36
Total Delay (hr)	27
Stops / Veh	0.82
Stops (#)	2213

7351: State St & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	550	680	200	126	636	99	237	564	43	97	606	652
Control Delay / Veh (s/v)	29	10	3	48	35	1	51	43	0	27	28	8
Total Delay (hr)	4	2	0	2	6	0	3	7	0	1	5	1
Stops / Veh	0.71	0.44	0.15	0.90	0.82	0.00	0.92	0.89	0.00	0.77	0.81	0.60
Stops (#)	388	298	29	113	524	0	219	502	0	75	493	394

7351: State St & 11400 S

Lane Group	All
Future Volume (vph)	4490
Control Delay / Veh (s/v)	25
Total Delay (hr)	31
Stops / Veh	0.68
Stops (#)	3035

4143: 1300 E & Union Ave/Creek Rd

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	All
Future Volume (vph)	179	91	82	28	88	186	75	961	239	1150	3079
Control Delay / Veh (s/v)	62	47	3	33	54	14	8	14	12	11	18
Total Delay (hr)	3	1	0	0	1	1	0	4	1	4	15
Stops / Veh	0.94	0.90	0.02	0.82	0.92	0.16	0.33	0.79	0.35	0.47	0.58
Stops (#)	168	82	2	23	81	29	25	761	83	546	1800

4149: Automall Dr & 10600 S

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	400	1166	94	886	400	100	126	57	342	310	3881
Control Delay / Veh (s/v)	62	18	54	13	86	37	7	53	307	31	56
Total Delay (hr)	7	6	1	3	10	1	0	1	29	3	61
Stops / Veh	0.92	0.60	0.97	0.39	0.89	0.81	0.13	0.93	0.68	0.28	0.60
Stops (#)	369	702	91	343	354	81	17	53	231	87	2328

4150: 1300 E & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	All
Future Volume (vph)	220	220	84	20	304	56	86	412	58	136	612	2208
Control Delay / Veh (s/v)	42	31	10	25	42	1	8	15	2	11	15	22
Total Delay (hr)	3	2	0	0	4	0	0	2	0	0	3	13
Stops / Veh	1.18	0.96	0.54	0.75	0.87	0.00	0.40	0.46	0.12	0.38	0.37	0.59
Stops (#)	259	212	45	15	264	0	34	188	7	51	228	1303

4364: Monroe St & 10000 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR	All
Future Volume (vph)	192	360	56	64	440	140	106	264	108	120	136	1986
Control Delay / Veh (s/v)	12	18	1	16	33	11	135	28	32	39	8	28
Total Delay (hr)	1	2	0	0	4	0	4	2	1	1	0	16
Stops / Veh	0.37	0.58	0.05	0.67	0.85	0.64	0.79	0.55	0.72	0.78	0.21	0.61
Stops (#)	71	208	3	43	372	90	84	144	78	93	29	1215

4403: 1300 E & 10230 S (Sego LIly Dr)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	40	76	28	296	48	44	24	856	144	156	816	28
Control Delay / Veh (s/v)	52	52	1	54	37	1	12	18	4	19	13	0
Total Delay (hr)	1	1	0	4	0	0	0	4	0	1	3	0
Stops / Veh	0.93	0.91	0.00	0.94	0.81	0.00	0.38	0.57	0.15	0.52	0.47	0.04
Stops (#)	37	69	0	277	39	0	9	491	21	81	382	1

4403: 1300 E & 10230 S (Sego LIly Dr)

Lane Group	All
Future Volume (vph)	2556
Control Delay / Veh (s/v)	21
Total Delay (hr)	15
Stops / Veh	0.55
Stops (#)	1407

4404: 1300 E & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	260	284	28	40	204	136	104	648	16	236	728	208
Control Delay / Veh (s/v)	71	26	0	49	50	2	55	20	0	36	14	4
Total Delay (hr)	5	2	0	1	3	0	2	4	0	2	3	0
Stops / Veh	0.94	0.55	0.00	0.93	0.92	0.00	0.93	0.74	0.00	0.82	0.67	0.28
Stops (#)	245	155	0	37	187	0	97	481	0	194	486	58

4404: 1300 E & 10600 S

Lane Group	All
Future Volume (vph)	2892
Control Delay / Veh (s/v)	26
Total Delay (hr)	21
Stops / Veh	0.67
Stops (#)	1940

4406: 1300 E & 7755 S/Forbush Ln

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR	All
Future Volume (vph)	147	135	42	89	111	31	59	847	44	821	162	2488
Control Delay / Veh (s/v)	49	36	1	30	53	0	9	21	7	11	1	20
Total Delay (hr)	2	1	0	1	2	0	0	5	0	3	0	13
Stops / Veh	0.78	0.87	0.07	0.76	0.90	0.00	0.54	0.85	0.23	0.29	0.03	0.57
Stops (#)	115	118	3	68	100	0	32	719	10	239	5	1409

4804: 1300 E & 8020 S

Lane Group	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	30	24	49	76	868	20	58	871	15	2011
Control Delay / Veh (s/v)	51	1	37	1	1	0	1	1	0	3
Total Delay (hr)	0	0	1	0	0	0	0	0	0	2
Stops / Veh	0.97	0.00	0.63	0.04	0.05	0.00	0.03	0.13	0.00	0.11
Stops (#)	29	0	31	3	41	0	2	113	0	219

4807: 1300 E & 7500 S

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT	All
Future Volume (vph)	20	10	28	20	10	1006	50	1019	2163
Control Delay / Veh (s/v)	50	0	52	1	50	1	73	2	4
Total Delay (hr)	0	0	0	0	0	0	1	1	3
Stops / Veh	1.00	0.00	1.00	0.00	1.20	0.05	0.84	0.22	0.17
Stops (#)	20	0	28	0	12	49	42	223	374

4854: 1000 E & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	74	550	118	30	558	23	113	64	30	30	85	71
Control Delay / Veh (s/v)	10	22	11	7	12	0	37	43	0	31	52	2
Total Delay (hr)	0	3	0	0	2	0	1	1	0	0	1	0
Stops / Veh	0.62	0.83	0.70	0.33	0.44	0.00	0.81	0.88	0.00	0.83	0.91	0.00
Stops (#)	46	456	83	10	248	0	92	56	0	25	77	0

4854: 1000 E & 11400 S

Lane Group	All
Future Volume (vph)	1746
Control Delay / Veh (s/v)	19
Total Delay (hr)	9
Stops / Veh	0.63
Stops (#)	1093

7014: 450 W & 9000 S

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	100	1350	480	1200	300	100	200	250	250	200	100	4530
Control Delay / Veh (s/v)	67	27	54	16	3	28	53	11	52	44	1	28
Total Delay (hr)	2	10	7	5	0	1	3	1	4	2	0	35
Stops / Veh	0.97	0.49	0.90	0.51	0.07	0.72	0.91	0.15	0.75	0.88	0.00	0.55
Stops (#)	97	658	434	608	21	72	182	38	187	175	0	2472

7018: 1300 E & 9400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	223	550	250	350	550	162	300	514	250	164	553	212
Control Delay / Veh (s/v)	61	29	7	57	30	9	50	47	21	33	40	15
Total Delay (hr)	4	4	0	6	5	0	4	7	1	1	6	1
Stops / Veh	0.94	0.77	0.31	0.93	0.79	0.43	0.97	0.89	0.73	0.90	0.97	0.49
Stops (#)	210	426	78	324	435	70	292	455	183	147	536	104

7018: 1300 E & 9400 S

Lane Group	All
Future Volume (vph)	4078
Control Delay / Veh (s/v)	35
Total Delay (hr)	40
Stops / Veh	0.80
Stops (#)	3260

7019: Highland Dr & 9400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	453	405	100	118	400	77	150	200	69	167	250	400
Control Delay / Veh (s/v)	32	18	8	48	22	4	36	47	2	36	48	24
Total Delay (hr)	4	2	0	2	2	0	2	3	0	2	3	3
Stops / Veh	0.88	0.74	0.52	0.82	0.65	0.17	0.77	0.90	0.01	1.01	0.97	0.75
Stops (#)	397	298	52	97	259	13	116	179	1	169	242	298

7019: Highland Dr & 9400 S

Lane Group	All
Future Volume (vph)	2789
Control Delay / Veh (s/v)	29
Total Delay (hr)	22
Stops / Veh	0.76
Stops (#)	2121

7176: State St & 10000 S

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	250	212	180	240	187	300	670	208	200	907	150	3504
Control Delay / Veh (s/v)	72	62	30	68	31	65	18	5	70	17	2	34
Total Delay (hr)	5	4	2	5	2	5	3	0	4	4	0	33
Stops / Veh	0.94	0.98	0.96	0.93	0.55	0.92	0.39	0.18	0.89	0.62	0.16	0.65
Stops (#)	234	208	173	222	103	276	258	38	177	562	24	2275

7178: State St & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	332	490	277	127	779	245	700	114	240	668	161	4133
Control Delay / Veh (s/v)	33	12	2	55	25	54	49	11	83	35	4	33
Total Delay (hr)	3	2	0	2	5	4	9	0	6	7	0	38
Stops / Veh	0.85	0.34	0.06	0.96	0.80	0.98	0.90	0.32	0.94	0.79	0.17	0.70
Stops (#)	281	169	18	122	626	239	629	37	226	531	27	2905

7200: 700 E & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	143	498	73	47	493	102	114	433	50	94	435	214
Control Delay / Veh (s/v)	86	48	12	67	40	6	79	14	1	74	15	5
Total Delay (hr)	3	7	0	1	6	0	2	2	0	2	2	0
Stops / Veh	0.86	0.99	0.55	0.98	0.80	0.20	0.91	0.58	0.08	0.81	0.75	0.45
Stops (#)	123	495	40	46	394	20	104	250	4	76	328	96

7200: 700 E & 10600 S

Lane Group	All
Future Volume (vph)	2696
Control Delay / Veh (s/v)	33
Total Delay (hr)	25
Stops / Veh	0.73
Stops (#)	1976

7351: State St & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	550	680	200	126	636	99	237	564	43	97	606	652
Control Delay / Veh (s/v)	47	17	6	42	45	6	58	37	0	29	29	10
Total Delay (hr)	7	3	0	1	8	0	4	6	0	1	5	2
Stops / Veh	0.94	0.60	0.25	0.98	0.84	0.28	0.86	0.74	0.00	0.81	0.84	0.77
Stops (#)	518	405	49	123	533	28	203	415	0	79	511	505

7351: State St & 11400 S

Lane Group	All
Future Volume (vph)	4490
Control Delay / Veh (s/v)	30
Total Delay (hr)	37
Stops / Veh	0.75
Stops (#)	3369

4143: 1300 E & Union Ave/Creek Rd

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	All
Future Volume (vph)	203	163	105	43	137	224	54	1265	316	2236	4746
Control Delay / Veh (s/v)	109	70	12	47	76	37	47	16	45	21	29
Total Delay (hr)	6	3	0	1	3	2	1	6	4	13	39
Stops / Veh	0.84	0.93	0.16	0.79	0.94	0.38	0.98	0.68	0.47	0.66	0.66
Stops (#)	171	152	17	34	129	86	53	864	149	1478	3133

4149: Automall Dr & 10600 S

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	450	1843	94	1226	450	100	126	157	189	166	4801
Control Delay / Veh (s/v)	55	37	63	25	64	70	10	40	85	12	40
Total Delay (hr)	7	19	2	9	8	2	0	2	4	1	53
Stops / Veh	0.98	0.79	0.95	0.76	0.94	0.95	0.10	0.80	0.87	0.14	0.78
Stops (#)	441	1463	89	928	423	95	12	126	165	23	3765

4150: 1300 E & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	All
Future Volume (vph)	324	348	120	20	320	24	72	868	28	120	1360	3604
Control Delay / Veh (s/v)	70	46	6	22	44	0	24	32	0	31	47	42
Total Delay (hr)	6	4	0	0	4	0	0	8	0	1	18	42
Stops / Veh	0.74	0.87	0.12	0.70	0.85	0.00	0.53	0.79	0.00	0.58	0.54	0.66
Stops (#)	239	304	14	14	271	0	38	684	0	69	731	2364

4364: Monroe St & 10000 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR	All
Future Volume (vph)	134	668	192	68	604	68	102	201	148	226	288	2699
Control Delay / Veh (s/v)	18	30	5	17	29	0	157	19	25	39	13	29
Total Delay (hr)	1	6	0	0	5	0	4	1	1	2	1	22
Stops / Veh	0.57	0.82	0.10	0.54	0.81	0.00	0.67	0.45	0.71	0.88	0.22	0.63
Stops (#)	76	549	20	37	490	0	68	91	105	199	63	1698

4403: 1300 E & 10230 S (Sego LIly Dr)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	56	124	96	380	132	36	72	1164	288	188	1636	28
Control Delay / Veh (s/v)	62	58	8	101	45	0	21	43	14	62	25	0
Total Delay (hr)	1	2	0	11	2	0	0	14	1	3	12	0
Stops / Veh	0.91	0.92	0.10	0.88	0.85	0.00	0.76	0.98	0.47	0.81	0.75	0.00
Stops (#)	51	114	10	334	112	0	55	1141	134	152	1221	0

4403: 1300 E & 10230 S (Sego LIly Dr)

Lane Group	All
Future Volume (vph)	4200
Control Delay / Veh (s/v)	39
Total Delay (hr)	46
Stops / Veh	0.79
Stops (#)	3324

4404: 1300 E & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	336	488	160	40	300	112	92	1168	48	288	1548	312
Control Delay / Veh (s/v)	46	47	18	56	56	2	55	40	1	68	56	9
Total Delay (hr)	4	6	1	1	5	0	1	13	0	5	24	1
Stops / Veh	0.95	0.97	0.54	0.95	0.93	0.00	0.92	0.81	0.04	0.94	0.69	0.36
Stops (#)	318	474	87	38	279	0	85	946	2	270	1071	112

4404: 1300 E & 10600 S

Lane Group	All
Future Volume (vph)	4892
Control Delay / Veh (s/v)	45
Total Delay (hr)	61
Stops / Veh	0.75
Stops (#)	3682

4406: 1300 E & 7755 S/Forbush Ln

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR	All
Future Volume (vph)	162	198	59	114	150	27	62	1156	58	1808	297	4091
Control Delay / Veh (s/v)	79	66	3	46	76	1	36	16	6	23	2	26
Total Delay (hr)	4	4	0	1	3	0	1	5	0	11	0	29
Stops / Veh	0.94	0.90	0.03	0.79	0.93	0.00	0.55	0.40	0.12	0.33	0.07	0.41
Stops (#)	153	179	2	90	140	0	34	461	7	589	21	1676

4804: 1300 E & 8020 S

Lane Group	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	51	46	68	106	1203	28	104	1866	11	3483
Control Delay / Veh (s/v)	95	13	56	25	6	0	2	6	0	9
Total Delay (hr)	1	0	1	1	2	0	0	3	0	8
Stops / Veh	0.96	0.13	0.62	0.32	0.30	0.00	0.04	0.15	0.00	0.22
Stops (#)	49	6	42	34	360	0	4	275	0	770

4807: 1300 E & 7500 S

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT	All
Future Volume (vph)	20	10	24	10	10	1342	15	2189	3620
Control Delay / Veh (s/v)	74	1	76	1	73	6	68	1	4
Total Delay (hr)	0	0	1	0	0	2	0	1	4
Stops / Veh	1.00	0.00	0.96	0.00	1.00	0.37	0.87	0.04	0.18
Stops (#)	20	0	23	0	10	491	13	98	655

4854: 1000 E & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	99	801	209	51	687	26	130	92	42	30	118	89
Control Delay / Veh (s/v)	12	23	5	11	23	0	23	31	0	21	38	7
Total Delay (hr)	0	5	0	0	4	0	1	1	0	0	1	0
Stops / Veh	0.45	0.77	0.12	0.49	0.75	0.00	0.68	0.77	0.00	0.77	0.83	0.12
Stops (#)	45	615	25	25	513	0	88	71	0	23	98	11

4854: 1000 E & 11400 S

Lane Group	All
Future Volume (vph)	2374
Control Delay / Veh (s/v)	21
Total Delay (hr)	14
Stops / Veh	0.64
Stops (#)	1514

7014: 450 W & 9000 S

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	23	1717	354	1691	180	263	201	638	366	262	129	5824
Control Delay / Veh (s/v)	59	66	70	46	17	45	52	140	63	59	8	64
Total Delay (hr)	0	31	7	22	1	3	3	25	6	4	0	103
Stops / Veh	0.96	0.97	0.95	0.81	0.59	0.71	0.84	0.54	0.80	0.90	0.11	0.82
Stops (#)	22	1665	338	1377	107	186	169	343	292	235	14	4748

7018: 1300 E & 9400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	296	800	400	250	650	200	300	706	350	310	1100	255
Control Delay / Veh (s/v)	75	39	20	60	45	13	93	62	34	54	90	17
Total Delay (hr)	6	9	2	4	8	1	8	12	3	5	28	1
Stops / Veh	0.94	0.73	0.68	0.96	0.90	0.62	0.90	0.90	0.63	0.98	0.72	0.42
Stops (#)	278	585	270	240	586	124	270	636	220	305	794	107

7018: 1300 E & 9400 S

Lane Group	All
Future Volume (vph)	5617
Control Delay / Veh (s/v)	56
Total Delay (hr)	87
Stops / Veh	0.79
Stops (#)	4415

7019: Highland Dr & 9400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	581	550	260	43	500	190	100	400	74	244	381	542
Control Delay / Veh (s/v)	42	19	8	53	31	10	33	52	1	103	33	18
Total Delay (hr)	7	3	1	1	4	1	1	6	0	7	3	3
Stops / Veh	0.83	0.70	0.43	0.91	0.77	0.55	0.72	0.91	0.00	0.59	0.73	0.41
Stops (#)	480	383	111	39	383	104	72	362	0	143	277	221

7019: Highland Dr & 9400 S

Lane Group	All
Future Volume (vph)	3865
Control Delay / Veh (s/v)	33
Total Delay (hr)	36
Stops / Veh	0.67
Stops (#)	2575

7176: State St & 10000 S

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	366	355	146	282	270	140	970	138	148	1280	408	4503
Control Delay / Veh (s/v)	52	55	9	56	47	79	13	1	60	30	9	32
Total Delay (hr)	5	5	0	4	4	3	3	0	2	11	1	40
Stops / Veh	0.82	0.92	0.12	0.86	0.84	0.99	0.27	0.05	0.88	0.89	0.45	0.66
Stops (#)	300	326	18	242	228	138	261	7	130	1136	183	2969

7178: State St & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	332	984	277	127	1031	245	550	114	240	949	261	5110
Control Delay / Veh (s/v)	32	20	2	63	40	59	48	3	28	35	6	32
Total Delay (hr)	3	6	0	2	11	4	7	0	2	9	0	45
Stops / Veh	0.85	0.55	0.08	0.96	0.83	0.84	0.84	0.07	0.76	0.88	0.33	0.71
Stops (#)	281	544	22	122	856	207	464	8	183	836	86	3609

7200: 700 E & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	203	914	96	52	664	117	113	780	85	152	951	240
Control Delay / Veh (s/v)	46	47	6	30	52	12	39	49	17	39	41	12
Total Delay (hr)	3	12	0	0	10	0	1	11	0	2	11	1
Stops / Veh	0.63	0.92	0.13	0.67	0.97	0.54	0.79	0.92	0.74	0.68	0.60	0.39
Stops (#)	128	838	12	35	645	63	89	720	63	103	573	93

7200: 700 E & 10600 S

Lane Group	All
Future Volume (vph)	4367
Control Delay / Veh (s/v)	42
Total Delay (hr)	51
Stops / Veh	0.77
Stops (#)	3362

7351: State St & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	621	1100	429	124	829	194	417	777	51	295	661	632
Control Delay / Veh (s/v)	76	20	5	57	42	6	80	64	1	44	37	13
Total Delay (hr)	13	6	1	2	10	0	9	14	0	4	7	2
Stops / Veh	0.91	0.57	0.17	0.93	0.87	0.09	0.95	0.96	0.04	0.89	0.92	0.69
Stops (#)	568	631	73	115	719	18	397	745	2	263	611	433

7351: State St & 11400 S

Lane Group	All
Future Volume (vph)	6130
Control Delay / Veh (s/v)	40
Total Delay (hr)	67
Stops / Veh	0.75
Stops (#)	4575

4143: 1300 E & Union Ave/Creek Rd

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	All
Future Volume (vph)	203	163	105	43	137	224	54	1265	316	2236	4746
Control Delay / Veh (s/v)	109	70	12	46	76	37	43	17	45	21	29
Total Delay (hr)	6	3	0	1	3	2	1	6	4	13	39
Stops / Veh	0.84	0.93	0.16	0.79	0.94	0.38	1.19	0.62	0.47	0.66	0.65
Stops (#)	171	152	17	34	129	86	64	788	148	1479	3068

4149: Automall Dr & 10600 S

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	450	1843	94	1226	450	100	126	157	159	145	4750
Control Delay / Veh (s/v)	78	38	78	27	88	88	11	53	99	7	46
Total Delay (hr)	10	19	2	9	11	2	0	2	4	0	61
Stops / Veh	0.98	0.86	0.96	0.80	0.92	0.96	0.07	0.84	0.85	0.04	0.82
Stops (#)	440	1588	90	979	413	96	9	132	135	6	3888

4150: 1300 E & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	All
Future Volume (vph)	324	348	120	20	320	24	72	868	28	120	1360	3604
Control Delay / Veh (s/v)	84	56	19	30	55	0	34	36	0	27	41	45
Total Delay (hr)	8	5	1	0	5	0	1	9	0	1	16	45
Stops / Veh	0.96	0.98	0.66	0.75	0.86	0.00	0.56	0.77	0.00	0.44	0.46	0.67
Stops (#)	311	341	79	15	276	0	40	665	0	53	631	2411

4364: Monroe St & 10000 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR	All
Future Volume (vph)	134	668	192	68	604	68	102	246	148	226	288	2744
Control Delay / Veh (s/v)	21	33	8	20	31	3	146	31	27	36	14	31
Total Delay (hr)	1	6	0	0	5	0	4	2	1	2	1	24
Stops / Veh	0.59	0.78	0.47	0.68	0.84	0.13	0.71	0.69	0.61	0.69	0.28	0.67
Stops (#)	79	520	91	46	510	9	72	169	91	157	81	1825

4403: 1300 E & 10230 S (Sego LIly Dr)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	56	124	96	380	132	36	72	1164	288	188	1636	28
Control Delay / Veh (s/v)	78	76	9	76	53	0	35	35	12	69	44	0
Total Delay (hr)	1	3	0	8	2	0	1	11	1	4	20	0
Stops / Veh	0.93	0.94	0.09	0.95	0.83	0.00	0.90	0.95	0.48	0.69	0.61	0.00
Stops (#)	52	116	9	361	110	0	65	1107	138	130	999	0

4403: 1300 E & 10230 S (Sego LIly Dr)

Lane Group	All
Future Volume (vph)	4200
Control Delay / Veh (s/v)	43
Total Delay (hr)	50
Stops / Veh	0.74
Stops (#)	3087

4404: 1300 E & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	336	488	160	40	300	112	92	1168	48	288	1548	312
Control Delay / Veh (s/v)	59	47	16	70	71	2	64	40	0	69	45	5
Total Delay (hr)	5	6	1	1	6	0	2	13	0	5	19	0
Stops / Veh	0.99	0.84	0.68	0.90	0.94	0.00	0.98	0.87	0.00	0.88	0.81	0.30
Stops (#)	334	409	108	36	283	0	90	1011	0	253	1247	93

4404: 1300 E & 10600 S

Lane Group	All
Future Volume (vph)	4892
Control Delay / Veh (s/v)	43
Total Delay (hr)	59
Stops / Veh	0.79
Stops (#)	3864

4406: 1300 E & 7755 S/Forbush Ln

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR	All
Future Volume (vph)	162	198	59	114	150	27	62	1156	58	1808	297	4091
Control Delay / Veh (s/v)	61	52	8	49	76	1	40	29	5	22	2	28
Total Delay (hr)	3	3	0	2	3	0	1	9	0	11	0	32
Stops / Veh	0.94	0.98	0.36	0.82	0.93	0.00	0.74	0.54	0.09	0.31	0.05	0.45
Stops (#)	152	194	21	93	140	0	46	619	5	568	16	1854

4804: 1300 E & 8020 S

Lane Group	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	51	46	68	106	1203	28	104	1866	11	3483
Control Delay / Veh (s/v)	95	7	56	58	2	0	5	13	0	12
Total Delay (hr)	1	0	1	2	1	0	0	7	0	12
Stops / Veh	0.96	0.07	0.62	1.42	0.28	0.00	0.08	0.77	0.00	0.58
Stops (#)	49	3	42	150	335	0	8	1431	0	2018

4807: 1300 E & 7500 S

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT	All
Future Volume (vph)	20	10	24	10	10	1342	15	2189	3620
Control Delay / Veh (s/v)	74	1	76	1	70	6	68	1	4
Total Delay (hr)	0	0	1	0	0	2	0	1	4
Stops / Veh	1.00	0.00	0.96	0.00	0.90	0.33	0.87	0.04	0.17
Stops (#)	20	0	23	0	9	442	13	91	598

4854: 1000 E & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	99	801	209	51	687	26	130	92	42	30	118	89
Control Delay / Veh (s/v)	2	5	2	13	21	0	50	56	1	42	76	2
Total Delay (hr)	0	1	0	0	4	0	2	1	0	0	3	0
Stops / Veh	0.06	0.21	0.11	0.39	0.56	0.00	0.78	0.85	0.00	0.83	0.94	0.00
Stops (#)	6	167	24	20	386	0	101	78	0	25	111	0

4854: 1000 E & 11400 S

Lane Group	All
Future Volume (vph)	2374
Control Delay / Veh (s/v)	18
Total Delay (hr)	12
Stops / Veh	0.39
Stops (#)	918

7014: 450 W & 9000 S

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	23	1717	354	1691	180	263	201	638	366	262	129	5824
Control Delay / Veh (s/v)	61	57	71	36	11	45	52	140	63	59	8	58
Total Delay (hr)	0	27	7	17	1	3	3	25	6	4	0	94
Stops / Veh	0.96	0.88	0.99	0.81	0.33	0.71	0.84	0.54	0.80	0.90	0.11	0.78
Stops (#)	22	1514	349	1368	59	186	169	343	292	235	14	4551

7018: 1300 E & 9400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	296	800	400	250	650	200	300	706	350	310	1100	255
Control Delay / Veh (s/v)	58	35	17	86	35	6	65	29	7	50	107	14
Total Delay (hr)	5	8	2	6	6	0	5	6	1	4	33	1
Stops / Veh	0.89	0.67	0.71	0.95	0.60	0.26	0.94	0.87	0.33	0.92	0.89	0.48
Stops (#)	262	533	284	237	389	51	281	611	114	286	983	123

7018: 1300 E & 9400 S

Lane Group	All
Future Volume (vph)	5617
Control Delay / Veh (s/v)	49
Total Delay (hr)	77
Stops / Veh	0.74
Stops (#)	4154

7019: Highland Dr & 9400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	581	550	260	43	500	190	100	400	74	244	381	542
Control Delay / Veh (s/v)	50	18	7	80	36	10	41	69	4	132	60	11
Total Delay (hr)	8	3	0	1	5	1	1	8	0	9	6	2
Stops / Veh	0.95	0.43	0.17	0.98	0.68	0.38	0.73	0.94	0.09	0.69	0.90	0.09
Stops (#)	550	238	44	42	340	73	73	374	7	169	343	49

7019: Highland Dr & 9400 S

Lane Group	All
Future Volume (vph)	3865
Control Delay / Veh (s/v)	41
Total Delay (hr)	44
Stops / Veh	0.60
Stops (#)	2302

7176: State St & 10000 S

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	366	355	146	282	270	140	970	138	148	1280	408	4503
Control Delay / Veh (s/v)	75	73	10	71	67	48	15	3	85	21	5	34
Total Delay (hr)	8	7	0	6	5	2	4	0	3	7	1	43
Stops / Veh	0.95	0.95	0.12	0.93	0.85	0.94	0.33	0.11	0.96	0.60	0.17	0.59
Stops (#)	348	336	18	263	230	131	319	15	142	774	70	2646

7178: State St & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Future Volume (vph)	332	984	277	127	1031	245	550	114	240	949	261	5110
Control Delay / Veh (s/v)	43	19	2	72	40	78	49	4	82	45	10	38
Total Delay (hr)	4	5	0	3	11	5	8	0	5	12	1	54
Stops / Veh	0.93	0.57	0.10	0.96	0.75	0.96	0.83	0.05	0.88	0.98	0.64	0.74
Stops (#)	310	560	27	122	777	234	457	6	210	934	167	3804

7200: 700 E & 10600 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	203	914	96	52	664	117	113	780	85	152	951	240
Control Delay / Veh (s/v)	76	41	7	40	62	14	38	24	2	25	20	3
Total Delay (hr)	4	10	0	1	11	0	1	5	0	1	5	0
Stops / Veh	0.75	0.82	0.25	0.75	0.98	0.64	0.65	0.48	0.07	0.32	0.42	0.10
Stops (#)	152	746	24	39	654	75	73	372	6	49	398	23

7200: 700 E & 10600 S

Lane Group	All
Future Volume (vph)	4367
Control Delay / Veh (s/v)	33
Total Delay (hr)	40
Stops / Veh	0.60
Stops (#)	2611

7351: State St & 11400 S

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Future Volume (vph)	621	1100	429	124	829	194	417	777	51	295	661	632
Control Delay / Veh (s/v)	70	34	8	85	38	10	71	51	2	76	60	14
Total Delay (hr)	12	10	1	3	9	1	8	11	0	6	11	3
Stops / Veh	0.92	0.79	0.38	1.00	0.92	0.38	0.94	0.92	0.08	0.95	0.92	0.58
Stops (#)	569	870	164	124	759	74	394	716	4	281	611	366

7351: State St & 11400 S

Lane Group	All
Future Volume (vph)	6130
Control Delay / Veh (s/v)	44
Total Delay (hr)	75
Stops / Veh	0.80
Stops (#)	4932

APPENDIX E – POTENTIAL TRANSPORTATION SYSTEM SOLUTIONS

Potential Roadway Improvements Based on Observations

- The trees in the median on 1300 E between 7500 S and 7625 S may present a safety issue as they block the view of the southbound queue. This queue often extends from 7625 S around the curve to Creek Road. The addition of an advanced warning sign could improve safety of vehicle approaching this signal.
- Improve the lane utilization and signal efficiency at 1300 E& 7800 S by restriping the southbound right to be a through/right lane with an additional through lane extending to the business access just north of Old Mission Road.
- Improve the intersection efficiency at 9400 S and Highland Dr by adding a southbound right turn overlapping signal which would run concurrently with the eastbound left turn signal phase.
- Add ATSPM/detection hardware improvements to gather additional data and improve the signal monitoring and performance for all Sandy City signals.
- Restripe the eastbound right at 10000 S & 500 W to be a through/right turn lane. The queue of eastbound through lane often extends 750 feet and additional eastbound capacity would improve intersection efficiency.
- The intersection at 11400 S & 1300 E would benefit from some additional study to identify future improvements, specifically for additional eastbound left turn capacity.
- At 1300 E& 11000 S, the permissive northbound left turn backs up with Alta High School traffic. While this traffic only lasts for a 10 to 20-minute period the addition of a left turn phase could ensure that the left turn queue never extends into the thru lanes.
- Consider adding retroreflective tape on the borders of the signal backplates to improve the visibility of the illuminated face of the signal by introducing a controlled-contrast background. Signal heads that have backplates equipped with retroreflective tape are more visible and conspicuous in both daytime and nighttime conditions.
- Advanced detection on 1300 E would be helpful to accommodate the larger volumes and higher speeds on 1300 East.
- A roundabout at 1700 E and 10600 S could efficiently control the intersection while potentially reducing delay.